Shared Living, Shared Strength:

Housing and Single Parenthood

By (Maria) Wo Kwan Tam

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Abstract

The number of single parent families in New Zealand is increasing. This household type is forecasted to represent twenty percent of all families in the country by 2021. Despite the growing concern over these families, the majority of New Zealand's existing housing stock fails to address their housing needs.

Single parent families often hold the following housing needs as important – affordability, accessibility to services, a sense of community, safety and security, and a positive image. The research investigates how housing in New Zealand can be designed to fit more closely to these needs.

A review of architectural literature and leading practice is conducted to find the relevant architectural ideas that can help to address these needs. Ideas include alternative housing strategies (i.e. work-live arrangements, cohousing, mixed-use and integrated living), concepts for the creation of social space, Crime Prevention Through Environmental Design (CPTED), guidelines for designing safer homes for children, methods of creating barrier-free design and approaches to reducing operating costs in housing.

Through a reinterpretation of these ideas, a new housing exemplar is designed within the context of Wellington City. The research acknowledges that the design in this thesis is only supported in theory. An actual construction of a design with similar parameters is required in order to test and consolidate the ideas further. Nevertheless this thesis demonstrates how housing design can begin to service single parent families in New Zealand.

Contents

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Finally to my family, thank-you for the years of support you have provided towards my passion for architecture.

1. Introduction

1.1 The rise of single parent families

The shape of New Zealand's family structure is changing. Soon the traditional two-parent family will no longer be the dominant family type in New Zealand. Between 2001 and 2021, the number of families in New Zealand is expected to rise from 1.05 million to 1.28 million, and the number of two-parent families is expected to decrease from 446,000 to 418,000, making up only 33% of all families in 2021. It is expected in the same year, couples without children will increase to 48% of all families in New Zealand, while single parent families will increase to 20% (Statistics New Zealand, 2004). Recently, the Government's new benefit: *Sole Parent Support* has raised a lot of public concern around how New Zealand as a country should respond to the needs of single parent families. The focus of this research is to consider this issue in the context of housing design.

1.2 Household makeup of single parent families

The majority of single parents in New Zealand are female. *'In 2001, there were 37,000 men and 162,000 women living as parents in one-parent families. By 2021, this group is projected to contain 55,000 men – and 196,000 women'* (Statistics New Zealand, 2004, p. 55). That means 78% of single parent families will be headed by women (refer to figure 1.1).

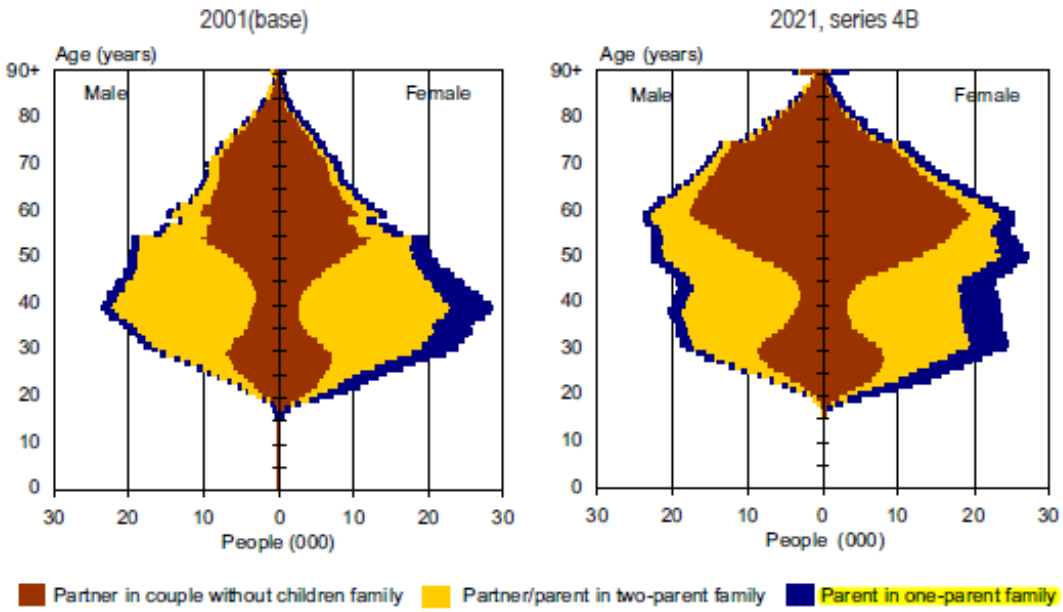


Figure 1.1: Population Age-sex Pyramids for Partner/Parent Living Arrangement Types

Source: (Statistics New Zealand, 2004, p. 51)

The household size of a single parent family is usually small. 82% of all single parent families in 2021 are forecasted to contain either 2 or 3 people (refer to table 1.1).

Household Type	Household Size					
	1	2	3	4	5+	Total
2001 (percent)						
Single-family households containing:						
Couple without children families	0	94	5	1	0	100
Two-parent families	0	0	33	39	28	100
One-parent families	0	42	34	16	9	100
Multi-family households	0	0	0	24	76	100
Other multiperson households	0	60	24	10	0	100
One-person households	100	0	0	0	0	100
2021 (percent)						
Single-family households containing:						
Couple without children families	0	95	4	1	0	100
Two-parent families	0	0	34	39	26	100
One-parent families	0	52	30	12	6	100
Multi-family households	0	0	0	24	76	100
Other multiperson households	0	50	24	17	9	100
One-person households	100	0	0	0	0	100

Note: Owing to rounding, individual figures may not sum to give the stated totals.

Table 1.1: Household size distribution of single parent families forecasted for 2021

Source: (Statistics New Zealand, 2004, p. 49)

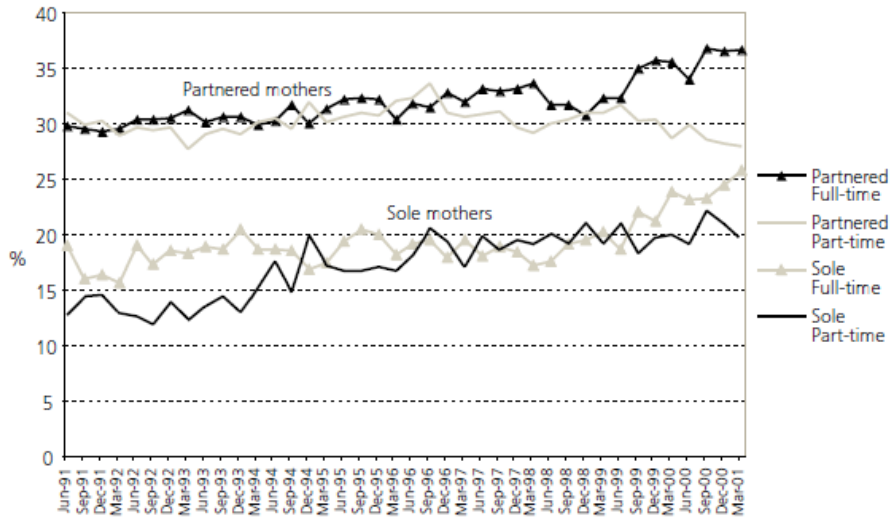
In summary, the household make up of single parent families are usually composed of a mother, and one to two children.

1.3 Housing needs of single parent families

Housing needs for single parent families are not the same as those for the traditional nuclear family. Much has been written about the housing needs of single parent families (Ahrentzen, 1989; Soper, 1980; Hayden, 2002; Anderson-Khleif, 1981). For single parent families, there are five needs of particular importance, they include:

- Affordability
- Accessibility to services
- A sense of community
- Safety and security
- A positive image

Affordable living is important to single parent families because they usually live with very low incomes. *'In 1996, 23 percent of children in sole-parent families had family incomes in the lowest 20 percent of family incomes for all families with children'* (Brown, 1999). In 2009, 90% of single parent family incomes were below the median household income for all household types (Ministry of Social Development, 2010).



Source: Statistics New Zealand, Household Labour Force Survey.

Figure 1.2: Sole and Partnered Mothers' Full-time, Part-time Employment Rates, 1991-2001

Source: (Goodger, 2001, p. 196)

The dominance of single mothers over single fathers has a significant contribution to the low income status of single parents. Women in New Zealand generally earn lower wages than men. On the scale of New Zealand's household income distribution, women are concentrated at the lower end, *'with 21 percent in the bottom quintile, and 17 percent in the top quintile'* (Statistics New Zealand, 1999). Even when women are just as equally qualified as men, men still commonly earn more (Hill, 2000). This is because women are often employed in medium income jobs, such as clerical, service or sales jobs, rather than in the higher paying occupational categories in which men dominate (Hill, 2000), in spite of their qualifications. The incomes of single mothers are low because they tend to work fewer hours than other women and men (Goodger, 2001). Regardless of full-time or part-time employment, single mothers have lower employment participation rates than partnered mothers (refer to figure 1.2). There are several reasons for this. Without a spouse to share child rearing duties, their expenditure on childcare is higher than partnered mothers. For the well-being of their children, some single mothers choose to avail themselves of social assistance to spend more time parenting (Ball & Wilson, 2002).

Social assistance in New Zealand is low. Many single parent families in New Zealand rely on social assistance, and as result, they often struggle to live. New Zealand has the second highest rate of single parent welfare dependency out of all OECD countries (Newman D. M., 2008). In 2009, around 73% of working-age single parents were beneficiaries (Ministry of Social Development, 2010). Over half of all single parent families in New Zealand were considered to be living in low level conditions in 2004 (Todd, 2008). In 2008, single-parent families had a 52% child poverty rate, compared to 13% for two-parent families (Every Child Counts, 2010). Many single parents often fear of unpredictable expenses such as doctor appointments, and prescription medicine. Living on social assistance has been referred to by some as being *"a real struggle"* (Baker & Tippin, 2004).

Accessibility to services refers to the single parents' concern of the proximity of public and community services to their housing. The daily routine of single parent families generally includes travelling between home, school, after school activities, work, and the supermarket (Dragon, 2010; Crosbie). *'The proportion of children in families with access to a car increases progressively with income'* (Brown, 1999, p. 10). Due to the low income of single parent families, they are usually unable to afford a car, relying on walking or public transport to get to these places (Ahrentzen, 1989).

With less adult supervision around the house compared to two-parent families, single parents often rely on childcare and after school activities to look after and occupy their children (Ginsburg, 2007). Childcare is difficult for single parents to attain. In 2009, 30% of all working single parents in New Zealand with their youngest child between the ages of 0 to 2 reported difficultly in securing places for their children. 21% found it difficult to secure childcare at suitable times (Welfare Working

Group, 2010). Problems accessing childcare create a barrier to their participation in employment (Department of Labour; National Advisory Council on the Employment of Women, 1998).

For single parents, employment that is close in proximity to their home can be very important. They often seek jobs that offer them flexible hours (Weiss, 2008), allowing them to juggle both their work and their private life. Jobs that provide school hours as working hours, or working from home, and or onsite childcare can appear particularly appealing to them (Weiss, 2008).

Social isolation is a commonly cited problem amongst single parents. When someone becomes a single parent as a result of separation, aside from the loss of their partner, they may also lose friends (Meakins & Gorman, 2010). With one less adult, emotional and practical support for domestic and childrearing duties around the home becomes hard to source (Smith, 1980). To cope with this, it is common for single parents to move in with their own parents after a separation. The problem with this arrangement is that the solution can come at a price. Single parents can lose exclusive authority over the rearing of their child to their parents (Smith, 1980). When support within the home is reduced, single parents find it difficult to allocate time for participation in social and community activities (Smith, 1980).

Safety and security is very important to single parent families. It is because this type of family is particularly sensitive and vulnerable to crime. Criminological literature consistently supports that women possess a greater fear of crime compared to men (Renzetti & Maier, 2002). The fear of crime has a more controlling dominance over the lives of women rather than men. Research has reported that some women '*do not go out alone at night - keep their doors and windows locked when at home*

and - sometimes choose clothing that ensures they will not draw attention to themselves in public' (Renzetti & Maier, 2002, p. 49). Since the majority of single parents in New Zealand are women, single parent families are particularly susceptible to the fear of crime compared to other family types. Social isolation, lack of income and therefore lack of resources surrounding single parent families often makes it difficult for them to cope with or escape from vulnerable situations (Estrada & Nilsson, 2004). Single mothers that have gone through a separation surrounded by domestic violence may continually be vulnerable to violence if they depend on their past partner for social and financial support. Maintaining this dependency opens them to regular contact, exposing them to potential conflict situations (Estrada & Nilsson, 2004). In the absence of another adult within the house, supervising children for single parents can be difficult. For these reasons, a sense of safety and security around the home is important for single parents.

Creating a positive image for themselves is important for single parent families. They want to fit into the society. Since a majority of New Zealand's single parent families rely on social assistance, they are often seen as problematic to society. As a result of this stigma, they often develop feelings of inadequacy, failure and low self-esteem (Todd, 2008). To counter this negative image, they often reject living in segregated developments that are concentrated in welfare mothers, broken families, or the poor (Anderson-Khleif, 1981). Single parents gravitate towards housing that is seen as appropriate for two-parent families with similar social levels to their own. For them, housing with a positive image is housing with a mixture of different family types (Anderson-Khleif, 1981).

1.4 Unsuitability of NZ's existing housing supply

New Zealand's existing housing stock, whether it is suburban or urban, is largely unsuitable for single parent families. In 2001, New Zealand had a total of 1,368,207 private and non-private occupied dwellings. 1,030,077 of these were detached housing, making up 75% of the country's housing stock (Statistics New Zealand, 2001). Detached housing is a common form of suburban housing (Gray, 2004). When a single parent inherits a suburban house after a divorce, it is often too costly to maintain. Single parents often find that they can't keep up with the maintenance costs (Anderson-Khleif, 1981). Detached housing is usually designed for two parent families (Gray, 2004), a family type that commonly consists of 3-4 people (Statistics New Zealand, 2004). As already noted earlier, single parent families commonly consist of 2-3 people. The extra space of detached housing can become an additional cost burden for single parent families (Hayden, 2002). Single parents that do retain these homes after a divorce often find that many of the services they require are located outside of their residential suburbs (Anderson-Khleif, 1981).

Apartment living may remedy some of the problems raised by detached housing, but in itself raises other problems that make it unsuitable for single parent families. They are generally smaller and are located in urban areas making them closer to services than detached housing. Despite these advantages, most apartments lack natural light, outdoor and indoor play space for children (McDermott, 2011).

1.5 Aim and Objectives

The aim of this thesis is to develop a housing complex that supports the needs of single parent families. The complex developed will act as an example of how New Zealand can design housing that is closer to the needs of single parent families than existing housing stock. To achieve this, the thesis carries out the objectives highlighted in the following chapter outline:

- Chapter two is a literature review. In this chapter, various architectural ideas that respond to the housing needs of single parents are reviewed.

- Chapter three is a review of precedents. Nine housing projects that extend on the ideas presented in the literature review are studied.

- Chapter four is a design case study. This chapter reviews the design of a new housing complex developed under the ideas found in the literature and precedent review.

- Chapter five is the conclusion. The design's ability to support the housing needs of single parent families is evaluated. The successes, assumptions and limitations experienced during the development of chapters two, three, and four are discussed, analyzed and summarized.

2. Literature Review

2.1 Introduction

In this chapter, architecture theories and ideas that support the housing needs of single parents (i.e. affordability, accessibility to services, safety and security, sense of community, positive image) will be examined.

Affordability has implications beyond architecture. However, architecture can support affordability by designing to reduce operational costs through passive heating and cooling. Accessibility to services can be strengthened through alternative housing strategies of work-live arrangements, mixed-use and cohousing. When housing is designed with Crime Prevention Through Environmental Design, mixed-use and children's safety around the home in mind, it can provide a sense of safety and security for its residents. A community atmosphere can be generated through the creation of social spaces and the strategies behind cohousing. The theory and guidelines behind integrated living and barrier-free design can contribute to creating housing with a positive image by encouraging a mixture of resident types to live in close proximity.

Some of these concepts support multiple needs, while the others just support one. Each concept will be reviewed separately. The conclusion of this chapter will discuss how these concepts can be combined to support the housing needs of single parent families.

2.2 Reduced Operating Costs

The cost of operating a house can be reduced through passive heating and cooling.

Passive heating harnesses the sun's energy to heat interiors. Its aim is to collect and conserve heat. When its principles are incorporated in the design of housing, it can significantly reduce the energy needed for heating a home, without significantly increasing construction costs in comparison to a conventional home (Smarter Homes). Space heating energy use represents one-third of the total energy use of an average existing New Zealand house (refer to figure 2.1). Reducing the consumption of energy in this manner can considerably reduce the energy consumption of a house (Energy Efficiency and Conservation Authority, 2010) and therefore its operational costs.

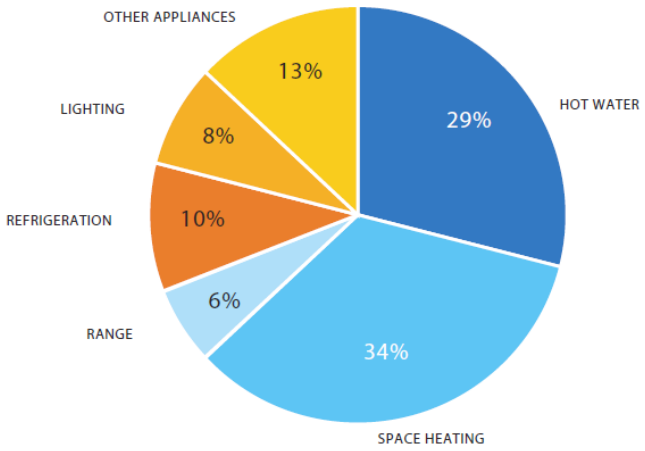


Figure 2.1: Typical energy consumption for an average existing NZ house

Source: (Energy Efficiency and Conservation Authority, 2010, p. 12)

Heat collection is influenced by building orientation and the provision of thermal mass. In the southern hemisphere, the sun is located north. In New Zealand, orientating the main living areas of a house to face north will allow sunlight to be brought into its interiors (Smarter Homes). Orientating plus or minus 20 degrees from north will not have a major impact on solar gain (Energy Efficiency and Conservation Authority, 2010). Hence, it is suggested that north facing windows should be optimized and south facing windows should be kept to a minimum. Furthermore there should be smaller and less windows on the east and west faces to reduce glare in the morning and evening, and overheating (Energy Efficiency and Conservation Authority, 2010).

Thermal mass are materials that function well in absorbing and storing the sun's heat. A material that is commonly employed as thermal mass is concrete (Energy Efficiency and Conservation Authority, 2010). Placing mass in walls and floors close to glazed areas facing north will expose them to sunlight and allow them to absorb heat. Carpet coverings isolate a floor's thermal mass from gaining heat. Thermal mass finishes like ceramic or concrete tiles allows thermal mass to be available for heat storage (Energy Efficiency and Conservation Authority, 2010). Ensure the rooms with thermal mass are well insulated. This allows the absorbed heat to be radiated back into the interiors, rather than to the outside (Smarter Homes). To ensure that the interiors do not over heat in summer or lose heat too quickly in winter, the area of exposed thermal mass to area of glazing should be carefully considered. As a rule of thumb, the area of exposed thermal mass should be around six times the area of glazing receiving direct sunlight. The exact ratio will vary according to the design and site climate. If the thermal mass is too thick, it may take too long to

heat. If it is too thin, it might not store enough heat. Generally, the thickness of thermal mass should be between 100mm to 250mm (Smarter Homes).

Conservatories can help to trap the sun's heat through the warming of the air within its interiors (Sustainable Sources). When they are more than half the length of the north face of a well-insulated house, they can reduce the consumption of space heating energy by 20-30% in the South Island and 40-70% in the northern areas of the North Island, if they are carefully designed and operated (Energy Efficiency and Conservation Authority, 2010). Conservatories should be able to be completely shut from main living areas as they can be overheated, and lose heat quickly when not receiving sunlight. Glazing in the roof can enhance these effects (Energy Efficiency and Conservation Authority, 2010). A well designed conservatory should have large areas of north-facing glazing and a well insulated roof. The installing of thermal mass as flooring within a conservatory, or as a wall between the conservatory and the living area is important. Without it, solar heat gained within the conservatory will be lost back to the outside (Energy Efficiency and Conservation Authority, 2010). Make sure doors and windows are fitted to the conservatory to allow the space to ventilate when it over heats as well as allowing stored heat to move from the conservatory into the living spaces on cool days (Energy Efficiency and Conservation Authority, 2010) (refer to figure 2.2).

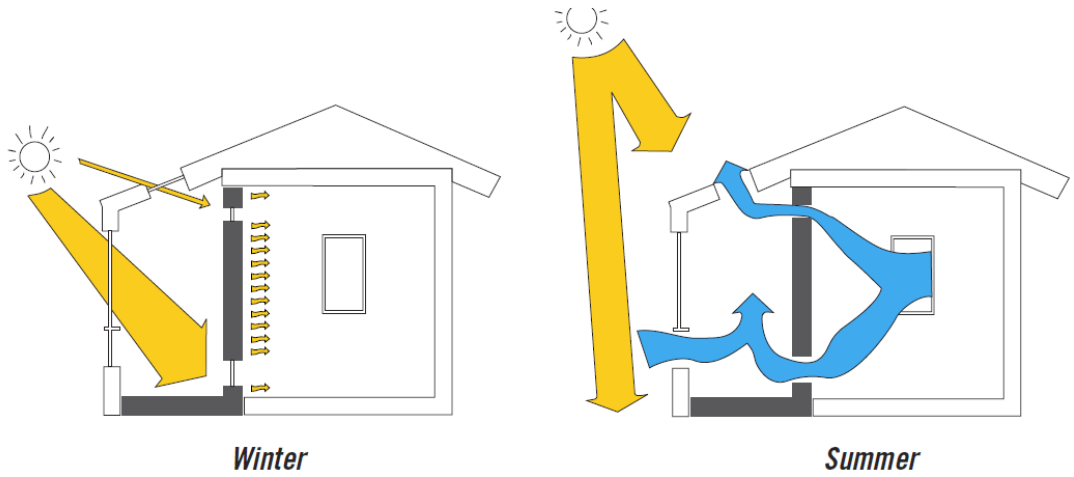


Figure 2.2: Conservatory collecting solar heat to warm interior living spaces in the winter, and its roof preventing sunlight from reaching its interiors during the summer.

Source: (Energy Efficiency and Conservation Authority, 2010, p. 19)

Insulation helps to conserve heat. Wool, polystyrene and polyester are examples of materials that can retain warmth in during the winter, and prevent heat from entering interiors during summer (Smarter Homes). One of the biggest sources of heat loss is through glass. Double-glazed windows can halve the heat loss in comparison to single-glazed windows (Smarter Homes). To maximize the advantages of passive heating, exceeding the minimum building code requirements for insulation should be considered. Rooms can also be located as insulators of main living areas (Smarter Homes). Placing garages, bathrooms, laundries and other rooms of low use around the living areas allows them to act as buffers for preventing heat loss (Smarter Homes). Apartments

in multiunit dwellings can also function in this way. As they sit side by side, apartments can help to insulate each other's interiors.

When the principles of passive heating are followed well, during cool weather, thermal mass will help to absorb heat during the day, and radiate the heat out during the evening (refer to figure 2.3), maintaining comfortable interior temperatures. Unlike heaters, a passive heating system requires no power, or mechanical maintenance, keeping operating costs low.

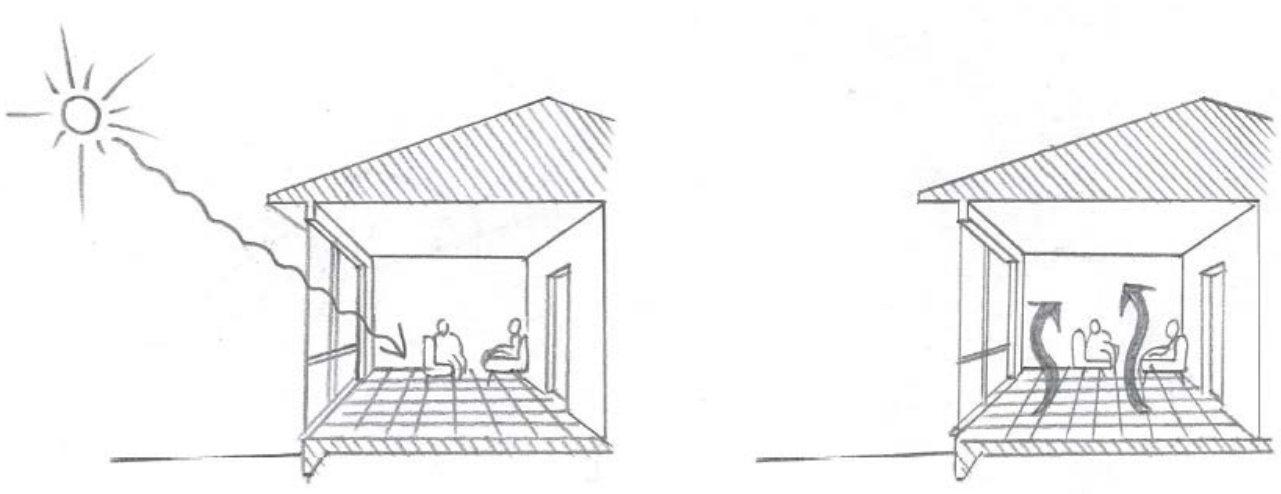


Figure 2.3: Thermal mass on the floor absorbing the sun's heat during the day, and radiating it out during the night. Image retraced by author.

