TITLE: High Density Housing

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A Research Project submitted in partial fulfillment of the requirements for the degree of Master of Architecture (Professional)
Unitec Institute of Technology, 2015
Abstract

Under the process of urbanisation, more people settled in cities. This increasing population, along with demographic changes and purchase for investment, has broken the housing supply and demand balance. Meanwhile, without a fully established development regulation, the city has been out of control during recent decades. At this stage, policy makers and developers want to achieve higher density through making land sections smaller, which will lead to inhabitants losing privacy. This project creates a living community development in a suburban area which will achieve higher density numbers and better living conditions compared with a traditional suburban living environment. Architecturally designed, medium high rise apartment buildings sitting on the site, engaged with landscaped, public open space will build a model for future living community development. Local climatic conditions have been considered in the design process, helping to improve the quality of living in increased density situations.
I would like to thank those who helped and encouraged me while I was doing this project.

Many thanks to my supervisors David Turner, Mark Mismash and Bin Su for their advice, guidance, and encouragement.

I would like to thank Brendan Smith who helped a lot on proofreading.

I would like to thank my friends and family for their support and encouragement.
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Introduction
Background

The housing crisis issue in Auckland city was caused by population growth, family structures tending to be smaller, and heat in the real estate investment market. To satisfy the demand for housing in the city, the Council has approved subdivision rules, whereby developers can intensify developments in suburban areas. This transformation will affect the traditional life-style in Auckland.

Population

The population of New Zealand, especially in Auckland, has reached the highest point in history. Statistics New Zealand’s “National Population Projections: 2014(base)-2068,”¹ gives an indication of New Zealand’s future population which will achieve 4.91 – 5.16 million in 2025. Long term indications are that New Zealand’s population has a 90 percent probability of reaching 5.27 – 5.92 million in 2041 and 5.28 – 7.17 million in 2068.

Figure 1: New Zealand population growth prediction.

![New Zealand population growth prediction](image)

The natural birth rate decreased between 2007 to the end of 2014, but the population did not decrease, international migrants contributing to the population growth.

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International migrants contributed the most in population growth. In May 2015, New Zealand had a net increase of 5,100 migrants which has been kept at a high level, increasing for the past nine months.²

Family Structure Change

In New Zealand, family structure has changed from the traditional nuclear family to single parent households, or single people living on their own. This demographic change has influenced people’s need for more houses, as households get smaller. In the 2013 Census, New Zealand had 1,549,890 households, up from 1,454,175 in 2006, and is projected to be over 2 million by 2031. The young generation, born between 1971 and 1993, prefer to live alone. In 2006, 23 percent of total households were people living on their own and will increase to 26 percent by 2021.

Figure 4: Household composition.

However, based on the “National Family and Household Projections”, one person households are projected to increase by an average of 2 percent a year, from 363,000 in 2006 to 602,000 in 2031. The average household size will keep decreasing from 2.6 people in 2006 to 2.4 people by 2031.

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The generation, born between 1971 and 1993, especially young women, is more likely than the older generations to be un-partnered, or partnered later. Since the 1980s, the number of women residents in New Zealand has been increasing relative to men, particularly in the 20–49 age group. More women are either living on their own or are single parents.5

Figure 5: Projected Households.

Investment

Besides population growth and family structure changing, there is another factor that is causing demand for houses: investment value. Because of the value of owning a piece of land as an asset, many people started investing in real estate. According to the New Zealand Housing Report 2009/2010,6 there are several reasons why people invest in houses:

• Investing in a tangible asset – in ‘bricks and mortar’ – is seen to be safe.
• Demand for housing is reliable, because housing meets the basic need for shelter.
• Financial investments are seen as intangible, more complicated, and less easily understood.
• The New Zealand financial market is smaller, more volatile and more vulnerable to global events compared with other developed economies like Australia and the US.

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• Both the global financial crisis and the recent string of financial corporate collapses have damaged individual investor confidence in financial markets.

• There are tax advantages to investing in housing, namely; the ability to deduct investment losses against other income and many investors not being liable for tax on capital gains.

• Housing investments generally provide high returns during periods of strong investor demand."

Chase O’Brien’s paper shows that, for the period 1999-2011, the percentage growth in housing value (184%) is greater than the percentage increase in housing interest (146%).

Figure 6: Household sector accounts.

<table>
<thead>
<tr>
<th>Household sector accounts – housing variables and saving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Households sector accounts year ended March</td>
</tr>
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<td></td>
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<td>--------------------------------------------------------</td>
</tr>
<tr>
<td>$ (million)</td>
</tr>
<tr>
<td>--------------------------------------------------------</td>
</tr>
<tr>
<td>Housing interest</td>
</tr>
<tr>
<td>Owner-occupied dwellings: taxes on production</td>
</tr>
<tr>
<td>Owner-occupied dwellings: intermediate consumption</td>
</tr>
<tr>
<td>Contribution to saving from the above variables</td>
</tr>
<tr>
<td>Published household saving</td>
</tr>
<tr>
<td>Residential buildings net capital stock at replacement cost</td>
</tr>
<tr>
<td>Housing value (Reserve Bank)</td>
</tr>
</tbody>
</table>

Symbols:
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Losing Privacy

To satisfy the demand for houses in New Zealand, especially in the Auckland region, developers are trying to provide more accommodation within a minimum lot area, terraced houses and low-rise apartment buildings, so that market needs could be met. However, due to a lack of regulations and practical inexperience in high density housing design some unacceptable design mistakes happened, for instance, internal bedrooms being constructed without ventilation or sunlight, a column placed in front of a window and overlooking from neighbourhood windows to another, etc.

