FLEXIBLE FAMILY FRIENDLY:

Developing an
alternative high-density,
vertical housing option

Figure 0.0 - 3D overview sketch of Wynyard Quarter, Auckland and the building designed for this thesis, located within the chosen site

FLEXIBLE, FAMILY-FRIENDLY: DEVELOPING AN ALTERNATIVE
HIGH-DENSITY, VERTICAL HOUSING OPTION IN THE AUCKLAND CONTEXT

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Figure 0.1 - Wynyard Quarter Pump Station, a park located next to the chosen site for this thesis. The building designed as part of this thesis can be seen in the background

ABSTRACT

There are many benefits associated with living in low density, detached housing conditions. However, the increase in housing demands have prompted Auckland's surge of peripheral land to be developed into homes and the amplified cost of housing. Defined as urban sprawl, many of these housing types are standalone and built on private land, as the preferred type of housing. Studies have demonstrated that Auckland families' housing preference is the standalone dwelling.

The objective for this thesis is to gain a better understanding of urban sprawl, higher-density and vertical development conditions, and recognise the various family types and their associated living preferences. The collected data influences what is considered family-friendly housing attributes, which are reviewed in three different scales of urban, building and unit. This is with the aim to propose another housing option that considers and addresses a family's housing requirements, as an alternative to the standalone housing option. The resulting design proposes flexible, expanding and contracting units as a solution to provide families the freedom to adapt their living spaces to suit their requirements. By providing family-friendly, higher-density dwellings as a suitable option, this could offset the Auckland families' preference of the standalone house, which is currently contributing towards Auckland's sprawl.

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Figure 0.2 - New Zealand's preference for the standalone dwelling is evident as houses are built up in difficult, sloped sites such as hills, rather than up vertically in the form of higher-density, vertical towers. Photo captured in Wellington

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1.0 INTRODUCTION

This chapter covers the background behind the chosen thesis topic and the structure of the overall thesis. It also presents the scope and limitations of this thesis.

BACKGROUND

There are many sources, from research papers to newspaper articles, that have highlighted the growing environmental issues of urban sprawl in Auckland. Although it is the product of the individual's benefits, which comes with living in a private, detached house on its own piece of land, the mass demand and preference of this type of dwelling is considered unsustainable. This applies significantly to families. A family's various requirements and preferences, depending on their situation, influences their belief that the only suitable housing solution for raising their children is the standalone dwelling. Therefore, in the attempt to offset the demand for the detached dwelling, another form of housing, that doesn't contribute to sprawl and is suitable for families, needs to be developed. One aspect to minimise sprawl is to densify areas. This establishes the thesis question,

"Can the idea of high-density, vertical housing be revised to provide an alternative housing option that is suitable for families, as it addresses their various and evolving needs"

This research-led design thesis develops into a design-led thesis as it implements the various findings from guidance documents, investigates a suitable high-density, vertical housing option for families. The design phase tests various building iterations and concept of flexible design, to achieve an alternative housing solution to the typical standalone dwelling on its own

section of land.

The programmes chosen for the design encompasses the family requirements for a home. Programmes addressed in this thesis are not limited by the physical walls of the apartment unit but also engages with the surrounding urban fabric and building context. Therefore, the site, in Wynyard Quarter, Auckland, was chosen for its close proximity to the CBD and current urban transformation. What was originally an industrial area that facilitated harbour transport activities, is now in the process of being converted into a mixed-use area with various amenities, parks and outdoor spaces (Waterfront Auckland; Auckland City Council, 2014, p. 4). This provides a perfect backdrop for a family-friendly, high-density complex. The proposal of a family-friendly, high-density, vertical community in Auckland's CBD could offset the Auckland families' preference of the standalone house, which is currently contributing towards Auckland's sprawl.

The objectives for this thesis are

- (a) to understand urban sprawl, specifically in the Auckland context
- (b) to understand different family types, their housing preferences and varied requirements
- (c) to understand current high-density and high-rise conditions in Auckland
- (d) provide recommendations for family-friendly design in high-density context
- (e) explore housing design options for families in the high-density context

Figure 1.1 - Methodology diagram

METHODOLOGY

As a research-led design thesis, the initial stages of this process involves intensive research. To achieve the objective of better understanding urban sprawl, the literature review references various studies and philosophy behind the cause. Other sources such as existing surveys, studies, and guidance documents, were referenced to establish a family-friendly, high-density design

brief. Further design investigations lead to analysing case studies, which evoked the idea of flexible architectural design. The concept of flexible spaces plays a significant role in defining the form and progression of the design. From the conceptual stage, the process then morphs into a design-led research, as various iterations of building forms were explored, influenced by various considerations. The journey is then concluded with a critical reflection of the design and process.

SCOPE

The thesis begins by establishing various parameters that are considered to be family-friendly, high-density features, which are based on existing local and international data. Until the point of site specific exploration and development, the untethered concept of flexible, family-friendly, high-density, vertical development, can be applied within any context. The site chosen for this thesis is located within Wynyard Quarter, and therefore, all design explorations are limited to this context. The

scope of residential and attending to the various family preferences are both equally broad and varied. Therefore, due to time and resource limitations all aspects cannot be resolved or relies on assumptions or simplifications. Where possible, all considerations are mentioned, even though they may not be developed within this thesis.

Overall, this project is limited to the provisions expected from a Master of Architecture thesis.

THESIS STRUCTURE

The thesis is organised as follows:

Chapter two (literature review) - reviews relevant literature in order to set the foundation that this thesis is built on and to develop the design brief for the thesis. It examines and defines urban sprawl in order to establish a good understanding of the problem identified. This chapter reviews literature, examining the three scales of higher density, and outlines current proposed solutions found in family-friendly guidance documents. These are all examined in order to identify how architects internationally and locally have addressed family-friendly design in higher density conditions.

Chapter three (case studies) – further examines solutions regarding family-friendly high-density dwellings through four relevant case studies. Each case study has been chosen based on their family-friendly design merit, and to provide a range of international responses to the issue. While guidance documents examined in the literature review provide a prescriptive means of addressing family-friendly, high density dwelling, this analysis of case studies explores more descriptive and tangible solutions. The precedents explored in this chapter led to the concept of flexible unit design, which is explored further in the chapter four.

Chapter four (flexible design) – explores the concept of flexibility, which was influenced by the different types of families and their life stages, identified in the literature review, and two case studies that included flexible units. This chapter pushes the idea of flexibility further through a proposal to remove the need to obtain a building consent when expanding or contracting an apartment unit to accommodate

the changing needs of a family. Both horizontal and vertical unit expansion was examined in this chapter and this formed the basis of the developed design as one means to implement flexible design.

Chapter five (site analysis) – analyses the site chosen to test this thesis's design concept, which is located in Wynyard Quarter, an area near the Auckland CBD. The purpose of this chapter is to gain an extensive understanding of the site and associated elements in order to create a suitable high-density living environment for families.

Chapter six (design process and iterations) – develops the preliminary design, by implementing and exploring various conceptual design solutions within the site context. The purpose of this chapter is to develop the design further, by refining and finalising the building form, outdoor spaces, orientation and density levels.

Chapter seven (final design proposal) - describes the final proposal for family-friendly, vertical community development and elaborates on the details and elements of the design. Final drawings of the conceptual plans, sections, details and renders of the design are presented in this chapter of the thesis.

Chapter eight - summarises and reflects on the findings of this thesis. A critical analysis of the design and outcomes is conducted as part of this thesis conclusion. Recommended next steps and potential future research, extending this topic are also presented in this chapter of the thesis.

Figure 2.0 - Aerial view of Manurewa, a suburb in the South of Auckland, 25 minute drive and around 1 hour public transport ride away from the CBD. Capturing the different types of housing that make up Auckland City and its sprawl

2.0 LITERATURE REVIEW

One negative result of the current housing construction in Auckland is urban sprawl. A contributing factor to Auckland's urban sprawl is many families' desire to live in a detached dwelling and the comprehensive rejection of higher-density dwellings. Therefore, this chapter reviews and evaluates relevant literature, survey findings from Auckland families, and current guidance documents and standards. These resources provide a good understanding of the current high-density standards, different family-type households and their priorities (both those living in low and high density housing). The aim of this chapter is to understand current thinking about, family-friendly housing and family-friendly high-density housing.

This chapter is divided into three sections. The first section (2.1) aims to understand the overarching problem of urban sprawl, and defining high density and high rise. The second section (2.2) refines the targeted problem of family housing preferences, reviews information describing Auckland families currently in high-density conditions and recognise the various types of family households. The third section (2.3) reviews and evaluates possible solutions presented in guidance documents.

The conclusions of this chapter will identify the key issues found in the literature that prevent and assist families living in higher density dwellings within the CBD.

2.1 TO SPRAWL OR NOT TO SPRAWL

Urban sprawl can be described as the unplanned, uncontrolled, and uncoordinated spread of an urban area, where houses are associated with terms like "single use and isolation" (Arbury, 2009, p. 15). There are many contributing factors to urban sprawl, including the mass ownership of vehicles, which enabled the possibility of numerous low density, sprawling housing developments (2009, p. 19). A further contributing factor is the dominant preferences for the standalone, private dwelling (2009, p. 17).

"Standalone dwelling" was identified in a 2015 Auckland survey, as the second most important factor that families consider when looking for a home (Akehurst & Yeoman, 2015, p. 23). From the individual perspective, there are many benefits to owning a suburban standalone dwelling. These factors include the provision of a private space that is located far away from the polluted and populated city centres (Arbury, 2009, p. 10). Unfortunately, the popularity of the desire for seclusion is ecologically unsustainable. Curran-Cournane, Vaughan, Memon and Fredrickson have recognised the negative impact urban sprawl has on Auckland farmlands with fertile soil, as potential land for growing food is sold to become housing developments (2013, p. 17). Increased emissions from commuting, and escalated costs to provide infrastructural development are also other consequences of sprawl (Arbury,

2009, p. 16). Although urban sprawl has many negative consequences, it is beneficial from the individual's perspective.

To minimise the depletion of land, a more efficient way of building and land usage should be explored. This can be accomplished by promoting higher-density developments, or by implementing the concept of a compact city. The process of intensifying existing developments (from low density to high density) and the provision of various mixed-use developments to enable self-sufficiency within the area are important to achieve a successful compact city (Arbury, 2009, p. 17). However, for those who are accustomed to low-density dwellings, are likely to reject the proposition of living in high density conditions (Carroll, Witten, & Kearns, 2011, p. 362).

This housing situation corresponds with the "Tragedy of the Commons", where "we want the maximum good per person; but what is good?" (Hardin, 1968, p. 1244). In this scenario, to one person it is living in a detached dwelling, privately situated on their own parcel of land. To the collective, it is the compact city, consisting of conveniently designed high-density, vertical communities with minimum traffic congestion and maximum land for the production of food. Although the radical execution of either options are undesirable, an equal courtesy for both the individual's rights and standards at the city scale, need to be considered to progress positively.

Hardin discusses one solution to the

commons as “mutual coercion” (Hardin, 1968, p. 1247). Not to prohibit further development of low-density dwellings, but instead, positively influence the idea of living in high density dwellings. Proactively addressing higher-density family-friendly housing in Auckland can be part of the solution. “City Centre Master Plan” was developed by Auckland Council to facilitate an inclusive and child-friendly city. This involves the implementation of high quality spaces and affordable housing for families (2012, p. 54). Based on a study conducted by the City of New Westminster, funding considerations should not play a significant obstacle for achieving Auckland Council's family higher-density housing goals. The study concluded that there is no significant difference on the return on cost if the development of single bedroom units are increased to two and three bedroom units as building costs are reduced by the decrease

of expensive rooms (i.e. kitchens) and increase of cheaper rooms (i.e. bedrooms), refer to figure 2.1 (2016, p. 8). However, the current high-density living conditions of many families conclude otherwise. This can be due to the main issues associated with developing larger units (2-3 bedroom). These include the challenges of selling three bedroom units when compared to studios or one bedroom units, and the lower profit margin per square metre for larger units. Therefore, implementing incentives or requirements for developers to increase the number of larger units in their developments can be an action towards accommodating more families in high-density dwellings.

Further assessment of current higher density dwelling conditions are conducted to identify why it isn't currently a housing preference for Auckland families.

Figure 2.1 - Comparison of two one-bedroom unit and one two-bedroom unit, the number of "expensive" and "cheap" rooms to build

HIGH DENSITY AND HIGH-RISE

There is a common misconception around the topic of high density and high rise, where the two entities are perceived to be the same thing. However, it is important to define the differences, where rise is only one parameter of density. Separating the differences between density and rise is a fundamental step in understanding the varying implications they have on occupants. Identifying the different effects associated with rise and density can ensure these are appropriately addressed and managed in accordance with families' preferences.

Towers defines housing density as the number of occupants or dwellings per square metre of land, where the greater the occupancy numbers per area, the greater the density (2002, p. 147). The New Zealand Department of Internal Affairs categorise density into three groups. Low density, or "single family homes on individual sections", is defined as 10-25 dwellings per hectare (10,000m²), medium density or "townhouses and flats", as 50-100 dwellings per hectare, and high density, or "apartment block", as 125-250+ dwellings per hectare (2008).

Rise is defined by the number of storeys high, and is therefore, only a vertical dimension. According to the "medium-density housing" study conducted by BRANZ, the definition of mid-rise is identified as dwellings with a height between ten to twenty-five metres (three to eight storeys tall) (BRANZ, 2018, p. 1). With this definition, it can be deduced that low-rise is considered as one to two storeys tall and high-rise buildings have a height exceeding twenty-five metres or nine storeys and above.

The greatest issue associated with most apartment living conditions is

Figure 2.2 - Typical floor plan of the luxury Auckland apartment

Scale - 1:100 @A3

apartment "Shangri La", which only has one unit per storey

privacy due to crowding, which leads to a reduced sense of control and limited social support (Gifford, 2007, p. 6). This high density problem has an immense impact on parents physically and psychologically, as they deal with issues such as noise from their children and neighbouring gazes by keeping windows closed and blinds shut (Andrews, 2018). Although high rise is usually associated with high density, there are examples that defy this assumption, a local example is the luxury apartment "Shangri La" in Auckland. The unique 17-storey apartment tower on a 3048m² area of land, contains only 16 apartment units, with one unit per storey as indicated in Figure 2.2 (Gibson, 2015). Therefore, the "Shangri La" is considered both high rise and medium density, with 52.49 dwellings per hectare. Although this solution is one means of addressing crowding in apartment buildings and other issues regarding privacy, another problem arises in terms of affordability, where the rateable value (RV) of the 14th floor Shangri La apartment unit is \$3,750,000, with a floor area of 243m² (OneRoof, 2018). Therefore, a balanced level of density needs to be considered when designing family-friendly apartments. Not too high where privacy is compromised, but not too low where the unit becomes unaffordable.

Jan Gehl states that beyond the height of five storeys, the human scale and social interaction with the earth is disconnected and becomes associated with airspace (2010, p. 42). This idea runs in parallel with the idea that occupying high-rise dwellings is isolating. Other studies show negative impacts on children occupying dwellings above five storeys, such as delayed development in infants compared to infants occupying dwellings four storeys and under (Gifford, 2007, p. 10). Past assessments made regarding New Zealand families in high-rise dwellings

LOW RISE, LOW DENSITY

PRIVACY: ● ● ● ● ●
 SEPERATION: ● ● ● ● ●
 SAFETY (FROM FALLING): ● ● ● ● ●
 QUALITY OF OUTDOOR SPACE: ● ● ● ● ●

LOW RISE, MEDIUM DENSITY

PRIVACY: ● ● ● ● ○
 SEPERATION: ● ● ● ● ○
 SAFETY (FROM FALLING): ● ● ● ● ○
 QUALITY OF OUTDOOR SPACE: ● ● ● ● ○

MEDIUM RISE, MEDIUM DENSITY

PRIVACY: ● ● ● ○ ○
 SEPERATION: ● ● ● ○ ○
 SAFETY (FROM FALLING): ● ● ● ○ ○
 QUALITY OF OUTDOOR SPACE: ● ● ● ○ ○

MEDIUM RISE, HIGH DENSITY

PRIVACY: ● ● ○ ○ ○
 SEPERATION: ● ● ○ ○ ○
 SAFETY (FROM FALLING): ● ● ● ○ ○
 QUALITY OF OUTDOOR SPACE: ● ● ○ ○ ○

HIGH RISE, MEDIUM DENSITY

PRIVACY: ● ● ● ○ ○
 SEPERATION: ● ● ● ● ○
 SAFETY (FROM FALLING): ● ● ○ ○ ○
 QUALITY OF OUTDOOR SPACE: ● ○ ○ ○ ○

HIGH DENSITY, HIGH RISE

PRIVACY: ● ○ ○ ○ ○
 SEPERATION: ● ● ○ ○ ○
 SAFETY (FROM FALLING): ● ● ○ ○ ○
 QUALITY OF OUTDOOR SPACE: ● ○ ○ ○ ○

Figure 2.3 - A basic diagram depicting the differences between density and rise, where various qualities are compared

have all concluded that “there is no evidence such living environments are suitable for children” (Carroll, Witten, & Kearns, 2011, p. 355).