Source: (Smarter Homes)

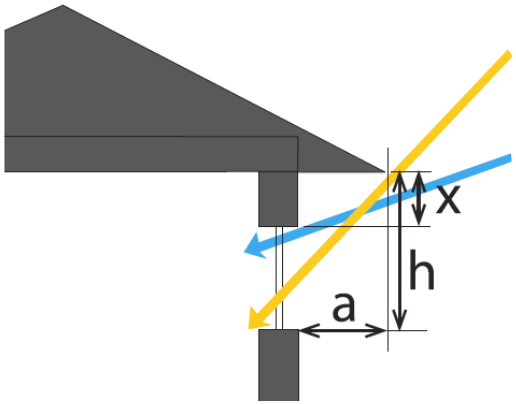


Figure 2.4: Cross section of a window and eave showing the location of the factors to consider in the calculation of eave depth.

Source: (Energy Efficiency and Conservation Authority, 2010, p. 29)

Passive cooling is a cost effective way to prevent housing interiors from overheating in the summer. Air conditioning is expensive to operate, while passive cooling is inexpensive as it requires no additional energy and is mechanical maintenance free (Smarter Homes). Passive cooling operates by keeping heat out, absorbing interior heat and providing natural ventilation.

Shading and insulation work to keep heat out of building interiors. Shading should be positioned to keep high-angle summer sun from the north and low-angle summer sun form the east and west out, and let low-angle winter sun in from all directions (Smarter Homes) (refer to figure 2.5). There are fixed and adjustable options for shading. Eaves, pergolas, fixed louvers and covered balconies provide fixed shading. Adjustable louvers, shutters, curtains, sliding screens, retractable awnings and removable shades provide adjustable shading. Insulating the walls, floors and ceilings will also help to keep the heat out (Smarter Homes). The approximate depth (a) of a north facing overhang can be calculated by multiplying the height of the overhang from the window sill (h) with the factor associated to the house's location (f1) (Energy Efficiency and Conservation Authority, 2010) (refer to figure 2.4).

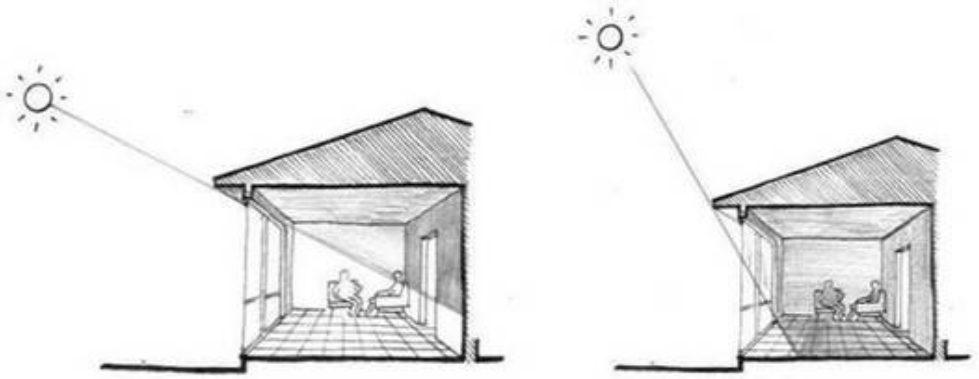


Figure 2.5: Eaves allowing winter sun into the interior and eaves keeping out summer sun.

Source: (Smarter Homes)

Auckland	0.24
Wellington	0.32
Christchurch	0.35
Dunedin	0.39

Table 2.1: f1 factors for major centres in New Zealand.

Source: (Energy Efficiency and Conservation Authority, 2010, p. 29)

For example, the depth of a north facing overhang in Wellington can be calculated as following:

If h = 2m,

a = h x f1

a = 2 x 0.32

a = 0.64

Therefore the depth of the overhang should be about 0.64m.

If the top of a window is too close to an overhang, it will not receive any sun even during winter. To ensure a whole north facing window receives sun, the distance from the top of the window to the overhang (x) needs to be calculated: multiply the height of the overhang above the window sill (h) by the factor (f2) associated to the house's location in the following table.

Auckland	0.14
Wellington	0.15
Christchurch	0.15
Dunedin	0.16

Table 2.2: f2 factors for major centres in New Zealand.

Source: (Energy Efficiency and Conservation Authority, 2010, p. 29)

For the example in Wellington:

$$x = h \times f2$$

$$x = 2 \times 0.15$$

$$x = 0.3$$

Therefore, the distance from the top of the window to the overhang should be around 0.3m.

Thermal mass can also be used for passive cooling. It can absorb heat from its surrounding air as long as the air temperature is higher than the temperature of the thermal mass (Smarter Homes).

Ventilation can cool down interiors by taking hot air out, and bringing cooler air in. Orientating housing and it windows to catch the prevailing breeze encourages natural ventilation within its interiors (Smarter Homes). To maximize cross-ventilation, it is suggested that windows should be placed on different walls, not directly across the room, and at different heights (Energy Efficiency and Conservation Authority, 2010) (refer to figure 2.6). If the site is windy, locate doors and windows in sheltered recesses. Sliding windows and doors should be used so that the wind cannot slam openings shut. Installing windbreaks can help to defuse the wind as well (Smarter Homes).

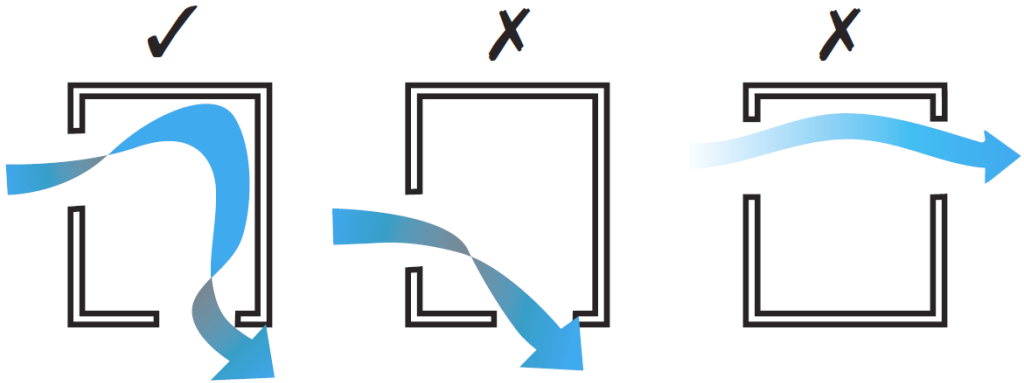


Figure 2.6: Floor plans showing effective and un-effective window relationships for cross-ventilation.

Source: (Energy Efficiency and Conservation Authority, 2010, p. 31)

2.3 Alternative Housing Strategies

Today, many alternative housing strategies exist to suit various lifestyles. In this section, the following four strategies will be discussed: work-live arrangements, mixed-use, cohousing and integrated living.

Work-live Arrangements

'The industrial revolution separated the workplace from the home' and *'the information age has reconnected them'* (Dietsch, 2008, p. 25). The advances in computers, the internet, email and voice over internet protocol services such as *Skype* has made home business easier and more efficient to run. Colleagues and clients in different locations can be connected instantaneously via the internet (Conroy, 2011; Dietsch, 2008). Working at home has become popular in contemporary society. In the U.S. *'the Census Bureau's Working at Home 2000 report estimated that 4.2 million self-employed Americans work at home, and five years later the federal government's American Housing Survey revealed that 5.75 million were spending forty hours or more working from home'* (Dietsch, 2008, p. 18). New Zealand has also reported high preferences towards work-live arrangements. Statistics New Zealand's *Survey of Working Life: March 2008 quarter* reported 29.3 percent of the New Zealanders interviewed had done some work at home (Statistics New Zealand, 2008).

Work-live arrangements provide a number of benefits. Economically, they save on transportation costs by reducing commuting distance and eliminate office rent. A single mortgage can finance both the home and the workplace. Tax deductions can be applied for home-based business (Dietsch, 2008). In the U.S., home-based businesses have lower fixed costs and higher profit margins than non-home-based businesses. According to a 2006 small business report in the U.S., in the year of 2002, '*home-based businesses (HBB) earned lower average receipts ($62, 523) and net income ($22,569) than businesses operated in rented space (non-HBB) ($178,194 and $38,243, respectively). Home-based firms gain a higher return on gross revenues compared with non-HBBs (36 percent versus 21 percent)*' (Pratt, 2006, p. i). The reduced time spent on commuting relieves more time for domestic and public life. Social relationships can be maintained with less work sacrifices (Leavitt, Designing Women's Welfare: Home/Work, 1996). Some parents find work-live arrangements helpful in maintaining a balance between career pursuits and the raising of children (Dietsch, 2008). According to a survey in New Zealand, people with children or had the responsibility for the caring of children was reported as more likely to have worked at home (Statistics New Zealand, 2008). It is because these arrangements give people the flexibility to organize their domestic and work responsibilities in a manner that works for them (Leavitt, Designing Women's Welfare: Home/Work, 1996).

Designing work-live arrangements can be difficult in regards to zoning. Work-live buildings often have to comply with commercial building codes. Adhering to fire-safety, staircase, ramps and parking space provisions demanded for commercial buildings can make work-live arrangements costly to construct (Dietsch, 2008). To meet the increasing demand for work-live

arrangements local building codes may need to change in order to provide new regulations that make their construction more convenient.

The architect's role is to design these arrangements in a manner that allow both work and family life to coexist (Lewis, 2009). To support work done in a zone free from the disruptions of whining kids and household chores, it is important to distinguish clearly working space from living space. Work-live arrangements should have clear visual, acoustic and spatial separations between these two spheres (Dietsch, 2008). *'Working from home can be lonely – and staying connected to the outside world without having people around is difficult'* (Dietsch, 2008, p. 34). In response to this challenge, work-live arrangements can be located within areas that have existing meeting places such as cafes, shops and other public services (Dietsch, 2008). Mixed-use developments and zones can provide these types of services within close proximity.

Mixed-Use Development

There are a range of benefits surrounding mixed use development. They provide housing with easy access to a range of services. This reduces time and money spent on transportation. Day and evening activity of mixed use developments supports safer environments. For example, commercial activity in the daytime can contribute to passive surveillance of residential units above it, and residents around the area during the morning and evening offer passive surveillance for the commercial spaces. The variety created by these developments, brings together a diverse mix of people (Lindsay, Peterson, & Tinsel, 2005).

Mixed-use developments may be arranged vertically or horizontally. For example, apartments may be located above retail spaces, or residential spaces may be separated across a site from commercial spaces (Lindsay, Peterson, & Tinsel, 2005). Successful mixed use developments are commonly located in or close to town or suburban centers. This is because these areas usually offer a wide range of existing facilities (e.g. shops, banks, public transport) that supports its commercial and residential inhabitants (Lindsay, Peterson, & Tinsel, 2005).

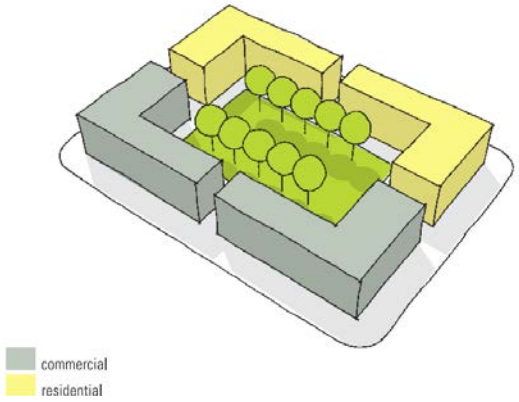


Figure 2.7: Physical distancing of different uses through a courtyard.

Source: (Lindsay, Peterson, & Tinsel, 2005, p. 14)

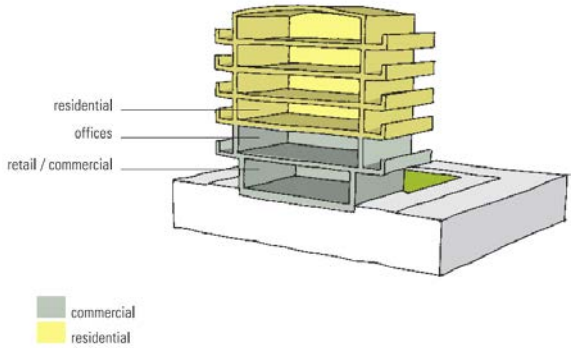


Figure 2.8: Using offices to separate commercial spaces from residential spaces.

Source: (Lindsay, Peterson, & Tinsel, 2005, p. 15)

The variety of programmes in mixed use developments makes ‘compatibility’ a key concern in their design. That is compatibility of uses and compatibility with the surrounding context. Many commercial uses are compatible with residential development. These include shops, offices, cafes, restaurants, educational and institutional facilities, and community services like community centers and crèches (Lindsay, Peterson, & Tinsel, 2005). To prevent disturbance between different uses, there are various ways to separate them from one another. These methods include:

- Physical distancing (e.g. courtyard) (refer to figure 2.7).
- Building elements (e.g. acoustically insulated walls, floors and windows)
- A floor of offices can be used to separate ground floor commercial areas from upper floor residential units (refer to figure 2.8).
- Landscape features (e.g. row of planting, ground level changes) (refer to figure 2.9).
- Noise tolerant areas within the home, such as kitchens and bathrooms, laundries and storage areas, can be located to shield noisy areas from quieter areas like living rooms and bedrooms.

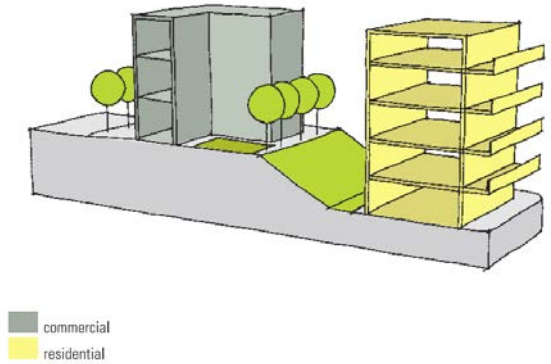


Figure 2.9: A row of trees separate commercial spaces from residential spaces.

Source: (Lindsay, Peterson, & Tinsel, 2005, p. 15)

- Provision of separate entrances between public and private areas (Lindsay, Peterson, & Tinsel, 2005).

When selecting a location, the area chosen should provide a range of services that are compatible with the needs of the development's users. Equally the development should be designed to be compatible with its surroundings. Siting next to areas of high noise and pollution such as industrial developments should be avoided. Mixed use buildings may be larger than their surrounding buildings. By continuing the rhythms and the perceived scale of the surrounding facades through window spacing, structural modules and massing, they can be designed to fit into their surrounding context (Lindsay, Peterson, & Tinsel, 2005).

Figure 2.10: Parking at the edge of a cohousing development.

Source: (McCamant & Durrett, 2011, p. 258).

Figure 2.11: Common terrace and pedestrian pathways connecting individual dwellings and common areas.

Source: (McCamant & Durrett, 2011, p. 258)

Cohousing

Cohousing is an alternative housing strategy that holds the fostering of community as a core motivation. Cohousing is a type of housing that combines the independence of private dwellings and the advantages of community living (McCamant & Durrett, 2011). Cohousing developments vary in size, location, type of ownership and priorities, but they generally all have the following architectural characteristics in common - centralized layout, shared facilities and individual dwellings.

Cohousing developments are usually arranged with a centralized layout. A common house sits at the core of the development with individual dwellings surrounding it (refer to figure 2.12). Parking is located beyond the houses at the periphery of the development (refer to figure 2.10). Walkways flanked with seating connect these areas (McCamant & Durrett, 2011) (refer to figure 2.11).

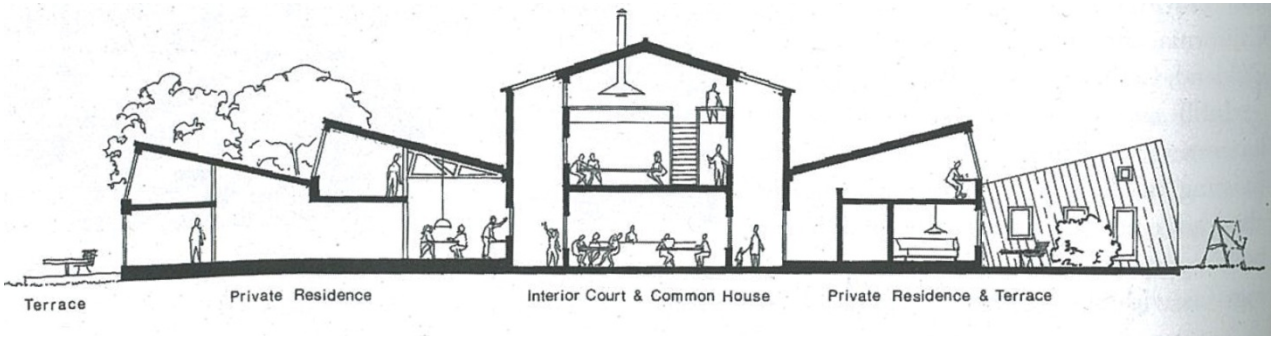


Figure 2.12: Common house located at the core of the development

Source: (McCamant & Durrett, 2011, p. 252)

Figure 2.13: Dining rooms sized to accommodate various sized groups.

Source: (McCamant & Durrett, 2011, p. 264).

Cohousing usually provides its residents with an extensive range of shared facilities. The common house shelters a dining room, kitchen, lounge and laundry. Sometimes a library, music studio, and playroom may also be included (McCamant & Durrett, 2011). Outside of the common house may sit a pool, craft workshops, playhouses and tree forts. Common houses within any cohousing development usually have a communal dining room and kitchen (refer to figures 2.13, 2.14 and 2.15). Every resident is expected to cook a communal dinner in the shared kitchen at least once every month. In return residents can dine at all the other communal dinners for the rest of the month without cooking (McCamant & Durrett, 2011).

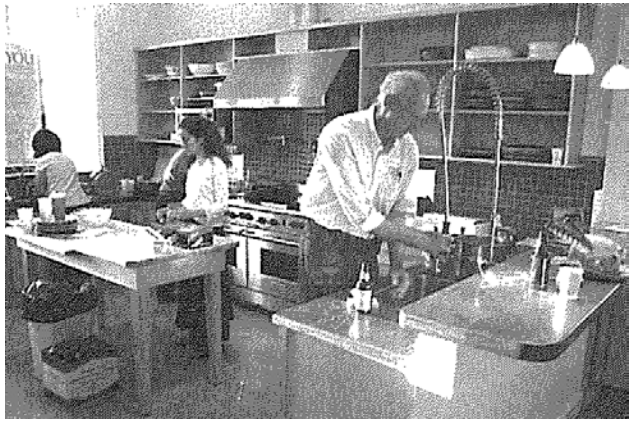


Figure 2.14: Communal kitchen facilitates group cooking.

Source: (McCamant & Durrett, 2011, p. 261).

Figure 2.15: The communal kitchen is open to other communal spaces, creating a social atmosphere around the act of cooking.

Source: (McCamant & Durrett, 2011, p. 261).

Individual dwellings within cohousing developments are self-contained. Each house has its own bathroom and kitchen. Compared to detached dwellings they are usually smaller. Each dwelling "donates" 10-15% of their total floor area to shared facilities. Usually space reduction occurs in the kitchen, dining room and living room. In return, the shared facilities compensate for these functions (Fromm, 1991).

Residents of cohousing developments normally save money by consuming less energy than people not living in this housing form. The extensive range of on-site facilities of cohousing developments increases the accessibility of services for its residents. This reduces residents' dependence on vehicles, reducing their costs on transportation (McCamant & Durrett, 2011). The small sizes of individual dwellings within cohousing developments make them cost less to maintain, heat, and cool than conventional detached houses (McCamant & Durrett, 2011). The proximity of residents to one another can lead to them sharing essential goods, such as a lawnmower, or power tools. This in turn saves residents the cost of buying "one of everything" (McCamant & Durrett, 2011).

Cohousing developments support the development of community. Their centralized and pedestrian-friendly layouts direct residents together, and promote social encounters. Dinners shared in the common house can be beneficial socially and practically. They provide a regular activity in which residents can get to know each other through. Encounters here, can lead to other social activities such as playing pool (McCamant & Durrett, 2011).

Integrated Living

Integrated living understands architecture as the spatial background to human interaction. It can encourage or prevent human contact, but in itself it cannot generate social interaction (Schittich, 2007). The idea opposes social exclusion in regards to residential projects. It encourages support between different sociologically categorized groups including the elderly, the disabled, single parents, large families and immigrants (Schittich, 2007). Opportunities can be created for the exchange of mutual support for the handicaps of each group. The intensity of design focus on different groups will vary between developments; in one development disabled residents maybe the focus, while in another, immigrants could be the focus (Schittich, 2007). Existing residential forms that can be categorized under integrated living include elderly housing, multi-generation living, barrier-free housing and interethnic and intercultural living. A residential form that specifically supports single parents unfortunately seems to be non-existing (Schittich, 2007).

Bill Latimer's *Single-Parent Housing* scheme in 1975 begins to suggest how integrated living developments could be designed to focus around single parents. To prevent the creation of a ghetto, the complex also provides housing for single people and the elderly with the intention that these groups could be complimentary to single parent families. Their presence would offer additional role models for children and informal surveillance on outdoor play areas supporting children's safety (Soper, 1980). The elderly could re-assume child-rearing duties by offering babysitting support (Schittich, 2007). The social exposure generated through the performance of this support, can in turn alleviate the loneliness following old age.

The architecture of integrated living developments cannot control the ratio mix of different resident types. However, it is believed that by offering living space suitable for the targeted residents the desired composition can be achieved over time. For example, the Swiss project *KraftWerk1* aspired to have a composition of disabled, large families, single parents, foreigners and lower-income households that reflected the average population of the city of Zurich (Schittich, 2007). During the initial occupancy of the project, the elderly and foreigners were underrepresented, but in the years following the population mix has moved closer to the desired proportions (Schittich, 2007).

The probability of generating mutual support within integrated living developments is high. A study on these developments by the Department for Housing and Housing Economics of the Technical University of Munich found that a significant amount of residents within these developments are willing to participate in community activities such as shopping, standing in during vacation, providing household assistance and babysitting (Schittich, 2007).

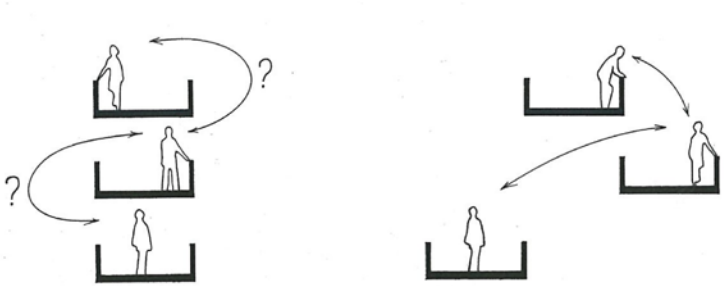


Figure 2.16: Slipping floors out of alignment

Source: (Hertzberger, 2000, p. 156).

2.4 Concepts for Creating Social Space

A social space is a space that can encourage people to encounter each other. Careful placement of sightlines, intersecting circulation routes such as bridges and landings can promote encounters between inhabitants (Hertzberger, 2000). Openings in floors, slipping floors out of alignment and transparency between spaces, creates a spatial continuum that can help to make visual connections between people in different areas of a building (Hertzberger, 2008) (refer to figure 2.16). A concentration of light induces an area of focus and creates a gathering point (Hertzberger, 2008) (refer to figure 2.17).

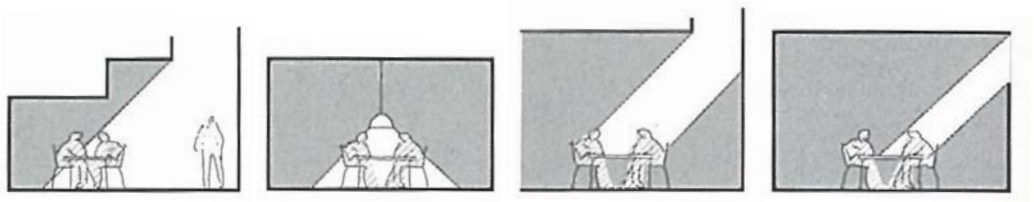


Figure 2.17: Concentrated lighting

Source: (Hertzberger, 2008, p. 84).