*Figure 7: Overlooking in terraced housing area.*

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Low-rise residential projects have produced an out of control city sprawl. This research focuses on providing higher density living in a suburban area, building up and drawing the city skyline from the city centre to the areas around the city, freeing up land to control the city’s endless sprawl.

It is also important to design a good quality living space for people to inhabit, not merely a shelter for surviving. The site chosen is at Te Atatu Peninsula on the east of Te Atatu Road. The aim is to design a high density suburban living area surrounded by nature and with a harbour view towards the city centre.

Design a high density dwelling complex that ensure a resident’s privacy, while providing a high standard of living conditions.

This project is initially aiming to create a higher level of living density, meanwhile providing the same, or better, living environment compared to what is currently in a suburban area and also be recognized as affordable. To solve issues about density, privacy and affordability in this project, an understanding of New Zealand apartment design regulations and house pricing is important.
Research Question

What aspects of technical and social design in high density housing can be improved to achieve standards of privacy that compare with those commonly enjoyed in suburban environments?
Scope and Limitation
This document is about focusing on high density residential design, while achieving at least the same level of living quality compared to the traditional suburban New Zealander’s living environment. Based on the knowledge of demographic change in recent years, target groups are single people or small families. Families with more than two generations living together will be considered, but they are not a priority consideration. A study of Auckland’s history and how the city sprawled in today’s form and shape will help people to understand Auckland’s current overall density level, and what process can improve the density to the next, or even higher level.

This project will be architecturally designed to enhance the current suburban density. The apartment buildings are about 4 to 7 storeys high, facing north to get more sunlight. A study of what aspects are contributing to residential prices will be helpful towards understanding what makes housing currently unaffordable, such as labour costs, materials and construction time spent on site. To reduce cost, all apartments are designed within a 5 metres by 5 metres module which can be produced faster in a factory and assembled easily on site. Thus, it will reduce the fee from the beginning of design to the end of the construction process, which will cut the overall cost of building and lower the housing price. When the construction fee is decreased by efficient construction, affordability will be increased. Another aspect which will influence the housing price is wasted interior area. The floor plan should avoid waste areas, making the space more useful and well organized based on human behaviour. Reasonable minimum room size and grouped different habitable rooms around the threshold will reduce wasted space, reducing the construction cost and contributing to affordability.

However, the apartment design regulation in Auckland is unsound. By looking into New Zealand housing regulations, the current regulation we have and mentioned about minimum room size is “Housing Improvement Regulations 1947.” The first part of this regulation, “Minimum Standard of Fitness for Houses,” sets out that for a new house, 14 square metres is an adequate area for living room and kitchen combined; for existing houses this figure is a mere 9 square metres. There were no relative rules controlling apartment buildings until Auckland City Council imposed a minimum size of 35 square metres for a studio flat, 45 square metres for a one bedroom flat, and 70 square metres for a two bedroom flat in 2004. The challenge for this project is to design a residential building under an unsound regulation. The design should not only use the local rules, but also use worldwide experience as a guide towards achieving higher living conditions.

Methodology

Literature Review

Due to the lack of resources of high density design knowledge and experience in New Zealand, some experiences of success and failure from Europe, Australia and Asia will be introduced because of their longer history of solving the conflict between density and population. These published studies will help to understand what high density is and how it will affect and change people’s lives. Also, this section will talk about the history of Auckland city and how to define traditional New Zealander’s lifestyle, city development and population growth, and the history of local apartment living and future expectations.

History Review

In order to understand the city’s history, especially focusing on the relationship between city sprawl and local population growth.

Demographic Data Collection

Collection of data from published books, papers and government websites, and use the data to analyse the city’s future development.

Regulation Review

Look at the Auckland local residential regulations and how they impact the design process. Also, compare with the regulations worldwide to achieve a better design process outcome.

Precedent Studies

Analyse existing Auckland residential projects, houses and apartments, compare with the projects done by peer cities. Simple diagrammatic drawings will be introduced.
Auckland’s Urban Sprawl History/Apartment Development History

“Historically, the development of Auckland’s urban form has been characterised by growth in suburbs, sprawl and low density development, accompanied by a dependency on private motor vehicles to get around.” 12

Auckland was founded in 1840 as the capital of New Zealand. In 1842, 2,895 people were living on approximately 33.2 hectares area. 13 It was the first time that such rapid growth in both population and built up area was seen in the middle of the 19th century. By 1864, the population of Auckland had increased to 12,423. The built-up area was 565 hectares, 17 times bigger in 1840. 14

The second urban boom was in the early 20th century when the urban form changed dramatically during the first two decades. 15 Both population and urban built area reached higher levels and city sprawl was continuing. At this time, middle-class families left the run-down and crowded inner-city districts for new, more spacious neighbourhoods on the edge of town. 16 Within 25 years, Mount Albert grew from a population of 2,085 in 1901 to 17,516 by 1926. The overall population in 1915-1916 was 133,712 living in a built area about 5,039 hectares. 17 During the whole of the 20th century, Auckland development remained at a very high level, doubling population and urban built area for every 20 years and, at the same time, keeping the density at about 20 people per hectare. 18 City sprawl reduced fluctuation in density figures. Apartment blocks in the inner-city were developed in the 1940s, but the main focus of the government at that time was single unit suburban homes which were considered more suitable for families. 19