In order to address the issues identified beyond five storeys, another means of facilitating social interaction must be explored if occupants cannot rely on earth’s ground. In an article that is critical of occupying high-rise dwellings, solutions are offered including providing greater amenities “local food markets, parks, and sports halls” and “sky gardens and rooftop running tracks” (Turner & Wigfield, 2017). The literature indicates that reduction in high-rise isolation can be achieved through purposely designing social interaction spaces. Research has identified the benefits of nature and trees to enable social interaction and attracting various ages and groups of people (Gifford, 2007, p. 10). The implementation of vertical public green spaces has been a solution for countries with greater population increases and scarcer natural environments, such as Singapore (Housing New Zealand Corporation, 2018). To support the promotion for higher-rise buildings and facilitate the increase in density, BRANZ have outlined a list of building design considerations, which is typically not

applicable in a low-rise context. A few of these factors include, planning controls, attention to greater wind loads and direction, addressing safety and security of occupants, acoustic and fire design obligations of inter-tenancy walls/floors, shadows casting on adjacent sites and public spaces, and blocking existing views (BRANZ, 2018, pp. 1-2).

In addition to the design struggles associated with family-friendly high-density developments, there are also intangible conflicts. Developers of Auckland apartments have confirmed that families have not been considered as potential occupants and that apartments are only suitable for child-absent households (Carroll, Witten, & Kearns, 2011, p. 354). Furthermore, there are negative perceptions associated with developers, where families believe they are “greedy” and only produce designs with a profit over quality focus (Research First, 2015, p. 23). To break the cycle (figure 2.4) that insists high-density is an unsuitable option for families, the exploration of Auckland’s current high density conditions (i.e. strengths and weaknesses) and family preferences in housing features is conducted.

Figure 2.4 - Diagram of the problem, how lack of housing options and the individual mindset contributes to urban sprawl

2.2 AUCKLAND FAMILIES' APPROACH TO HOUSING CHOICES

Although it has been established that high-density dwellings in the city were not intended for families, Carroll, Witten and Kearns found that families do occupy apartments. Unfortunately, it was also identified that most of these families did not want to live in apartments but rather settled for this option due to various circumstances. "Housing Intensification in Auckland, New Zealand" found numerous reasons such as location, convenience to amenities, and security, to live in an apartment, but the main reason why these families occupy apartments is affordability (2011, p. 353). These findings can also be compared and contrasted with a different study conducted by Akehurst and Yeoman, on behalf of Auckland Council (2015, p. 14). The two-part survey took responses from 824 families with children, to establish a quantitative understanding of housing features that people consider when deciding where to live (2015, p. 54). The following design features (ranked from highest priority to lower), were identified to be the most important aspects Auckland families consider when deciding where to live (2015, pp. 22-26):

1. Safe neighbourhood
2. Standalone dwelling
3. Preferred school zone
4. Have a large yard
5. Size related aspects
6. Located near a public sports field

A safe neighbourhood was considered the top priority, which aligns with the families living in apartments as they

believe "restricted entry to most apartment blocks also afforded a sense of security some felt was lacking in suburban homes." (Carroll, Witten, & Kearns, 2011, p. 363). This was especially significant for single parents. On the contrary, families living in apartments do have neighbouring concerns such as busy roads and stranger danger.

Outdoor space was considered to be the fourth most important design feature, which is also supported by the families living in the apartments as "all participants considered a backyard to be part of the 'ideal' family environment" (Carroll, Witten, & Kearns, 2011, p. 361). However, this aspect was more difficult to meet within the current high rise context. Due to the vertical displacement that comes with living in a high rise building, the provision of a large, shared outdoor space was unlikely to be visible from the occupant's unit, and therefore, prevents supervision. This reduces the chance for children to play outside, as indicated in a different Auckland Council study and in figure 2.5 (2012, p. 54). Although it is indicated as a positive factor, 43% of children in high-rise dwellings played in the park also means over 50% didn't. A common form of a private outdoor space for apartment units are balconies. However, anxieties were identified by a high-density occupant who did not utilise their balcony, due to the fear of their children falling, "I'm on the fifth floor, which is quite high so basically I rarely use it [the balcony] because of my children. I don't want them out there whatsoever so basically I don't use it" (2011, p. 361). Therefore, the provision of a space did not guarantee

a family's requirements were met. The outdoor space is an important aspect to achieve, as the lack of this space was identified to be the main reason for why these families saw apartments as a short-term accommodation solution (2011, p. 361).

The all-encompassing factor of a family's housing decision was identified in the second part of the Akehurst and Yeoman survey. This is the cost and affordability of the dwelling (Akehurst and Yeoman, 2015, p. 49). This aligns with the beliefs held by the families from Carroll, Witten and Kearns' study (2011, p. 353). When it comes to buying or renting a home, apartments with small units are more affordable when compared to houses (Page, 2007, p. 32). Families with difficult financial situations have no other option but to occupy cheap, small and poorly designed high-density dwellings (Carroll, Witten, & Kearns, 2011, p. 355). Families that are facing financial difficulties typically live in high-density dwellings with problems such as insufficient indoor and storage space, and the improbability of a private and adequately sized outdoor play space for the children.

Although concerns were identified with regard to higher density dwellings, multiple studies confirmed occupants were content with their higher density homes (CityScope Consultants, 2011). This is especially the case for families that chose to live in high-density conditions.

One family who was financially comfortable, decided to live in higher density dwellings due to a desire to relocate to a location with better views

POSITIVE FACTORS:

NEGATIVE FACTORS:

Figure 2.5 - Positive and negative statements made by children and families living in high-density, high-rise dwellings
Auckland Council. 2012. City Centre Masterplan 2012.
Auckland: Auckland Council.

and convenient access to the city, even though it meant downsizing from their original living conditions, “big house in Mt Albert with five bedrooms, three bathrooms and a pool... into a two-bedroom, 100sq m apartment... (with a) 50m² deck” (Metro, 2017). Unlike the families from Carroll, Witten and Kearns’ study, this family speaks primarily positively with regard to their change in lifestyle. Benefits including the reduction in cleaning time and dependency on cars, and time saved from the omission of garden maintenance.

Another stand-alone experienced family of three living in a 90m², Wellington central apartment unit, also saw predominantly positive aspects to living in higher density conditions. Their only significant compromise for occupying an apartment was the lack of a private backyard, which was easily addressed by the close proximity of a local park and beach (Didovich, 2018).

Both of these families mention their dogs, who also live with them in their apartment units. This contrasts with the information identified in figure 2.5,

where a high percentage of children living in high density conditions disliked not being allowed to have pets. The reduced number of negative aspects expressed by families who are financially comfortable, identifies that the families who are struggling with high density living, are families who are financially struggling. This was also the conclusion of another research paper, which identified “High rises are more satisfactory for residents when they are more expensive, located in better neighbourhoods, and residents chose to live in them” (Gifford, 2007, p. 13).

The combination of information from the general Auckland families and families living in high density, has helped define what aspects should be considered, family-friendly features (refer to figure 2.6).

Families are wide-ranging, consisting of various types and sizes. Therefore, the established list of important family-friendly features can be only be applied broadly. To obtain an understanding of the clients and to provide better designs for them, an exploration of various family types are explored.

Affordability

Facilitate neighbourly
interaction

Provision of a
well-designed
outdoor space

Provision of a
safe and secure
home

Larger sized units
with more bedrooms

Designed to isolate
noise pollution
(internal and external)

Provision of more
storage space

Enable good quality,
naturally lit and
ventilated interior
without compromise

Within proximity
to a school

Within proximity
to a shops and
other amenities

Within proximity to
green spaces and parks

Provide a private but
not isolating home

Figure 2.6 - Various family-friendly housing features identified from an Auckland-specific context

IDENTIFYING DIFFERENT FAMILY PHASES

The differentiation of numerous family stages are important to recognise as this also contributes a significant part in defining a family's housing decision (Research First, 2015, p. 12). Four different family stages, pre-family, young family, older family and mature family, have been identified by an Auckland Council report. One family type that wasn't mentioned was a household that consists of various family stages, also known as the multi-generational family household. As indicated in figure 2.7, the importance of family-friendly features fluctuate depending on the family's stage of life. More specifically, the importance of family-friendly features is largely defined by the children.

Single or child-less couples are recognised as the pre-family stage (Research First, 2015, p. 13). Their

circumstances enable them to put their preferences first. This is generally a home that is conveniently located within proximity to their place of study or work, amenities such as cafes, gyms and stores, regardless of the dwelling's internal and outdoor spaces. However, when they intend to have their first child, transitioning from pre-family to young family, a change in their living situation to a "real house" is expected (Research First, 2015, p. 13). This is due to a pre-family's perception of an apartment being a short-term accommodation solution.

The alteration in accommodation options can also be associated with the change in hierarchy of whose needs comes first. The introduction of a young child or children defines a young family, with concerns and decisions revolving around the child (Research First, 2015, p. 14). Therefore, family-friendly features, such as an affordable, big property near a good school

Figure 2.7 - Graph showing the various stages/types of family households and the level of family-friendly requirements

zone, cafes, restaurants, shopping centres, and near friends and family are considered very important. A sense of community is desirable but the number one priority is the safety of their children. Therefore, urban safety concerns, i.e. pollution and busy roads, are avoided. Enabling parents to supervise their children when they are outside of their homes is crucial. According to these considerations, young families usually conclude that the only appropriate dwelling for them is one with a large, private backyard (Research First, 2015, p. 14).

As the children grow older and become more independent, the focus on their needs is reduced. When the children reach high-school age, the household is defined as an older family (Research First, 2015, p. 15). Concerns revolve around how children will attend school independently, rather than being within the desired school zone.

The household is recognised as the mature family stage when the children have grown up and moved out (Research First, 2015, p. 15). There are conflicting beliefs around the amount of space required for a mature family. Although the household downsizes in the number of members, some argue for the additional space for play when the grandchildren visit or sleep over. According to a recent Auckland Council study, constantly moving from home to home has a negative impact on seniors due to the difficulty of establishing connection, which results in isolation

and anxieties with safety and security.

A household that is becoming more common is the multigenerational family, when the children have grown up but due to various circumstances, does not move out. According to Lysnar and Dupuis the various circumstances include immigrated (Chinese, Polynesian, Pacific) and local (Māori) cultural traditions of families staying together, the global economic crisis impacting self-sufficiency, housing shortage and high cost of living (2015, p. 20). Therefore, due to the increased population and immigration numbers, and the high demand for housing and affordable housing in Auckland, it is becoming more common to find households with three or more generations under the same roof. Lysnar and Dupuis (2015, p. 23) also identify the scarcity of dwellings designed to support multi-generational households. The lack of housing options that support the multi-generational family has resulted in the overcrowding of households. Auckland has contributed to half of the multigenerational family dwellings recorded in New Zealand (2015, p. 23). Therefore, there is a requirement for further exploration of higher-density housing to support larger number and varied types of occupants, as a solution for the multi-generational household. As a starting point, the exploration of various local and international guidance documents are reviewed to further grasp the concept of family-friendly design.

City of Vancouver : Urban
Auckland Design Manual : Urban

Scale - 1:10,000 @A4

Figure 2.8 - Urban guidance for proximity of family-friendly sites to family-friendly amenities

2.3 GUIDANCE DOCUMENTS

As part of their plan to encourage more families into their CBD, various international councils, including Auckland, Toronto, and Vancouver, have developed guidance documents and recommendations around building high-density, family-friendly dwellings. These references are a starting point as methods for achieving the defined high-density, family-friendly features. They are divided into three categories, urban, building and unit scale.

Safe neighbourhood:

Although a majority of the Auckland families identified "safe neighbourhood" as the most important housing feature, "Strategies with Kids and Information for Parents" or SKIP (2018) found that the design of Auckland's city centre did not consider families or children. SKIP, with the help of Plunket, conducted a series of interviews with parents within the Auckland CBD. The interview identified both the current issues within the city neighbourhood and also design and conceptual solutions to resolve the mentioned issues. These resolutions consider both the children, by suggesting more child-friendly play areas for a wide range of age groups and situations (i.e. quietly, dynamically, individually or in a group, controlled or freely), and the parents, with the provisions of more comfortable seating for resting, feeding their baby and changing their diapers. Another issue identified was safety concerns with children around cars and roads. The

development of new family-friendly buildings, such as the home, schools, parks and day-cares, should be built away from streets to enable children to develop a greater independency. For established urban settings, the alteration of existing roads to share spaces and prioritising pathways are means to provide a safer neighbourhood. According to the City of Toronto, "a public realm that meets the needs of children also accommodates the population as a whole" (2017, p. 9). This suggests the benefits of implementing family-friendly urban features to the CBD is not only limited to families within the city, but also the general public.

Proximity to amenities:

Another means of promoting independency of children living in the CBD is to develop high-density homes within close proximity to family-friendly amenities. This is reinforced by the findings of the Auckland family housing preference survey, which favoured housing within a preferred school zone and public sports field. To encourage the implementation of this preference, various local and international councils have established various maximum distances between the home and family-friendly amenities (City of Vancouver, 1992, p. 1). These are summarised in figure 2.8. Therefore, when considering a location to develop a family-friendly high-density building, the existing range of amenities within an 800 metre radius should be assessed.

Figure 2.9 - Design to enable supervision, child friendly playgrounds with spaces for parents to sit and rest.

Number of larger units:

Another important feature identified in the results of the housing preference survey was the number of bedroom and bathroom, or size of a dwelling. The dissatisfaction of families living in small apartment units influenced some international councils (e.g. Toronto) to develop recommendations for all new high density developments to include a minimum number of larger units. For Toronto, a 25% minimum of units are to be large (refer to figure 2.11), namely a minimum of 10% three bedrooms and 15% two bedrooms (2017, p. 30).

Although it is anticipated for families to occupy the larger units, there is no certainty that this is guaranteed. A Vancouver based post occupancy study on the False North Creek (FNC) high density development, concluded that some of their units were "under-utilised" (Hofer, 2008, p. 76). The study identified various respondents' use of their second bedroom as an office or additional storage. Thus, the maximum capacity was deemed by the study to have not been met. However, this finding is conflicting as another conclusion from the study was the inadequate size and quantity of amenities, such as day-cares and schools, indicating insufficient facilities for children, despite the lower than capacity number of families (2008, p. 83). Therefore, both capacity and proximity must be considered when

locating and designing family-friendly high density amenities. Additionally, the perception of "underutilisation" requires further investigation as this action could be misdiagnosed, and instead it should be considered futureproofing. The additional bedroom ensures pre-families have enough space for when they want to have a child, without having to move out to a larger dwelling. This is an important consideration as most families who anticipated leaving FCN within the next three years, attributed their decisions to the insufficiently sized and inflexible design of the unit floor area (2008, p. 82). Therefore, an apartment unit's inability to accommodate a family's changing need, greatly affects the retention rate of families in higher-density dwellings. This should be addressed when considering the design of a high-density family-friendly housing development.

Quality of space:

As established earlier, natural ventilation and light were commonly compromised for privacy in high density dwellings (Andrews, 2018). Therefore, the orientation and coordination of various apartment units needs to be considered to enable privacy and good quality spaces. The need for spaces to be naturally ventilated and lit was recognised by Auckland Council as their high-density guidance document

Figure 2.10 - Recommended minimum number of large units within a family-friendly building development

Figure 2.11 - Recommendations from Auckland guidance document, maximum depths of rooms depending on the number and location of windows

Figure 2.12 - Building guidance for size of units according to bedroom numbers. Scale - 1:100 @A3

specifies a minimum unit depth, depending on the number and location of exterior windows (figure 2.12).