Figure 2.18: Shelving and seating unit.

Source: (Hertzberger, 2008, p. 89).

Steps can create areas of focus as well. As they raise or lower sections of a floor, they may open up views, or give a sense of protection. They attract people as hangout areas, long worktops, seating, and theatrical space (Hertzberger, 2008) (refer to figure 2.19).

Figure 2.19: Various uses for steps

Source: (Hertzberger, 2008, pp. 85, 86).

Figure 2.20: Shelving unit

Source: (Hertzberger, 2008, p. 90).

Furniture in mid-space can articulate themselves as social hubs. When furniture like tables, shelving units, alcoves for sitting and platforms are located within a central position, they become islands that attract attention. People will congregate around them by approaching them from multiple sides (Hertzberger, 2008) (refer to figures 2.18, 2.19 and 2.20).

Figure 2.21: Montessori School in Delft. Entrance to the primary school.

Source: (Hertzberger, 1991, p. 33).

Figure 2.22: Montessori School in Delft. Entrance to the kindergarten.

Source: (Hertzberger, 1991, p. 33).

Figure 2.23: De Drie Hoven. Entrance to two homes.

Source: (Hertzberger, 1991, p. 35).

When the thresholds between different territories are signalled as spaces in their own right, they can become areas for social interaction (Hertzberger, 1991). This theory can be explained with reference to a primary and kindergarten school. In the *Montessori School in Delft*, the entrance to the primary school is framed by low walls (refer to figure 2.21). This offers an area for children to sit and gather before and after school. The entrance to the kindergarten is often used by parents as an area to farewell their children for the day, as well as an area to wait for them after school. During those waiting periods, it becomes an area for parents to gather around to get to know each other (Hertzberger, 1991) (refer to figure 2.22). In the *De Drie Hoven, Home for the Elderly,* half doors are installed to the entrance of each home as an inviting gesture (refer to figure 2.23). Doors that can half open allow casual conversations to take place with passersby, without residents having to completely open up their homes (Hertzberger, 1991). In the *Documenta Urbana Dwellings*, communal staircases are designed to be spacious and well day lit, rather than residual dimly-lit areas. Additional to circulation, they serve as places for children to play and neighbors to sit and talk (Hertzberger, 1991) (refer to figure 2.24).



Figure 2.24: Documenta Urbana Dwellings. Communal staircases, an example of its exterior, and interiors.

Source: (Hertzberger, 1991, p. 35).

Figure 2.25: De Drie Hoven. Porch-like areas. Small window to the right.

Source: (Hertzberger, 1991, p. 40).

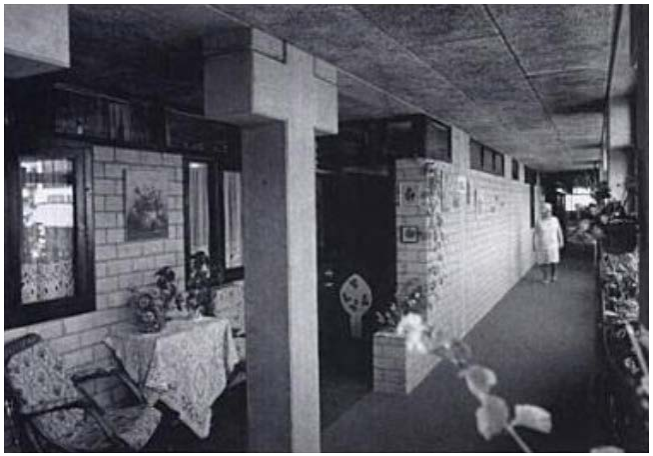


Figure 2.26: De Drie Hoven. Porch-like areas.

Source: (Hertzberger, 1991, p. 40).

Spaces that are truly communal are created through joint effort. For people to identify with a space, they have to make a personal contribution to it (Hertzberger, 1991). If the proper spatial suggestion is incorporated into a design, they will be encouraged to exert their influence on the communal space (Hertzberger, 1991). Here are some examples of this. In the *De Drie Hoven, Home for the Elderly*, porch-like areas are installed between the dwelling units and the hallways connecting them (refer to figures 2.25 and 2.26). This creates areas that simultaneously belong to the dwellings and the hallway.

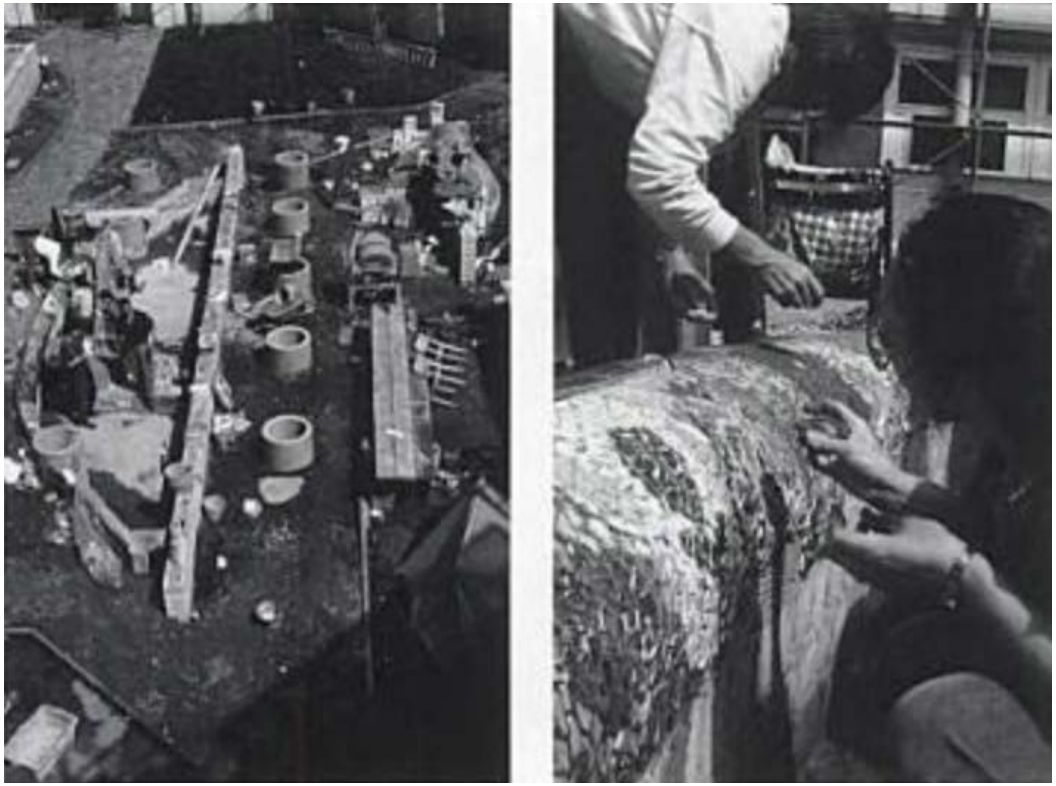


Figure 2.27: Lima Housing Estate. Sand pit in communal courtyard. Residents adding tiles to mosaic.

Source: (Hertzberger, 1991, p. 42).

Residents are open to furnish the area with their own plants and furniture, since small windows by the door allows them to oversee the space (Hertzberger, 1991). *Lima Housing Estate* has a communal courtyard marked by a large sand-pit. The curved edges of the pit have been decorated with a mosaic created by the residents (refer to figure 2.27). Both children and adults contributed ‘tiles.’ This act created a sense of communal ownership over the sandpit. If something happens to it, say if parts of the mosaic falls off, residents are likely to band together to do something about it (Hertzberger, 1991).

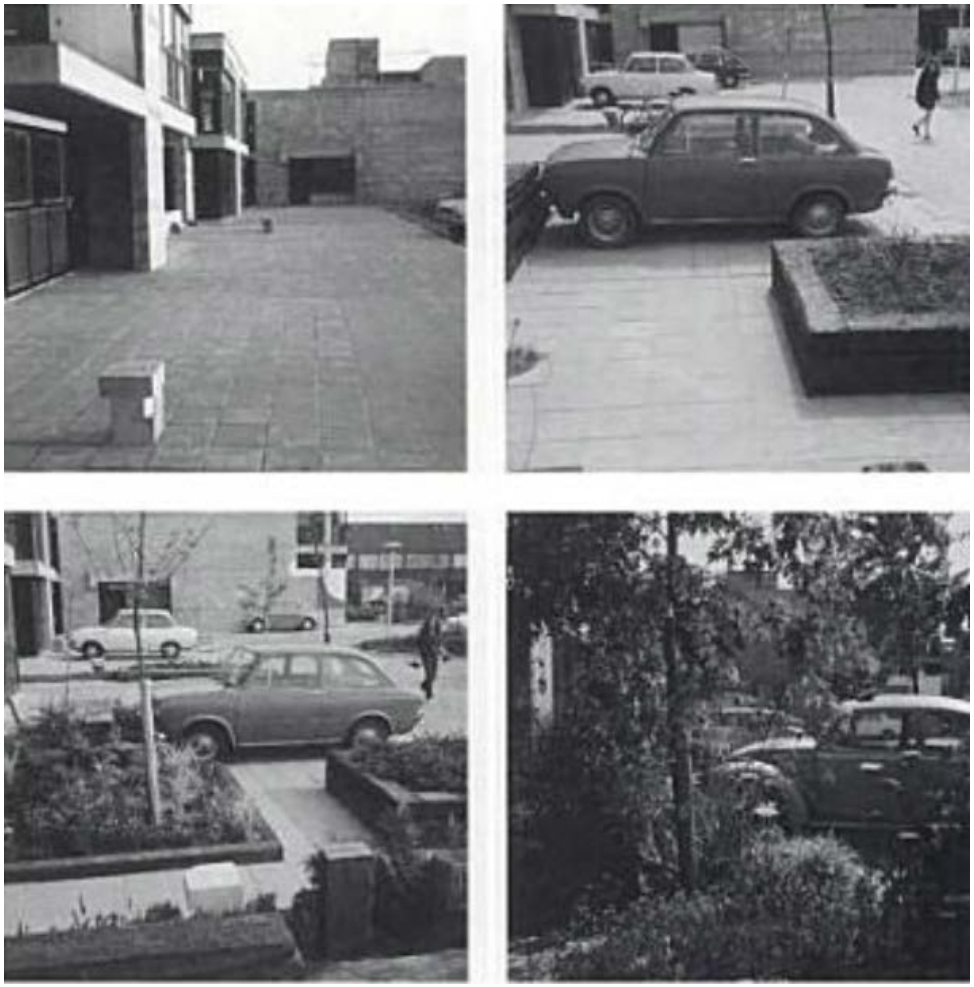


Figure 2.28: Diagoon Dwellings. Changes to the front area of the dwellings.

Source: (Hertzberger, 1991, p. 41).

The front of the *Diagoon Dwellings* in Delft was built as a blank area, void of gardens or porches. This strip was not strictly public, but it was paved like a regular sidewalk. Legally, different portions of this area belonged to different dwellings. Without any suggestion of private claims, each resident removed some tiles out in front of their house to create areas to suit their own needs. They laid out plants. Some tiles were left as pathways to their house or as car parking (refer to figure 2.28). When claims overlapped, they had to be resolved through mutual agreement. In this way, every resident was responsible for how the space is formed (Hertzberger, 1991).

Arcades are spaces with a duality of accessibility and intimacy. Their high, long form, covered by glass roofing provides a sense of simultaneously being inside and outside (Hertzberger, 1991). Since both of these domains become less explicit, this kind of architectural articulation can make private space feel more accessible, and yet still feel intimate, encouraging use (Hertzberger, 1991) (refer to figure 2.29).

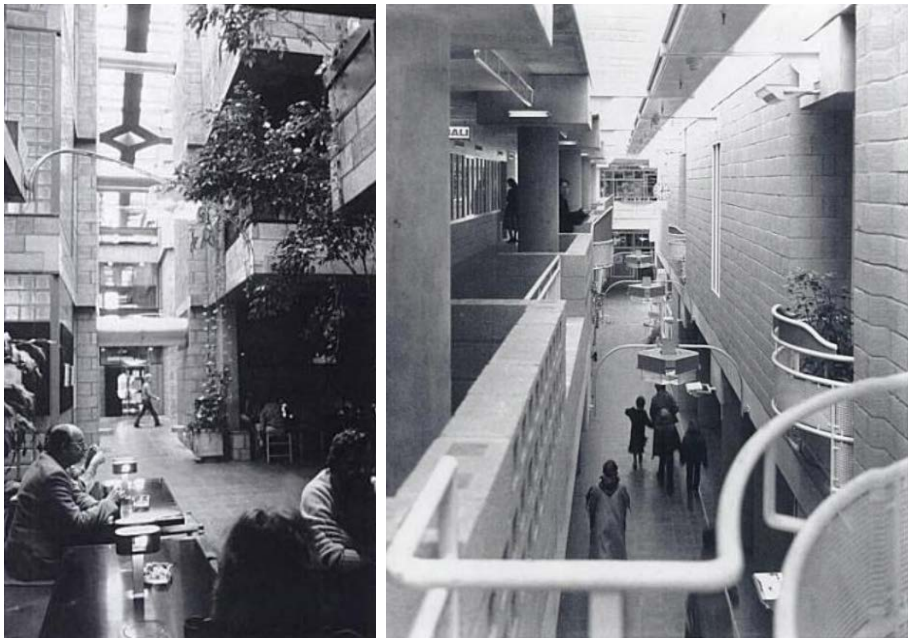


Figure 2.29: Centraal Beheer Office Building. Example of an arcade interior.

Source: (Hertzberger, 1991, p. 80)

2.5 Crime Prevention Through Environmental Design

Crime Prevention Through Environmental Design (CPTED) is a security design strategy widely applied around the world. In the UK it has been adopted as the *Secured By Design* scheme. Evaluations of the scheme have reported significant levels of reduced crime and fear of crime (Cozens, Saville, & Hillier, 2005).

Aspects of CPTED include territoriality, surveillance, image, activity support, access control and target hardening (Cozens, Saville, & Hillier, 2005). Territoriality is about creating a sense of ownership in legitimate users of a space, and discourage illegitimate users from offending it (Cozens, Saville, & Hillier, 2005). Surveillance is concerned with how informal (e.g. residents' observations through their windows) and formal (e.g. police patrols, CCTV) surveillance can be promoted. The sense of observation felt by potential offenders makes them less likely to offend due to the increased risk of being caught (Cozens, Saville, & Hillier, 2005). A well kept image of the built environment through routine maintenance will reduce the likelihood of crime and the fear of crime (Cozens, Saville, & Hillier, 2005). Activity support is focused on locating "unsafe" activities such as making a money transaction with an ATM in areas where there are high levels of surveillance opportunities (Cozens, Saville, & Hillier, 2005). Access control denies offenders access to potential targets through surveillance and mechanical restrictions such as locks and bolts (Cozens, Saville, & Hillier, 2005). Target hardening is similar and denies or restricts access

to potential targets through physical barriers such as fences, gates, locks, electronic alarms and security patrols (Cozens, Saville, & Hillier, 2005).

The ideas behind activity support and access control overlap with the concepts of territoriality and surveillance. There is a lot of debate concerning whether target hardening is a component of CPTED. The fortress mentality portrayed by this concept opposes the natural policing capacity of the environment. In this respect it is not in line with CPTED's concepts of surveillance, territoriality and image (Cozens, Saville, & Hillier, 2005; Newman O. , 1972). Hence, for this study only the aspects of territoriality, surveillance and image will be reviewed with reference to an Auckland, a Wellington and a UK urban design guide.

Clear definition of territory encourages residents to deter criminal and anti-social behavior within and around their residence. Careful selection and location of walls, fences, gates, planting, signs and changes in surface texture and color can help to highlight where public space changes into semi-public, semi-private or private space (Llewelyn Davies, Holden McAllister Partnership, 2004). Showing clearly where these transitions occur allows residents to have a clear understanding of which areas within and around the residence belong to them. This heightened sense of ownership and responsibility increases the chances of residents challenging criminal behavior within and around the building (Llewelyn Davies, Holden McAllister Partnership, 2004).

Designing to promote informal and formal surveillance in and around a residence increases the chances of any criminal activity around the area being caught. Informal surveillance refers to the

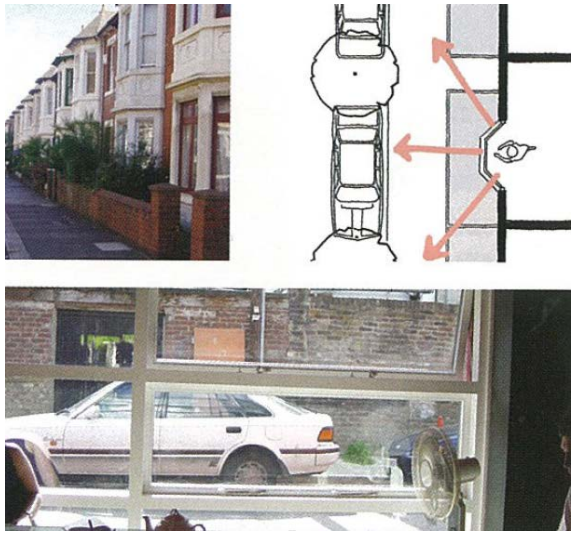


Figure 2.30: Large bay windows of house provide clear visibility of activity on the street.

Source: (Llewelyn Davies, Holden McAllister Partnership, 2004, p. 25).

idea of ‘eyes on the street.’ The ‘eyes’ are eyes of everyday people in and around the area overlooking its public spaces. There are several ways to encourage ‘eyes on the street.’ The edges of the residence could be activated by activity generators such as – cafes, recreational activities and shops (Wellington City Council; Bartlett, 2001) (refer to figure 2.31). Commonly occupied rooms could have windows overlooking public surroundings (refer to figure 2.30). Entries and exits to a residential building should face the street, or be overlooked by public space or nearby buildings. Windowless facades at street level should be avoided (Wellington City Council). On top of these informal forms of surveillance, formal surveillance can be enforced by installing video cameras, audio monitors and implementing security patrols onsite. The risk of criminal activity being caught increases, deterring crime (Bartlett, 2001; Wellington City Council).

Figure 2.31: Outdoor cafe tables encourage ‘eyes on the street’.

Source: (Llewelyn Davies, Holden McAllister Partnership, 2004, p. 39).

Easy maintenance of a residence's appearance can also help to deter crime. If a building appears well looked after, it will encourage more use, leading to more 'eyes on the street,' deterring crime (Bartlett, 2001). Large blank walls or fences should be avoided (Bartlett, 2001). These areas encourage graffiti by acting like a large canvas. Especially at street level, building fronts should be designed in a way that encourages users to claim sections of it as their maintenance responsibility (Wellington City Council). When a building is designed for easy repair, vandalism to it can be promptly remedied, deflating the efforts of criminals, deterring criminal activity (Wellington City Council).

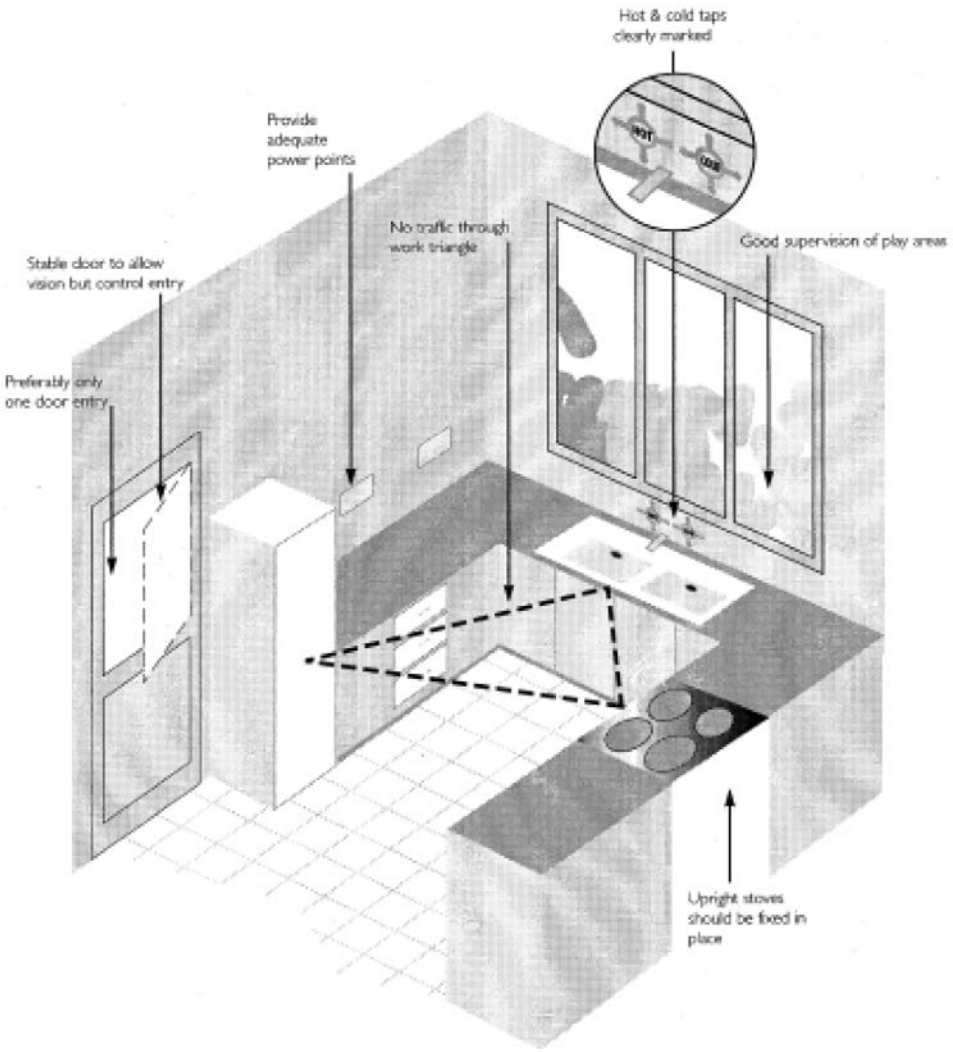


Figure 2.32: No traffic through the kitchen.

Source: (Queensland Government, Kids Safe, 1998, p. 6)

2.6 Home Design Guidelines for Children's Safety

The home is the most common stage for unintentional injuries. This issue is particularly prominent for very young children (Ancliffe & Kokotailo, 1996) especially when parents are not watching (Queensland Government, Kids Safe, 1998). To relieve the likelihood of children coming in contact with hazards, when designing a home, room layout and placement of barriers should be carefully considered.

Locate areas of play, such as the living room and backyard in clear view from main work areas within the home, such as the kitchen and the laundry (Child Accident Prevention Foundation of Australia, 2008; Queensland Government, Kids Safe, 1998). This can help adults to look after their children even when they are busy with domestic duties. The kitchen is the most dangerous place in a home (Home Safe Kids, 2011). Children should be protected from the hazards of poisonous cleaning agents, hot equipment and other kitchen hazards. Design can assist by preventing traffic through the kitchen (refer to figure 2.32) and a childproof barrier at the kitchen entrance is suggested (Queensland Government, Kids Safe, 1998).

Figure 2.33: Barrier at the bottom of the stairs.

Source: (Home Safe Kids, 2011)

Figure 2.34: Window screen.

Source: (Kid Safe: Home Safety Products)

Careful consideration to the design of stairs, windows and balustrades can help to avoid child falls. The longer and higher the fall of a staircase, the more injury a child is likely to suffer if they fall down from it. Relieve the potential of severe injury by shorting their flights through the adoption of “U” or “L” shaped stairs. (Queensland Government, Kids Safe, 1998). Locating barriers at the top or the bottom of staircases can prevent children from fall down them (Child Safe Home, Inc.) (refer to figure 2.33). Design must be mindful of where these barriers are located so they do not hinder general circulation (Home Safe Kids, 2011). Gates can be located approximately one and half stair widths back from the top of a staircase, to allow it to be negotiated before the beginning of decent (Home Safe Kids, 2011). Windows with sill heights less than 1.5m should have their openings restricted to 100mm or be fit with a window screen easily removable by an adult (Queensland Government, Kids Safe, 1998, p. 13) (refer to figure 2.34). Keep the height of stair balustrades to a minimum of 1.05m, and those for balconies to a minimum of 1.2m (Queensland Government, Kids Safe, 1998).

By considering these guidelines around layout and barriers when designing a home, the probability of child injury within the home can be reduced.