By the 1970s, the continued outward growth had raised the awareness among town planners. The first Regional Planning Scheme for Auckland was established in 1974. The main proposal of the scheme was:

“The direction of urban growth is to be guided in such a way that an urban form following a ‘multi-linear’ pattern evolves – that is growth will be related to the main transportation corridors and coastlines”. 20

13 Ibid., 5.
14 Ibid., 7.
15 Ibid., 11.
16 Ibid.
17 Ibid.
18 Ibid., 11-22.
19 Ibid., 13.
20 Ibid., 19.
The following year, the Auckland Regional Authority released a report, “Auckland Alternatives for Future Regional Growth”, which concluded that:

“Further urban development was tightly constrained in the south-west and south. Land to the east of south Auckland, the north, and the west was the least constrained. On the grounds of physical constraints, a redirection of Auckland’s growth away from the south and to the north and west was necessary. Even with the best intentions of concentrating growth more in the future there would have to be ‘major compromises’. Continuing development of Auckland must not cause further loss of land that is valued highly for at least one purpose other than urban development.”

“The trend of growth outside central Auckland continued into the 1980s as the outer areas grew, enabled by the reliance on private transport and the motorway system.”

“By the mid-1980s, Auckland was already facing a traffic dilemma, particularly on the main routes in and out of the CBD.” This dilemma has still not been solved. At the end of the decade, the CBD began to revive from the economic reforms. In line with the “growth in finance and insurance, and property and business service industries increased after the economic reforms, and created a number of employment opportunities in the central city, the demand for inner city apartments grew.”

However, there was no sign of the expansion of the city stopping at that time. The total population was up to 754,845 and city area had reached 40,022 hectares, a density of 19 people per hectare. The city sprawl had continued all the time and the endless sprawl was recognized by the government as leading to increasing inefficiencies and continuing damage to Auckland’s natural resource base. In response, the Auckland Regional Planning Scheme brought into effect limits to contain the expansion of urban Auckland, and requirements for sequencing and structure planning of future urban expansion areas.

The city’s population reached over one million in the 1996 census, and has continued to increase since then. To satisfy the demand for housing which came with population growth, the CBD developed high density mixed-use, while medium density terrace and apartment developments were built in areas such as Ellerslie, One Tree Hill, New Lynn and New market. The urban form, in the 21st century, continues to be low-density housing for most of the city. Development in the first decade has focused on redevelopment of remaining vacant lots within the MUL (Metropolitan Urban Limit) and densification of the existing CBD areas. Some new development continued, but these were pre-planned and pre-controlled, such as Hobsonville and Flat Bush, but these developments are still low-density low-rise housing.

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22 Ibid., 19.
23 Ibid.
24 Ibid.
25 Ibid., 19.
26 Ibid.
27 Ibid., 23.
28 Ibid., 25.
Currently, half way through the second decade of the 21st century, the expansion shows no signs of slowing. Planners and government will have to transfer their attention from development of low-density housing to compact apartment buildings. The benefits of compact living will be realised by the residents through ongoing development in the CBD and other centres, such as New market, Takapuna and Henderson. Providing a well-designed project is essential for those who are planning to live within the central area, or any other high density living areas. It will determine the locals’ attitudes about compact living. To ensure that, Auckland’s Regional Growth Strategy retains a high quality living environment by promoting compact urban environments with high amenity, well integrated with the transport system.

Figure 12: Proposed Frequent Network (every 15 min) in 2016.

Figure 13: Auckland historical urbanization.
New Zealander’s Lifestyle Transform and Housing Affordability

New Zealanders are known and loved worldwide for their laid-back and relaxed attitude which is reflected in all areas of life from work to leisure time. The traditional living model in New Zealand is a stand-alone house set in the middle of land, with both front and back yard. It is usual to have a spacious deck, with table and chairs facing north, acting as the major outdoor living space.

However, this lifestyle has contributed to the city sprawl, forming the current shape of Auckland. With the increasing population and the demands of housing, this spacious lifestyle is too luxurious. A transformation of the traditional New Zealander’s lifestyle has been forced to happen. The city planners have approved subdivision rules whereby the residents can subdivide their land, allowing infill development with more houses. The minimum residential unit must have at least 200 square metres of net site area, depending on the living environment.

The overall population is projected to grow to 2.2 million to 2.5 million over the next 30 years. Around 400,000 additional dwellings will be required by 2040, which means that at least 13,000 additional houses have to be built each year. This is a huge challenge given that “New Zealand’s building industry is small-scale and fragmented, with a lot of bespoke design, construction skills shortages, and low productivity.”

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The housing shortage issue has not slowed down, even though the city is trying to build thousands of new houses and apartments every year. Because of the rapidly increasing population, new house production is not able to catch up. In May 2015, 2,171 new dwelling consents were issued, (Figure 15)\(^{31}\) but the net gain through permanent and long-term migration was 5,100 people.\(^{32}\) This unbalanced relationship between more migrants and fewer houses will increase the shortage of housing, thereby increasing housing prices. Houses in Auckland have become unaffordable since the balance has been broken. Home ownership has fallen to 64.8 percent of households— the lowest rate since 1951 (Figure 16).\(^{33}\) The number of households renting their home in New Zealand as at 2013 was 31.2 percent compared with just over 25% in 1991 (Figure 17).\(^{34}\) Owning a house in Auckland is becoming more and more impossible for the younger generation.