Unit sizes:

Another significant housing preference consideration is the size of the unit spaces. This was also confirmed by an Auckland family-friendly housing article, which stated that “the total and per-room floor space of a given house is the primary consideration for child-friendly apartment design” (Toby and Matthew, 2016). This is typically influenced by the number of bedrooms in the unit. Figure 2.13 outlines two minimum floor area recommendations from different guidance documents. The City of Toronto document is specifically tailored to family-friendly considerations and therefore, recommends a larger floor area per number of bedrooms. However, neither of the documents come close to the average size of a New Zealand house, at 182m² (Stats NZ, 2016). More specifically, three bedroom houses in Auckland are found to have a greater floor area average at 205m² (Goodyear and Fabian, 2014, p. 14). Due to the various and conflicting recommendations around total unit sizes, a better process may be to establish the adequate size of rooms depending on the use. Space for play, large family gatherings, facilitating various levels of supervision, and number of storage options need to be considered when designing the internal

area of the unit. These have all been acknowledged and laid out in figure 2.14. A compare and contrast exercise was conducted between two guidance documents and a certification system, Lifemark, to establish good benchmarks for each room in terms of sizes and layouts. Lifemark is an accredited star rating system that certifies dwellings based on their achievement of various “life time” design features or the ability to accommodate a diverse range of occupants (Lifetime Design Limited, 2012, p. 1). The concept of “life time” design aspects includes proposing a minimum size for rooms to futureproof spaces that may include the use of a wheelchair (2012, p. 3). Having collected all the various data regarding the design of units, the suitable option from each category was chosen. Most of the options were chosen if it wasn't covered in the other groups. Other decisions were made based on which had the largest floor area minimum.

Storage:

The provision of adequate storage space is critical when establishing family-friendly units. This was recognised by a family in the Carroll, Witten and Kearns' study, who paid “\$120 a month for storage off-site” as the storage within their home was insufficient (2011, p. 361). Therefore, a greater number of storage options need to be considered. Minimum dimensions for storage space have been outlined in figure 2.14.

STORAGE, ENTRY AND CIRCULATION

Bedroom wardrobes should be a minimum 600mm deep internally and 2m wide

2 bedroom storage (3 - 4 people) 8m³

3+ bedroom storage (5-6 people) 10m³

LAUNDRY

At least 1050mm clearance in front of fixed benches and appliances

KITCHEN

A 1.2m access space in front of the base kitchen units. This can overlap with living or dining room circulation space to be 700mm.

DINING

Access around a dining table should be a minimum 600-700mm

300mm per occupant, 1.2m for 2 bedroom unit and 1.8m for three bedroom unit.

Minimum area 2.5m², length of 1.4m, dept of 450mm and 900mm in front of shelving

A minimum entry area of 4m² and a minimum width of 1.5m

Room: minimum area of 3.4m² with a minimum depth of 1.9m

Closet: minimum depth of 1.2m and a minimum area of 2.2m²

Minimum 9m² for a kitchen area

A minimum area of 9m² to allow for communal eating

Entrance landing area measuring 1200mm x 1200mm

An entrance door with a minimum clear opening width of 810mm

Corridors or passageways shall provide a minimum clear width of 1050mm

The laundry space or room shall be large enough to provide at least 1050/1200/1500mm clearance provided in front of fixed benches and appliances

The kitchen space is located next to the dining area. The kitchen space includes at least a 1200mm clearance provided in front of fixed benches, major appliances and fittings which extends to a 1500mm turning circle

BEDROOM

Play area (in all bedroom, excluding master bedroom)

Preschool: minimum 1.0m² per bedroom

Elementary and teenage: minimum 1.5m² per bedroom

A minimum of 12m² to allow secondary furniture, flexibility and circulation

BATHROOM

LOUNGE

25-30m² Living room space (considering 800mm perimeter for circulation only)

Others to be no smaller than 8m²

At least one bedroom should be a minimum of 11m², not including the closet.

A minimum area of 16.5m² for standard sofa, chair, coffee table and storage cabinet

Plus 2mx3m flexible play and storage space

A standard single bed (900mm x 1900mm) can fit with a minimum 800mm clear space available around one side and the foot and a clear minimum 800mm wide path from the door to the side of the bed

A standard double bed (1350mm x 1900mm) can fit with a minimum 800-900mm clear space available around both sides and the foot and a clear minimum 800-900mm wide path from the door to the two sides which also includes a 1500mm turning circle

A minimum 800mm clear space beside the toilet and a centre line of the toilet pan that is 450mm from the wall. A level entry shower recess with minimum dimensions of 1200x1200mm, drainage for the shower recess located in the corner of the room, a clear space that provides for a 1500mm turning circle and 800mm clear space beside a shower seat.

High |—————| Level of Privacy |—————| Low

Scale - 1:100 @A3

Figure 2.14 - Diagram of the programme for the family-friendly high-density housing design

IMPLEMENTING THE GUIDANCE

Based on the collected data in the literature review, an architectural programme was established. Figure 2.15 identifies all the spaces that need to be included in the family-friendly, high-rise building and their relationships with each other, both physical and visual connections. The diagram is arranged with rooms that require most privacy to least privacy, from left to right. Establishing this early will help address privacy concerns, for both visual and audio.

Various iterations of apartment unit designs were developed as a exercise to better understand the recommended guidelines and trial the programme. These can be found in Appendix A. One conclusion obtained from the exercise was the total area of the unit was always significantly higher than the recommended minimum unit size, i.e. two bedroom units should be a minimum of 75-90m², the iterations achieved 90-100m² when rooms were correctly sized.

CHAPTER CONCLUSION

Literature reviewed identified apartments as less suitable for families than the detached suburban house. This conclusion suggests a need to re-evaluate the original standards of an apartment if family-friendly, higher density living is to be viable.

Consequently, this thesis will propose a design which addresses the areas of concern identified in the literature review. It will focus on private, adequately sized dwellings, with communal facilities that facilitate supervision between parents and children, with links also to urban amenities, such as schools, supermarkets and parks.

Family-friendly dwellings have three difference scales with the specific needs as identified below (refer to table 1).

These features inform the selection of the four case studies analysed in the next chapter.

Urban:	Building:	Unit:
<ul style="list-style-type: none"> - Facilitate convenient access to family-friendly amenities such as schools, day-care, supermarket, and parks. Amenities considered will be those that are within 10m. - Provision of a safe neighbourhood, away from cars and roads. 	<ul style="list-style-type: none"> - Achieve affordability by design to facilitate co-housing and sharing amenities such as the laundry - Density and therefore, control of occupant numbers with the arrangement and number of units per level - Offer more larger units (i.e. two and three bedroom units) - Building organised to facilitate various levels of supervision between spaces 	<ul style="list-style-type: none"> - Privacy between units - Quality outdoor space, in terms of size and barrier, that is within close proximity to the unit - Quality indoor space: storage, size of space, and orientation of rooms - Interior design to facilitate supervision between rooms

Table 1 - Conclusions of family-friendly findings from the literature review

Figure 3.0 - Exterior of the Arlington Housing Development, one of the case studies discussed in this chapter

3.0 CASE STUDIES

This chapter presents and analyses four different case studies, that range in their geographic location, densities and height. The criteria used to select the four case studies were:

- Location
- Family-friendly urban considerations, such as proximity to public transports, parks and amenities
- Family-friendly building features, such as larger unit sizes (three bedroom units), communal spaces and facilities
- Family-friendly interior unit features, such as storage spaces, supervision facilitating layouts and space for play

The case studies are:

1. Ramona Apartments - 1550 NW 14TH AVE, Portland, OR 97209, USA (2011)
2. Kent Vale (Block K) - 107 Clementi Road, Singapore, 129790 (2012)
3. Nightingale Housing - 1/6 Florence St, Brunswick VIC 3056, Australia (2017)
4. Arlington Apartments - Arlington St, Mount Cook, Wellington 6011 (2019)

The case studies have been analysed at three different scales: namely the urban, building and apartment unit, in order to identify architectural strategies and techniques to inform my design proposal, which is developed and described in chapters six and seven.

REDACTED

Figure 3.1 - Entrance to Ramona Apartments

3.1 RAMONA APARTMENTS

1550 NW 14TH AVE, PORTLAND, OR 97209, USA

The Ramona apartments (Portland) are a high-density housing complex design especially for families. A mix of architectural and non-architectural methods are proposed to cater for families. One non-architectural method is the implementation of restrictions that minimise the number of student occupants. Additionally, the apartments also require a minimum occupancy number based on the number of bedrooms in the unit (Pinnacle, 2018).

URBAN SCALE

The site is located in a mixed zone area of commercial, industrial and residential uses. Google maps, via street view mode, suggests that the area has numerous apartment developments. Within a 10 minute walking radius from the site are three different supermarkets. Because the site is not located in an area with many other family-friendly amenities, the development provides on-site pre-school, outdoor play area and an indoor communal area. In addition to the external courtyard, there is also The Fields Park, which is a 5 minute walk away from the site.

Nearby is a Montessori School, which facilitates toddler, primary

elementary schools in one location. There are also recreational buildings, such as rock climbing and gyms, which are located within the area. Local public transport includes trams.

The most significant challenge for families living in Ramona Apartment at the urban scale appears to be the distance to schools. The distant from the nearest Primary school (19 minute walk), High school (22 minute walk) and especially, an Intermediate school (22 minute car ride or over an hour via public transport). The high number of residential buildings, which is continuously growing (as indicated through the various construction sites from Google Maps), is likely to encourage additional amenities, such as day-cares and recreational buildings.

Informing the design:

A key takeaway from this study in the urban context is the proposal of on-site amenities if it is lacking in the surrounding area. The provision of shared amenities on the ground floor (i.e. a day-care, which could not be identified within the urban context of the site) enables occupants of the building, easy access to these facilities.

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Figure 3.2 - Urban analysis of the Ramona apartments. Mapping the surrounding amenities

Scale - 1:200 @A3

- Laundry
- Balcony
- Storage
- One Bedroom
- Two Bedrooms
- Three Bedrooms
- Four Bedrooms

Figure 3.3 - Building analysis of the Ramona apartments. Identifying the different range of apartment unit sizes - typical building floor plan

BUILDING SCALE

The 21,438m² Ramona apartment complex offers 139 units in total (i.e. x70 three bedroom units, x60 two bedroom units and x9 one bedroom units) and, since it is recognised as a family-focused development, it has a significant number of large (two to three bedrooms) units at 94%. This can be broken down into 43% two bedroom units and 51% being three bedroom units.

The size of the dwelling depends on bedroom sizes. Two bedroom units with one bathroom can range from 81m² to 87m², when one bedroom is internal only one occupant is required to live there (Pinnacle, 2018). Larger units with three bedrooms vary between 100m² to 115m², when one of the three bedrooms is internal only two occupants are required (Pinnacle, 2018). These unit sizes align closely to the recommendations made in the guidance documents, and therefore, reinforces these numbers.

Ramona Apartments compensates for the limited number of private outdoor spaces by providing a centralised 700m²

outdoor courtyard. This is oriented so that many of the units and spaces, including the communal laundry rooms, have a line of sight to the central courtyard.

Although some apartments are provided with their own private washing machine and dryer, the Ramona apartments also provides them within a shared laundry room. These consist of three shared washing machine and dryers per floor. The provision of shared laundry machines are typically at a higher quality or industrial when compared to private-unit machines. These can therefore facilitate larger amounts of laundry, typical with families.

There are two elevators in this six storey apartment. This meets and solidifies the recommendations made in the City of Vancouver guidelines.

Informing the design:

Building features that can be translated into the preliminary design for this thesis are the provision of shared amenities, including a communal outdoor space that is visible from various units. This was successfully achieved by the shape of building and orientations of units.

UNIT SCALE

The units within the Ramona Apartments are a mix of those with single and corner aspects. The depth of an apartment unit that is single aspect is around 9m, which exceeds the maximum allowed depth to achieve good natural sunlight, as advised by the Auckland Guidelines (i.e. under 8 metres). While apartments with corner aspect typically have depths ranging between 9m and 11m. Quality of access to natural light is further questioned for the single aspect units as majority of these large units consists of one internal bedroom. Furthermore, the option of second-hand natural lighting, via internal windows, is also not provided into these bedrooms. However, this isn't necessarily identified as only a weakness as this bedroom could be used for additional storage space or facilitate a parent's ability to sleep if they work night shifts.

There are a mix of units that either have a private laundry space, or no laundry space in their units and therefore, rely on the communal laundry facilities. The private washing machines are typically located in a 1m² closet, which is insufficient according to the recommendations made in the Auckland Guidelines, however this can be excused, due to the provision of the shared laundry facilities.

Open plan living and dining area have been designed in these units to maximise natural lighting and space. It also enables visibility between the children playing in the lounge while a parent is in the kitchen.

Some units have a private 5m² to 6.5m² balconies. These spaces are enclosed by standard metal balustrades, with vertical metal balusters, an affordable but possibly unreliable barrier solution for children due to the gaps between the rails and height.

2m² to 3m² general closets are located within close proximity to the entry. However, as identified in figure 3.3, the size of the unit-shared closet does not increase proportionately to the number of bedrooms.

Informing the design:

The appealing aspect of the Ramona apartment units are the minimal design that achieves the fundamental family-friendly design requirements and also affordability. One strengths of the unit design is the size and storage space offered to the occupants. However, one weakness would be the design of the spaces, specifically, the provision of hallways to achieve privacy between the private (i.e. bedrooms) and communal (i.e. kitchen, living and dining room) rooms. A finding from the FCN post occupancy studies identified a negative perception with apartment unit hallways, "too many hallways" which made the unit feel smaller and in some cases, darker", (Hofer, 2008, p. 144). This conclusion is also applicable within the Ramona apartment units, as identified in figure 3.3, where the spaces with no exposure to natural light, has been recognised. Therefore, the provision of a large apartment unit solely does not make a family-friendly housing, but the organisation and programs within the large unit are also significant considerations.

1) Two bedroom - 81.4m²
Storage total - 9m²
Kitchen Size - 9m²
Bedroom sizes range from 11m² to 12m² which sufficiently fits a single bed, desk, draws and at least 1m² for play.

2) Two bedroom unit - 81.4m²
Storage total - 7.5m²
Kitchen Size - 9m²
Bedroom sizes range from 10.5m² to 13m² which sufficiently fits a single bed, desk and at least 1m² for play.

3) Three bedroom - 100m²
Storage total - 7.5m²
Kitchen Size - 9m²
Bedroom sizes range from 11m² to 14m² which sufficiently fits a single bed, desk, draws and at least 1m² for play.

4) Three bedroom - 115m²
Storage total - 10m²
Kitchen Size - 9m²
Bedroom sizes range from 9m² to 17.5m² which sufficient fits a single bed, desk, draws and at least 1m² for play.

No natural light

Scale - 1:100 @A3

Scale - NTS

Figure 3.4 - Unit plans of the Ramona apartments. Floor plans of four different large units

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Scale - 1:500 @A3

Figure 3.5 - Various floorplans of the Ramona Apartments

Figure 3.6 - Sketches of spaces within The Ramona Apartments

DESIGN LESSONS

The analysis of The Ramona apartment has identified various beneficial design features that can be adopted.

These include the affordable features of communal, shared facilities such as the laundry room, gym and communal internal and external areas. If the urban context is lacking family-friendly facilities, they can be implemented within the building. These include an on-site day-care centre and central courtyard.

The “U” plan of the building shape is also an effective design feature of the Ramona apartment complex. This design enables

more corner apartment units, a unit type that allows a greater level of natural light access. The “U” plan provides the geometry for a protected outside space, while also allowing more units to overlook the central landscaped courtyard. (i.e. natural surveillance).

Supervision, space for play and communal areas within the unit and around the building have successfully been achieved in the Ramona apartment design. However, the quality of the spaces (i.e. single aspect, as a result of greater densities and hallways within units, minimises access to natural lighting) are the weaknesses of this case study. Although, these may be the compromises taken to achieve affordability.