2.7 Barrier-free Design

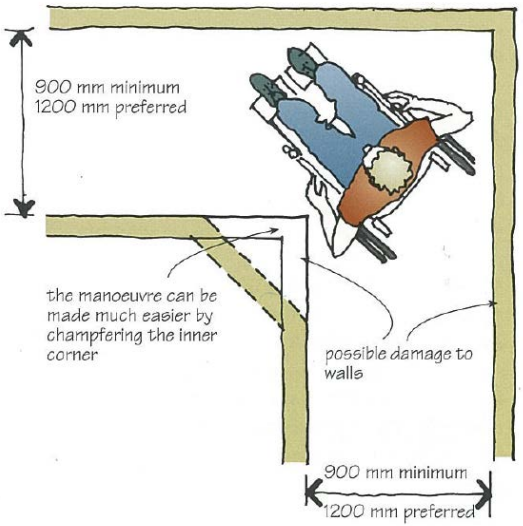


Figure 2.35: Min dimension of a 90 degree corridor.

Source: (Bulleyment, 2001, p. 31)

To build a barrier-free residential complex means to create housing that is accessible to all people without assistance, regardless of their physical condition or age (Meuser, 2009). Incorporating barrier-free design principles into residential design not only make it more convenient and safer for the disabled and the elderly to live within their housing, these advantages also extend to other users as well. Housing designed with these principles is easier for parents with prams and young children to use. Moving in and out furniture is also more convenient. Key design principles surrounding barrier-free housing focus on wheelchair users rather than users with ambulant, manipulatory (impairment in the arms, hands or legs), blind or deaf disabilities, as these users usually have the largest dimensional requirements.

For general horizontal and vertical circulation around a building, barrier-free housing have various requirements in the design of corridors, doorways, stairs and elevators. A wheelchair can be manoeuvred down a 900mm wide corridor and around a 90 degree turn, but this can create a barrier to anyone wanting to pass through at the same time (Bulleyment, 2001). Therefore it is preferable to make corridors wider, at least 1200mm (refer to figure 2.35). Where possible minimize the number of corridors through open planning. By relieving the segmentation of space through combining circulation as portions of other spaces, this can significantly remove mobility barriers within the home (Bulleyment, 2001; Schittich, 2007). Wheelchair users require minimum corridor widths when turning 90 degrees into a doorway. These widths depend on the width of the

doorway. The narrower a door is, the wider the corridor needs to be (refer to figure 2.36). When opening a door, wheelchair users need a corridor width of 1060mm or more (refer to figure 2.37).

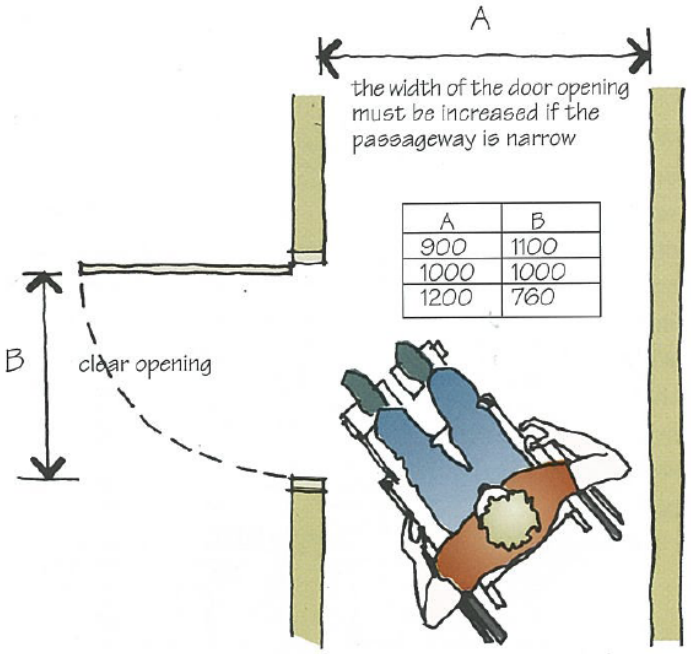


Figure 2.36: 90 degree corridor to door dimensional relationship.

Source: (Bulleyment, 2001, p. 32)

Figure 2.37: Dimensions needed for a wheelchair user to negotiate a door.

Source: (Bulleyment, 2001, p. 30)

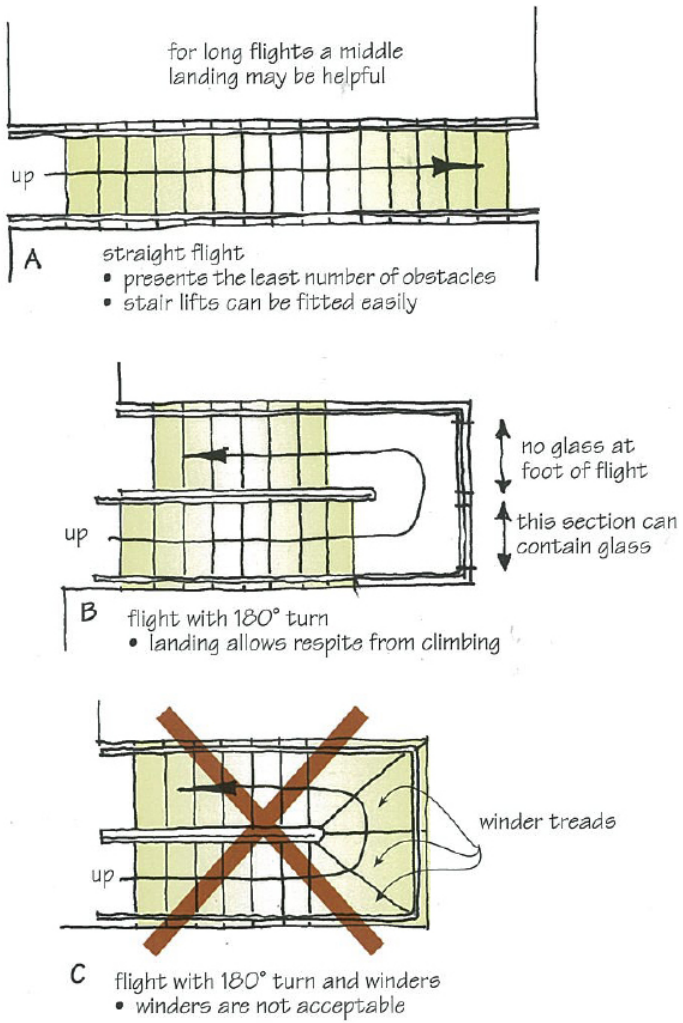


Figure 2.38: Preferred and inappropriate stair layouts in plan.

Source: (Bulleyment, 2001, p. 36)

Stairs are impossible for wheelchair users to use. For the elderly and people with other disabilities, stairs are difficult to use. Ideally, stairs should not be installed inside barrier-free homes (Bulleyment, 2001). Otherwise, it is preferred that they are designed according to the following guidelines. Stair flights should be straight. At the top and bottom of each flight, there should be enough room for users to steady themselves before turning in a different direction. Opened doors should not project an obstruction on the stairway. To minimize injuries caused by falling down stairs, the installation of glazing along the bottom of a flight should be avoided (Bulleyment, 2001) (refer to figure 2.38).To provide adequate footing, tread and riser dimensions of stairs should be at least 250mm and 170mm respectively. The nosing of each step should project no more than 25mm, and should be rounded off by the insertion of a timber fillet, a sloping riser or overlay of carpeting (Bulleyment, 2001).Handrails should be provided on both sides of the stairs (Bulleyment, 2001).

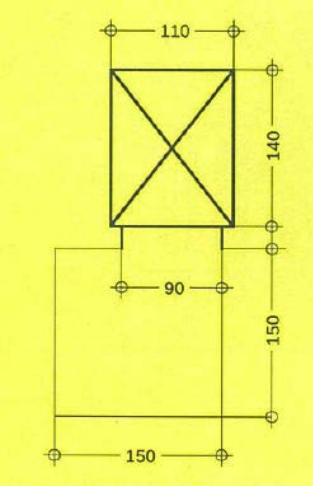


Figure 2.39: Dimensions of an elevator and its entry area suitable for wheelchair access.

Source: (Fischer & Meuser, 2009, p. 295)

In multi-storey buildings, elevators should be provided where possible. To accommodate wheelchair users, the elevator door should have a minimum entrance dimension of 900mm, with a 1500mm by 1500mm entrance area in front, and a 1400mm by 1100mm interior carriage (Fischer & Meuser, 2009) (refer to figure 2.39).

In the design of a barrier-free bathroom, the main considerations are to ensure that there is enough space for a wheelchair user to use the toilet, wash, bathe or shower. There are minimum dimensions to support these functions, but bigger is usually better (Bulleyment, 2001) (refer to figure 2.40 for example dimensions of a wheelchair accessible bathroom). To use the toilet, wheelchair users usually transfer themselves onto the amenity from the side. To do this they require around 1600mm width of space (refer to figure 2.41). This includes the width of the toilet. Baths require a lot of manoeuvring to use, so it is best to avoid providing a bath for bathing. In order to use a bath, a person has to step over the edge, descend into a seated position, stand up and step out again (Bulleyment, 2001). Showers are more preferred in barrier-free design as they are easier to access, especially if they are wet-area showers. These showers are part of the bathroom. As they have the same floor level as the rest of the bathroom they provide no barrier upon entry. Its interior space can also be used as turning space within the bathroom. They provide room for a waterproof chair or a shower wheelchair. Sometimes they are also installed with a fold-down seat (Bulleyment, 2001).

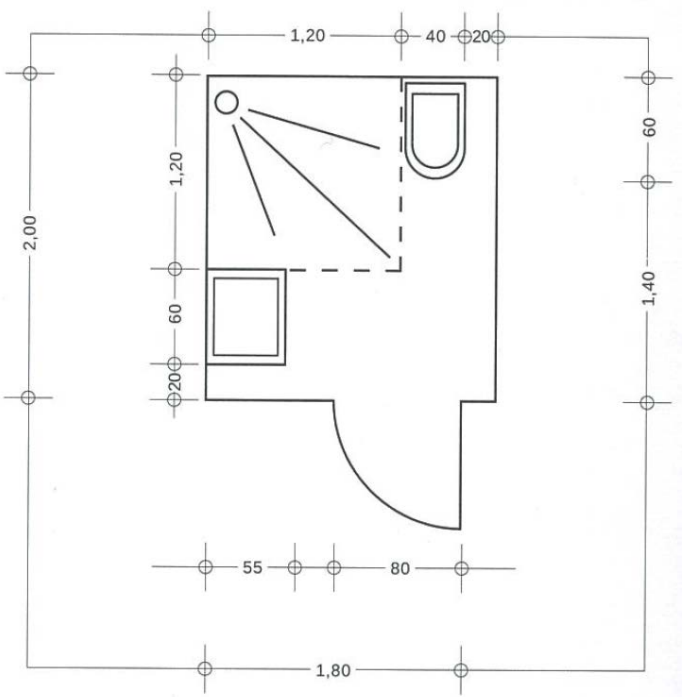


Figure 2.40: Dimensions of a bathroom with a shower, toilet and vanity unit for wheelchair access.

Source: (Fischer & Meuser, 2009, p. 316).

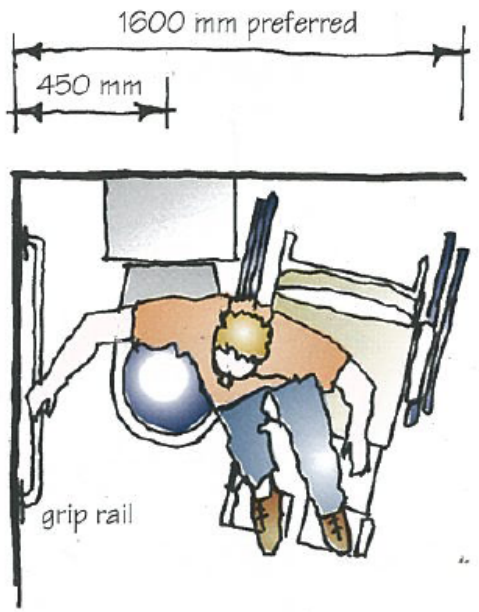


Figure 2.41: Side transfer dimensions.

Source: (Bulleyment, 2001, p. 63)

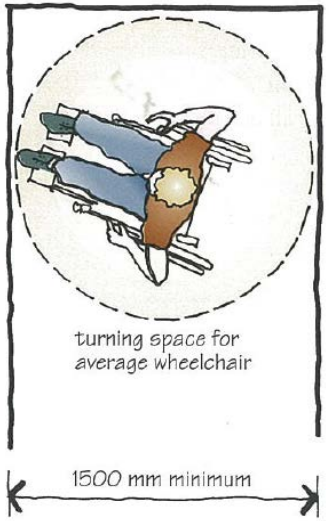


Figure 2.42: Average turning space needed for a wheelchair.

Source: (Bulleyment, 2001, p. 30)

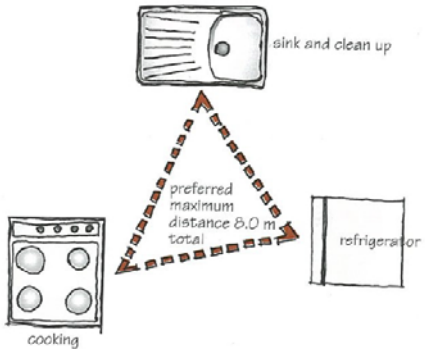


Figure 2.43: Preferred max distance between different parts of the kitchen.

Source: (Bulleyment, 2001, p. 81)

Similar to a bathroom, the bigger the kitchen the more accessible it is. 1500mm diameter turning circle is the preferred minimum area within a kitchen to allow for the manoeuvring of a wheelchair (refer to figure 2.42 and 2.44). When creating a large kitchen, it is important to prevent the distances between the main areas of the kitchen from being very far apart. The total distance between the sink, refrigerator and stove should ideally have a maximum distance of 8 meters (Bulleyment, 2001) (refer to figure 2.43).

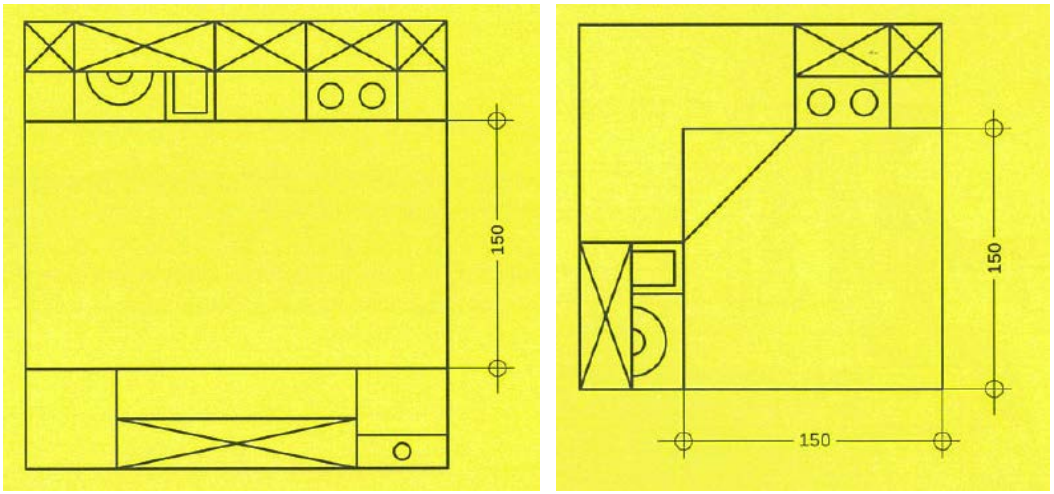


Figure 2.44: Minimum dimensions for manoeuvring within the kitchen.

Source: (Fischer & Meuser, 2009, p. 313).

Bedrooms should be dimensioned to allow turning movement for a wheelchair in most areas of the room. There must be enough space for a wheelchair user to turn, get in and out of bed, open, close and look into their wardrobes (Fischer & Meuser, 2009, pp. 324, 325).

2.8 Conclusion

The theories and ideas discussed in this section can be combined in various ways to support the housing needs of single parent families.

Affordability:

Passive heating and cooling offers low maintenance, low cost means to regulate comfortable temperatures within the home. Work-live arrangements, transforms the home into an income generator, with less expenses to non-home-based businesses. These arrangements, along with mixed-use developments bring daily services in close proximity to the home, reducing expenditure on transportation.

Accessibility to services:

Work-live arrangements encourage employment close to home, making the transition between work and private life more convenient. Mixed-use developments are often sited close to a range of services, allowing an array of services to be conveniently available to their residents. The provision of onsite services by cohousing brings services even closer to home.

Sense of community:

The articulation of collective space and threshold zones, manipulation of light and furniture as social anchors and the encouragement of user participation in space design can all contribute towards creating spaces that foster social interaction and a sense of community. Cohousing promotes a sense of community through its provision of communal spaces and pedestrian-friendly layouts. The careful mixture of inhabitant types within integrative living encourages mutual support.

Safety and security:

The CPTED principles of territoriality, surveillance and image reduce the likelihood of crime in an area. Children’s safety within the home can be supported through the open communication between spaces within the home, the placement of barriers and the careful design of vertical circulation.

Positive image:

Integrative living promotes a mixture of people of various backgrounds living in close proximity by illustrating this as a mutually beneficial arrangement for residents. Barrier-free design prevents the construction of buildings that exclude people because of their physical condition and age.

When these ten ideas are combined harmoniously into the design of a housing complex, the result would be a hybrid form of housing that would address all the five housing needs of single parent families.

3. Precedents Review

3.1 Introduction

This chapter presents nine projects. Each project was selected based on its potential to explore and examine characteristics that compliment the architectural ideas reviewed in the literature. They elaborate on the literature review by providing building examples that offer more detailed design guidance on those ideas. The precedents list has been refined to ensure that each precedent presents a fresh characteristic compared to the ones reviewed before it. They were sourced through published books, journals and prominent architectural websites.

The projects reviewed are listed in the following table:

Project Name	Location	Year completed	Architect
Fiona House	London, England	1972	Sylvester Bone
New American House	Un-built, USA	Designed 1984	Jacqueline Leavitt
Sargfrabrik	Vienna, Austria	1996	BKK-3 Architects
Miss Sargfrabrik	Vienna, Austria	2000	BKK-3 Architects
York Street Social Housing	Dublin, Ireland	2008	Sean Harrington Architects
Switch	Tokyo, Japan	2010	Yuko Shibata
Alberta Mercantile	NE Portland, Oregon	2010	Vallaster Corl Architects
Le Lorrain	Brussels, Belgium	2011	MDW Architecture
Montessori College Oost	Amsterdam, Netherlands	2000	Architectuurstudio Herman Hertzberger

Table 3.1: Projects reviewed

Source: Author's collection

Where contemporary housing projects that displayed the ideas highlighted in the literature were not available, other types of buildings were explored. Sometimes branching into old housing projects and projects with an education programme, offered a clearer illustration of design approach.

Very few housing projects were found to be specifically themed around single parent families. Despite the continuing rise in single parent families in developed countries like New Zealand, very little research and innovation around the architectural design of their housing has arisen in recent times.

3.2 Fiona House

London, England
1972
Sylvester Bone

The *Fiona House* is one of the first residential complexes designed specifically to address the needs of single parent families. The project was initiated and managed by Nina West, a single parent at the time and founder of a housing association for divorced and single parents. She commissioned Sylvester Bone as the architect (Strong, 1975). Together they designed the *Fiona House* as a block of 12 apartments complemented by a daycare building (refer to figure 3.1).

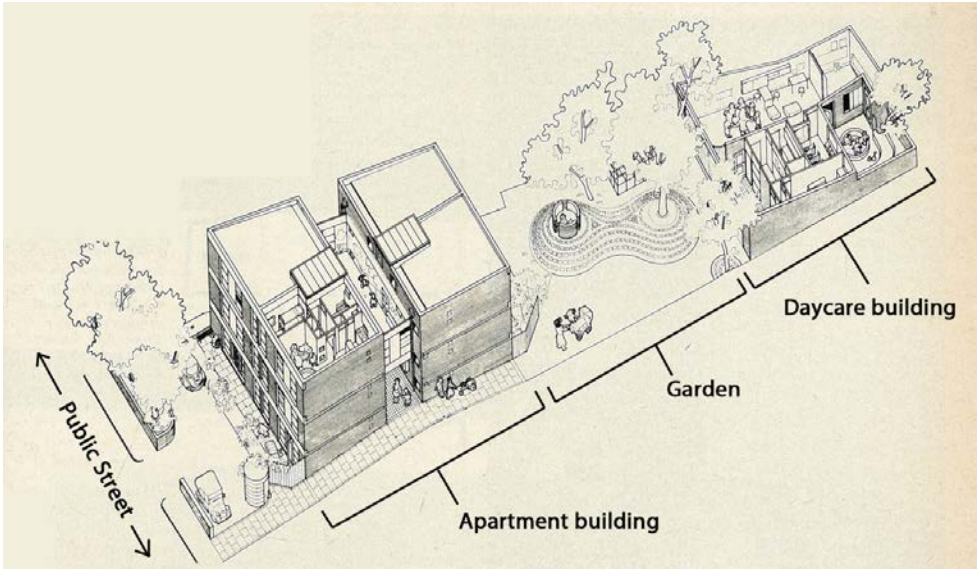


Figure 3.1: Axonometric overview of Fiona House (annotation added by author)

Source: (Bridge over troubled water, 1972, p. 681)

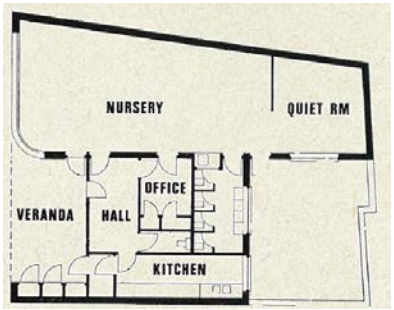


Figure 3.2: Fiona House. Plan of daycare.

Source: (Bridge over troubled water, 1972, p. 682)

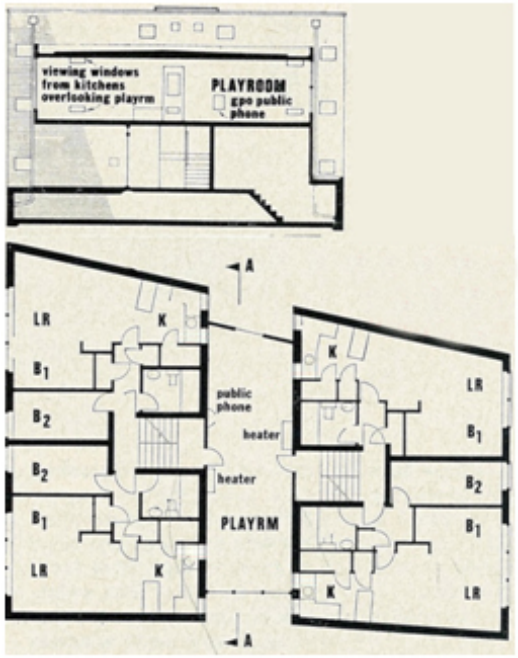


Figure 3.3: Fiona House. Section and plan of the apartment building. Red annotations added by author.

Source: (Bridge over troubled water, 1972, p. 682)

The onsite daycare offers convenient access to childcare and employment. It was designed to accommodate 31 children within the residence and the neighborhood (Ahrentzen, 1989) (refer to figure 3.2). Single parents that occupy the housing could use the daycare to free themselves for paid employment, and in some cases find employment in the daycare itself (Hayden, 2002).

For children, finding safe areas for play is convenient. Each apartment shares a common access corridor that doubles as play space. The kitchen windows of the apartments are positioned to oversee these areas (refer to figure 3.3). An intercom system is linked between these spaces to the telephones of each apartment (Ahrentzen, 1989). The combination of these aspects allows parents to simultaneously supervise their children's play whilst performing domestic chores within the home. Outdoor play is accommodated within a backyard garden space, overlooked by the apartment block and daycare (refer to figure 3.4).

Nina West and Sylvester Bone recognized the low income of single parents. Apartment units are small by American standards (Hayden, 2002). They mainly consist of two bedroom units between $32m^2$ to $64m^2$ (refer to figure 3.3). Their sizes make them economic to operate, and with the support of the corridor play spaces and the backyard garden, children are not short of spaces to play. In some cases, the day care provides single parents with temporary work and the capital cost of the development is supported by government and charitable funding (Hayden, 2002).