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Based on the published data from the Auckland Council, there is no affordable housing in the whole Auckland Region (Figure 18).\textsuperscript{35}

\textit{Figure 18: Housing affordability in 2006.}

Housing affordability “is an aggregate term, referring to a household’s capacity to pay to rent or purchase a home without difficulty.”\textsuperscript{36} “It is generally agreed that if the Median House Price is less than three times the annual MHI (Median Household Income), it is ‘affordable.’ If the Median House Price is more than three times the annual MHI, it is considered ‘unaffordable’… In 2006, the annual MHI was approximately $64,000 – in 2012 annual MHI is approximately $72,000.”\textsuperscript{37}

\textsuperscript{35} Auckland City Council, \textit{The Plan}, 281.
\textsuperscript{36} Ibid., 278.
\textsuperscript{37} Ibid., 279.
Definition of Density

The word ‘density,’ although familiar at first glance, is a complex concept upon closer examination. The complexity mainly stems from the multitude of definitions of the term in different disciplines and under different contexts.38

The measurement currently used in Auckland is dwelling per hectare, which means total number of build dwellings divided by total site area. This measurement has its limitations and is only useful when referring low density areas, such as suburban and rural areas. It does not consider building layout, and the site coverage.

“Plot ratio is the ratio of total gross floor area of a development to its site area,” and it is “considered as one of the most unambiguous density measures.”39 Plot ratio is widely used in master planning in order to prevent over-development and also can be used to estimate the design and development budget.

“Site coverage represents the ratio of the building footprint area to its site area.”40 Similar to plot ratio, site coverage is often controlled in urban master planning in order to prevent over-build and also preserve areas for greenery and landscaping.

When the site coverage is the same, a higher plot ratio is referring to a higher building height. Vice versa, if the plot ratio is the same, the smaller site coverage will represent a high building (Figure 20).

Figure 19: Same density, different building forms.

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39 Ibid., 5.
40 Ibid., 6.
Auckland has sprawled far from the centre without any limitation or planning since the day the city was founded. New Zealand towns and cities have some of the lowest residential densities in the world at around 2,200 persons per square kilometres (ppk^2). While London has a density of 5,100 ppk^2, Hong Kong and Mumbai come in at 25,500 ppk^2 and 35,000 ppk^2, so that even a doubling of New Zealand’s urban densities could not be seen as extreme.\textsuperscript{41} Due to the ongoing urban development, high density development has become a topic attracting worldwide interest. The term of high density does not yet have a universal definition due to it being related to the cultural background of each society. “Hence, societies or individuals of different backgrounds and under different contexts come up with different definitions of high density.”\textsuperscript{42} In the UK, a residential development with less than 20 dwellings per net hectare is considered low density; between 30 to 40 dwellings per net hectare is considered medium density; and higher than 60 dwellings per net hectare is considered high density.\textsuperscript{43} In the US, low-density refers to 25 to 40 dwellings per net hectare; medium density refers to 40 to 60 dwellings per net hectare; and high density refers to development with higher than approximately 110 dwellings per net hectare.\textsuperscript{44}

In terms of this project, the high density definition will compare to neighbouring Australia, due to their lifestyle and climate being similar to ours. In Australia, “medium density housing can range from about 25 to 80 dwelling per hectare.”\textsuperscript{45} Thus, over 80 dwellings per hectare may be considered to be a high density living standard for New Zealand.

\textit{Figure 20: Relationship between FAR and site coverage.}
Benefits of High Density

Save Urban Land and Infrastructure

Providing more built-up space on individual sites, maximizes the utilization of scarce urban land. High building density helps to reduce the pressure to develop open spaces and releases more land for communal facilities and services, improving the quality of urban living. Infrastructure such as roads, drainage and sewerage, electricity, telecommunication networks and so on, are very costly to provide and maintain; and, in many cases, a minimum utilization threshold is required in order to operate these systems cost effectively. “High people density, by concentrating a population in a smaller area, can make greater use of these infrastructural services and help the systems to run more economically.”

Support Public Transportation System

Once land has been saved by providing more built-up spaces, there will be more space for the infrastructural services, such as roads. It will be a chance to have bus lanes for every major road instead of having a bus ‘priority-stop-point.’ New Zealand is a car-dependent society – there are some 730 vehicles for every 1,000 people and they are heavily used. Around 84% of New Zealanders drive to work and complete their day-to-day activities by car. “Buses make up 2.5% of vehicles on the road but carry nearly a third of commuters into Auckland city.” Public transportation will not be recognized as successful unless more people are willing use it as their priority option when planning their trip. Higher population density will support the public transport system efficiency. Like many other infrastructural services, public transport needs a minimum utilization rate in order to be profitable and efficient. “High people density, by providing a greater

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number of users, would sustain the use of the mass transit system and thus improve its efficiency and viability.\textsuperscript{49} On the other hand, “areas with higher densities, well-mixed land uses, and accessible and connected transport options demonstrate less reliance on private cars.”\textsuperscript{50} Furthermore, the increasing number of people taking public transport for their trip helps to reduce traffic congestion in the urban centre. Once the number of private cars has been controlled, it can lead to a reduction in use of gasoline. Pollution from traffic and the resulting global warming will be reduced and people’s health will be improved.