Affordability

Facilitate neighbourly interaction

Provision of a well-designed outdoor space

Larger sized units with more bedrooms

Designed to isolate noise pollution (internal and external)

Provision of more storage space

Provision of a safe and secure home

Within proximity to a shops and other amenities

Within proximity to green spaces and parks

Figure 3.7 - Family-friendly features achieved in The Ramona Apartments

REDACTED

Figure 3.8 - Exterior of Kent Vale apartment blocks

3.2 KENT VALE (BLOCK F) 107 CLEMENTI ROAD, SINGAPORE, 129790

Kent Vale (Block F) is a 49,910m² apartment building located within a larger 100,490.8m² Singaporean housing development. It was built to house the National University of Singapore staff and their families (MKPL Architects, 2016). It has two three-bedroom units, two two-bedroom units and two one-bedroom unit per floor. The early considerations of family requirements for the development

is why this apartment was chosen as a case study. Additionally, it has a different range of design considerations when compared with the Ramona apartments, not only due to cultural influences but also the differences in height, density and affordability. The Ramona apartments are six storeys with 63m²/per occupant*, while the Kent Vale apartments are 25 storeys with 173m²/per occupant*.

*assuming occupancy of 1 person per bedroom

URBAN SCALE

According to multiple guidance documents, the important amenities that need to be at a close proximity to a family-friendly development are schools, day care, grocery shops, a community centre, parks and public transport.

According to Google maps, the Kent Vale development has access to a variety of schools, including a Primary school that is a 10 minute walk, an Intermediate School is a 4 minute walk and High school is a 15 minute walk away.

Located on-site and a 5 minute walk

away, is a day care. Also on-site, and a 5 minute walk away, is a supermarket, with two other supermarket options being less than 10 minutes away. Clementi Woods park is also conveniently located next to the site. The paths of the park are designed to extend the running space for joggers, maximising the space.

Informing the design:

The pre-design intention for the building to facilitate families. It enables the development to be built in an optimum area with various appropriate amenities.

REDACTED

Figure 3.9 - Urban analysis of the Kent Vale. Mapping the surrounding amenities

Standard Occupancy

Possible Occupancy

- Laundry
- Balcony
- Storage
- One Bedroom
- Two Bedrooms
- Three Bedrooms

Scale - 1:200 @A3

Figure 3.10 - Building analysis of Kent Vale. Identifying the different range of apartment unit sizes - typical building floor plan

BUILDING SCALE

The two tower, 25 storey apartment development recognises the unique aspect of family living that is the change in either numbers or maturity of family members, which triggers the need for an increase or decrease of living space.

The building addresses this aspect of families by designing the units so that they facilitate flexibility. This is achieved by positioning two-bedroom units next to one-bedroom units; enabling the conversion of the two units into a three-bedroom unit when required. Therefore, the apartment tower is designed to offer an equal number of one, two and three bedroom units, but can be altered to increase bedroom numbers per unit. It can be 66.66% large units: 33.33% two bedroom and 33.33% three bedroom units.

To reduce the high-density feeling of the development, each floor only contains four units but achieves higher density by building upwards; offering 96 units per tower.

Many storeys have a 72m², west-facing terrace, providing a semi-private outdoor space. Access to each of the floors is via any of the three elevators.

UNIT SCALE

The apartments range from studio to three bedroom. For example, one two bedroom apartment is 100.3m², with two bathrooms and a storage area. The size of a three bedroom unit is 145m². This includes two and a half (toilet with sink) bathrooms, storage, utility and a den space.

The Kent Vale apartments significantly exceed the minimum floor area specified in the guidance documents. The country's climate is notably different from Auckland. Singapore's tropical climate, according to Meteorological Service Singapore, indicates that the apartment occupants experience higher temperatures and humidity all year round. Additionally, Singapore can also be inundated with extreme rainfalls and thunderstorms (Meteorological Service Singapore, 2015). Due to the extreme conditions faced in Singapore, it is expected that Singapore would require a larger unit floor area, as more of the children's time spent would be inside.

In addition to minimising the feeling of higher-density, by having only four units per floor, the Kent Vale Apartments are also designed to maximise natural lighting because all the units have corner aspects. Space and natural light are also utilised through open plan living and dining spaces. These spaces can be further extended by opening out to the private 8m² balcony, which all units have. The balconies have movable perforated metal screens that act as safety and sunlight barriers.

One unique aspect of the unit layout is the isolation of the kitchen area from the main living space. This is due to cultural differences in terms of food, where cooking grease and odours need to be minimised, therefore, compromising the visibility and together-time generally established in an open-planned, family kitchen (Khim, 2018).

(A) - One Bedroom - 45m²
Storage total - 2m²
Kitchen Size - 3m²
Bedroom sizes -12m²
which sufficiently fits a bed, desk,
wardrobe and at least 1m² for
play.

(B) - Two Bedroom - 100.3m²
Storage total - 8m²
Kitchen Size - 8m²
Bedroom sizes -21m² - 9m²
which sufficiently fits a bed,
wardrobe and at least 1m² for
play.

(C) - Three Bedroom - 145.3m²
Storage total - 9.5m²
Kitchen Size - 14m²
Bedroom sizes -22.5m² - 12m²
which sufficiently fits bed,
wardrobe and at least 1m² for
play.
Study space - 6m²

One Bedroom
Two Bedrooms
Three Bedrooms

Scale - 1:100 @A3

Figure 3.11 - Unit plans of the Kent Vale. Floor plans of the three different unit options, drawn to give an idea of room ratios and layouts

My interpretation of how the flexible units can be combined:
 (A) One Bedroom Unit
 + (B) Two Bedroom Unit
 = Three Bedroom Unit - 145.3 m²
 Storage total - 18m²
 Kitchen Size - 7m²
 Bedroom sizes - 21m² - 9m²
 which sufficiently fits a bed, wardrobe and at least 1m² for play.

My interpretation of how the flexible units can be combined:
 (A) One Bedroom Unit
 + (B) Two Bedroom Unit
 = Four Bedroom Unit - 145.3 m²
 Storage total - 8m²
 Kitchen Size - 7m²
 Bedroom sizes - 21m² - 12m²
 which sufficiently fits a bed, desk, wardrobe and at least 1m² for play.
 9m² bedroom fits a bed, wardrobe and at least 1m² for play.

Scale - 1:100 @A3

Figure 3.12 - Iterations of one and two-bedroom apartment units combined at Kent Vale, two examples that the flexible unit can form

Figure 3.13 - Sketches of spaces within Kent Vale. Spatial analysis, identifying family-friendly features

Figure 3.14 - Sketches of various outdoor spaces within and around Kent Vale

DESIGN LESSONS

The Kent Vale case study has various design features that can inform the conceptual chapter of this thesis.

The most significant building and unit scale design features that will inform the family-friendly design for this thesis is the concept of flexible units. The unit expansion or contraction design that is achieved through unit orientation and structural configuration to minimise column obstruction.

Another design consideration influenced by Kent Vale is the number of units per floor and their orientation to minimise density while maximising natural light and privacy between neighbours. Although, this may mean the increase in cost for the units.

The final idea that can be adopted from this case study is how the design resolves anxiety regarding danger to children from falling off balconies. This is achieved through the integration of a movable façade that doubles as a sunscreen, and a full height barrier to enclose the balcony.

Provide a private but not isolating home

Facilitate neighbourly interaction

Larger sized units with more bedrooms

Designed to isolate noise pollution (internal and external)

Within proximity to a school

Within proximity to a shops and other amenities

Provision of a well-designed outdoor space

Provision of a safe and secure home

Within proximity to green spaces and parks

Enable good quality, naturally lit and ventilated interior without compromise

Figure 3.15 - Family-friendly features achieved in Kent Vale

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Figure 3.16 - Entrance and front facade of the Nightingale 1.0

3.3 NIGHTINGALE HOUSING 1/6 FLORENCE ST, BRUNSWICK VIC 3056, AUSTRALIA

The Nightingale 1.0 apartment is one of a few sustainable and affordable developments. Unlike the other higher density housing case studies, the Nightingale does not focus solely on accommodating families but a variety of occupants to achieved a mixed community. This case study was chosen for its sustainability and affordability achievements in a higher density context. These are achieve through the implementation of a German housing model called "Baugruppen", where a conglomerate of private owners enter into an affordable multifamily, construction

project (Paul, 2017). The Nightingale Development Company manages the different private owners (Nightingale, 2018). Affordability is achieved by excluding the need for a developer (who strives for large profits), and real estate agents and their costs (for marketing). Instead, the developer's role is replaced by architects, and around 20 ethical investors. Removing the developers removes the stigma that is associated with developers, who are perceived to value quantity of profit over quality development, which is one step towards redefining the idea of an apartment.

URBAN SCALE

The Nightingale 1.0 apartment is located in an industrial area of Brunswick; a suburb that is a 25 minute drive from central Melbourne. The closest primary school is a 14 minute walk, and the local kindergarten is a six minute walk away (Australia does not have Intermediate schooling).

The Nightingale apartment is close to a main shopping street with options for grocery shopping; two vegetable and meat markets, that are three and four minute walk away and a clearance supermarket is a seven minute walk away. The closest community centres is a 25 minute walk away. For a more local gathering space, an accessible communal rooftop space is available within the building. Outdoor space is limited, however, a public park for great physical activities such as running and playing is only a six minute walk from the site.

The Nightingale 1.0 apartments take

advantage of the high-quality public transport infrastructure of Melbourne by being situated one to three minutes away from various bus stations, a light-rail/tram station and train station. The convenience to public transport is vital for the development as it aimed to save costs by removing the need for a basement carpark; saving approximately \$500,000 (Dragomir, 2015).

Informing the design:

Some of the Nightingale 1.0 design decisions rely on Melbourne's well-established urban infrastructure (i.e. lack of carparks due to the public transport options). Although Auckland's inferior public transport system means there is a heavy reliance on private cars, and the redesign of an area at the urban scale is outside the scope of this thesis, this means there is a heavy reliance with choosing a good site, located near amenities and opportunities for work.

REDACTED

Figure 3.17 - Urban analysis of the Nightingale Housing. Mapping the surrounding amenities

Ground Floor
- Mix of services and commercial spaces.

Second, Third, Fourth and Fifth Floor
- One and two bedrooms with associated balcony.

Accessible Roof
- Semi-private, shared outdoor space, including sandpits, summer and winter garden, a lawn, garden and shared laundry facilities.

Scale - 1:200 @A3

- Laundry
- Balcony
- Storage
- One Bedroom
- Two Bedrooms
- Three Bedrooms

Figure 3.18 - Building analysis of the Nightingale Housing. Identifying the different range of apartment unit sizes

BUILDING SCALE

Although the Nightingale developments do not specifically focus on family-friendly aspects, there are many families that occupy the apartments. Occupant preferences and requirements are identified through a series of questions in a pre-design questionnaire (Cumming, 2018, p. 67). These answers can remove the costs of unwanted design features (Nightingale 2018). One example of a question asked was:

"We are considering additional light courts to provide light into the bathrooms. This would reduce the size of each apartment by approximately 4m² but will not reduce their price. Given the choice, what would you prefer?

- I would prefer the extra space
- I would prefer the natural light and ventilation"

A number of people preferred the natural light and ventilation over the additional space. This shaped the east side of the exterior to include lightwells. This allows natural light ventilation into both the east side unit bathrooms and the bedrooms, but they are consequently 5.5m² smaller than the west side units.

The Nightingale development is a modest five storey tall apartment block. There are 20 units in total and five units per floor. The initial scope of the apartments specified one to two bedrooms, and therefore, the large units (40% of the total apartment units) are all two bedrooms with no three bedroom units (refer to the pie chart in figure 3.12).

One storage solution with the Nightingale 1.0 is to provide occupants with large storage facilities outside of the apartment unit, on the ground floor. This is to facilitate families with large items, such as strollers and other big and seldomly used items, to be easily stored in a convenient location.

To maximise the limited sized site, the 189m² roof was designed to be accessible. This provides an outdoor communal area for the occupants that consists of a summer and winter garden, sand pits and lawn. Additionally, the roof space also houses the six industrial communal washing machines and a large space for clothes drying (one set per four dwellings, which exceeds the City of Vancouver guideline recommendation of one set per 10 dwellings). Communal laundry space was implemented as an affordability feature, saving approximately \$150,000 and an additional \$250,000 on reduced services (Dragomir, 2015). As initially identified, the provision of a program or feature, does not guarantee that it will be utilised. This is especially the case for shared amenities as some people prefer their own private facilities. The Nightingale validated potential occupants' acceptance of shared amenities through the pre-design survey. A confirmation was established when majority responded that they preferred "a communal laundry on the roof and 2.5 square metres of living space" over "a private laundry" (Perinotto, 2015).

Informing the design:

The implementation of a pre-design survey to gain a better understanding of the potential occupants and their needs is a beneficial action. However, due to time constraints, a site-specific survey cannot be conducted. Instead the design will rely on the existing family preference survey results that was analysed in the literature review. Although the constrained size and shape of the site minimised design options for the Nightingale 1.0, it does a better job of maximising natural light into the spaces when compared to the Ramona apartment. The implementation of the central lightwells within the building meant potential internal bedrooms now have secondary natural light. This may be important depending on the site chosen for this thesis.

UNIT SCALE

Affordable considerations have also been made at the unit scale. One factor was to exclude the option of more than one bathroom per unit, saving approximately \$200,000 (Dragomir, 2015). Excluding private laundry and additional bathrooms, contributes 2m² of additional living space (Design for Auckland, Housing for Life, 2017). This is significant when compared to the sizes of the other case studies' living spaces, relative to the overall unit size. The Ramona apartment units have an average of 23% of their unit floor area dedicated to the living space, 32% for Kent Vale units and 37% for the Nightingale 1.0 apartment units. The owner-occupier benefit by reducing the cost of their apartment by \$6,000 (Design for Auckland, Housing for Life, 2017).

The one-bathroom-only situation reinforces the importance of the pre-design survey as the preference for more bathrooms over savings may be true from a family's perspective. According to the findings from the FCN post occupancy study, parents, especially those with teenagers, described additional bathrooms as "indispensable" (Hofer, 2008, p. 144). However, excessive numbers of full bathrooms, (i.e. one bathroom for every bedroom) was considered an "unforgivable waste of space when space is at such a premium" (2008, p. 144). The latest Nightingale Brunswick East apartment, is currently establishing the parameters of their design. Proposed as larger 2-3

bedroom units, the pre-design survey therefore, includes questions that considers families. One question enquires about the bathroom, outlining the compromise of an additional bathroom to be 9m² and an additional cost of \$9000 for a full bathroom and \$4000-\$6000 for the toilet separated from the bathroom (Nightingale Housing LTD, 2017). The result of this questionnaire would have been very beneficial, instead, all three options can be considered to inform the family-friendly design for this thesis.

Bedroom sizes are in accordance with the Toronto guidelines, therefore, confirming adequate bedroom sizes to range between 9m² to 12m².

Private outdoor spaces are achieved through winter-garden-type balconies, which was the preferred option over the open-aired "summer garden". These are 8m² (or 16m² for a few larger units). The balcony area is enclosed by a gridded glass facade, similar to a greenhouse appearance. A section of the greenhouse grid is hinged to open, while the fixed gridded glass acts as the balustrade (refer to figure 3.13).

The apartment entry opens into a 1m wide hallway. No storage space is provided in each unit other than 2m² or 3m² wardrobes in bedrooms. Instead, additional storage space for the occupants is located on the ground floor. The total storage area for a one bedroom unit is 3m². For a two bedroom unit, the total storage area is 5m². (Note that the kitchen/lounge bench area consists of numerous cupboards and draws for general storage).

- Studio - 65.0m²
Storage total - 3m²
Kitchen Size - 5.5m²
Bedroom sizes - 9m², which sufficiently enables a single bed, wardrobe and at least 1m² for play.

- Two Bedroom - 82.1m²
Storage total - 5m²
Kitchen Size - 5.5m²
Bedroom sizes - 10-9m², which sufficiently enables a single bed, wardrobe and at least 1m² for play.

- Two Bedroom Unit - 96.6m²
Storage total - 5m²
Kitchen Size - 8m²
Bedroom sizes - 9-12m², which sufficiently enables a single bed, wardrobe and at least 1m² for play.

Studio
Two Bedrooms
Three Bedrooms

Figure 3.19 - Unit analysis of the Nightingale Housing. Floor plans of three different unit options, drawn to give an idea of room ratios and layouts

Scale - 1:100 @A3

Figure 3.20 - Sketches of interior and exterior spaces within Nightingale 1.0

Figure 3.21 - Sketches of Nightingale facade and interior, gridded appearance

DESIGN LESSONS

The Nightingale housing development is a relatively new example of a high-density design process in Australia. Although it does not specifically cater to a family demographic, the concepts taken from this case study are still applicable when it comes to creating higher quality, affordable high density dwellings.