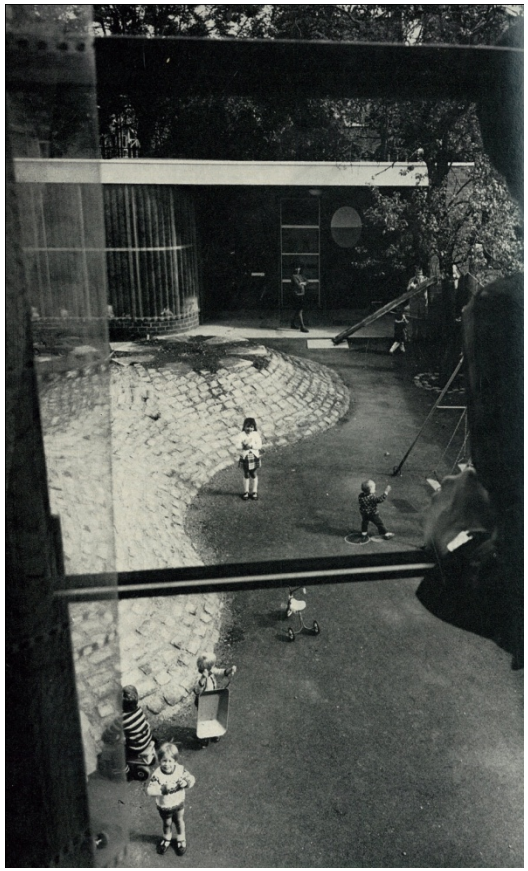


Figure 3.4: Fiona House. View from an apartment window onto backyard garden.

Source: (Bridge over troubled water, 1972, p. 680)

Figure 3.5: Street frontage view of Fiona House

Source: (Bridge over troubled water, 1972, p. 681)

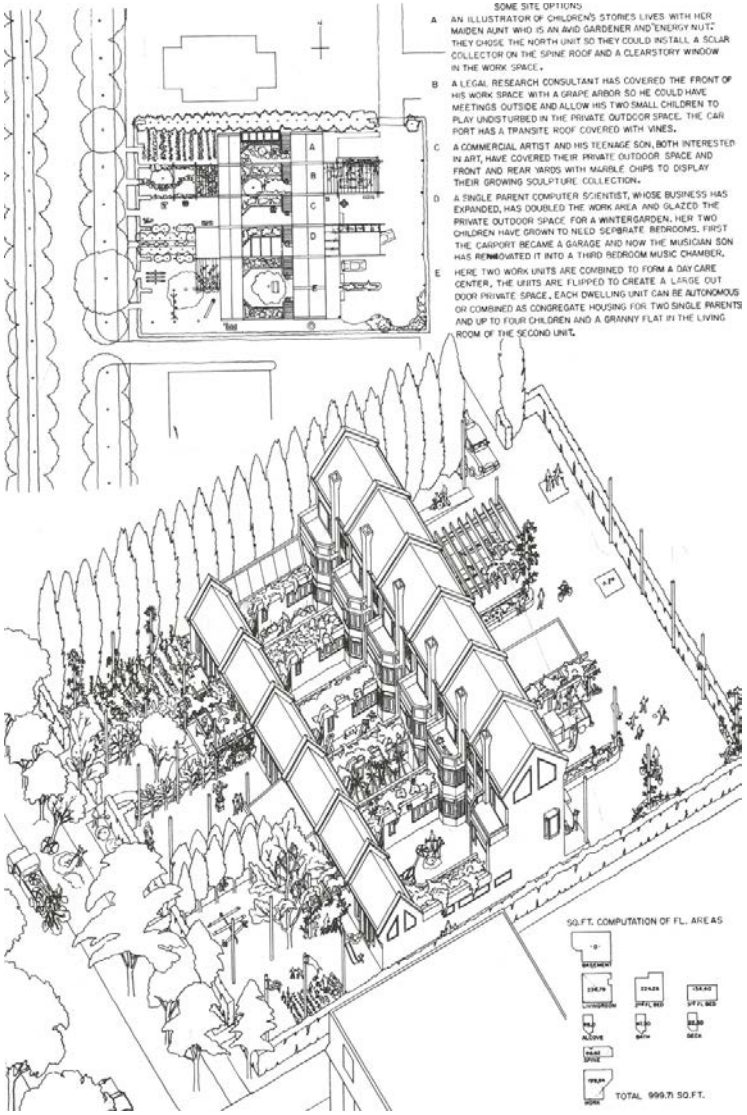


Figure 3.6: Axonometric site plan of the New American House

Source: (Leavitt, 1989, p. 172)

3.3 New American House

Un-built, USA
Designed 1984
Jacqueline Leavitt

The *New American House* was a design competition set in 1984. Its aim was to find new urban housing concepts supportive of non-traditional households, such as single parent families, two-income families, unrelated young adults sharing a single residence, adults without children at home, and retired active adults (Leavitt, Two Prototypical Designs for Single Parents: The Congregate House and the New American House, 1989). The winning entry was a linear arrangement of six row-houses. Each house has a single-storey, workspace at the front, with a two-storey living unit connected behind. A kitchen and courtyard lie in between. Each house has its own front yard, and access to a shared backyard (Leavitt, Two Prototypical Designs for Single Parents: The Congregate House and the New American House, 1989) (refer to figure 3.6).

Work spaces are designed to facilitate a range of businesses, such as an artist's studio, lawyer's office and a child-care centre. Each house's workspace is 18.5m2 (Leavitt, 1989). They have the potential to be enlarged before construction through the flipping of one house unit's plan. This creates a double unit such as building E on figure 3.6. This arrangement provides sufficient

workspace for a neighbourhood child-care centre. The combined front yards can act as the centre's play area (Leavitt, 1989).

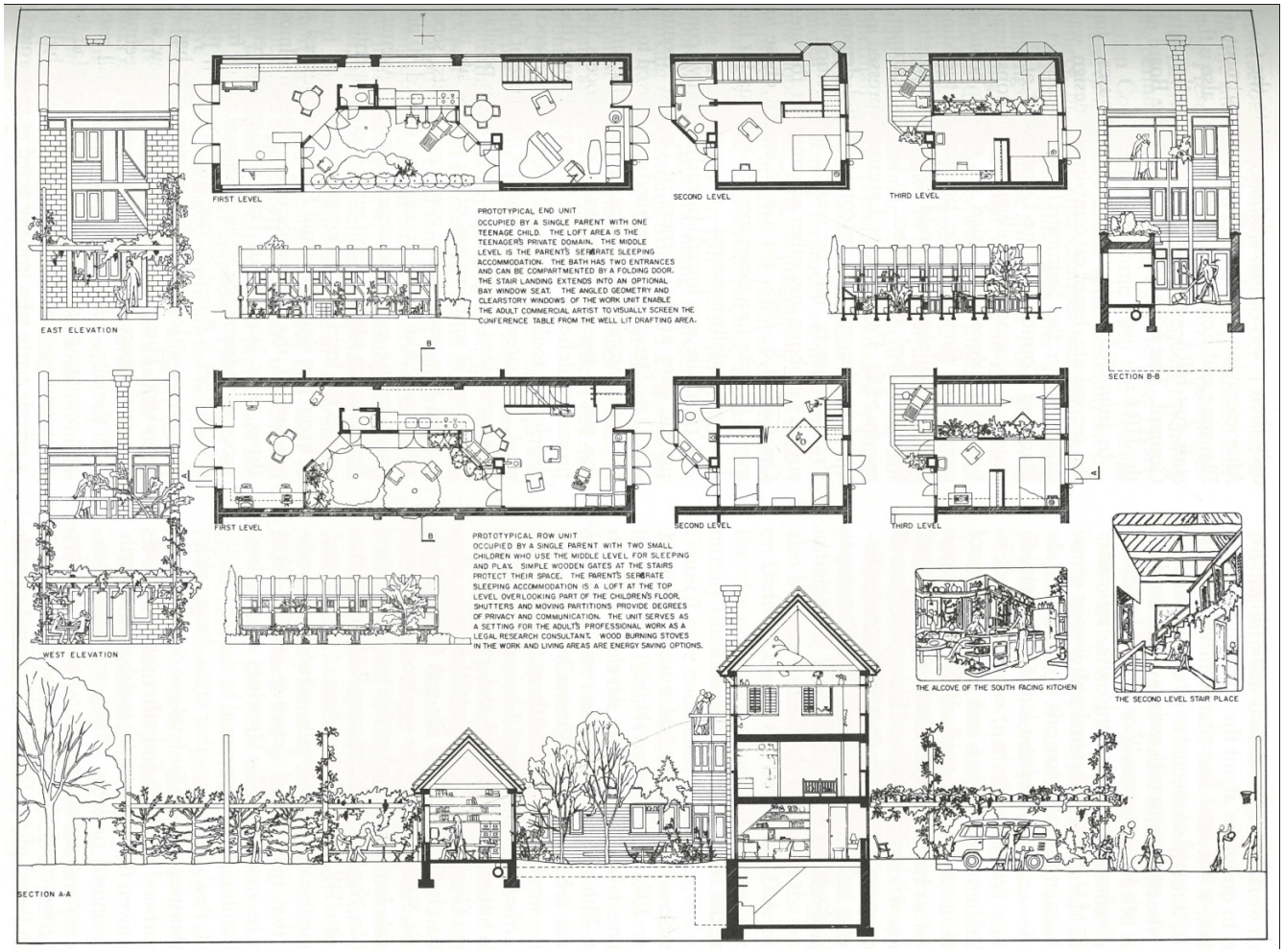


Figure 3.7: Section and floor plans of the New American House

Source: (Leavitt, 1989, p. 173)

By bridging the gap between private life and work, this design opens up work opportunities to its residents by facilitating onsite employment.

The design is also mindful of children's safety within the home. The potential play space of the inner courtyard of each unit is overlooked by a kitchen, living room and work space. Safety at the foot of stairs can be enforced through the installation of folding gates at each level. The shared backyard provides a large area for children to play, away from the traffic of the street (Leavitt, 1989) (refer to figure 3.7).

Figure 3.8: Sargfrabrik. Front Entrance

Source: (Mazzo, 2011)

3.4 Sargfrabrik

Vienna, Austria
1996
BKK-3 Architects

BKK-3 Architects' *Sargfrabrik* is a housing project created on the land of a former coffin factory in Vienna. It supports 112 housing units and a mix of community spaces including an events hall, a seminar room, a bathing house, a kindergarten and a restaurant. These spaces serve both residents and locals. It has a range of outdoor spaces including a playground and a roof garden (Helms, Hiess, Slunsky, & Urbanek, 2001; Hurton) (refer to figure 3.9). With the vast range of facilities on offer, it is not surprising that the *Sargfrabrik* has been termed as a *"village in the city"* (Helms, Hiess, Slunsky, & Urbanek, 2001, p. 1).

Figure 3.9: Sargfrabrik. Roof Garden

Source: (Sargfabrik - ket ujabb cikk, 2010)

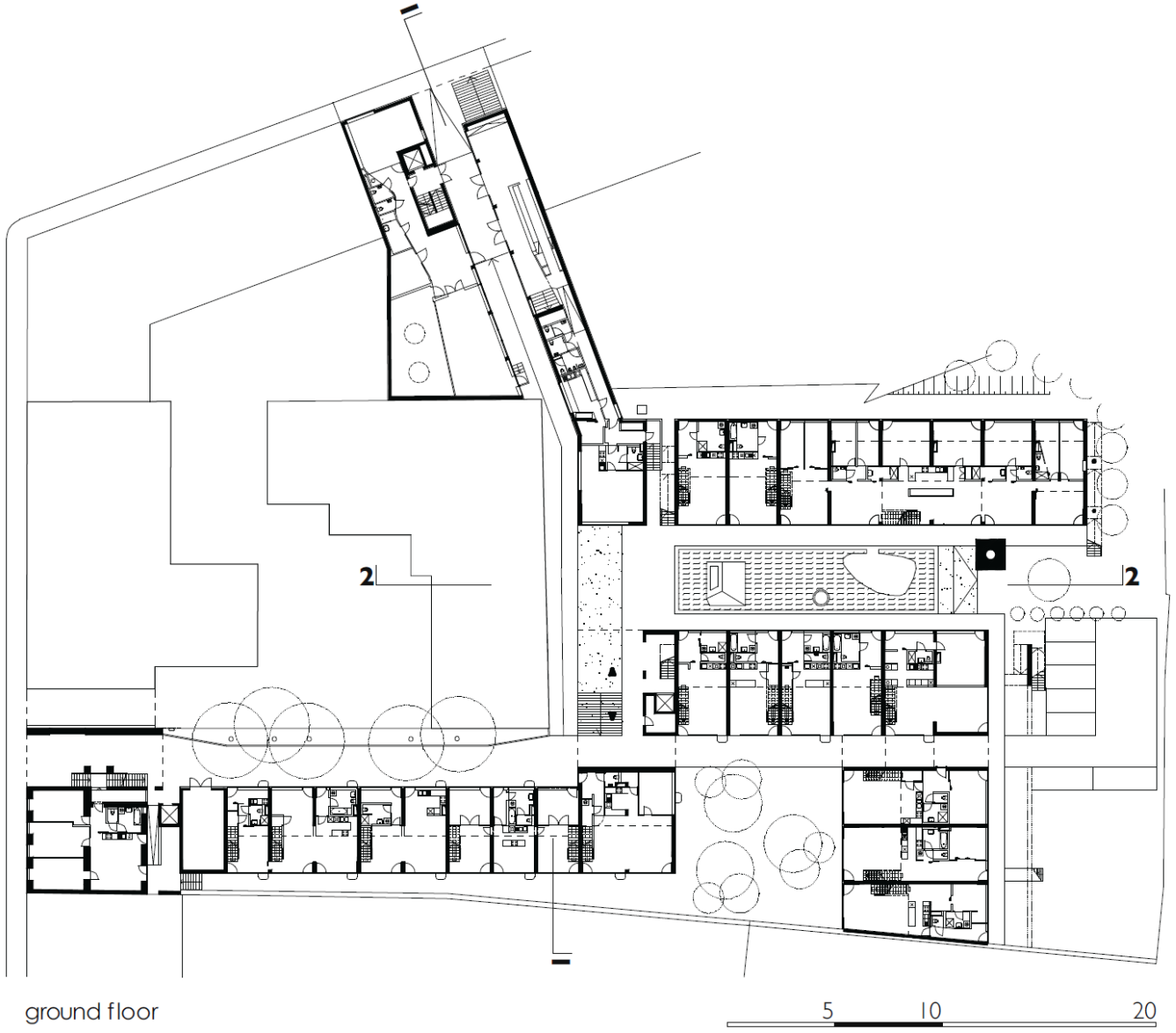


Figure 3.10: Sargfrabrik. Ground floor plan

Source: (Viehhauser, 2008, p. 41)

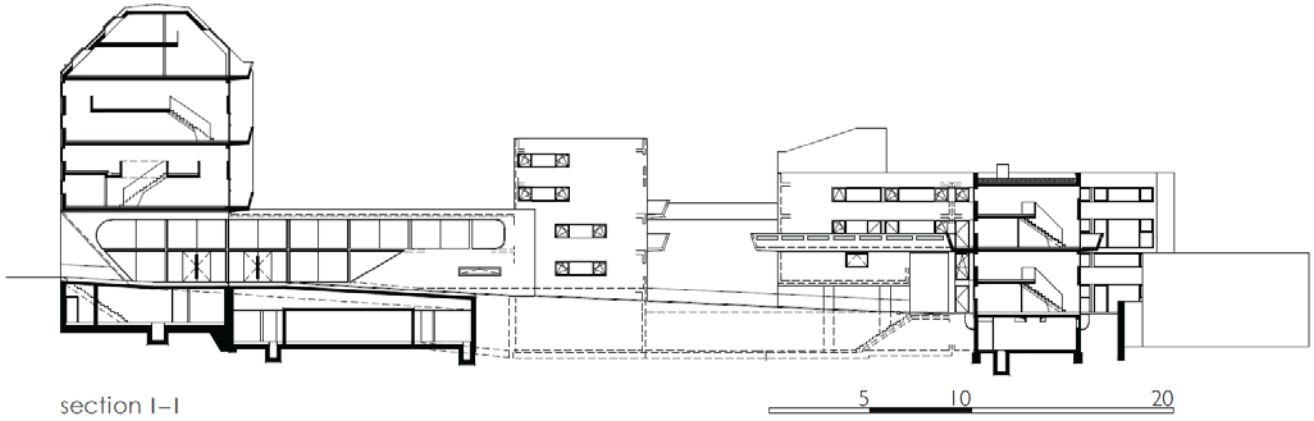


Figure 3.11: Sargfrabrik. Section 1-1

Source: (Viehhauser, 2008, p. 41)

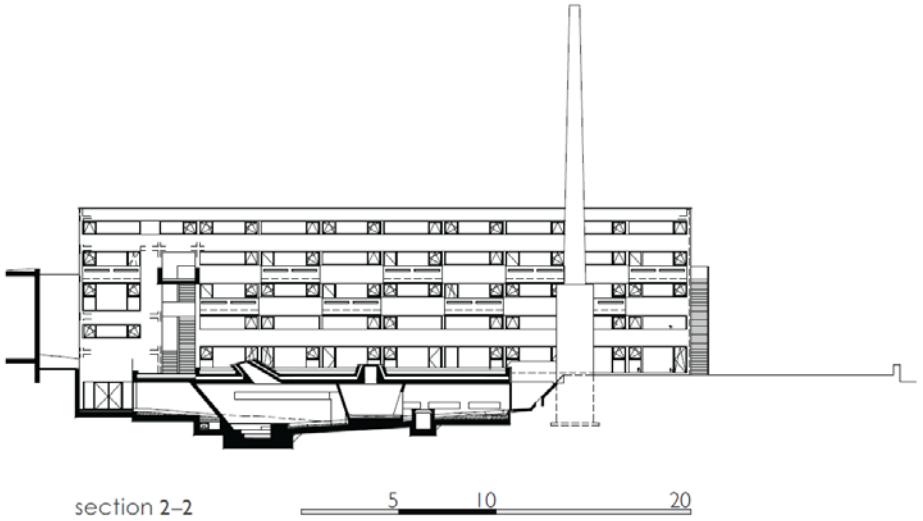


Figure 3.12: Sargfrabrik. Section 2-2

Source: (Viehhauser, 2008, p. 40)

Figure 3.13: Sargfrabrik. Bath House

Source: (Lettner & Pace, 2011)

The events area is 315m^2 and can seat around 300 people. It is large enough for parties, concerts, dance and theatre productions, readings, and various meetings (Helms, Hiess, Slunsky, & Urbanek, 2001). The seminar room is 104m^2 and can accommodate up to 80 people. It is suitable for workshops, meetings and movement and therapy programmes (Helms, Hiess, Slunsky, & Urbanek, 2001). The bathing house has a range of facilities including a Finnish sauna, a cold water pool, a tepidarium, a heated swimming pool and wave machine, a whirlpool, Kneipp healing pool and 3 bath tubs (Helms, Hiess, Slunsky, & Urbanek, 2001) (refer to figure 3.13).

The kindergarten has the capacity for 60 children between the ages of three to ten. The other community facilities compliment the running of the kindergarten. Children are regularly taken to visit the bath house, as well as the events hall for theatre productions, and the seminar room for gymnastics and playing activities. The onsite cafe and restaurant is responsible for serving healthy meals to the children (Helms, Hiess, Slunsky, & Urbanek, 2001).

The reason the complex can support so many facilities is because of its large scale (Beck & Cooper, 2002). By registering the complex legally as a hostel, allowed a reduction of space devoted to car parking, saving them for the development of the community facilities. Normally, according to building regulations within the Sargfrabrik's area, one car park must be provided per housing unit. However, by registering as a hostel, the portion of car parking could be minimised to one car park per 10 housing units (Schmaub, 2008).

The *Sargfabrik* has won a number of prizes including the *Adolf Loos Architecture Prized for Residential Buildings* and the *Bauherren Prize* in 1996 (Helms, Hiess, Slunsky, & Urbanek, 2001).

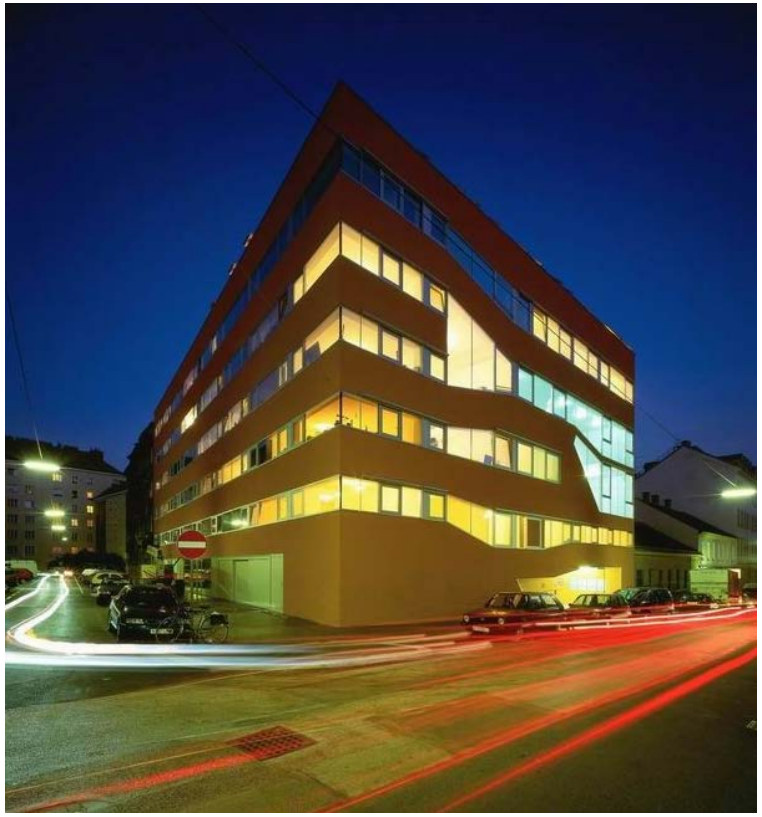


Figure 3.14: Miss Sargfrabrik. Street view

Source: (Miss Sargfabrik)

3.5 Miss Sargfrabrik

Vienna, Austria
2000
BKK-3 Architects

The *Miss Sargfrabrik* is the second generation of collective housing following on from the *Sargfrabrik*. It was designed by the same architects. The complex contains 39 apartments of differing sizes, mixed with a range of communal facilities (Beck & Cooper, 2002). Three apartments are equipped for wheelchair users (Hurton) (refer to figure 3.17).

The complex also encourages work and living in close proximity. Five ground floor apartments have spaces allocated for home offices (Architecture Center Vienna, 2001). Each one has both a private and public entrance (Hurton) (refer to figures 3.15 and 3.16).

Figure 3.15: Miss Sargfrabrik. A home office interior.

Source: (Architecture in Progress, 2011).

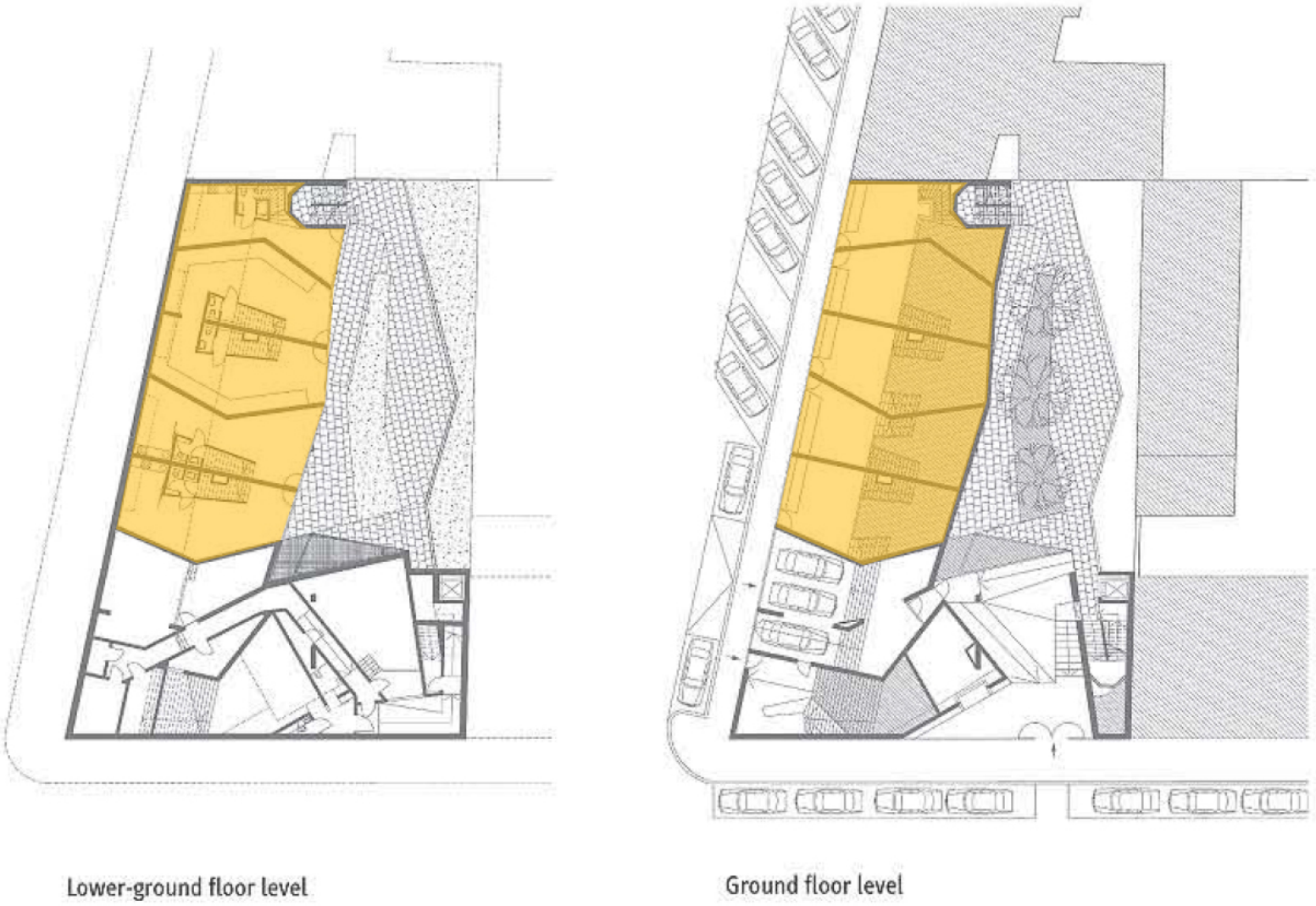


Figure 3.16: Miss Sargfrabrik. Lower-ground floor and Ground floor plans. Office apartments highlighted in yellow. Highlights added by author.