**Define Privacy**

Like the definition of density, “the degree of privacy granted to people throughout history and in different societies has been variable, depending on a wide range of factors including political, economic, socio-cultural, and demographic.”\textsuperscript{51} Privacy may be defined as “the protection (controlling mechanism) of the dwelling and its residents (individual or group) from being violated by other’s undesired visual observation (interaction).”\textsuperscript{52} Privacy is not only about unexpected visual interaction. It relates to sound, space, sight and security.

*Figure 22: What privacy contains.*

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\textsuperscript{49} Cheng, “Understanding Density and High Density,” 15.
In a high density living environment people will sacrifice some level of privacy. However, the sense of living together as a community will make up for the lower level of privacy by providing community spirit. The whole community acting as a self-management territory providing rules, help and even security. Privacy and community work as two parts within a unified and complete whole, “the Yin and Yang of a harmonious neighborhood.”

*Figure 23: The relationship between privacy and community.*

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53 Ibid., 5
Solutions for Enhancing Privacy

“Carefully designed and planned room layout helps to reduce privacy problems caused by sound transmission and overlooking. When living rooms and bedrooms are shielded from the party wall by less sound sensitive spaces such as hallways, kitchens and cupboards, privacy is enhanced.” Vertical separation of space provides different private zones for different household members and for different functions. Meanwhile, the changing levels within the dwelling keep unexpected interruptions at a certain level. For example, living room, kitchen and dining, and guest room and one of the toilets can be located on the first level which is recognized as being less private than the household’s bedrooms and bathroom. This vertical separation within one dwelling provides prioritized private areas, guests are controlled by the separation and they will not go into private areas, recognising the separation.

Overlooking or overhearing is not always negative, as with many things, there can be positive aspects when people are living in high density housing. “To create a successful outdoor communal space, a key element is whether proper provision is made for children to play.” Security is considered to be a very important reason for choosing to live in high density housing. Because there are many people living in a given high density area it is difficult to control safety. High density living could become a high crime area. Overlooking and overhearing from the neighborhood becomes very important in protecting the safety of your property. Others will be able to notice if there is someone unfamiliar breaking in and alert the police.

*Figure 24: Hierarchy of privacy.*

<table>
<thead>
<tr>
<th>Bath/Bedroom</th>
<th>Home</th>
<th>Private</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living/Dining/Kitchen</td>
<td></td>
<td>Very</td>
</tr>
<tr>
<td>Front Garden/Balcony</td>
<td></td>
<td>Mid</td>
</tr>
<tr>
<td>Shared Driveway/Garden</td>
<td>Neighbours</td>
<td>Less</td>
</tr>
<tr>
<td>Roads/Amenities</td>
<td>Outdoor</td>
<td>Public</td>
</tr>
</tbody>
</table>

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54 Ibid., 19.
55 Ibid., 15.
On What Aspects Make an Apartment Successful

“The trend for city living has seen the number of new apartment buildings increase dramatically and, with it, concerns about poor design.”

Successful apartments are not simply providing shelter for people to dwell in. As well as the physical aspects of surviving, mental satisfaction is more concerned with judging the success of the apartment design.

New Zealanders are going through the transition of moving their housing preferences from low density, stand-alone suburban housing towards high density, urban apartments. “Since 1991, the number of building consents issued for new apartment buildings has increased by over 2,000%. …The rapid increase in apartment numbers to accommodate city lifestyles has resulted in problems caused by poor design and finishes, compounded by a Building Code that is not fully equipped to deal with this type of building.

Reported issues include:
- Inadequate natural light
- Poor noise control
- Limited outdoor access
- Inadequate ventilation
- Small unit sizes
- Inadequate storage provisions.”

“A New Zealand and international literature review identified over 100 factors in the built environment that may affect livability in a variety of ways. From these, six basic requirements were identified:

Access to community amenities.
Connections to the outdoors.
Satisfying indoor environments (visually, aurally, thermally and spatially).
Privacy and sanctuary.
Well-built buildings.
Social inclusion.”

57 Ibid.
58 Ibid.
The review it shows that people pay more attention to quality of livability. Interior environmental quality relates to sound, ventilation, thermal comfort and visual privacy. Building quality focuses on design and construction. It is important to keep focusing on architecturally designed solutions which affect the indoor environment quality.
Housing Costs

New Zealand Institute of Economic Research (NZIER) have pointed out that the average build cost of an Auckland residential home is $1,965 while in Sydney it is $1,958.\(^{59}\) The breakdown of total building cost shows that materials were the largest part of the cost in construction. If we build more single stand-alone houses, we need more materials such as exterior walls, insulation and foundations, which will increase the cost of houses dramatically. On the other hand, if we provide more apartments or terraced houses, we only need to build the foundation and roof once and we can reduce the total exterior wall area by having more interior walls. Thus, it will lower the total cost of each dwelling making them more affordable.

*Figure 27: Total building cost breakdown 2007.*

However, the labour cost is a part of the total cost which could be improved by increasing productivity. Labour productivity in the construction industry is lower in New Zealand than Australia, in the order of 26%. Lower wages in New Zealand appear to be offset by lower productivity and possibly higher material costs. There is still plenty of room for improvement in the residential construction sector.\(^{60}\)

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60 Ibid.
Precedents Study

Wohnsiedlung Brunnenhof, Zürich
Het Kasteel, Amsterdam
Adelaide Wharf, London
Figure 28: Site plan of Buchegg Park.

Wohnsiedlung Brunnenhof, Zürich

“Two lightly bent, elongated volumes of different heights restructure Buchegg Park.”  