One concept is achieving affordability through implementing shared facilities such as laundry and drying areas, and minimising unwanted aspects such as profit-driven developers, interior finishing (i.e. false ceilings) and more than one

bathroom per unit. Implementing a pre-design questionnaire to identify the preferences of the people who may live in the apartment units provides confidence that beneficial design features will be implemented into the dwellings, instead of relying on assumptions.

Another idea that is similar to the Kent Vale case study is the integration and multi-functional use of the façade. Just like Kent Vale's movable full height screen, the Nightingale 1.0 apartment has an outdoor space that can be controlled by enabling the glass façade to be openable or closed for parents to comfortably allow their children to play within this area.

Affordability

Facilitate neighbourly interaction

Provision of a well-designed outdoor space

Within proximity to a shops and other amenities

Designed to isolate noise pollution (internal and external)

Provision of more storage space

Within proximity to green spaces and parks

Enable good quality, naturally lit and ventilated interior without compromise

Provision of a safe and secure home

Figure 3.22 - Family-friendly features achieved in Nightingale 1.0

REDACTED

Figure 3.23 - Entrance to a block in the Arlington Apartments

3.4 ARLINGTON APARTMENTS ARLINGTON ST, MOUNT COOK WELLINGTON 6011

The Arlington social housing complex is a city council-funded development, established to “avoid an Auckland-style housing crisis” (Devlin, 2017). Although the housing has a smaller density than the other case studies, it is still “higher density” when compared to the typical

single dwelling, low-density housing in New Zealand. The affordability and location of the development, in the New Zealand context, was also another reason why this case study was explored.

URBAN SCALE

The Arlington development is located on the border of the city centre and a suburban area. Within a 10 minute walking radius from the site are supermarkets (Yans Supermarket and Preston meat store), a pre-school (PolyHigh Community Child Care Centre) and open parks (including the semiprivate onsite, central courtyard). A larger supermarket, Countdown, is also located one kilometre or a 13 minute walk away from the site.

The social housing complex is located within reasonable distances of various schools including a Primary and Intermediate integrated school, which is a 12 minute walk, and a High School located across the road or a four minute walk.

The development does not offer one parking spot per development but instead focuses on providing spaces for bicycle storage. The reduced

parking options is a means to reduce construction cost. This can be justified as the location of the site, is within walking distance of the CBD and many important amenities. Therefore, cars would not be considered a necessity. Additionally, another argument made for not providing numerous car parks is the idea that there are other social housing options in Wellington that offer units with car parks, and therefore this social housing development caters for occupants who prefer to walk or bike instead of drive.

Informing the design:

The site for this case study is located within a residential area that is a walkable distance away from the Wellington CBD. This would be a desirable situation for the chosen site as the best of both worlds are obtained. A site chosen for this thesis will be within a safe and quite residential area but with a walkable distance to the CBD, various amenities and place of work.

REDACTED

Figure 3.24 - Urban analysis of the Arlington Apartments. Mapping the surrounding amenities

Figure 3.25 - Building plan of the Arlington Apartments. Identifying the different range of apartment unit sizes and the arrangement of the different units to facilitate the application of flexible units

- Community Centre
- Laundry
- Storage
- One Bedroom
- Two Bedrooms
- Three Bedrooms
- Four Bedrooms

Scale - 1:200 @A3

Standard Occupancy

Possible Occupancy
(Engage all large units)

BUILDING SCALE

There are 10 medium density buildings that make up the Arlington development these have a maximum height of three storeys to enable them to blend with the surrounding residential context. In total, there are one hundred and six units, with four units per floor, except for one block.

Similar to the Nightingale 1.0 apartment, the Arlington housing development, also provides their occupants with a shared laundry facility. However, the clothes drying lines are not shared but instead, built into the private balcony of every unit. After speaking with the site manager of the development, it was understood that people were not comfortable with hanging their under garments for others to see, and had concerns regarding thieves. There is the option of private washing machines, but this is at the occupiers' expense. Other shared, on-site facilities included a community centre, located on the ground floor of one block (refer to figure 3.16).

Like the Kent Vale case study, some units are designed to be flexible. This means that two, one-bedroom units can be combined into one, two or more bedroom units (refer to figure 3.17 and 3.18). Therefore, the density of the units can fluctuate depending on unit organisation. Figure 3.16 depicts two pie charts, "standard occupancy", which shows the smallest number of large units and "possible occupancy (engage all large units)" shows the

largest number of large units (i.e. applicable one bedroom units are combined to make larger, two or more bedroom units).

The three storey complex was designed so no elevators needed to be provided. This was to minimise construction and maintenance fees, and the stigma associated with elevators in a social housing context, including the threatening feeling of being cornered and isolated.

One method of providing a higher-density family-friendly outdoor space is via a central courtyard. Similar to The Ramona apartment case study, The Arlington development also provides a central semi-private outdoor space. The area is large enough for children to run around and play, while enabling supervision to occur by their parents within the comfort of their own home.

Informing the design:

The orientation of the building around a central courtyard, solidifies the recommendation also identified in the Ramona apartment case study. The units organised around the perimeter of an outdoor communal space will likely be the approach taken for the design of the family-friendly building form. In addition to facilitating supervision, the consideration for privacy between apartment units must also be considered, in this case, 32.5m was achieved and deemed adequate. Depending on the size of the chosen site, this distance may or may not be achieved.

UNIT SCALE

Similar to the Kent Vale apartment unit layout per floor, the Arlington complex also maximises sunlight and minimises the feeling of higher density by limiting the number of units per floor to only four. The corner aspect design of the units means most rooms have access to natural light and ventilation. The only internal rooms are the hallways, smoke rooms and bathrooms.

A 3m² smoke room is the entry to each unit, and was incorporated to increase the escape time for occupants in the surrounding units. The smoke room prevents smoke from a fire inside one unit from escaping into the shared space. Smoke rooms are typically required when there is only one single means of escape in a residential dwelling. A number of smoke rooms have coat hooks installed on the walls, which suggested the space could double as a cloak room. Additional storage within the unit include custom-made 0.5m² wardrobes, sized to fit within spaces around the unit. These wardrobes are near the entry and in every bedroom.

Similar to all the other case studies, the living, dining and kitchen areas are open planned. Bedroom sizes range from

14.5m² to 9.5m², complying with the recommendation for no bedrooms to be less than 8m². All units above the ground floors have a private 5.28m² sized balcony with solid concrete balustrades. The absence of rails provides better security for children to play on the balcony. However, not as secure as the full-height solutions identified in Kent Vale and Nightingale.

In order to achieve the concept of flexible unit spaces, the main structural element is pre-cast shear walls with established penetrations. The pre-case penetrations into the shear walls are filled in with non-loadbearing timber frames, which support the plaster board, fire-rated lining that is required between the two units. To implement the expansion of a unit, the fire-rated, timber partitions can easily be removed, enabling a direct connection between the two units.

Informing the design:

Although the concept of flexibility is shared with Kent Vale, the approach taken by Arlington differs in terms of the structure. Therefore, there are various options in terms of structural formation that can be applied to the proposed design, to achieve flexible designs.

Figure 3.26 - Unit plans of the Arlington Apartments. Alterations of the floor plan as intended as part of the Arlington design

- Three bedroom - 96m²
 Storage total - 2m²
 Kitchen Size - 10m²
 Bedroom sizes - 11.5 - 13.5m², which sufficiently enables a single bed, desk, wardrobe and at least 1m² for play.

- Five bedroom - 121m²
 Storage total - 3m²
 Kitchen Size - 10m²
 Bedroom sizes - 9.5 - 14.5m², which sufficiently enables a single bed, desk, wardrobe and at least 1m² for play.

- One Bedroom
- Two Bedrooms
- Three Bedrooms
- Four Bedrooms

Scale - 1:100 @A3

Figure 3.27 - Floor plans of two different unit options offered within the Arlington Apartments

DESIGN LESSONS

This final case study provides good examples of design considerations, where there is no questionable context concerns as it is located within New Zealand. Desirable features include the flexible, dual-key features of the units, divided by a fire-rated partition that can be removed to enable the expansion of one unit into another.

Similar to the Nightingale 1.0 apartment, Arlington also strives for affordability by including communal facilities such as the laundry space and large central outdoor space. Just like The Ramona apartments, the orientation of Arlington is also an important aspect to get correct. This is to enable maximum visibility of the central courtyard from inside of most units.

Figure 3.28 - Sketches of spaces within the Arlington Apartments. Spatial analysis, identifying family-friendly features

Affordability

Facilitate neighbourly interaction

Provision of a well-designed outdoor space

Provision of a safe and secure home

Larger sized units with more bedrooms

Designed to isolate noise pollution (internal and external)

Within proximity to a school

Enable good quality, naturally lit and ventilated interior without compromise

Within proximity to a shops and other amenities

Within proximity to green spaces and parks

Provide a private but not isolating home

Figure 3.29 - Family-friendly features achieved in the Arlington Apartments

3.5 CHAPTER CONCLUSION

The explorations of the various case studies has provided a more descriptive means of achieving family-friendly high-rise and high density design. A variety of design features, ranging from the urban scale to the unit scale, have been identified and will contribute towards defining a more family-friendly, high-density dwelling design. These are

highlighted in table 2.

One dominant concept identified from the case studies is "flexible units". The expansion and downsize of unit size is a unique solution to address the changing needs of families. In the next chapter, the concept of flexible units will be further refined, and developed from what was learnt from the case studies.

Urban:	Building:	Unit:
<ul style="list-style-type: none"> - Provision of a safe neighbourhood, away from cars and roads. - Confirmation of the proximity to family friendly amenities such as day-cares, supermarket, parks and public transport. - Amenities not identified within the urban context can be integrated into the proposed building design, on the ground floor. - Site to be located in a residential area, within walking distance to the CBD. 	<ul style="list-style-type: none"> - Facilitate affordability by designing co-housing and shared amenities such as the laundry and outdoor spaces - Density and therefore, control of occupant numbers with the arrangement and number of units per level - Building organised to facilitate various levels of supervision between spaces - Achieve distances between units to ensure privacy - Adopt a perimeter style of building form (i.e. U, C, L, O) - Structural considerations (i.e. columns and beams or concrete walls with penetrations) to establish flexible units - Achieve adequate high-medium and low-high density levels within the building. - Ensure an adequate number of large (two bedroom and three bedroom) units 	<ul style="list-style-type: none"> - Privacy between units - Quality outdoor space, in terms of size and barrier, that is within close proximity to the unit - Quality indoor space: storage, size of space, and orientation of rooms - Interior design to facilitate supervision between rooms - Open plan living, dining and kitchen, to facilitate supervision - Design considerations for flexible units - Establish a flexible facade that incorporates barriers for an outdoor space where children can play - Minimise internal finishing to promote affordability - Organise rooms to maximise space within the large rooms (i.e. no internal rooms and no hallways)

Table 2 - Conclusions of family-friendly findings from the case studies

Figure 4.0 - View of the Auckland CBD and Wynyard Quarter site from the harbour side.

4.0 SITE ANALYSIS

The previous chapters had explored family-friendly high density designs in a general setting. This chapter describes a site proposed for a site-specific exploration of this concept. A site was chosen in Wynyard Quarter, Auckland. This chapter will explain why this site was chosen and present an analysis of the site.

0 25200m

Site
Scale - 1:1000000 @A3

Figure 4.1 - Chosen site located in Auckland City, New Zealand

REDACTED

0 660m

Site
Scale - 1:25000 @A3

Figure 4.2 - Chosen site located in Wynyard Quarter, Auckland City

4.1 SITE (WYNYARD QUARTER)

The drastic housing situation currently experienced in Auckland, means that any site in Auckland (CBD or Suburb) would benefit from new housing. However, for the purpose of this thesis, a site in Wynyard Quarter with access to suitable amenities was selected. The recent development of the urban environment in this area, which is currently transforming what was originally an industrial trade port, into a "harbourside community" was also considered to be a positive feature of this site area. A thorough site analysis has been conducted in order to explain why this site was chosen, including its current, proposed and suggested amenities.

Wynyard Quarter is a harbourside area near the CBD. The risks of choosing a harbour-side location have been identified in a Climate Change Adaptation Pathway report. Many of the risks cannot be addressed as part of the high-rise design, however, there are a few that can be mitigated through design decisions. These include rising groundwater, and inundation of the marina land (Waterfront Auckland, 2015, p. 5).

4.2 AMENITIES

Various *NZ Herald* articles also solidifies the choosing of this site. One celebrates the success of Wynyard Quarter for families, due to the various playground options, parks and general outdoor spaces (*Herald*,

2011). Another article captures the disappointment in the lack of diversity that is proposed for Wynyard Quarter. Phil Twyford was quoted saying "The regret I have is they seem to have decided there's no place for affordable housing there... I wish they'd rethink that and put affordable housing into the mix," (Gibson, 2017). Thus, the area is a good place to propose a family-friendly, high-density, vertical community, as affordability and diversity are insinuated.

When selecting a site to explore affordable, high density apartments in Auckland, the literature indicated that proximity to public transport is important. This can be used to remove the need for carparking, as a means to save costs. This may be more difficult in the Auckland context as the city is very car dominant, while its public transport system is considered inferior when compared to Melbourne's system.

The site chosen is 51-59 Gaunt Street, which is a 1,747m² site that has a consented integrated development proposal to allow for a 52m high, tower development. The intention of permitting such a tall maximum height to the site is for people to see it within the area, as it acts as a reference point for those within the Wynyard Quarter site. This aligns with the aim of the building, to provide a good reference and example of a family-friendly, high-density dwelling.

REDACTED

Figure 4.3 - Urban analysis of the chosen Wynyard Quarter Site. Mapping the surrounding amenities

SUPERMARKET

Supermarkets were identified in the guidelines as an important amenity to be close to family-friendly housing.

There is a large supermarket located within a 10 minute proximity to the site. The journey to the supermarket requires crossing roads (both minor roads (1 and 3) and main roads by traffic lights (4, 5, 15 and 16), but majority of the path is via a park.

Figure 4.4 - Various photographs documenting the journey from the chosen site to the closest supermarket

REDACTED

Figure 4.5 - Urban scale mapping of the journey from the chosen site to the closest supermarket

Figure 4.6 - Various photographs documenting the journey by foot from the chosen site to the closest primary school

CBD SCHOOLS

An urban scaled map of the Wynyard Quarter area shows a lack of local (within a 10 minute walk) schools. The closest primary school identified is "Freeman Bay Primary School", which is a 15 minute walk away.

The walking path was mapped from the Wynyard Quarter site to the primary school. Captured in the various photographs, the journey from home to school would require children to cross seven different roads (image 1, 3, 4, 5, 12, 20, 23). Due to the distance and possible dangers associated with walking to the school, it is reasonable to assume that the parents would either drive their child to school (Google estimated 4-12 minutes) or walk with them, escorting them to the front gate of the primary school before heading to work in the city.

Other means of transport for children to take includes public transport. The only option between the site and primary school is a bus, and that takes around 13 minutes. The trip is a mix of walking and being on the bus. Due to the lack of time saved and short period of actually being on the bus, this travel option is not feasible.

Biking has also been considered as a transport option. According to Google Maps, it takes around 7 minutes to reach Freeman Bay Primary. Although a quarter of the travel is through a park, majority of the trip is still exposed to traffic and roads, as there are no direct cycling paths between the two locations.

Due to the lack of schools within the city, the proposal of a new primary school is recommended as part of the urban staging plans to create a more family-friendly environment in Auckland's CBD. Due to the demand of space and high cost of CBD land, the exploration of a vertical primary school is required. However, with the limited resources assigned to completing this thesis, and the complexities involved with designing a school, no development was explored regarding the design of a vertical primary schools. Instead, it is heavily recommended as significantly beneficial, future research, for developing a family-friendly CBD.

Figure 4.7 - Urban scale mapping of the journey from the chosen site to the closest primary school

Figure 4.8 - 3D perspective drawing of the Wynyard Quarter area. Site analysis including recognising various urban features such as seating, amenities, play spaces and other residential buildings.