Source: (Beck & Cooper, 2002, p. 22).

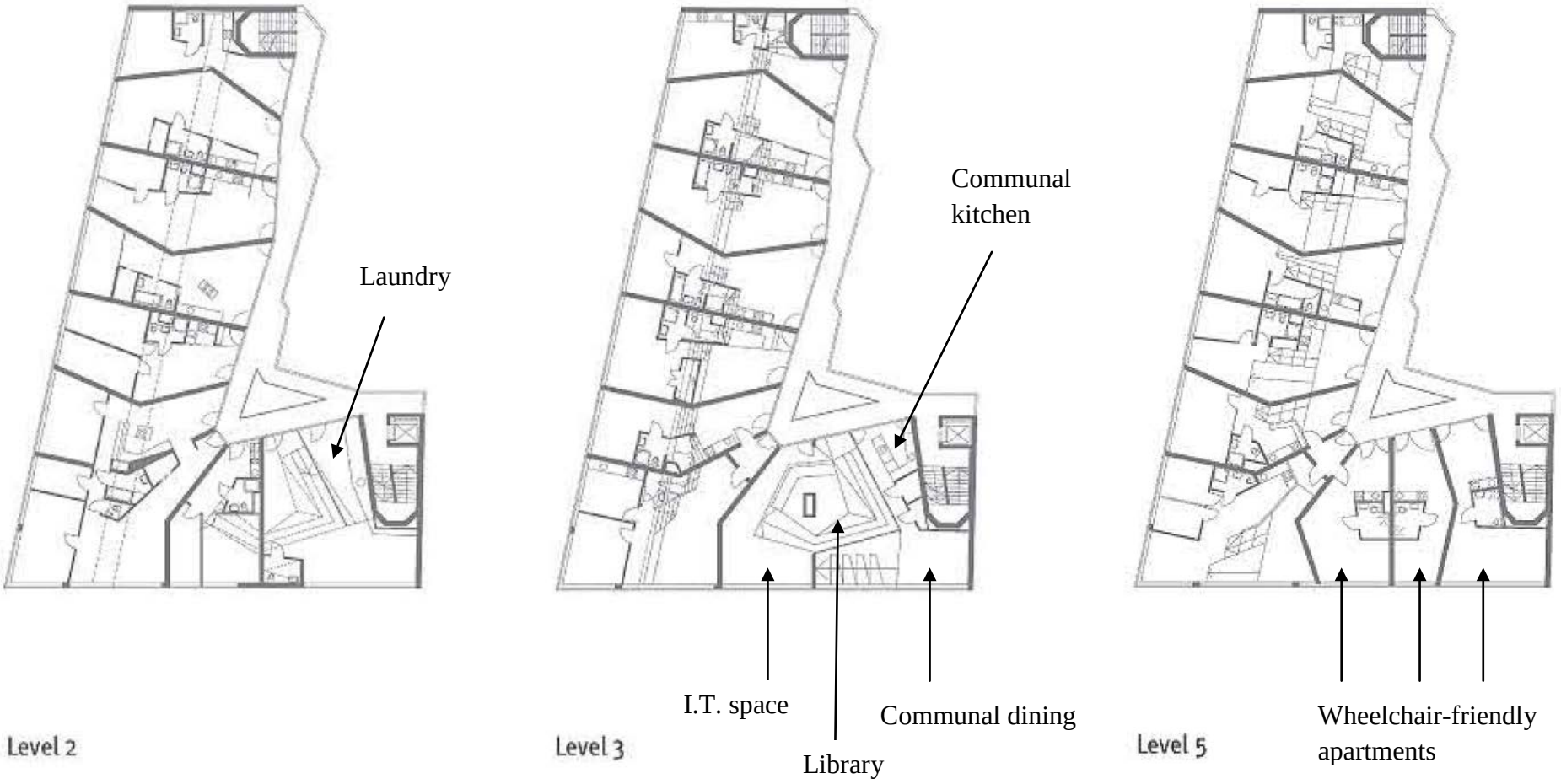


Figure 3.17: Miss Sargfrabrik. 2nd floor, 3rd floor and fifth floor plans. Annotations added by author.

Source: (Beck & Cooper, 2002, pp. 22, 23).

Figure 3.18: Miss Sargfrabrik. Library.

Source: (Davis, 2007)

The variety and arrangement of its communal facilities help to foster a sense of community within the complex. Communal facilities within the *Miss Sargfrabrik* include a courtyard garden, library, IT space, fully-equipped kitchen and dining room, laundry and a clubroom for teenagers (Beck & Cooper, 2002) (refer to figures 3.17, 3.18, 3.19, 3.20, 3.21, 3.22, 3.23, 3.24, 3.25). These facilities cover 260m^2, so approximately 10% of the total effective building area (Ebner & Klaffke, 2009). These spaces are arranged to cross over each other. Transparent glass walls open up a visual dialogue between these areas (Miss Sargfabrik; Ebner & Klaffke, 2009). The interlocking nature of the communal spaces encourages residents using them to encounter other residents, even when they are residing within different communal spaces.

Figure 3.19: Miss Sargfrabrik. Courtyard garden.

Source: (Architecture in Progress, 2011).

Figure 3.20: Miss Sargfrabrik. IT space is on the right. Library is on the left.

Source: (Architecture in Progress, 2011).

Figure 3.21: Miss Sargfrabrik. Library on the left. Laundry to the right.

Source: (Architecture in Progress, 2011).

Figure 3.22: Miss Sargfrabrik. Laundry

Source: (Architecture in Progress, 2011).

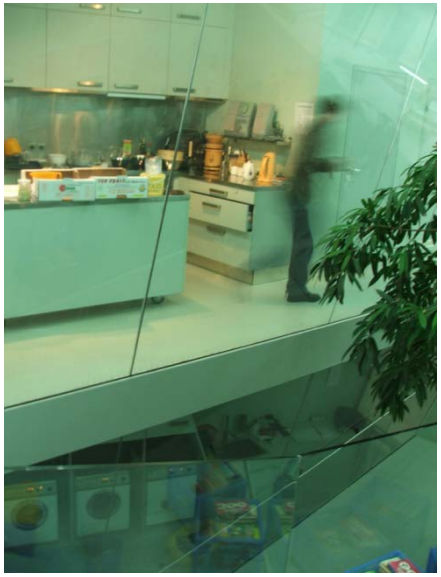


Figure 3.23: Miss Sargfrabrik. Communal kitchen above. Laundry below.

Source: (Davis, 2007)

Figure 3.24: Miss Sargfrabrik. Communal kitchen to the left. Communal dining room straight ahead. Library to the right.

Source: (Architecture in Progress, 2011).

Figure 3.25: Miss Sargfrabrik. Clubroom

Source: (Davis, 2007)

Access galleries to the apartments facilitate social interaction. The width of these galleries range between one, two and a half to three meters. This width provides space for circulation as well as forecourt space in front of apartments. Residents often furnish these spaces with plants and seating (Ebner & Klaffke, 2009) (refer to figure 3.26). As residents inhabit these semi-private forecourts, they expose themselves to other residents passing by.

Figure 3.26: Miss Sargfrabrik. Access gallery.

Source: (Architecture in Progress, 2011).

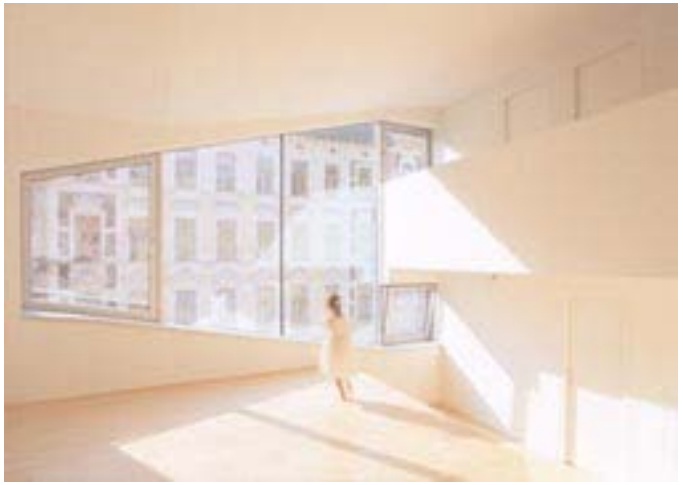


Figure 3.27: Miss Sargfrabrik. Apartment interior.

Source: (BKK-3)

Apartment sizes are compacted to maximise the site area. The communal laundry, kitchen and dining facilities, saves space within the apartments by eliminating the need for individual laundry rooms (Beck & Cooper, 2002) as well as large kitchens and dining rooms. Residents can book the communal kitchen and dining facilities for dinner parties and private celebrations (Beck & Cooper, 2002). Many residents choose to store their personal books within the communal library, helping to save more space within their apartments (Beck & Cooper, 2002). By keeping apartments within the small area of 50 to 60 meters squared, many apartments could be fitted onto the site. The smaller sense of space within apartments is compensated by high ceiling heights between 2.26 and 3.13 metres and the installation of large windows (Hurton). These design features bring in large amounts of daylight and transparency into the apartment, creating a feeling of spaciousness (refer to figure 3.27).

Similar to the *Sargfabrik*, *Miss Sargfrabrik* is also a recipient of two prizes, the 2001 *Austrian Cement Industry Prize for Architecture* and the 2002 *Berlin Academy of Arts Support Prize for Building Design* (Helms, Hiess, Slunsky, & Urbanek, 2001).

Figure 3.28: York Street Social Housing. Street view of exterior.

Source: (e-architect)

3.6 York Street Social Housing

Dublin, Ireland
2008
Sean Harrington Architects

York Street Social Housing is a social housing scheme designed with 66 apartments of varying sizes, a community centre and a retail unit. Constructed in 2008, it is located in York Street in the city centre of Dublin, Ireland (e-architect; Design Commission for Wales).

The project reduces operating costs by demonstrating a number of passive design aspects. Tall windows have been installed to maximize the use of natural lighting, avoiding artificial lighting (Sean Harrington Architects). Almost all of the 66 apartments have dual or corner aspect (Design Commission for Wales) (refer to figure 3.29), to allow for natural ventilation. Glazed winter balconies have been installed and orientated to the south to maximize solar gain (e-architect) (refer to figures 3.31 and 3.32). Warm air collected in these glazed balconies can be redistributed though out apartment interiors (Sean Harrington Architects), for added warmth through the winter. In summer, spaces can be ventilated out by opening up the glazed balconies and the interiors of the apartments. High insulation materials have been used throughout the development, such as sheep's wool. Northern elevations have small windows to minimize energy loss (e-architect) (refer to figure 3.30).

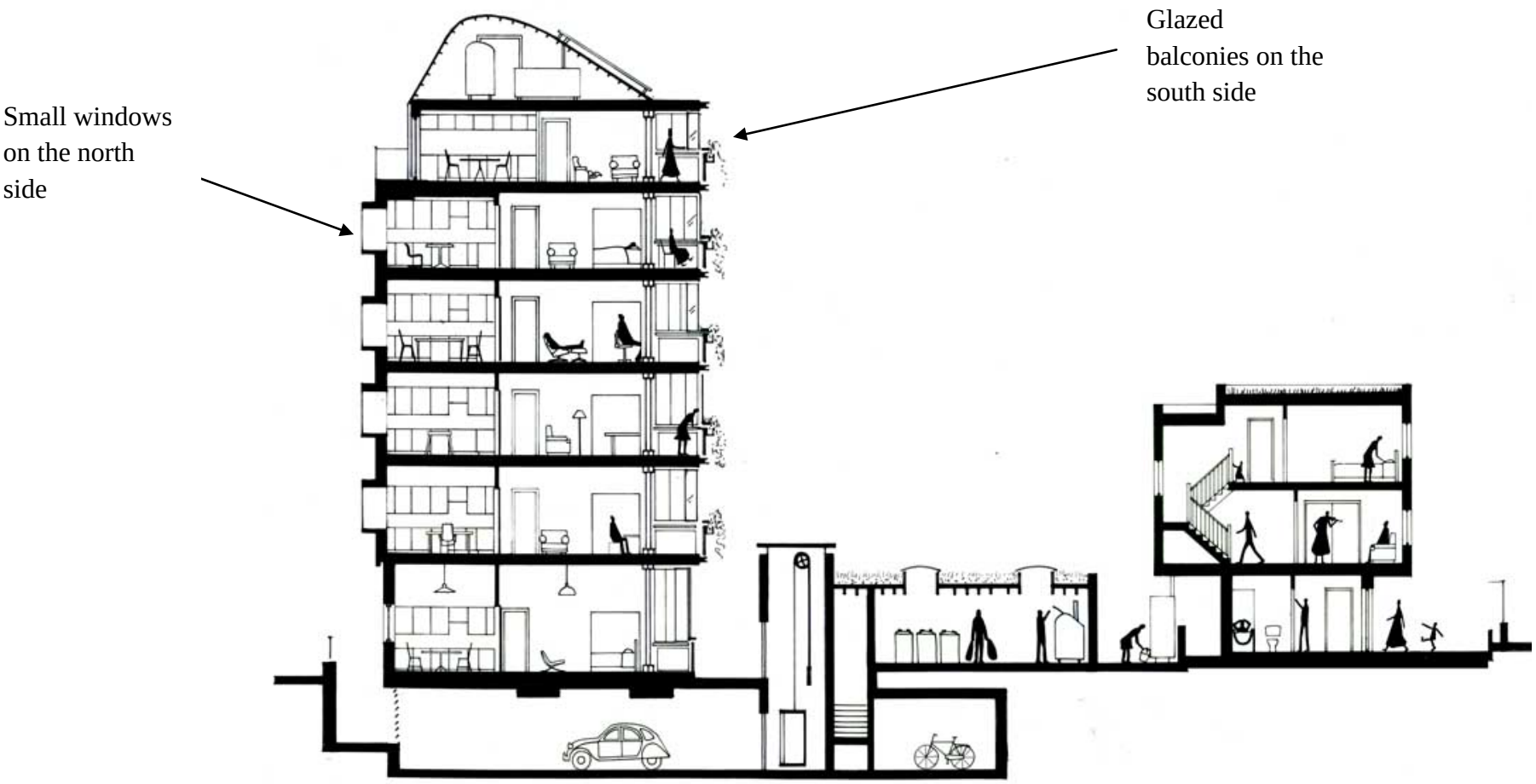


Figure 3.29: York Street Social Housing. Detailed section through development. Annotations added by author.

Source: (e-architect)

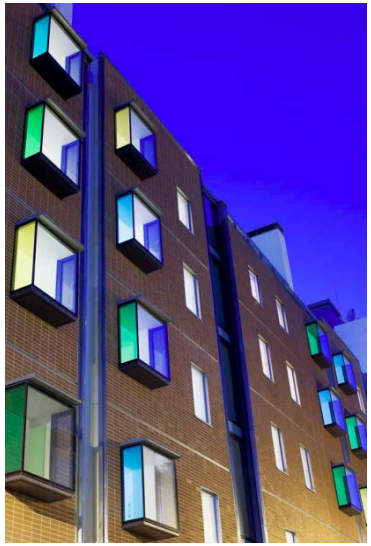


Figure 3.30: York Street Social Housing. Small windows on the north side.

Source: (e-architect)

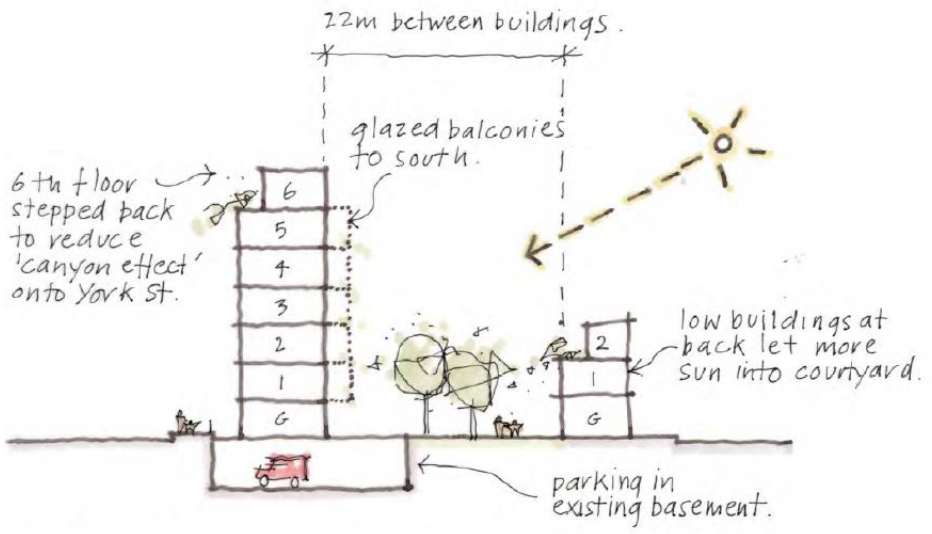


Figure 3.31: York Street Social Housing. Concept drawing of section through development.

Source: (Sean Harrington Architects, p. 8)

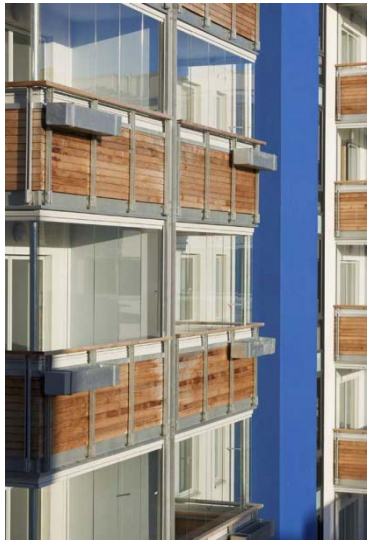


Figure 3.32: York Street Social Housing. Glazed balconies on the south side.

Source: (e-architect)

Figure 3.33: Switch. Original floor plan above. Revised floor plan below.

Source: (Etherington, 2010)

3.7 Switch

Tokyo, Japan
2010
Yoko Shibata

Switch is an interior fit out of a Tokyo apartment designed by Yuko Shibata. The design incorporates two bookshelves into the existing apartment to provide it with the ability to switch from living space to office, and vice versa without changing the original floor plan (Etherington, 2010) (refer to figure 3.33). By sliding a large door, the dining room can be transformed into a library and meeting room for the day (refer to figure 3.35). Swing open a large bookshelf door can allow the office to claim bedroom space that is unused during the day (refer to figure 3.34). For the evenings and mornings, these changes can be reverted back to support domestic life.

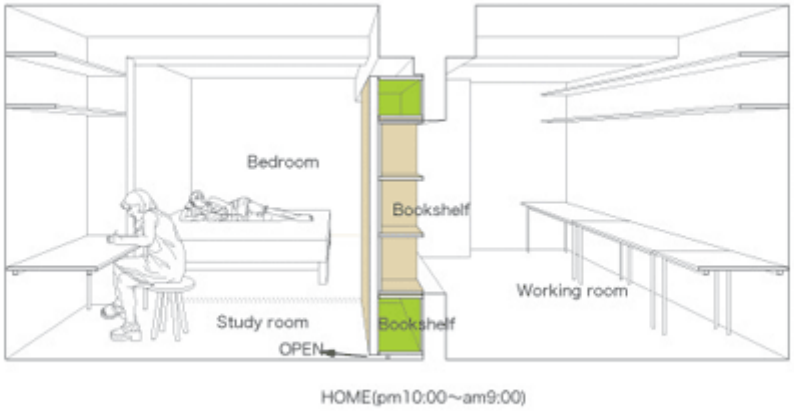


Figure 3.34: Switch. Bedroom to workroom / office extension

Source: (Etherington, 2010)

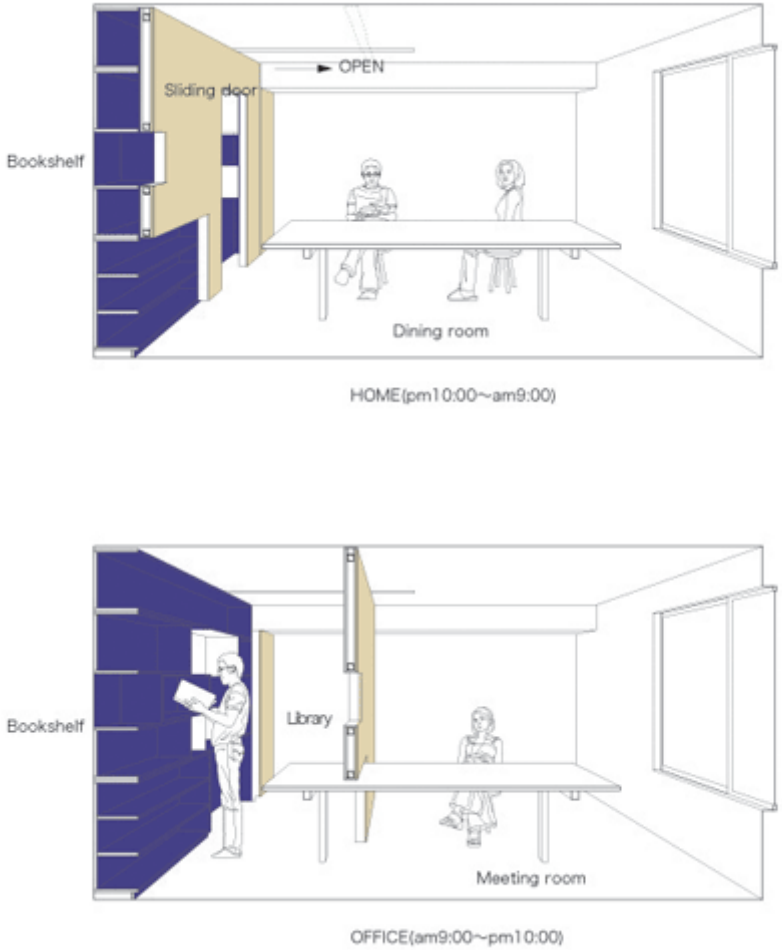


Figure 3.35: Switch. Dining room / library and meeting room.

Source: (Etherington, 2010)

This project provides an interesting interpretation of work-live arrangements. Since the existing residence did not have free space for the building of an extra office, such as by taking over a garage or a portion of a backyard, it allows both office space and living space to overlap. A dining table can become a conference table, and a bedroom study could become part of the main office. Recognizing that office space is primarily used during the day and living spaces like the dining room and bedroom are mainly used in the morning and evening, extra office space is gained without extending the building envelope.

The specific physical mechanisms used in *Switch*, such as a large sliding door, is not what makes the project an interesting contribution to the design of work-live arrangements. What is more interesting is that the project raises the idea that some facilities within the home can also assist in the functioning of an office. As mentioned, a dining room can offer a meeting space. Other dual functioning spaces could be a toilet. A kitchen can also be an office's break space. By sharing these facilities, the upfront costs and maintenance costs needed for having these facilities for both work and private life can be reduced, because only one set of facilities is needed instead of two.

Figure 3.36: Alberta Mercantile. Warehouse before renovation.

Source: (Portland Built, 2010)

Figure 3.37: Alberta Mercantile. View of overall development.

Source: (Portland Built, 2010)

3.8 Alberta Mercantile

NE Portland, Oregon, United States
2010
Vallaster Corl Architects

Alberta Mercantile is a good example of a work-live arrangement. It is a mixed-use project composed of four retail spaces, café, and six work-live units, renovated from an existing warehouse building (refer to figures 3.36 and 3.37). It is sited within the Alberta Arts district in NE Portland (Urban Works Real Estate, 2010; Investors, 2010).