The linear building form captures the maximum sunlight, and the dual aspect apartment layout maintains cross ventilation. “The noise-polluted building on Hofwiesenstrasse’s access to the apartments is via longitudinally arranged stairways and loggias that adjoin to the eat-in kitchens and serve as protected exterior space oriented towards the evening sun.”  

Bedrooms are along one side, facing toward the vegetation covered, quiet and sun filled park. Generous balconies were built outside of bedrooms and can be accessed from each room. Living room are dual aspect and a deep, cut-in balcony is designed facing toward the park. “…storey-height windows and alternately coloured glass panels form together with sliding anti-sun and screening glass panels an interplay of reflecting and matt, translucent and transparent coloured surfaces.”

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61 Aurora Fernandez Per, Javier Mozas and Javier Arpa, HoCo, Density Housing Construction and Cost (Vitoria-Gasteiz, Spain : a+t ediciones, 2009), 380
62 Ibid., 382.
63 Ibid.
Figure 29: View from Buchegg Park.

Figure 30: Typical floor plan.

Figure 31: View from street.
However, looking at the apartment layout, the transition zone within each apartment takes a lot of space. Due to all bedrooms being organized on one side of the building, the services rooms, such as kitchen, dining and bathroom are located on the other side of the apartment. A long internal corridor is unavoidable. This project is focused on large families, but only provides two bathrooms which seems too few. Instead of having more bathrooms a spacious threshold is supplied at the entry of each apartment.
Het Kasteel, Amsterdam

The site is located in a new living area in the eastern part of Amsterdam. The building stands beside the Science Park train station which means the building requires a sound baffle. To satisfy the requirements of sound insulation and the beauty of architecture, glazed cassettes were chosen for the double skin façade. It is also enables natural ventilation through the cassettes’ joints.

There are two types of accommodation in the building, a 45 metres high apartment tower, standing on a four to five-storey terraced house base. A half-open wooden deck is surrounded by the terraced houses and all dwellings have access from the deck. The idea of designing an internal courtyard was to stimulate the social and interpersonal relationships between the inhabitants. All dwellings are entered through this inner courtyard where the inhabitants meet their neighbours. Under the wooden deck is the basement parking area where the cars are hidden from the sight. Meanwhile, the deck is safe and comfortable for daily social activities.

Figure 34: Site plan.
Figure 35: View of pedestrian and cyclist entrance.

Figure 36: View from courtyard.

Figure 37: Terraced house floor plan.
Material used in the design is well considered. “What from the outside gives the impression of an ice castle contains a warm welcome on the inside.”

In the apartment tower building, the bedrooms are all designed facing towards north where they do not benefit from sun and ventilation. The vertical circulation core should be located along the busy street, instead of standing towards the inner courtyard. Putting the kitchen, bath, lifts and stairwell on the north side, and bringing the bedrooms towards the south could enhance the quality of living.

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Ibid., 280.
“Adelaide Wharf is a pioneering mixed tenure housing scheme.” The six-storey building stands along Regent’s Canal in Hackney, which is a key regeneration area in London. All the apartments follow a similar design strategy, which is keeping the circulation area to a minimum so that the living space can be maximized. Deep plan locates all the functional services along the corridor wall so that living/sleeping areas can make maximum use of the window wall. The courtyard is designed as a shared garden for residents by using geometric lines subdivided into smaller spaces for different groups of people. Prefabrication was applied on the project to reduce the time spent on site and the cost of construction, “First Base has reduced overall construction costs by 20% whilst reducing delivery time for the project by 20%. This has also contributed to a 10% increase in property values across the schedule.”

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65 Ibid., 348.
66 Ibid., 355.
67 Ibid., 356.
Figure 42: View from courtyard.

Figure 43: View from street.

Figure 44: View of entry.
Figure 45: Section facing west.

Figure 46: Two bedroom with ensuite floor plan.

Figure 47: Two bedroom floor plan.
The whole strategy of Adelaide Wharf works well and “there is no visible differentiation between tenures.” However, the circulation within the building is arranged in a double banked corridor which means that almost all apartments are single aspect, facing toward north, east and west, instead of facing south. Even though the service spaces, such as kitchen, dining and bathroom, are located along the corridor wall in deep plan it is not good for natural cross ventilation. West facing apartments will gain too much sun radiation during summer and the indoor temperature will increase massively. East facing apartments will not get enough sunlight during winter because of the low sun angle and shading from the apartment in front.

Ibid., 348.
Design Process
The site selection is based on the Auckland Unitary Plan, where it is recognized that apartment buildings should be close to town centres. This means the dweller can access as many service facilities as possible within 15 minutes walking distance, such as schools, hospitals, bus stations, retails, etc. (Figure 51)

Looking at a map of Auckland, one can see that the city has been shaped along the water, even the city sprawl has gone out of control. (Figure 52) Most areas in Auckland are within 10 km distance from the sea. Aucklanders appreciate living near the water. The site chosen is at Te Atatu Peninsula on the east of Te Atatu Road and along the shore. It is currently a reserved green land with no building on it, providing a potential opportunity to develop as a higher density living community area in the future. The land is on Te Atatu Road which will be one of the major frequent bus network lanes in the future. Easy access to the western motorway means that it only takes 20 minutes to travel to the CBD at off peak times. Also, the location has walkable distances to public transportation stations, childcare, church, restaurants, supermarket, schools and Te Atatu Peninsula community centre and library, etc. The industry area on Lincoln Road, plus these service facilities, provide many employment opportunities and student resources which will bring more people to this area. (Figure 53)
Figure 51: Future town centres.
Figure 52: Auckland satellite map showing city and water.
Figure 53: Site surroundings.
The land has been flattened and is used as a people’s park. The border along Te Atatu Road has been already renovated for future development. In consideration of pedestrian and cyclist safety and comfort trees are planted between the busy road and the pedestrian and cyclepath.