(1) PLAY

(2) SEATING

(3) AMENITIES

NORTH VIEWS - THE HARBOUR

WEST VIEWS - THE HARBOUR BRIDGE

EAST VIEWS - THE SKY TOWER

SOUTH VIEWS - VICTORIA PARK

Figure 4.9 - Four focal points identified around the site. Accurate depictions of the views from the building on the 10th floor (approximately 30 metres about ground level)

Figure 4.10 - Site plan indicating the direction of where the views (figure 4.9) were taken

Figure 4.11 - Site plan indicating the shadows casted during the Summer solstice (20th December) from 6am to 7pm, at every hour

Figure 4.12 - Site plan indicating the shadows casted during the Winter solstice (21st of June) 8am to 4pm, at every hour

4.3 ENVIRONMENT

Sun/shadow analysis:

Sun and shadow study was conducted during the winter (shortest day) and summer (longest day) solstice, for every hour. The building was modelled to occupy all of the site space. This was done to understand the maximum extent of where the shadows will be casted. The areas with darker shadows depict the spaces where the shadows are casted the longest throughout the day.

The conclusion of this quick study shows the proposed building will not shade the park in the north - Central park. The west side of the site is least affected by the shading, casted by the building. Considering it is on the main

street, which is potentially a pedestrian only street, it has a great opportunity to be a social gathering space, such as cafes and restaurants, with an outdoor seating area.

Wind analysis:

Another natural element that needs to be considered when developing high-rises buildings, is wind. According to NIWA's Auckland climates report, Auckland prevailing winds are primarily from the cold southwest direction, predominant during the Winter and Spring seasons. During the summer, warmer north-easterlies are predominant. Being a harbour area, sea breezes from the east also need to be considered when designing. (Chappell, 2013, p. 13)

Scale - 1:1000 @A3

CORNER EFFECT

EAVES

DOWNWASH

COLUMNS

WIND TUNNEL

PODIUM

Figure 4.13 - Three types of wind effects on high-rise buildings

Figure 4.14 - Design iterations of wind mitigation techniques

A fundamental understanding of how wind reacts around tall buildings must be explored. Obtaining this knowledge prior to designing the building form is essential. This is to ensure high wind speeds that cause discomfort to people occupying the building's outdoor spaces and the surrounding area are mitigated. Figure 4.13 are diagrams of different wind effects on a 52m tall building, modelled as if the block was built to maximise the occupancy of the site according to the resource consent.

WIND DESIGN CONSIDERATION

According to a *BUILD* article there are various options to consider when designing to mitigate the effect of wind on outdoor spaces of tall buildings (Pringle, 2015). These design considerations can be separated into two categories:

- Building design
- Boundary design

The general concept regarding wind mitigation is to disperse the wind, rather than completely blocking it with a solid surface. Blocking the wind will result in guiding it to another location, while increasing its force.

Wind should also be designed and manipulated to create a more comfortable indoor space by facilitating cross ventilation. This is especially important for north facing units during the summer when the spaces are likely to overheat. This was one high-rise related issue that was identified in the False Creek post occupancy survey (Hofer, 2008, p. 101).

BOUNDARY DESIGN

VEGETATION

VERTICAL

HORIZONTAL

Figure 4.15 - Design iterations for minimising wind tunnel

4.4 RESOURCE REQUIREMENTS

According to H8.6.33, a minimum dwelling size for a studio apartment is 35m² and for a one or more bedroom dwelling is 50m² (Auckland City, 2016, p. 46).

Although 50m² is an appropriate minimum requirement for a one bedroom dwelling, aligning with the guidance documents, any greater number of bedrooms (2+) would see 50m² as insufficient. Therefore, a recommendation for the unitary plan to promote more family-friendly dwellings is to include greater minimum restrictions for variously sized bedroom units.

According to I214.6.6 Building height, for sub-precinct B: The maximum cumulative floor plate area per floor must not exceed 1200m² (Auckland Council, 2016, p. 20). For levels that exceed the height of 31m, the maximum floor area must not exceed 45m by 45m.

According to I214.10.5 the maximum building height, for the specified site is 52m (Auckland Council, 2016, p. 51). The site is one of the few 52m

assigned sites, which provides a variety of building form and scale. According to the Wynyard Precinct: Urban Design framework, section 4.7.2. the purpose of the selected site heights was to "reinforce the principal site axis and to assist in establishing a legible urban structure" (2014, p. 28).

I214.6.1. Parking

When compared to other unitary plans, many have minimum parking requirements (i.e. Porirua, which requires no less than 4.5 car parks per 100m² according to the Porirua district (Porirua City Council, 1999, pp. D1-5)). However, Auckland council's intention with the CBD is to minimise and decrease the number of singular vehicles on the Auckland roads. Therefore, instead of requiring a minimum number of carparks, the Auckland unitary plan specifies a maximum number of parking, relative to the gross floor area (Auckland Council, 2016, p. 15). Due to specified maximum requirements and lack of minimum requirements, the proposed design will not have any private and individual car parking but instead, compromise with the provision of various shared electric cars. The reduction of private car parking will enable the apartments to be more affordable.

4.5 CHAPTER CONCLUSION

A site analysis, including an understanding of the precinct and unitary plans were explored in this chapter. Understanding the restrictions of the chosen site and design outlines, provides context-specific considerations that need to be made to establish this family-friendly, high-density, residential building. This also provides a realistic element to this design. A better understanding of the site also enables better design outcomes, that is not limited to only the people occupying the building, but also others in the surrounding area.

These site-specific items that need to be addressed in the design process includes:

- Site boundaries of 52m in height and 1,747m² in area.
- Building to be designed as a "reference point" for the surround area.
- Effects on wind for high-rises
- Maximising sun, while minimising shade
- Maximising views from all four sides of the site
- Rising ground water and inundation
- No minimum requirement for car parks and therefore, propose a shared car facility

With regard to the suitability of the site for family-friendly accommodation, the revitalisation of Wynyard Quarter to include more parks, playgrounds and pedestrian friendly spaces, makes the site suitable for exploring family-friendly building design.

Figure 5.0 - View of Auckland CBD from motorway, captures the essence of Auckland; Construction, cars and Sky Tower

5.0 CONCEPT OF FLEXIBILITY

This chapter develops a concept that was used in two of the case studies (Kent Vale and Arlington). This enabled the case studies' unit size and space to expand or contract.

The implementation of flexible apartment units considers structural design, orientation of certain apartment units and the design of the inter-tenancy wall that separates the two units. The two case studies achieved flexibility through a shared, non-loadbearing partition that was either a small penetration casted into the shear wall or a column and beam structural system.

The chapter aims to push the idea of flexibility further, to provide the families who occupy these units, a greater level of flexibility. Therefore, an evaluation and identification of weaknesses in the level of flexibility in the case studies, will be conducted. It is anticipated that the exploration of the flexible unit concept will help refine the design of family-friendly high rise apartment unit.

5.1 DUAL-KEY APARTMENTS AND CONSORTIUMS

To be flexible, and to allow a fluctuating number of occupants, the ownership of the units would also need to differ from the standard apartment arrangements. Typically each unit would be under their own unit title.

Unit title:

A unit title is the legal term for ownership of a unit and the airspace that the unit occupies (Tenancy Services, 2017, p. 4). The communal spaces, like the hallways, elevators and entry ways, are shared by all the occupants in the apartment block (2017, p. 8). Management of the shared areas are controlled by the Body Corporate, and they vary from apartment to apartment.

Dual-key units:

The concept of dual-key units can also be defined as the ownership of air-space within the apartment unit, but instead of only one occupant/s, the unit is designed to accommodate two dissociated occupant/s under one title (figure 5.1).

The ownership of the two units will enable the owner to expand into the other unit, when required, without

conflict. Additionally, the owner of the apartment can rent out the other, when a large space is not required.

Alternatively the whole complex could be government or solely owned to allow a range of occupants to be managed by the building owner, depending on the requirements of the new occupants.

Dual-key apartments and consortiums are not a new type of housing. There are many examples internationally, including in Singapore, with one being referenced as a case study. Dual-key apartments are also being developed in Auckland, with a few examples being the Lakewood Plaza and the Union & Co (refer to figure 5.1).

Dual-key apartment units are typically more attractive to investors, as a means to provide two incomes from one property. As a result, a lot of current dual-key apartments are not sized for large families, with some dual-key, double units, being smaller than two separate studio and one-bedroom unit floor area combined (figure 5.2).

Developing the concept of a dual-key unit to consider family-type occupants, can provide another residential option in the housing market.

Figure 5.1 - Floor plan of the proposed dual-key apartment, Lakewood Plaza, located in Auckland, a 33.8m² one-bedroom unit and 29.2m² studio apartment unit

Figure 5.2 - Floor plan of the Lakewood Plaza apartment if they were two standard apartment units. Note that as dual-key apartments, they are under the minimum Auckland District Plan requirement of 35m² for a studio and 50m² for a one-bedroom unit

Occupant
Ownership

5.2 DUAL FIXTURES

To facilitate the transition from one unit to combining two units into one dwelling space, the understanding of the unit layout alteration must be recognised. The Arlington unit designs have positioned the kitchens of two joining units, on opposite sides of each units (refer to figure 5.3). When an apartment is combined with another, it is envisaged that the kitchen is removed and the services are capped.

As identified in the Vancouver post occupancy study, the occupants in larger units, had a greater dissatisfaction with their kitchen (Hofer, 2008, p. 75). One reason identified was that:

“Three-bedroom units are normally home to a greater number of people, but kitchens may not always be designed to accommodate a greater number of people - the kitchen in a three-bedroom unit may only be 25 percent larger than a kitchen in a one bedroom unit, even though the larger kitchen may need to support the needs of more residents” (Hofer, 2008, p. 75).

It is also important to recognise the need for greater storage space in family kitchens and acknowledge that kitchens are more frequently used in family-households (2008, p. 77).

This finding is also supported by some of the case studies by comparing the

size of the kitchens between the two and three bedroom units:

The Ramona apartments:

- Two bedroom: 9m²
 - Three bedroom: 9m²
- 0% increase

Nightingale:

- One bedroom: 5.5m²
 - Two bedroom: 8m²
- 46% increase

Kent Vale:

- One bedroom: 3m²
 - Two bedroom: 8m²
 - Three bedroom: 14m²
- 267% and 175% increase

Arlington:

- One bedroom: 8m²
 - Three bedroom: 10m²
- 25% increase

(However, implementing the flexible capabilities and changing a one-bedroom unit into a three-bedroom unit has a 0% increase of kitchen area for both Arlington and Kent Vale)

It is important to consider the design of the kitchen area when designing flexible spaces. Unlike bedrooms and bathrooms, the kitchen area needs to increase in area and not by number of rooms.

Figure 5.3 - Arlington floor plans showing the flexible alterations of the units from one bedroom to a four bedroom unit, where the kitchen area remains the same despite the increase of occupants

Figure 5.4 - Authors redesigned Arlington floor plans to facilitate the increase of the kitchen area when the number of bedrooms increase

Frustration identified regarding the double-up of space being used for circulation between the connecting units and moving space when the kitchen is in use.

A greater penetration through the shear wall would be required to address the circulation issue. This may result in deeper beam to compensate for the reduced structural wall area.

The increased connectivity between the two units reduces the conflict of space in the kitchen area.

Figure 5.5 - Further development of the redesigned Arlington units. Consideration to the circulation problem and addressing it

Three bedroom unit at 96.5m²
with a kitchen of 10m²

The design of a dining table that can fold down will mean the circulation space is not compromised if an additional bedroom is required.

Three bedroom unit at 96.5m²
with a kitchen of 10m²

Another design solution is to remove the part of the kitchen to make space for a small dining room.

Figure 5.6 - Final development options of the redesigned Arlington units

5.3 FLEXIBLE DESIGN

One restriction has been identified in the implementation of flexible units. This is the requirement to obtain a building consent. The Building Act allows some building work to not require a building consent. Section 11 covers internal walls and doorways in an existing building, including conditions where the exemption is not applicable. The New Zealand Building Act (S11) requires a building consent for walls that are (Ministry of Business, Innovation and Employment, 2017, p. 11):

- load-bearing
- a bracing element
- a firewall

The proposed flexible system would still require a building consent because the partition is most likely, always a firewall.

Figure 5.10 depicts the two different levels of flexibility that could be achieved. The aim of the following exploration is to identify various design solutions that eliminate the requirement to obtain a building consent.

STRUCTURE

To avoid structural alterations of the existing building, and triggering a building consent requirement, only certain types of structural members could be specified.

The City of Toronto guidelines recommend avoiding shear walls when designing flexible spaces (2017, p. 31). However, shear walls were specified as the structural member for the inter-tenancy walls between the units in the Arlington case study. Penetrations

Figure 5.7 - Structure option one, column and beam with wall partitions

Figure 5.8 - Structural option two, shear walls with penetrations

Fire-rated plaster board

Fire-rated door

Concrete

Figure 5.9 - Various fire-rated design options

pre-casted into the shear walls and sealed with a fire-rated plaster-lined timber partition meant structural alterations were not required. The area that connected the two Arlington units together were small (size of a door).

It is therefore, recommended to adopt a column and beam structural grid if a greater area of flexibility between the walls is preferred.

FIRE

The Building Act, Clause C's objective is to "(b) protect other property from damage caused by fire" and to ensure "C3.3 Buildings must be designed and constructed so that there is a low probability of fire spread to other property vertically or horizontally across a relevant boundary" (Department of Building and Housing, 2012, pp. 1, 3).

In order to achieve these requirements, the inter-tenancy walls between the different units are typically firewalls. Although Kent Vale and Arlington case studies had avoided alterations to the structure, the two case studies still required the removal of the shared partitions between the two units. The alterations of the shared partition and therefore, the firewall, triggers the requirement for a building consent.

One solution to avoid the requirement of obtaining a building consent is by specifying a fire-rated partition that can be legitimately moved out of the way, rather than a non-loadbearing, removable partition. A simple proprietary system would be a fire door.

Figure 5.10 - Two established levels of flexibility held by apartment units

HORIZONTAL FLEXIBILITY (FIRE DOOR)

Proposing a fire door between two units will mean the doors can be opened or closed and locked, rather than removed. The units can expand and contract without the need to obtain a building consent. A greater level of connectivity can be achieved through the implementation of a double door.

+ Positives:

- Flexibility achieved without requiring a building consent.
- Although initial costs of fire doors are higher than a standard door or partition, savings would be achieved from the cost omissions of demolition and building consent fees.

- Negatives:

- The level of connectivity between the two units is limited and depends on the size of the door opening. Only a double-leaf fire door could be specified to provide wider hallway connection between the two units.
- More research required with regard to the acoustic performance of the door.

Figure 5.11 - Example of how a flexible unit can transition horizontally, to accommodate a household as they evolve into different family phases

VERTICAL FLEXIBILITY (FIRE STAIRCASE)

Different floor levels of expansion can also be explored to provide an alternative means of flexibility. Providing individual staircases for the separate units enables expansion vertically.

+ Positives:

- Another level of flexibility achieved without requiring a building consent.
- Provides a greater level of separation to occur between private rooms (bedrooms and bathroom) and open spaces (living, dining and kitchen areas).

- Negatives:

- Expansion vertically does enable greater number of bedrooms to be incorporated. However, it does not allow important facilities such as the kitchen and living spaces to increase and accommodate the additional occupants.
- Expensive to construct but removes the need for demolition and obtaining building consents.

Figure 5.12 - Example of how a flexible unit can transition vertically, through a fire staircase, to accommodate a household as they evolve into a different family phases

HORIZONTAL AND VERTICAL FLEXIBILITY (FIRE DOOR PLUS STAIRCASE)

The combination of the two methods, both horizontal and vertical flexibility will enable a greater variation of flexible unit options.

+ Positives:

- Provides more options for occupants regarding how the units expand.
- Does not require building consent when expanding and contracting units.

- Negatives:

- There is still some limitations of connectivity caused by the limited size of the fire door opening.
- This option is more expensive than implementing a removable fire-rated partition.

Figure 5.13 - Example of how a flexible unit can transition both horizontally and vertically, through fire-doors and a fire staircase, to accommodate various sized family-households

Figure 5.14 - Physical model iterations of horizontal and vertical flexibility unit options

5.9 MOVABLE FIRE WALL

To address the previously identified limitations, a simple movable fire-rated wall was established. The elements that make up this wall include fire-rated plaster boards, 90x45 timber studs, wall insulation, roller wheel system on the top and bottom of the wall and intumescent strip lining in areas of separation (i.e. bottom of wall to floor, top of wall to ceiling and wall to other separate wall).

+ Positives:

- Provides more control to owners, where a greater level of connectivity is achieved when compared to the previous options.
- The movable walls enable important facilities such as the kitchen and living room to expand and accommodate the additional occupants.

- Negatives:

- Although it provides a greater level of flexibility and open plan, the walls still act as barriers to prevent maximum open connection between the two units. Therefore, the units need to be designed so that the obstruction of the wall itself, is minimised.
- All the components within the movable fire-rated wall means it is an expensive option and also takes up space.