The project had two key goals – to completely reuse the existing 7,000 square-foot warehouse building, taking advantage of its 22 feet ceiling heights, as well as creating *'small efficient spaces targeted to the local entrepreneur'* (Investors, 2010; Portland Built, 2010). New or expanded businesses are often low on cash. This project provides rentable "turn-key" retail spaces paired with livable areas (Portland Built, 2010).

Each retail unit has around 900 square feet on the ground floor and a mezzanine space of around 375 square feet (refer to figure 3.40). That is a total of 118 m2. The interiors open onto Alberta Street through transparent roll up doors (refer to figure 3.38 and 3.39). Aside from retail, they can be used to accommodate an office and residential uses on the mezzanine level (Urban Works Real Estate, 2010). The work-live units also feature roll-up doors, ground floor and mezzanine spaces (refer to 3.41, 3.42 and 3.43). A full kitchenette is located on the ground floor. A bathroom, washer/dryer, and living area are located on the

Figure 3.38: Alberta Mercantile. Entrances of retail units.

Source: (Portland Built, 2010)

Figure 3.39: Alberta Mercantile. Entrance into a retail unit.

Source: (Portland Built, 2010)

mezzanine level. The dimensions of each unit and its amenities, provides flexibility for a small business person or artisan (Urban Works Real Estate, 2010).

The commercial exposure of these work-live units through their connection to the ground floor, makes them suitable to support both retail and office work.

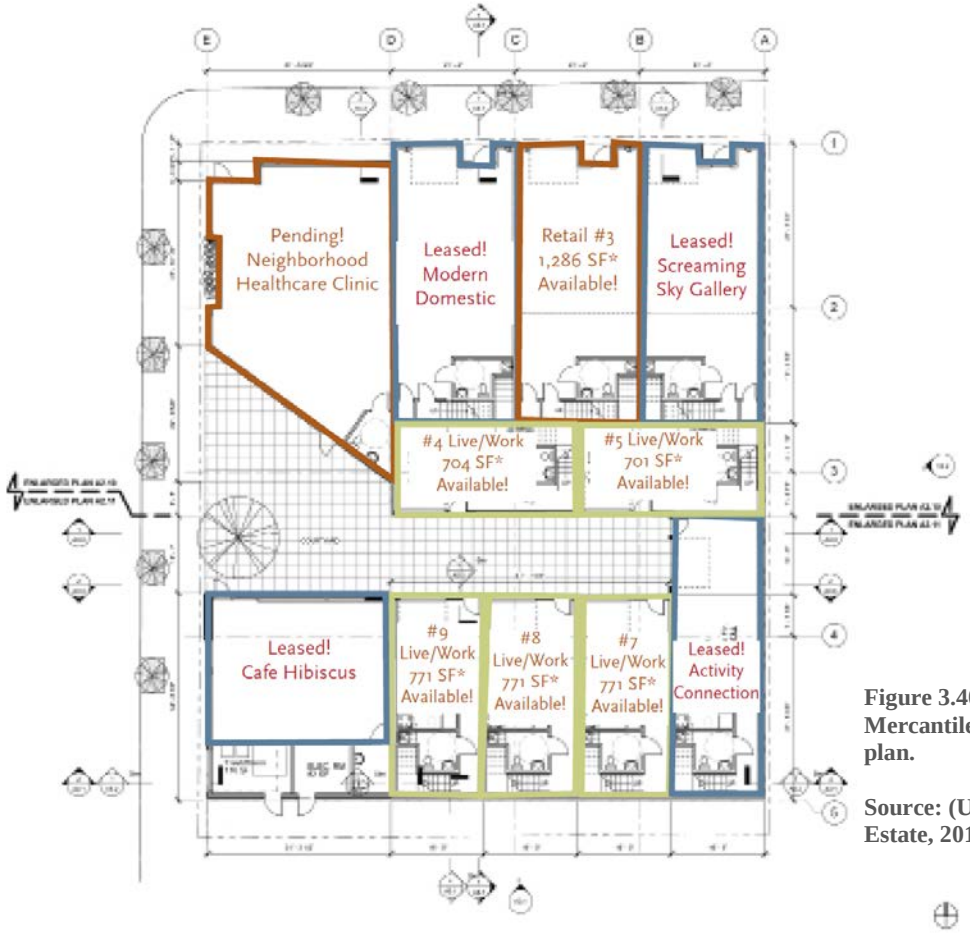


Figure 3.40: Alberta Mercantile. Ground floor plan.

Source: (Urban Works Real Estate, 2010, p. 3).

Figure 3.41: Alberta Mercantile. Courtyard entrance to work-live units.

Source: (Portland Built, 2010)

Figure 3.42: Alberta Mercantile. Entrance to a work-live unit.

Source: (Portland Built, 2010)

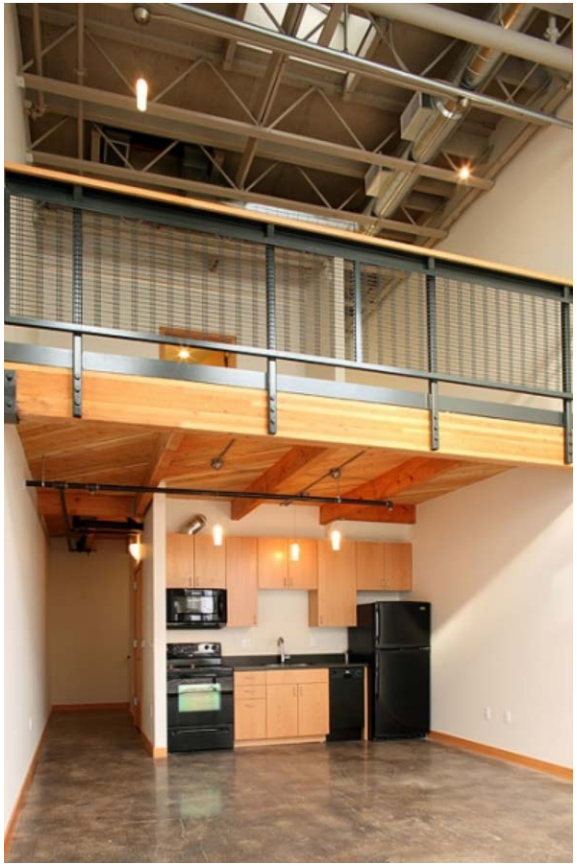


Figure 3.43 Alberta Mercantile. Ground floor of a work-live unit.

Source: (Portland Built, 2010)

Figure 3.44: Le Lorrain. Street elevation.

Source: (Griffiths, 2011).

3.9 Le Lorrain

Brussels, Belgium
2011
MDW Architecture

Le Lorrain is a social housing complex in Brussels, Belgium. It was designed by MDW Architecture (Griffiths, 2011). The complex is composed of a large common open space surrounded by an apartment building and three terrace houses. It provides a range of different residential units, including simplex, duplex and triplex of two to four bedrooms (Griffiths, 2011).

Figure 3.45: Le Lorrain. Approaching the building from the street.

Source: (Griffiths, 2011).

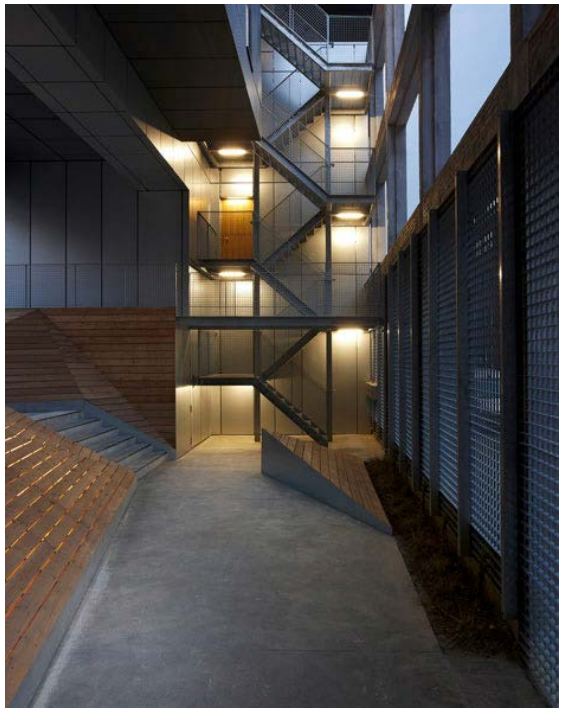


Figure 3.46: Le Lorrain. Hot dip galvanized steel mesh along the original scrap metal building street facade.

Source: (Griffiths, 2011).

The need for high durability in social housing is reflected in the architects' use of materials (Griffiths, 2011). The buildings are clad with grey metallic sheets and the distribution and circulation functions are identified by hot dip galvanized steel elements (Griffiths, 2011) (refer to figures 3.46, 3.47 and 3.48). The modularity of the metallic sheets contributes to easy maintenance as they can be replaced individually. The scrap metal building's original street front has been kept. A layer of galvanized steel mesh has been installed onto it to enhance security on the site, and for the growing of creeping vegetation (Griffiths, 2011) (refer to figures 3.44 and 3.46). The robust and durable nature of the material pallet has been balanced out by the use of wooden materials on tactile elements such as doors, windows, railing, terraces and benches (Griffiths, 2011) (refer to figures 3.47 and 3.48).

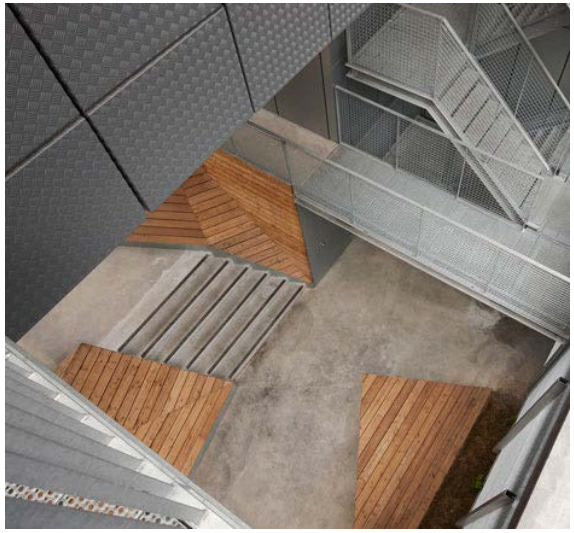


Figure 3.47: Le Lorrain. Galvanized steel surfaces balanced by the warmth of wooden terraces.

Source: (Griffiths, 2011).

Figure 3.48: Le Lorrain. Dark grey metallic sheet cladding contrasted by wooden window frame.

Source: (Griffiths, 2011).

Figure 3.49: Montessori College Oost. Exterior view

Source: (Scholen Bouwen).

3.10 Montessori College Oost

Amsterdam, Netherlands
2000
Architectuurstudio Herman Hertzberger

Dutch architect Herman Hertzberger wrote three key books on architectural theory: *Lessons for Students in Architecture, Space and the Architect: Lessons in Architecture 2*, and *Space and Learning: Lessons in Architecture 3.* Within these texts, he articulated the concepts of creating social spaces explored in the literature review. The secondary school *Montessori College Oost* designed by his architecture firm displays many of these concepts. As secondary school pupils usually hang around in the city with their friends, it was the architects' intention to design a school that evoked associations with the city, providing a range of areas to linger, and meet people (Scholen Bouwen).

The building is essentially arranged as two blocks of classrooms spit by the void of an atrium. The levels of each row of classrooms are staggered at half height to each other creating cross visual relationships between each level (refer to figures 3.50 and 3.52).

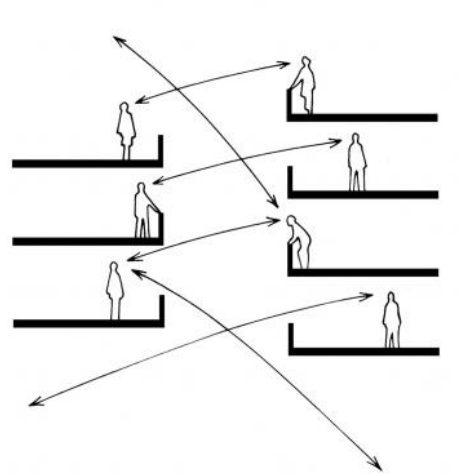


Figure 3.50: Montessori College Oost. Cross visual relationships between levels.

Source: (Scholen Bouwen).

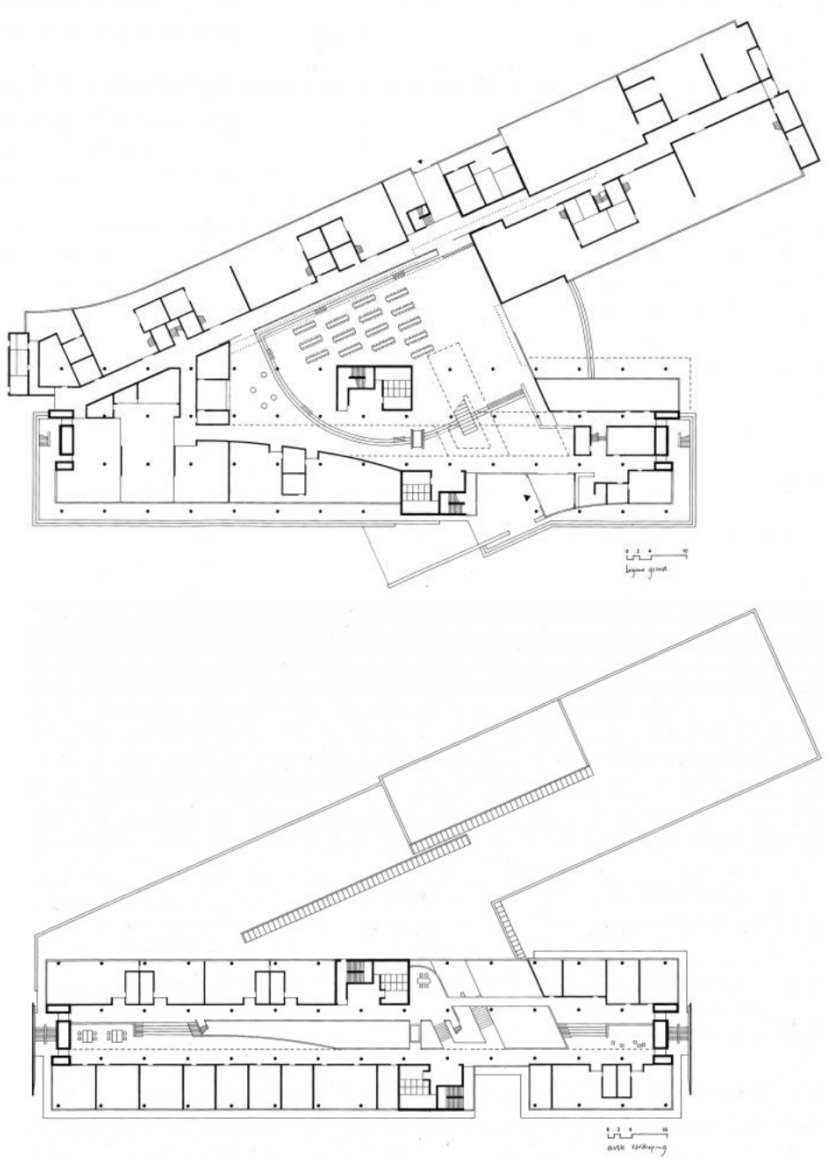


Figure 3.51: Montessori College Oost. Ground floor (top). 1st floor (bottom).

Source: (Scholen Bouwen).

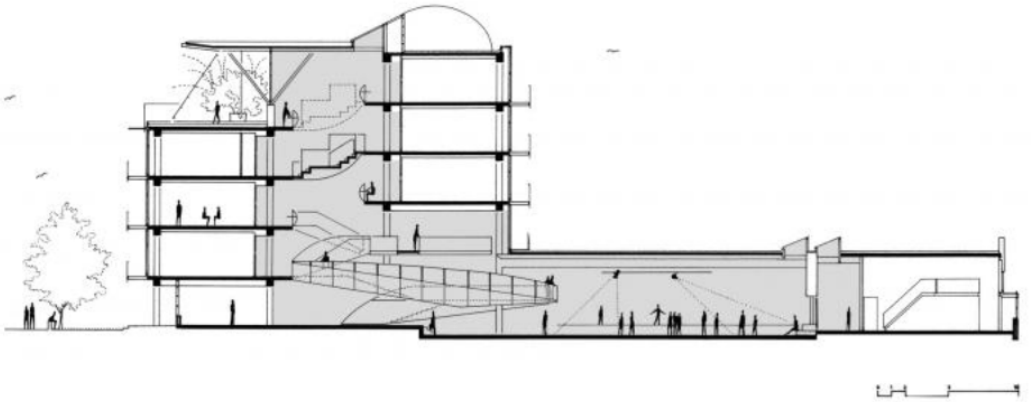


Figure 3.52: Montessori College Oost. Section

Source: (Scholen Bouwen).

The two blocks of classrooms are connected by galleries and staircases spanning across the void (refer to figures 3.53, 3.55 and 3.56). Rather than stacking the stairs on top of one another, they are spread around to generate visual relationships between them. Some of the staircases are extra wide acting like an amphitheatre (refer to figure 3.54). They have become areas for teaching outside the classroom, and informal meeting places for students between classes (Scholen Bouwen).

This arrangement resulted in a strong spatial continuity throughout the school. Movement through the school is celebrated as a focal point, rather than being hidden within corridors and closed-off stairwells. This circulation area becomes a collective space where people cross paths, hang out and engage in various forms of social interaction.

Figure 3.53: Montessori College Oost. Staircases connecting between the two blocks of classrooms.

Source: (Scholen Bouwen).

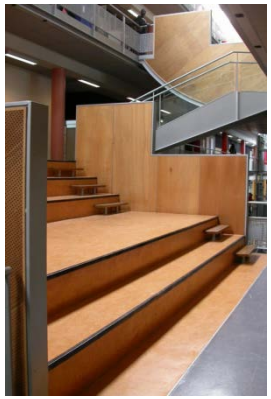


Figure 3.54: Montessori College Oost. Wide staircases

Source: (Scholen Bouwen).

Figure 3.55: Montessori College Oost. View of atrium space from the 1st floor.

Source: (Scholen Bouwen).

Figure 3.56: Montessori College Oost. View of atrium space from the ground floor.

Source: (Scholen Bouwen).

3.11 Conclusion

The reviewed projects highlight a variety of architectural approaches that support the housing needs of single parent families.

Some of the projects demonstrate the means to achieve affordability through small apartment footprints and passive heating and cooling arrangements. The *Fiona House* and the *Miss Sargfrabrik* provide apartments with small footprints that are efficient to maintain, heat and cool. Despite the small size, the apartments of the *Miss Sargfrabrik* create a spacious atmosphere through light coloured finishes and large windows. The apartments of *York Street Social Housing* are equipped with dual or corner aspects for cross ventilation. Small windows are orientated to the sides of the building that have the least sun to minimise heat loss, while the main living spaces are positioned towards the sun and armed with large windows and glazed balconies to collect solar heat.

The means to achieve affordability is further emphasized, as some projects relieve its user's dependence on transportation by providing spaces that bring employment and community facilities closer to the home. The ground floor work-live units of the *Alberta Mercantile* with their visually transparent frontages present workspaces that were flexible as both offices and retail spaces. *Switch* suggested that dining, kitchen and bathroom spaces could be shared between other living spaces and the workspace without much invasion of the private sphere of the bedroom. The *Miss Sargfrabrik* suggests how the privacy of these domains can be enforced,

through its provision of both private and public entrances per work-live unit. The *Fiona House, Sargfrabrik,* and *Miss Sargfrabrik* provide community facilities to residents and locals. Early childhood centres, pools and large gathering spaces provided by the *Fiona House* and the *Sargfrabrik* are open to their surrounding neighbourhoods. The *Miss Sargfrabrik* provides an I.T. space, a library, a laundry, and dining room and a fully-equipped kitchen for the communal use of its residents.

Aside from community spaces, the means to foster a sense of community is further enforced through the *Montessori College Oost,* and the *Miss Sargfrabrik.* The college's covered access galleries and open stairwells flanked with spaces to sit and linger, provide an example of how circulation space could be designed to be inviting areas to dwell and meet people. The large widths of the *Miss Sargfrabrik's* access galleries encourage residents to use this space as balconies by placing their personal plants and furniture.

The *Le Lorrain* and the *New American House* portray approaches to safety and security. *Le Lorrain's* durable metal facade in combination with its soft timber pallet, allows for easy maintenance of the building's appearance without creating an atmosphere of hostility. The *New American House's* overlooking position of kitchen to living room, dining room and courtyard, shows how layout can support children's safety within the home.

The *Miss Sargfrabrik's* apartments are composed of a range of sizes to suit a variety of household sizes and as well as wheelchair users, supporting a positive image.

In conjunction with the architectural ideas reviewed within the literature, the approaches of these projects will be incorporated into the design of the new housing complex to ensure that it supports all the housing needs of single parent families.

4. Design

4.1 Introduction

This chapter reviews a new housing scheme designed with respect to the ideas set in the literature and precedent review. The scheme is examined with a focus towards site selection and analysis, programme, building form, facade development, structure and interior arrangement.

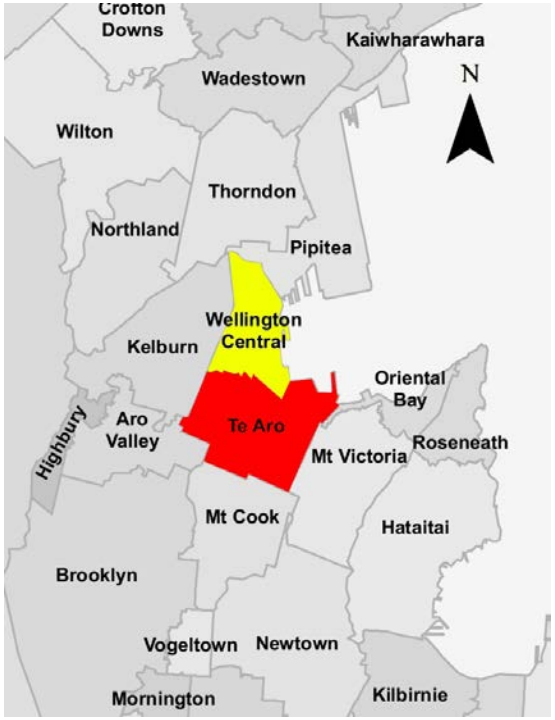


Figure 4.1: Suburbs around Wellington's CBD. North arrow, yellow and red highlighting added by author.

Source: (Wellington City Council, 2003)

4.2 Site Selection

Wellington City's Te Aro district presents a suitable suburb for site selection. The suburb is located just below the central business district (CBD), offering a vast range of employment opportunities within close proximity (refer to figure 4.1). Its land is just outside the high value zone of the CBD. As a mixed-use area, it provides a wide variety of services. Within this suburb there are three vacant and under-utilized sites to choose from (refer to figures 4.2 to 4.8).

A points system was set up to assess which site would be the most appropriate. Accessibility to services is the main concern during this selection. Sites are allocated points based on their ability to satisfy the following categories:

Note: The base map for the following seven maps have been sourced from the Wellington City Council website (Wellington City Council, 2008).

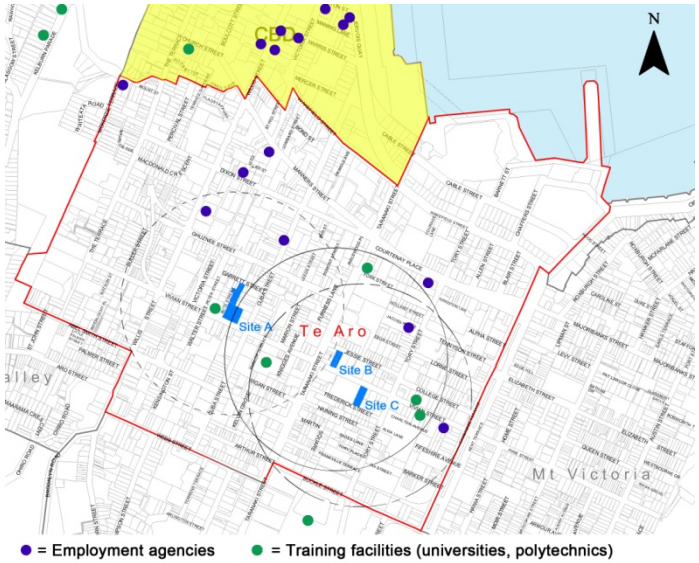


Figure 4.2: Employment facilities in Te Aro.

Source: Author's collection

- *Proximity to employment facilities: employment agencies and training facilities including universities, and polytechnics.*

  Reason: These facilities provide employment opportunities for single parents.