Keeping two main walkable access point across the busy road connects the church and restaurants on north and south end of the site. A driveway, extended from Gloria Avenue, has been built as the current access to the land.

The site is wide and flat, 150 metres south-north and 200 metres east-west, with a little slope toward the beach on the eastern edge. The predominant wind is from southwest and the secondary is northeast. The context of the land is mostly 2 storey, standalone houses sitting on the north and across the busy Te Atatu Road, while the south is empty. A footpath along the eastern boundary to the beach is accessed from the current driveway with parking within the site area. Currently people use this driveway and car parks when they are having a break and to enjoy the view. According to the Auckland Unitary Plan, based on the Te Atatu Peninsula town centre, most blocks have been zoned as apartment buildings. Therefore, the site is seen as being suitable for a potential future development of high density living area.
Figure 54: Site Survey.
Modular apartments layout

Start with a module which is five metres by five metres. It will suit the minimum size of basic living requirement which are: nine square metres bedroom, two square metres bath/toilet and 14 square metres living combined with kitchen and eating. Plus another five square metres balcony to meet the outdoor living space requirements. Also, five metres depth will allow natural ventilation for one aspect apartment and more floor area will receive winter sun light. (Figure 55)

Based on this module, creating four types of apartment: studio (5 x 5m), one bedroom (5 x 10m), three bedroom (5 x 10m on 2 storey) and 4 bedroom (10 x 10m on 2 storey). As mentioned earlier, a priority concern will be small families due to the decreasing number of people in each dwelling as was seen in the census figures.
Studio space:

Target people: one person living on their own. This could be an overseas student or a single workman renting the space as a temporary place, or a young person who has the ability to purchase a single bedroom unit and is ready to start living without his/her parent(s).

Size: the room is designed by the minimum size, 5 by 5 metres. The size of the studio space is 30 square metres, including the balcony.
One bedroom apartment:

Target people: one person living on their own, or a couple without dependent children. One master bedroom and spacious living and kitchen area plus outdoor balcony.

Size: the size of one bedroom is double the size of studio room. 5 metres by 10 metres.
Three bedroom apartment:

Target people: a couple with up to 2 children under 12 years old. This is applied by the concept of “vertical separation”, where the entry level could considered as a semi-private area when guests or friends come over. The bedroom on the entry level could be used as a guest room.

Size: same floor footprint with one bedroom apartment but on two level.
Figure 59: Three bedroom + one study apartment floor plan. (dual aspect)

Three bedroom + one study:

Target people: a couple with up to two teenagers.

Size: 60 m² footprint on two floors.
Four bedroom apartment:

Target people: multi-generation, traditional nuclear families where grandparents are still living with their child or grandchild. It is not a priority consideration in this project, so the number of this type of apartment should be small. This type of apartment was also designed under the concept of “vertical separation”.

Size: 75 m² floor footprint on two levels, plus 25 m² outdoor living space.
Initial Site Master Planning
Master Planning

Site planning is based on the building being oriented towards north to capture maximum sunlight during winter. The distance between apartment building blocks has been calculated based on the winter sun angle, from 22 metres to 36 metres according to building height. Summer heat and sun radiation will be excluded by balconies and overhangs applied on the facade. The dominant wind direction in Auckland is from the south-west, which means that locating the tall building block on the south-east corner will act as a wind barrier.

The idea of designing high density living area is to achieve over 80 dwellings per hectare, compared to the current 20 dwellings per hectare in Te Atatu Peninsula, and maintain a similar living environment to that of traditional suburbia. The site is about 3 hectares, which means that over 240 dwellings can be introduced.
The first thought of the site is to subdivide into three small sites by extending Landmark Drive through the middle of the site and extending the current drive way to it. The apartment building blocks are a linear shape located along each site, creating semi-public squares for residents and public. Underground parking is accessed from the proposed road extension.

The linear shaped building blocks can achieve higher density by having more east-west oriented dwellings. However, the concept is to provide better living quality in a high density area and orientation is one of the most important aspects which will affect living quality. Having more east-west facing apartments means not using sunlight efficiently to warm up interior rooms. In winter, east facing apartments will not have enough time to warm up because the early sun time is short and cold. In summer, west facing apartments will gain too much heat and the room temperature will increase because of long exposure to the sun's radiation. It is not sustainable to place buildings oriented east-west. Removing all east-west facing apartment on the site will lose some density, but will increase the living quality.
Figure 63: Winter sunlight through the north facing apartments.
Figure 64: Summer sun excluded.
The concept on site is to have people as the priority concern instead of vehicles. Remove the extension from Landmark Drive and extend the driveway to the upper left corner. The site is subdivided into two parts, the left part is wide and flat, but the right part is small, strip shaped and sloping. One curved main pedestrian path replaces the Landmark Drive extension and is only for people and cyclists, with the exception of emergency services (Figure 65). Cars are parked underground so that the circulation of vehicles and people are separated. The ground becomes a safe place for children to play.