Figure 5.15 - Exploded axonometric of the conceptual movable firewall

Figure 5.16 - 3D physical model of a working movable firewall, built to a 1:50 scale

Single apartment units

Two single apartment units connected by the moveable firewall

Two single unit stacked on top of each other

Vertical connection between the two units via fire staircases

Plan's Scale: 1:100

5.4 CHAPTER CONCLUSION

Flexibility is a unique design feature that can be used to address the various requirements for each family type. The concept recognises the development of families into different types and the need for more space when the number of family members increase.

The use of flexible fire walls, that achieves the required acoustic rating and good level of connectivity, will be used in the next stage of designing family-friendly high density. This concept will be implemented and tested within a context, in the following chapter.

Figure 5.17 - Conceptual diagram of the flexible unit design development. Implementing both the vertical fire staircase and horizontal movable firewall, this diagram considers the flexible concept in floor plan, unit and building form

Figure 6.0 - West boundaries of the site (between the chosen site and public park / Wynyard Quarter Pump Station)

6.0 DESIGN PROCESS AND ITERATIONS

This chapter provides an overview of the initial design explorations based on the findings from the literature review, case studies and site analysis.

The scope of residential design is very broad, and therefore, this thesis intends to acknowledge the various aspects associated with family housing and living conditions, but focus on:

- Addressing family-friendly design
- Minimising wind effect on high-rise
- Maximising natural sun lighting
- Developing a "reference point" building
- mitigating rising ground water and inundation

Various iterations of the building form were explored and a description of a finalised design proposal is presented in chapter 7.

6.1 DESIGN CRITERIA

The first step of this design process focused on the planning of the individual units and an explanation of the flexibility concept.

To begin this process, design criteria were established based on the literature review, guidance documents and case studies. These will be followed when establishing the developed design.

Indoor considerations

- Facilitate affordability by designing co-housing and shared amenities such as the laundry
- No single-aspect apartment units
- No internal rooms and no hallways
- Maximum depth of a double aspect dwelling is 10m
- Incorporate various storage options, including but not limited to, ground floor storage, coat storage near the entry, and a minimum of 1m² area within the bedrooms to be dedicated to storage.
- Minimum area for a:
 - one bedroom dwelling is 50m²
 - three bedroom dwelling is 100m²

Only two types of units have been noted, as the concept of flexibility will be tested within this chapter. Fundamentally, this means two one-bedroom units at 50m² can be combined into one three-bedroom unit with a floor area of 100m².

- Meet the minimum requirements for room areas
- Organise unit arrangements to facilitate supervision between rooms
- Open plan living, dining and kitchen, to facilitate supervision
- Minimise internal finishing to promote affordability
- Adopt a perimeter style of building form (i.e. U, C, L, O)

Outdoor considerations

- Amenities not identified within the urban context can be integrated into the proposed building design, on the ground floor.
- No carparks need to be provided, but a shared car facility should be provided
- All units must have access to a "backyard", outdoor spaces that are private and semi-private
- Outdoor spaces need to provide sufficient barriers that prevent children climbing or falling off the balcony, i.e. flexible facade that incorporates barriers for an outdoor space where children can play
- Maximise private space by establishing various shared amenities such as large outdoor space and laundry facilities.
- Orient the semi-private outdoor spaces either north facing or west facing to capture at least three hours of afternoon sun. This is to promote the use of the shared space, after work or school, in an attempt to facilitate neighbourly interactions.
- Building orientation should also frame the surrounding views (i.e. the harbour and Harbour Bridge, Sky Tower, Victoria Park)

Figure 6.1 - Physical model of Wynyard Quarter area and site. Building modelled on site to show max capacity

6.2 ITERATION MODELS

Based on the preferences of families, identified in the literature review, and the research obtained in the site analysis, various building forms were established and evaluated depending on identified design criteria. Easy access to outdoor spaces was a common housing feature that was identified as important for all families, regardless of whether or not they occupy high-rise dwellings. Therefore, the orientation of the outdoor spaces have also been considered in this building-form-establishing exercise.

THE BLOCK

Typically, the establishment of an outdoor space for each unit comes in the form of a private, small, outdoor balcony. However, to trial different provisions of an outdoor space for the units, the individual private outdoor spaces are now inverted and combined to offer a larger, semi-private and communal outdoor space (refer to figure 6.2).

The iterations have a maximum floor area of 1200m². They are based on a 10mx10m square grid, as a guide of either one, 100m² three-bedroom unit, or two 50m² one-bedroom units.

Outdoor space "backyard"

Direct visibility to other units

Visibility to the outside

Scale - 1:1000 @A4

Figure 6.2 - Sketch iterations of building mass, where the circulation and outdoor space are combined

THE PLUS

- Number of units per floor: 12 one-bedroom units
- Area of outdoor space: 6m^2
- Level of visibility between units (Privacy): Average
- Number of exits required: One
- Quality of sunlight exposure (interior): Average
- Quality of sunlight exposure (outdoor spaces): Good

THE DONUT

- Number of units per floor: 16 one-bedroom units
- Area of outdoor space: 4m^2
- Level of visibility between units (Privacy): Poor
- Number of exits required: Two
- Quality of sunlight exposure (interior): Average
- Quality of sunlight exposure (outdoor spaces): Low

Figure 6.3 - Process iterations of how the building masses were developed, including plans showing visibility in and out of the units

THE "C"

- Number of units per floor: 14 one-bedroom units
- Area of outdoor space: 5m²
- Level of visibility between units (Privacy): Good
- Number of exits requires: One
- Quality of sunlight exposure (interior): Good
- Quality of sunlight exposure (outdoor spaces): Average

THE PAIR

- Number of units per floor: 16 one-bedroom units
- Area of outdoor space: 4m²
- Level of visibility between units (Privacy): Good
- Number of exits requires: Two
- Quality of sunlight exposure (interior): Good
- Quality of sunlight exposure (outdoor spaces): Good

Outdoor space "backyard"

Direct visibility to other units

Visibility to the outside

THE "U"

Number of units per floor: 20 one-bedroom units

Area of outdoor space: 3m²

Level of visibility between units (Privacy): Low

Number of exits requires: One

Quality of sunlight exposure (interior): Average

Quality of sunlight exposure (outdoor spaces): Average

THE "H"

Number of units per floor: 12 one-bedroom units

Area of outdoor space: 6m²

Level of visibility between units (Privacy): Good

Number of exits requires: One

Quality of sunlight exposure (interior): Good

Quality of sunlight exposure (outdoor spaces): Good

Figure 6.4 - More iterations of physical massing, building models

- Number of units per floor: 16 one-bedroom units
- Area of outdoor space: 4m^2
- Level of visibility between units (Privacy): Low
- Number of exits requires: One
- Quality of sunlight exposure (interior): Average
- Quality of sunlight exposure (outdoor spaces): Average

- Number of units per floor: 20 one-bedroom units
- Area of outdoor space: 3.5m^2
- Level of visibility between units (Privacy): Good
- Number of exits requires: One
- Quality of sunlight exposure (interior): Average
- Quality of sunlight exposure (outdoor spaces): Good

Outdoor space "backyard"

Direct visibility to other units

Visibility to the outside

6.3 CHOSEN FORM PROCESS

The chosen building form is defined by various site factors, such as maximising sunlight, provision of a communal outdoor space in close proximity to the units and views of various landmarks located in the Auckland CBD, while minimising wind exposure and controlling density levels.

Similar to how the other iterations were developed, this chosen form begins as a block shape, the maximum occupancy of the site. The form is carved to maximise afternoon sunlight, with an entry within the most shaded area. The entry area chosen is accessible from the main street but also stepped back from the general public as a security precaution for the residents.

An outdoor space is established in the north-west side of the building to maximise the afternoon sun, when occupants are likely to be home. These design considerations are to facilitate after work or school activities such as relaxing or reading in the sun or BBQs and group gatherings.

The ground floor public amenities were also decided in accordance to the

Number of units per floor: 12 one-bedroom units

Area of outdoor space: 3.5m²

Level of visibility between units (Privacy): Excellent

Number of exits requires: One

Quality of sunlight exposure (interior): Good

Quality of sunlight exposure (outdoor spaces): Good

Figure 6.5 - Development process of the chosen building form

Figure 6.6 - Axonometric drawing of building, indicating the ground floor public spaces

facilities that were missing in the urban context of the site (figure 6.6).

SUN EXPOSURE

Figure 6.8 and 6.9 indicates the level of sunlight exposure in the outdoor space. The diagrams show the depth of the natural light, depicted in one hour increments. The purpose of the diagrams are to confirm an adequate amount of natural light to the outdoor spaces during the summer and winter. Mapping winter was especially important due to the period being colder, therefore, confirmation of adequate sunlight into the outdoor space was imperative to ensure the space could be used all year round.

Figure 6.7 - Building section indicating level of sunlight access to the outdoor spaces

Figure 6.8 - Summer Solstice (20 - June)

Figure 6.9 - Winter Solstice (21 - December)

Figure 6.10 - Sketch analysis of ParkRoyal hotel

SKY GARDEN CASE STUDY

Just like family-friendly, high-density dwellings are a new concept within the New Zealand context, sky gardens are also a foreign concept. Therefore, references from an international context was required. One inspiration was taken from ParkRoyal.

This case study was chosen for its organic, natural form of the green balconies. Although the function of the building is a hotel, rather than an apartment, this results in numerous amenities provided as part of the communal outdoor area. These facilities includes infinity pools, nature walk routes, and bird-cage framed gazebos. The box-y glass form of the main building is broken down and fragmented via the projecting green balconies.

Influential aspects of this case study that can be used to define the proposed building and sky garden includes the organic form of the greenery, contrasting with the ridged structure.

REDACTED

REDACTED

Figure 6.11 - Section and plan sketch analysis of ParkRoyal hotel

FURTHER FORM PROCESS

Further developments of the building recognise the disproportionate quality between the various outdoor spaces. This is defined by the floor level, where the lower the storey, the harder it is for the light to enter into the deep areas of the outdoor spaces. To address this issue, the semi-private outdoor spaces were redesigned to be tiered, reducing in floor area, the higher the storey. Additionally, the number of semi-private outdoor spaces that were closest to ground levels, were reduced (because of their proximity to the park and to allow lighting), while separation between the outdoor floors were increase from two storeys to three storeys.

The tiering of the outdoor space was also required to address the obligations required for resource consent compliance.

AMENITY - COMMUNAL SKY GARDEN

The development of this final outdoor design has triggered a thought provoking debate regarding the usage and ownership of the shared outdoor spaces and the occupants of the apartments. A critic identified that the units closest to the areas with outdoor spaces would claim the space for themselves and neighbourly conflict would be caused by the shared outdoor spaces.

One argued resolution for this problem would be to provide only private spaces for the units, while providing only one well defined, communal outdoor space for the whole complex to share or rely on the neighbouring public park (therefore, removing all the semi-private sky gardens).

Figure 6.12 - Further development and refinement of the chosen building form

However, the argument for the provision of these sky gardens, is to provide each residence with a large outdoor space that is within a close proximity to their units. As identified in the literature review, Jan Gehl states that any units beyond five storeys will become disassociated with the ground level. Therefore, to minimise the feeling of isolation, the semi-private, shared outdoor space was designed as areas to facilitate a community between the neighbouring units. Additionally, the building at 5 storeys could have easily been an option, however, as part of the Auckland Council Wynyard Quarter

plan, the building intended for the proposed site to be a tall beacon for orientation.

To deter the possibility of occupants claiming spaces, various amenities have been established that can be proposed as part of the sky garden. Rather than a large green space, the outdoor area is developed to facilitate a range of different activities, both solo and group functions. The following pages includes sketched thoughts, program layout and structural design, all in the process of finalising the building design.

BUILDING AMENITY	INDIVIDUAL ACTIVITIES	ENGAGING GROUP ACTIVITIES	MATERIALS
Rainwater harvesting	Outdoor seating	Communal Garden	Grass
Compost bin	Tree house	Communal tables	Water
	Walking trail	BBQ area	Timber slatted pavers
	Gardening	Fire pit with benches	Concrete pavers

Figure 6.13 - Materiality, amenities and features considered for the communal outdoor space

Figure 6.14 - Development sketches of the communal outdoor space

Figure 6.15. Development of the communal outdoor area, based on the transitional space

Figure 6.16 - Exterior materiality collected around existing Wynyard Quarter buildings

MATERIALITY

Paving

Grass

PROGRAMS

Hangout space
BBQ Space
Fire pit

Seating

PRIVACY

Public

Semi-Private
Communal

CHILD DEVELOPMENT

Teenager

Figure 6.17 - Section of building, indicating progress and programming

Figure 6.18 - Sketch exploration of decorative column and beams to divide the space vertically

Figure 6.19 - Renders of various panel explorations

STRUCTURE AND SCALE:

The chosen structural system for the final building design is a column and beam layout. This structural choice is most evident in the outdoor communal sky garden (refer to figure 6.20). The vertical lines that protrude from floor to floor, provides support, and is also organised to minimise the blockage of views and light.

Defined by sun, wind and other site requirements to establish a comfortable and vertical green space, this resulted in a building with awkward geometry in terms of scale. This is notably evident in the green space areas, with a height of three standard storeys to allow sufficient light access. It was difficult to architecturally incorporate a backyard into the high rise context as there are few precedence that proposed large and vertical open spaces. To begin addressing this characteristics, various sketches and test renders of potential directions were developed (refer to figure 6.18 and 6.19)

Figure 6.20 - Chosen iteration, glass gridded panels, provides visible barrier for safety from falling, protection from wind and adopts the square geometry of the apartment block

6.4 BUILDING DESIGN

The initial facade concept was influenced by the idea of transition and change with the family unit. This resulted in using a glass panel to provide a semi-enclosed winter garden area for the lower storey unit. This glass panel extends to the upper storey unit to act as balustrade for the balcony (refer to figure 6.21). The shared glass panels between the two units also fuses the two storeys together, to create an overall illusion that the building is shorter.

However, due to the change and development of the floor plans, the exterior inevitably progressed with it.

Figure 6.21 - Section AA

Figure 6.22 - Facade concept integrating units together to provide a reduced-height appearance

Figure 6.23 - Render of initial facade concept

Figure 6.24 - Sketches, establishing the various flexible facade forms

The final design proposal of the floor plan had altered significantly and therefore, the merging glass panel is no longer applicable in this context. Instead a new flexible facade is developed for the private outdoor space.

For parents to be comfortable with their children running and playing on the balcony without the worry of falling, full height barriers were established. However, it is also important for the barrier to be porous enough for occupants to see the views of the city. The final design of the balustrade is a flexible facade, that has three arrangements (refer to figure 6.2.6).

Figure 6.25 - Section of the balcony with its flexible barrier

Figure 6.26 - Flexible barrier design for the private balcony

Figure 6.27 - Render of facade - sized at 1:100 @A4

6.5 INTERIOR DESIGN

Various iterations were created and tested for the interior design of the apartment units. One issue identified in the flexible inter-tenancy chapter was the static wall area where the movable walls retract and are stored (refer to figure 6.28). In order to minimise the obstruction caused by the static walls, various iterations were explored. Trialling a few different locations for both the fire wall and staircase, concluded that the optimum location would be central to the two units, as shown in figure 6.29, iteration 2. This orientation therefore, splits the open

plan living spaces to enable half to be visible from the communal outdoor space, while the dining and kitchen are stepped back for more privacy.

Identified in the site analysis chapter, utilising wind flow for cooling is important to establish good internal comfort levels, especially for the north facing units. Cross ventilation is achieved by all units as they are designed as double aspect units, with open plan living space and openable windows or doors at either side of the rooms (refer to figure 6.29, iteration 4).

Figure 6.28 - Original concept design of a flexible unit

Iteration 1:
Exploring different a configuration for the fire-staircase and movable firewall. An angled stairwell that still complies with D1 has been designed in an attempt to save space.

Iteration 1:
One bedroom -
Total floor area: 57m²
Usable floor space: 51m²
Therefore, Three plus bedroom -
Total floor area: 114m²
Usable floor area: 106.9m²

Iteration 2:
Interior reorganisation of the unit so that the fire-stairwell is located in the centre, between the connecting units. The movable firewall retracts into the established, fire-rated walls of the stairwell for efficiency.