Street life is another concept that has been introduced onto the site. Two-storey high commercial buildings, adjoining the apartment buildings, are planned along Te Atatu Road, providing various services to the site, such as dairy, restaurant, fast food, small companies, etc.
A further development on site is to create another two pedestrian lanes through the site, separating the commercial buildings from the apartment buildings. Vegetation placed around the apartment buildings along with pedestrian paths, will protect the residents from noise and provide a visually pleasant area. A curved footpath brings movement while people are walking along it. Commercial buildings on Te Atatu Road have been broken into three parts so that, at some point, a person on the street can still see the CBD and harbour view through the apartment building blocks. Playgrounds will be located into spaces between buildings in consideration of the fact that most target dwellers are younger generation. Children can be seen while they were playing outside by parents or neighbours (Figure 66). Hence, the overlooking of public spaces becomes a positive aspect, which will increase security.
Site Circulation

Site circulation is mainly pedestrian, vehicles are limited to emergency, services and maintenance. The shared driveway, in red, is designed in a curved shape to enhance driver awareness of controlling their speed. Residents’ cars are parked underground, so that people can feel free to move on the ground level along the pathways. (Figure 67)
Public Space

Public openings are shown in Figure 66 also. As the traditional detached housing has been replaced by medium-high level apartment blocks there are more open spaces at ground level. The openings will be designed for landscaping and playgrounds in the detail design.
Facade Material and Structure

Steel has many advantages, such as fast construction on site, which will reduce the labour cost. Steel provides greater spanning than timber and concrete, it is light in weight, but stronger than other products, and is flexible to assemble. Floor to roof height double glazed windows admit more sunlight during winter and reduce heat loss from inside. Floor plates are extended to reduce summer sun radiation entering the apartment. Fenestration reflects each unit’s layout: large openings in the living rooms and small windows in the bedrooms. Vertically arranged timber boards are fixed between floor plates with a cavity behind, infilling the space between windows. Each unit has a balcony cantilevering beyond the floor plates. Balconies are offset from one level to another following the windows, avoiding permanent shading. (Figure 69)
Access and Security

The site is accessible by all residents and neighbourhood communities. All public open spaces are shared by residents and surrounding neighbours. The pathway provides access for everyone to use and cross to the beach. As mentioned earlier, residents can access their apartment from the ground level entry or underground parking. Access is controlled and authorized via a basic secure system such as swipe card. Disabled access apartments are located on the ground level through a 1:10 ratio ramp from the outside.

Privacy

The primary visual concern for privacy is for the ground level apartments and pedestrians. Lifting the building about 1.2 metres above the ground and planting vegetation around the building provides protection from outside viewing of the apartment interior. (Figure 70) The lifted ground floor height will increase natural ventilation in the underground parking area. Offset windows and wide distances between buildings reduce visual intrusion. Sound-proof insulation, applied between interior walls, ceilings and floor plates will reduce airborne noise from adjoining apartments.

Parking

Single level underground parking will be designed in the final design. There will be 316 dwellings on site: 116 studio units, 140 one-bedroom units, 51 three-bedroom units and 9 four-bedroom multi-generation units. If there is one car park per unit at least 316 car parks plus visitor spaces will be required. If there is one car park per adult approximately 455 car parks will be required. The final number of parking spaces will be resolved in the detailed design.
Conclusion

This research project is an architecturally designed living community in response to the high density urbanism process. The aim of the project is to design a high density living area in a suburban environment which also provides a quality of living comparable with a traditional suburban area. The main issue of living in a high density area is lack of privacy. This project has achieved the aim of protecting the privacy of residents by master planning the apartment building’s layout. Visual intrusion has been reduced by spacing between buildings and offset windows. Insulation applied between walls, ceilings and floor plates will eliminate airborne noise from neighbours. Security is controlled by authorized access to each apartment and the underground parking area. Because there is secure access the outside areas may be shared and used for public activities and the children’s playground. To achieve a higher quality of living standard, all apartments face north and distances between buildings are calculated by the winter sun angle, allowing sunlight through the interior living area. All apartments are designed in a certain module, enhancing the construction speed on site, thus decreasing the cost of construction. Affordability starts with decreasing construction costs. Targeted groups are the younger generation who will be attracted to this area because of the convenient site location, future job opportunities and education resources. Each typology has been designed in a compact way to reduce waste areas and increase affordability.

This project will enhance the quality of suburban high density living, changing the negative impressions of current apartment buildings. It shows the advantages of a future densified development of Te Atatu. The density is five times more than currently and commercial businesses along the busy road will increase activities at ground level. The local economy will be stimulated by the increased population density and it will help Te Atatu Road become an attractive place because of the convenient daily life and sense of community.
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Appendix A: Presentation Drawings
Final presentation layout
Three bedroom + study

Four bedroom Multi-gen

Three bedroom + study

Lower level plan 1:100

Upper level plan 1:100

Ground level plan 1:100

Upper level plan 1:200

One bedroom floor plan 1:100

Four bedroom Multi-gen

Studio floor plan 1:100

Ground level plan 1:200

One bedroom floor plan 1:100

Three bedroom + study

Four bedroom Multi-gen
Ground level plan
Carpark level plan

Total number of parking space: 418
Ground level plan - zoom in
Long section
Exterior perspective
Exterior perspective
Exterior perspective
Apartment layout
Apartment layout
Interior perspective
Interior perspective
Interior perspective