Iteration 2:
One bedroom -
Total floor area: 69m²
Therefore, Three plus bedroom -
Total floor area: 138m²
Next step - reduce the floor area to a reasonable size; 19m² over the recommended minimum 50m²

Iteration 3:
Reduced the total floor area of the unit to align closer to the 50m² benchmark for a one bedroom unit. However, awkward spaces have been created.

Iteration 3:
One bedroom -
Total floor area: 64.4m²
Therefore, Three plus bedroom -
Total floor area: 128.8m²
Next step - reduce the floor area to a reasonable size; 14.4m² over the recommended minimum 50m². Additionally, remove the wasted space of a hall way created by the storage

Iteration 4:
Reduced the total floor area of the unit even further to align closer to the 50m² benchmark for a one bedroom unit. Closet is now closer to the entry and a semi-private outdoor space has been established

Iteration 4:
One bedroom -
Total floor area: 60m²
Usable floor space: 53m²
Therefore, Three plus bedroom -
Total floor area: 120m²
Usable floor area: 109m²
Private outdoor space: 3.5m²

Figure 6.29 - Development of the unit design

Figure 6.30 - Final design of the wardrobe and desk design

FLEXIBLE FURNITURE

Although most of the literature review guidelines were implemented in the final iteration of the apartment units, one variation was made for the bedrooms. To maximise the limited apartment floor area, the combination of the wardrobe and desk furniture were established (figure 6.30)

RISE AND DENSITY

The final design proposal of a 52m green beacon consists of 75 flexible one-bedroom units. On a 1,747m² area of land, this means the density of the building was considered very high (423 units per hectare). However, if the large area of sky gardens (total of 3,724m²) are also considered, the density is therefore, on the lower side of high-density (135.2 units per hectare).

6.6 CHAPTER CONCLUSION

The final design proposal was established in this chapter. Through the exploration of various building iterations, a family-friendly building form was created. This was heavily influenced by the site conditions and the need for family-friendly outdoor spaces. Large areas on a few floor levels were dedicated to communal sky gardens, to demonstrate their importance. The concept of flexible, family-friendly designs were also explored. The theme of flexibility is referenced in various scales, including the building and unit scale, and furniture design, emphasising its significance to families. The provision of flexible amenities provides the occupants more control over their space, compared to a standard high-density dwelling.

Urban:	Building:	Unit:
<ul style="list-style-type: none"> - This final design is located in a safe neighbourhood, away from cars and roads. - The lack of day-cares within the urban context is addressed by proposing a day-care on the ground floor of the building. - The site is within a close proximity to supermarket, schools, parks and public transport - The chosen site is located in a residential area, within walking distance to the CBD. - Larger amenities, such as primary schools, not within the CBD context, can be explored and designed in a high-density, vertical form. 	<ul style="list-style-type: none"> - The final design proposal facilitates affordability by designing shared amenities such as the laundry and outdoor spaces - The building has been designed to minimise density problems by dividing the building with communal outdoor spaces. - The units are organised in a perimeter style (L) around the outdoor space to facilitate supervision - The structural elements for this building is columns and beams to accommodate flexible unit designs. - The final design proposal of the building is recognised as a high-density, high-rise building. - Units have horizontal and vertical flexibility to provide a wide range of unit sizes 	<ul style="list-style-type: none"> - The final design proposal includes private outdoor spaces for units, controlled by a flexible barrier/facade. - The size of the indoor spaces are conform with the recommendations of the guidance documents. - For smaller rooms (bedrooms) flexible, multi-use furniture have been designed to maximise the limited amount of space. - Storage options include, ground floor lockers, entry cupboards and bedroom wardrobes - Open plan living, dining and kitchen, to facilitate supervision - There is minimal internal finishing to promote affordability - There are no internal rooms and no hallways

Table 3 - Review of family-friendly features established in the final design proposal

Figure 7.0 - South side boundary of chosen site (between the chosen site and existing bus station)

7.0 FINAL DESIGN PROPOSAL

This chapter presents the final design proposal stage of a family-friendly high density dwelling. The purpose of this chapter is to portray one idea of how families might suitably live in higher-density dwellings.

The complete set of various flexible floor plan iterations can be found in Appendix B.

Figure 7.1 - Urban plan of the site

Figure 7.2 - Ground floor plan of the building (public) 1:200 @A4

Figure 7.3 - Typical Building floor plan of the building (lower second storey) 1:200 @A3

Figure 7.4 - Typical Building floor plan of the building (upper second storey) 1:200 @A4

7.1 STANDARD - EAST APARTMENT UNIT

Located on the east side of the apartment, these units are the standard design developed as a response to the concept of flexibility. Flexibility is achieved vertically by two storeys and horizontally between two units. The transition between the smallest

option of a one bedroom unit to a six bedroom unit through moveable walls and transitional staircases, is indicated throughout this section of the thesis.

The design of this apartment unit is to accommodate the changing family aspects. The flexible unit design enable families to grow in their home, as their space can grow with them.

Figure 7.5 - 3D perspective render of proposed building, colour coded as reference to the location of each 3D unit iteration

Figure 7.6 - East side - one bedroom unit

This is the standard apartment unit offered on the east side of the apartment. The one-bedroom apartment would be perfect for pre-families or mature families.

Figure 7.7 - East side - three bedroom unit

When the pre-family decide to have children, they can expand their one bedroom unit into a three bedroom unit by moving into the neighbouring unit once it is unoccupied.

Figure 7.8 - East side - three bedroom unit

Another option for pre-families wanting to expand their apartment unit is to expand vertically via the fire staircase. This orientation provides better privacy for the private (i.e. bedroom) rooms, than the previous iteration.

Figure 7.9 - East side - four bedroom unit

For more space, and an additional bedroom, the retraction of the moveable wall can merge the existing unit with the neighbouring unit. This iteration provides more space for families to hold gatherings, and interior play space for children.

Figure 7.10 - East side - three bedroom unit

An alternative solution is to expand the upper level, rather than the lower level. The lower level enables a play space for the children that flows to the outside.

Figure 7.11 - East side - six bedroom unit

The greatest level of expansion provides the occupants with six bedrooms, perfect for a multigenerational family. Grandparents can occupy the bedroom on the lower storey, to avoid stairs.

7.2 SPLIT STOREY - EAST APARTMENT UNIT

This type of apartment was established as a response to the increased number of storeys per semi-private outdoor spaces. The increased height

separation of the communal sky gardens in the lower floor level of the building, from two storeys to three storeys, triggered the requirement for a new unit design. The reconfiguration of the units needed to address the different accessways into the various units.

Figure 7.12 - East side - three bedroom unit

Due to the configuration of the units in the building, some units have entrances from a different sky-garden floor level. These are standard three or four bedroom units and accessed via one staircase.

This resulted in the design of numerous units to have an entry from a certain outdoor floor level, but have a view of a different communal outdoor area, as shown in figure 7.12. This new configuration establishes another set of flexible unit options,

enabling even larger sized units. These can accommodate multigenerational families, who also required a greater range of privacy.

Figure 7.13 - East side - five bedroom unit

In order to obtain a direct, physical connection between an outdoor space and a unit's interior living space, the upper storey can be claimed and occupied.

Figure 7.14 - East side - six bedroom unit

Standard means of occupying the whole floor, by moving the fire-rated partitions, enables a greater area of living space, including an additional bedroom.

Figure 7.15 - East side - ten bedroom unit

Ten bedrooms is the largest unit offered in the building. This option would be perfect for a multigenerational family. Each generation could occupy a different floor level.

Figure 7.16 - East apartment unit. Floor plan of iteration one, four units of one-bedroom
(Floor plan for figure 7.6)

NTS @A4

Figure 7.17 - East apartment unit. Floor plan of iteration two, two units of three-bedroom (Floor plan for figure 7.7)

NTS @A4

Figure 7.18 - East apartment unit. Floor plan of iteration three, two units of two to three-bedroom
(Floor plan for figure 7.8)

NTS @A4

Figure 7.19 - East apartment unit. Floor plan of iteration six, one unit of seven-bedroom (Floor plan for figure 7.11)

Figure 7.21 - South side - four bedroom unit

Standard apartment units in the southern area of the building are typically larger than the east side apartments.

Figure 7.22 - South side - two bedroom unit

The standard units in the southern area of the building have two bedrooms. It is designed to have an open plan kitchen, and living closest to the sky garden, facilitating indoor/outdoor flow.

Figure 7.23 - South side - four bedroom unit

Due to the large size of the south units, only one expansion integration is offered. Vertical expansion through the fire stairwell enables occupants to gain more space.

Figure 7.25 - Physical model of a building section from above (north area of the building)

Figure 7.26 - Physical model of a building section, view from communal sky garden into units

Figure 7.27 - Physical model of a building section, north

Figure 7.28 - Section render of building showing afternoon sun flooding into the communal outdoor spaces

Figure 7.29 - View of communal outdoor space and circulation space

Figure 7.30 - South facing entry to access every communal outdoor / circulation space, taken from the 10th storey

Figure 7.31 - Southern unit, indoor-outdoor flow, easy expansion to facilitate large family or neighbourhood gatherings

Figure 7.32 - Interior perspective of unit expansion

Figure 7.33 - Perspective from child's point of view, doing homework

Figure 7.34 - View of lounge and communal outdoor space, showing potential flow and possible supervision

Figure 8.0 - Approaching the site from the south

8.0 CONCLUSION

This chapter summarises and reflects on the findings of the thesis. In addition, due to the scope of the thesis, a number of aspects could not be covered or only discussed with a surface level understanding and briefly discussed. These issues are also identified in this conclusion and inform recommendations for further research and analysis.

The aim of this thesis was to gain a better understanding of what is required for a family-friendly, high-density vertical housing development. The gathered knowledge is used to propose a design that facilitates families that want to live in high-density apartment buildings. New Zealand currently lacks high-density housing options that are considered suitable for raising children. Therefore, another objective was to propose another housing option that families can suitably choose if they did not want to live in a standalone dwelling.

Surveys, guidance documents, case studies and a post occupancy study helped define what is considered "family-friendly" high-density, vertical housing. The proposed design considered various family-friendly features from three different scales, including urban, building and unit. These are important to consider in unison to develop a holistic family-

friendly development. The concept of "flexible spaces" was a significant design tool that was developed and then referenced frequently throughout the design process. The provision of flexible furniture, units and facades would not only enable the homes to grow with the family, but would also increase the level of control experienced by the occupants.

Another significant focus in the thesis was the communal outdoor area. These areas include spaces where neighbours can gather or meet to minimise isolation, space for children to play outdoors safely, and an area where high-rise dwellers can be closer to nature, especially those living above five storeys. Density levels are also positively affected with the provision of large, vertical outdoor areas. The overall design proposal exhibits the specific qualities needed in a family-friendly, high-density vertical housing development.

8.1 CRITICAL REFLECTION

It is important to confirm that this thesis does not aim to convince all families to live in high-density vertical conditions. This is evident through the established concept of flexible units, which was a significant idea developed as part of this thesis. For the flexibility concept to work as intended, it relies heavily on the fact that not all families would want to continue living in high-density, vertical housing conditions. Therefore, as some families decide to move out of their unit, another family that sees the apartment as a long term accommodation, can expand into that unit.

The final design of the family-friendly, high-density dwelling proposal heavily promotes the importance of celebrating green spaces in the high-rise context. To challenge the status quo regarding high-density dwellings, the proposal was deliberately designed with less density per floor, than standard apartment developments. However, to differentiate from luxury apartments, which are not usually an option for most families, common areas and shared amenities were proposed to reduce costs.

One of the aims for this thesis was to develop an alternative, suitable housing option for families. This resulted in the development of a new typology that fused the domestic lawn with a high rise context. Defined by sun, wind and other site requirements to establish a comfortable and vertical green space, this resulted in a building with contrasting geometry in terms of scale. This is particularly evident in the green space areas, with a height of three standard storeys to allow

adequate light access. With more time, a greater attention to refining the overall building form would be conducted to resolve the conflicting scale and form. Difficulties were experienced with incorporating a backyard into the high rise context as there are few precedents that dealt with large open spaces organised vertically.

8.2 FUTURE RESEARCH

An interesting area of research identified in the process of this thesis includes exploring the concept of a movable fire-rated wall. This includes what a movable wall would contribute, such as the cost omission of demolition or rebuilding and building consent fees. A greater level of research into the movable fire-rated wall is important as it provides another level of realism into the design solution. This thesis assumed the implementation of a movable wall would be cheaper than the total cost of demolishing or rebuilding a shared, fire-rated partition. If proven to be correct, further research into the construction of this wall is justified. It would also be feasible as an affordable means of providing flexible living spaces in the real-world context.

Another interesting family-friendly feature that requires more in-depth research is the concept of vertical schools. The further research of higher-density, vertical schools is important as finding a home within a good school zone was considered very important to families. Due to the limited space and high cost of land within the city centre, the most reasonable means of developing a new school within this area is by building it up.

Figure 9.0 - View of the site from the main road (Fanshawe Street / Victoria Park)

9.0 APPENDIX

This chapter includes various appendix images, including every iteration of the flexible unit, depicted as floor plans.

Figure 9.1 - Single aspect, two bedroom design iteration

INTERIOR AREA: 94m²
 EXTERNAL AREA: 15m²
 INTERNAL PRIVACY: ● ○ ○ ○ ○
 LEVEL OF SPACE OVERLAP: ● ● ○ ○ ○

INTERIOR AREA: 90m²
 EXTERNAL AREA: 26m²
 INTERNAL PRIVACY: ● ● ○ ○ ○
 LEVEL OF SPACE OVERLAP: ● ● ● ● ○

INTERIOR AREA: 100m²
 EXTERNAL AREA: 13.5m²
 INTERNAL PRIVACY: ● ● ● ● ●
 LEVEL OF SPACE OVERLAP: ● ● ○ ○ ○

Private outdoor space
 Play space
 Minimum room space

Scale - 1:100 @A3

Figure 9.2 - Single aspect, three bedroom design iteration

INTERIOR AREA: 122m²

EXTERNAL AREA: 15m²

INTERNAL PRIVACY: ● ● ● ○ ○

LEVEL OF SPACE OVERLAP: ● ○ ○ ○ ○

INTERIOR AREA: 107m²

EXTERNAL AREA: 15m²

INTERNAL PRIVACY: ● ● ● ● ○

LEVEL OF SPACE OVERLAP: ○ ○ ○ ○ ○

- Private outdoor space
- Play space
- Minimum room space

Scale - 1:100 @A3

Figure 9.3 - Single aspect, three bedroom design iteration

INTERIOR AREA: 106m²
 EXTERNAL AREA: 15m²
 INTERNAL PRIVACY: ● ● ● ● ○
 LEVEL OF SPACE OVERLAP: ● ● ○ ○ ○

INTERIOR AREA: 102m²
 EXTERNAL AREA: 13.5m²
 INTERNAL PRIVACY: ● ● ● ● ●
 LEVEL OF SPACE OVERLAP: ● ● ○ ○ ○

INTERIOR AREA: 108m²
 EXTERNAL AREA: 13.5m²
 INTERNAL PRIVACY: ● ● ● ○ ○
 LEVEL OF SPACE OVERLAP: ○ ○ ○ ○ ○

Private outdoor space
 Play space
 Minimum room space

Scale - 1:100 @A3

Figure 9.4 - East apartment unit. Floor plan of iteration one, four units with one bedrooms. Scale - 1:100 @A4

Figure 9.5 - East apartment unit. Floor plan of iteration two, two units with three bedrooms. Scale - 1:100 @A4

Figure 9.6 - East apartment unit. Floor plan of iteration three, two units with two to three bedrooms. Scale - 1:100 @A4

Figure 9.7 - East apartment unit. Floor plan of iteration four, two units with one to four bedrooms. Scale - 1:100 @A4

Figure 9.8 - East apartment unit. Floor plan of iteration five, two units with one to five bedrooms. Scale - 1:100 @A4

Figure 9.9 - East apartment unit. Floor plan of iteration six, one unit with seven bedrooms. Scale - 1:100 @A4

Figure 9.10 - South apartment unit. Floor plan of three units, one and four bedrooms. Scale - 1:100 @A4

10.0 REFERENCE LIST

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Figure 4.8 (B) – 132halsey. (2015). 132 Halsey - Exclusive Waterfront Apartments For Sale, Wynyard Quarter Auckland. Retrieved from http://www.132halsey.co.nz/assets/uploads/sliders/_1920x1080/HomeSlider-1_copy-min.jpg

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