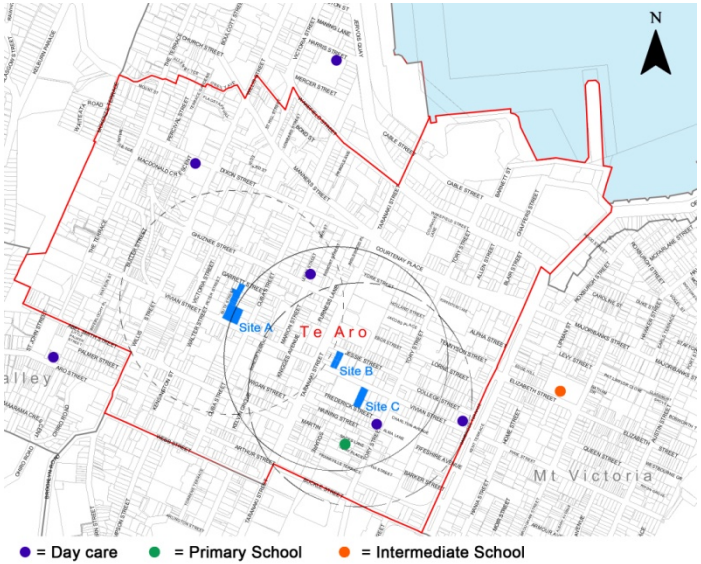


Figure 4.3: Children's schools in Te Aro.

Source: Author's collection

- *Proximity to schools: early childhood education centers, primary schools, and intermediate schools.*

  Reason: Young children often need to be accompanied by an adult on their way to and from school. Living within a close walking distance from school will reduce the time demanded by this task upon the schedule of parents.

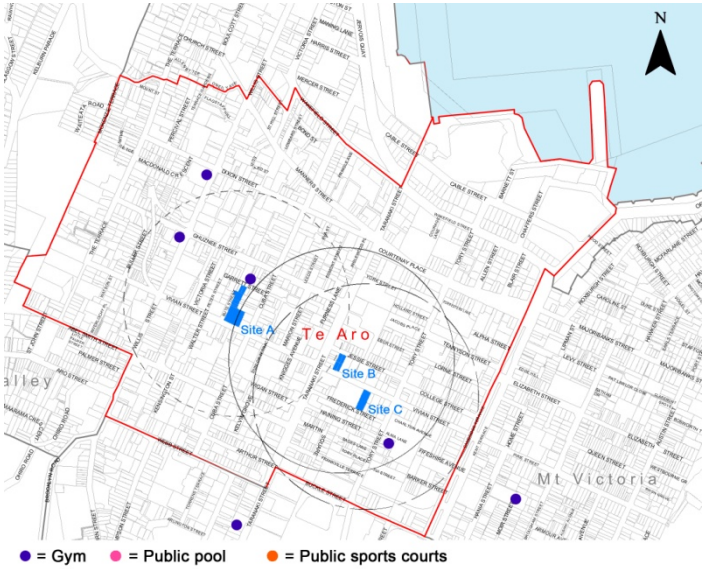


Figure 4.4: Sports facilities in Te Aro.

Source: Author's collection

- *Proximity to sports facilities: public gyms, swimming pools and sports courts.*

  Reason: These facilities provide activities for the children and their parents. They support a healthy lifestyle through physical exercise.

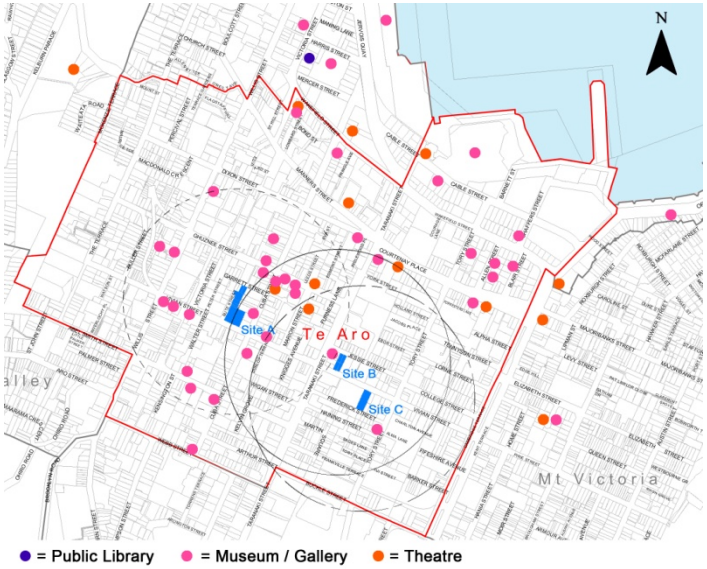


Figure 4.5: Cultural facilities in Te Aro.

Source: Author's collection

- *Proximity to cultural facilities: city library, museums, and theatres.*

  Reason: Visits to these types of facilities can enrich a child's education.

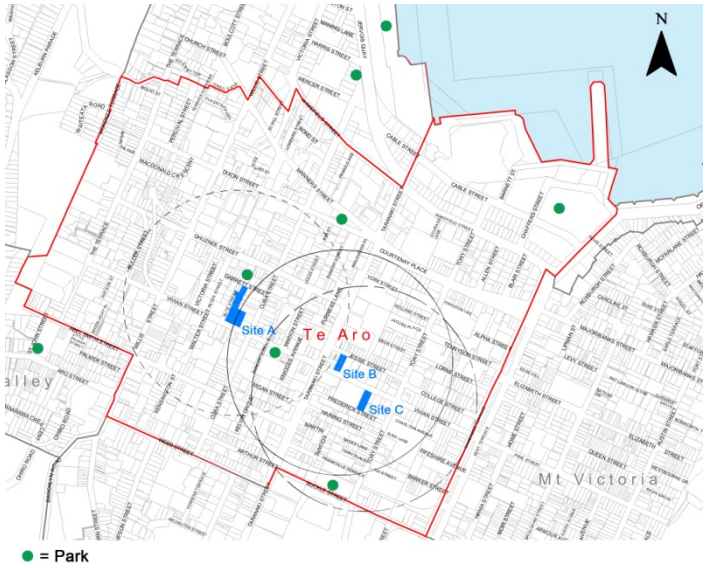


Figure 4.6: Parks in Te Aro.

Source: Author's collection

- *Proximity to parks.*

  Reason: Parks provide large recreational spaces for children. The closer they are to the home, the easier it is for the parents to visit them with their children frequently.

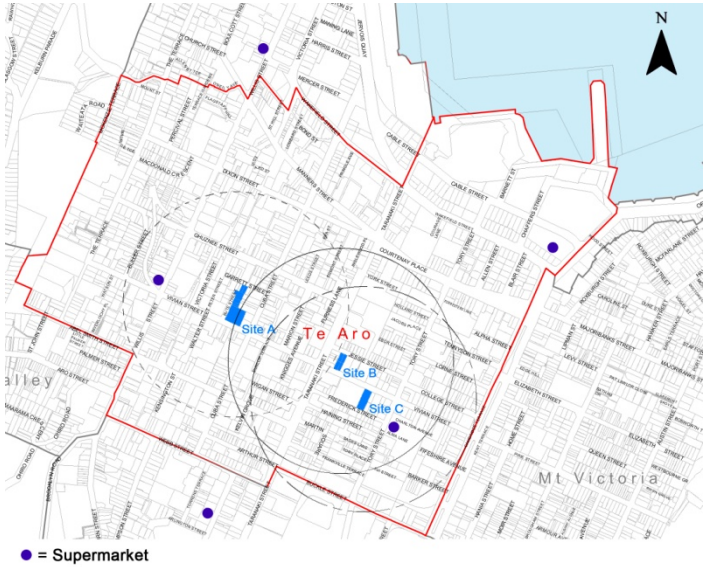


Figure 4.7: Supermarkets in Te Aro.

Source: Author's collection

- *Proximity to supermarkets.*

  Reason: Grocery shopping, especially in large quantities can be difficult for single parents, since many of them do not own a car. Living close to supermarkets makes it more convenient.

Figure 4.8: Bus stops in Te Aro.

Source: Author's collection

- *Proximity to bus stops.*

  Reason: This is the most used public transport within Wellington City. Since many single parents do not own a car, it is likely that they will travel long distances by bus.

- *Size of site.*

  Reason: A larger site gives more planning flexibility.

Each site is encircled by a five minute walking radius. The radius is drawn according to the average human walking speed: 1m/s (UK Metric Association, 2005). The more facilities a site encompasses within its five minute walking radius, the higher it will score within each category. The site that is ranked top in a category is allocated two points. The site that is ranked the lowest in a category is allocated one point. The site ranked in between these, is allocated one and a half points. If all the sites are ranked the same for one category, no site receives a point. The site with the highest total score will be chosen as the location for the new housing complex.

	Site A		Site B		Site C	
Category	**Number of facilities or m^2**	**Points**	**Number of facilities or m^2**	**Points**	**Number of facilities or m^2**	**Points**
Employment facilities	4	1	5	2	5	2
Schools	1	1	3	2	3	2
Sports facilities	2	2	1	1	1	1
Cultural facilities	23	2	14	1.5	4	1
Parks	2	2	1	1	2	2
Supermarkets	1	0	1	0	1	0
Bus Stops	9	2	8	1.5	4	1
Site Area	2934.9m^2	2	804.0m^2	1	972.7m^2	1.5
Total points		12		10		10.5

Table 4.1: Table ranking sites

Source: Author's collection

Site A scored the highest total. Therefore, it will be the location for the new housing complex.

Figure 4.9: Cuba Character Area boundaries. Red boundaries drawn according to the following source: (Wellington City Council, p. 4)

Source: Author's collection

4.3 Site Analysis

The site is essentially flat. It is currently composed of a former petrol station plot and a car-parking yard. It is located within Wellington City's Cuba Character area (Wellington City Council) (refer to figure 4.9). The Cuba Character area has a wide mixture of socio-economic groups. Old and young, rich and poor, and people of different ethnicities use the area (Wellington City Council). It is enclosed within four streets: Bute Street, Garrett Street, Vivian Street and Cuba Street. Bute Street is currently a dead end street (refer to figure 4.11). An informal pedestrian link exists between Bute and Garrett Streets (Wellington City Council) (refer to figure 4.10). It seems to have some warehouse and office spaces facing onto it. Garrett Street connects onto a public park called Glover Park (refer to figure 4.12). Vivian Street is high in vehicular traffic. Cuba Street is packed with a large range of restaurants, cafes and retail boutiques, attracting a large population of pedestrians (refer to figure 4.13).

Figure 4.10: View of Bute Street to Garrett Street showing informal pedestrian movement between them.

Source: Author's collection

Figure 4.11: View down Bute Street

Source: Author's collection

Figure 4.12: View down Garrett Street. Glover Park at the end of photo, to the right.

Source: Author's collection

Figure 4.13: View down Vivian Street (on the left) and Cuba Street (on the right).

Source: Author's collection

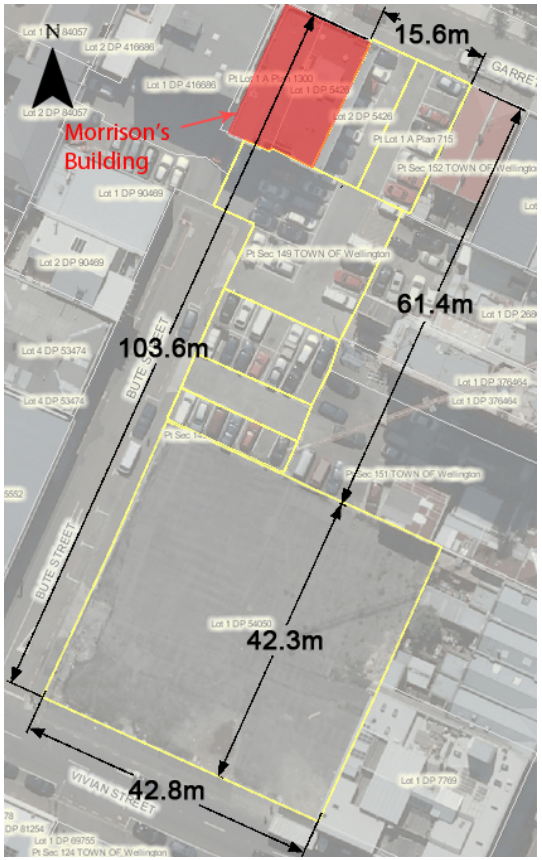


Figure 4.14: Existing site survey plan. Dimensions and red annotations added by author.

Source of underlining map: (Wellington City Council)

Figure 4.15: View of Glover Park from Ghuznee Street

Source: Author's collection

A portion of the site is under Wellington City Council (WCC) ownership. The council is willing to support and sponsor developments that support its vision for the area. They wish to make pedestrian and vehicle linkages between Bute and Garrett Streets, as well as incorporating a mixture of uses onto the site including car-parking, residential accommodation and commercial or service uses (Wellington City Council). Designing the new development to uphold this vision will increase its chances of gaining council sponsorship, enhancing its feasibility.

One way to provide a pedestrian and vehicle link between Bute St and Garrett St is to extend Bute St onto Garrett St by demolishing the *Morrison's Building* (refer to figure 4.14). The design of the new housing complex assumes that WCC brought control of the *Morrison's Building's* site and extended Bute St onto Garrett St. The profile of the site then changes to figure 4.16.

A number of potential benefits can result from the formalising a connection between Bute St and Garrett St. It would encourage more pedestrian and vehicular traffic along Bute St, giving it the

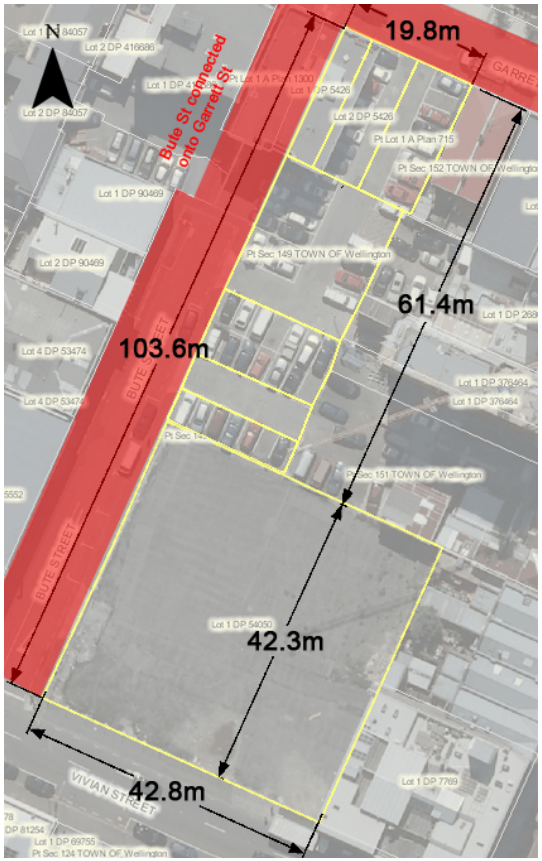


Figure 4.16: Changed site survey plan. Changes, dimensions and red annotations added by author.

Source of underlining map: (Wellington City Council)

potential to turn into a small commercial lane. The new housing complex could place commercial spaces along this street. The potential high commercial value of these spaces could significantly reduce the capital cost of residential spaces built on the site. Glover Park is sometimes considered as a dangerous place (Wellington City Council) . Higher traffic between Bute Street and Garrett Street will encourage more public use of the park, enhance passive surveillance on it, and prove an increased sense of safety.

The site is very deep. The maximum length between its northern edge to its southern edge is 103.6m. It has a thin 19.8m northern edge (refer to figure 4.16). Both the site and its surrounding building plots can build to a maximum building height of 27m (Wellington City Council). If in the future these building plots are built to their maximum capacity, to their boundaries and to their maximum height, a new building on the site will find it difficult to achieve sunlight penetration into its interiors (refer to figure 4.17). As the Wellington City Council's district plan requires the main living areas of residential units to receive sunlight (Wellington City Council), the design of the new housing complex must be designed to respond to the possible difficult sunlight conditions of the site in the future.

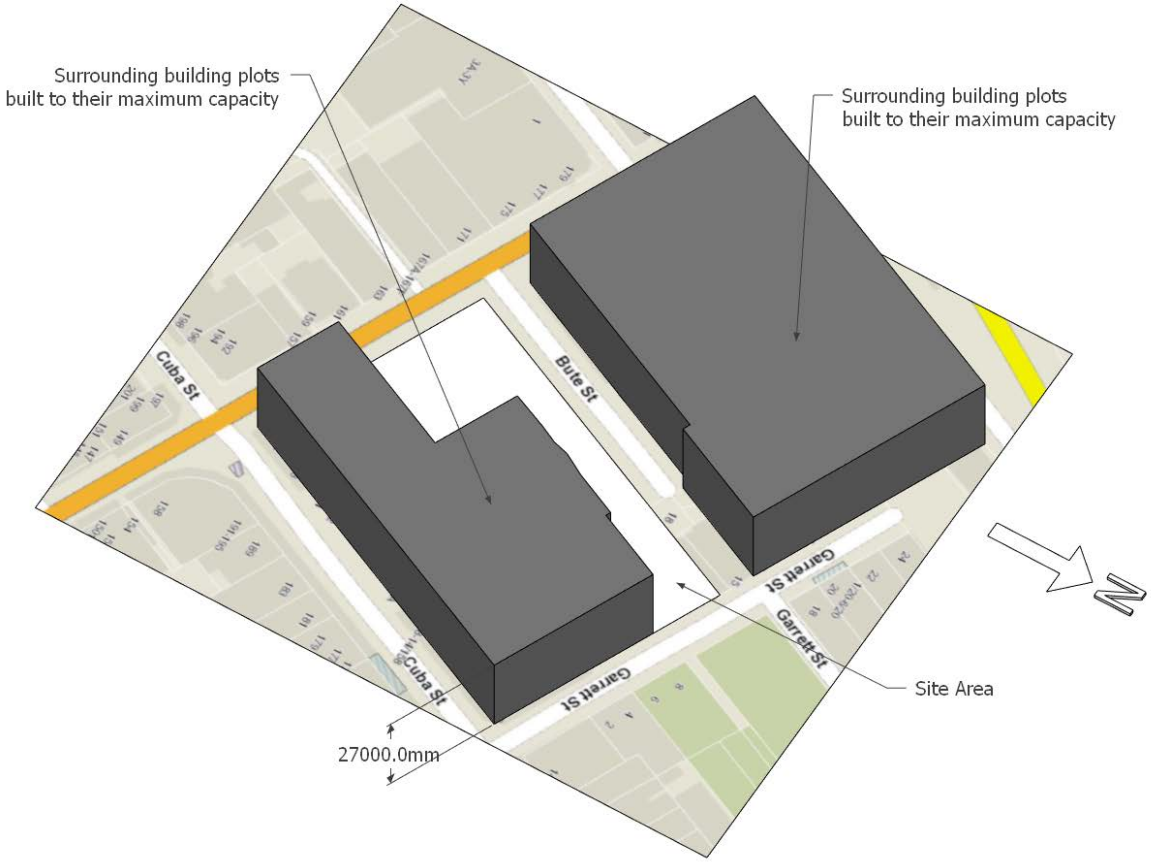


Figure 4.17: Surrounding building plots built to their maximum capacity around site.

Source of underling map: (Wellington City Council)

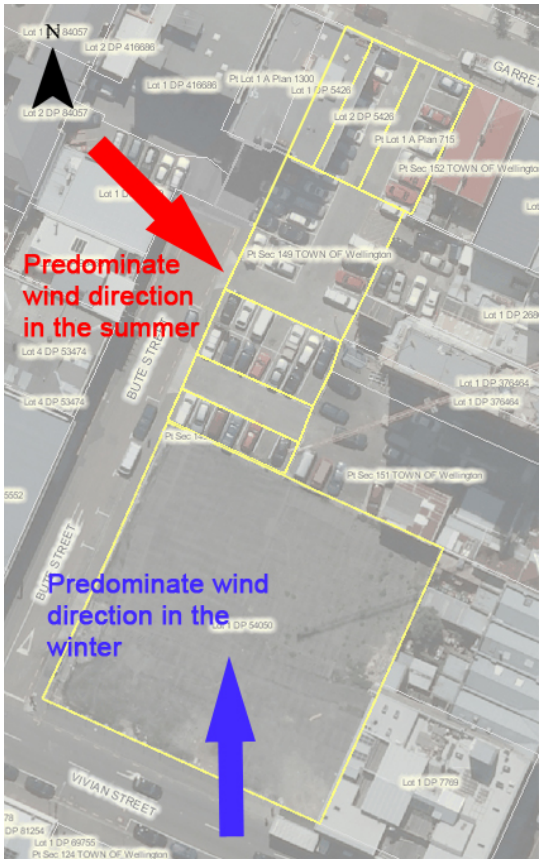


Figure 4.18: Prevailing winds. Annotations added by author.

Source of underlining map: (Wellington City Council)

Figure 4.19: Relationship between the site and the Watkins building's southern facade.

Source: Author's collection

Figure 4.20: Close view of Watkins building's southern facade.

Source: Author's collection

The old Watkins building east of the site, on Vivian St, possesses a visually strong eastern facade. The rhythm of its cornice lines and windows creates a dominating presence along Vivian Street (refer to figures 4.19 and 4.20). Wellington City Council's district plan encourages new buildings within the Cuba Character Area to maintain visual compatibility to old building stock like the Watkins building (Wellington City Council, p. 5). To achieve this, the new residential development will need to find a way of incorporating some of the rhythms set out by this facade of the Watkins building onto its own facades.

In summer and spring, north-westerly winds dominate Wellington. In the winter, southerly winds dominate (Maclean, 2009). For the interiors of residential units to be effectively ventilated in the summer time, units should be oriented towards the north-west on the site to catch the prevailing breeze.

4.4 Programme Outline

The types and sizes of spaces provided by the programme is designed to contribute to the housing needs of single parent families – accessibility to services, sense of community, safety and security, a positive image and affordability.

To support accessibility to services and a sense of community between residents, a range of communal facilities will be provided. The site selection process highlighted that the district of Te Aro does not possess a public sports court and a public swimming pool. Also childcare in New Zealand is hard to source. Inspired by the *Sargfrabrik,* the new housing complex will provide a communal roof garden, multipurpose sports court, swimming pool and daycare. The sports facilities will be supported by a plant room, storage space and changing rooms. Similar to the *Miss Sargfrabrik,* other communal facilities including a lounge, a library, an I.T. space, a laundry and a communal kitchen and dining space will also be provided. While all these communal facilities are freely open for use by all residents, locals may also rent them. The revenue generated from these spaces contributes to the running and maintenance costs of the communal facilities.

Work-live units and retail spaces will be provided on the street level of the complex to support informal surveillance of the site's surroundings during the day, and convenient access to work for those residents who prefer to work from home.

The range of apartment units provided by the complex will cater for a mixture of household types in order to support a positive image. In line with integrative living, the units provided will cater for a mixture of household types that have the potential to be mutually supportive. Following Bill Latimer's Single Parent Housing scheme, the types of households anticipated to reside within the new complex will include single-parent families, two-parent families and the elderly. Apartment units will be sized to cater for these three household types.

According to the *Household Size Distribution by Household Type* table introduced in the introduction, by 2021, it is forecasted that the majority of single-parent families will have 2 to 3 people per household, and two-parent families will have 3 to 4 people per household. This is true for 82% of single-parent families and 73% of two-parent families (refer to table 4.2).

Household Type	Household Size					
	1	2	3	4	5+	Total
2001 (percent)						
Single-family households containing:						
Couple without children families	0	94	5	1	0	100
Two-parent families	0	0	33	39	28	100
One-parent families	0	42	34	16	9	100
Multi-family households	0	0	0	24	76	100
Other multiperson households	0	60	24	10	0	100
One-person households	100	0	0	0	0	100
2021 (percent)						
Single-family households containing:						
Couple without children families	0	95	4	1	0	100
Two-parent families	0	0	34	39	26	100
One-parent families	0	52	30	12	6	100
Multi-family households	0	0	0	24	76	100
Other multiperson households	0	50	24	17	9	100
One-person households	100	0	0	0	0	100

Note: Owing to rounding, individual figures may not sum to give the stated totals.

Table 4.2: Household size distribution of single-parent families and two-parent families forecasted for 2021

Source: (Statistics New Zealand, 2004, p. 49)

Under the assumptions that single parents sleep in different bedrooms to their children, coupled parents sleep with each other in the same room, and that each child within a family has their own room, we can conclude that the majority of single-parent families (SPF) and two-parent families (DPF) will require 2-bedroom units and 3-bedroom units.

Household Type	Household Size					
	1	2	3	4	5+	Total
2001 (percent)						
Single-family households containing:						
Couple without children families	0	94	5	1	0	100
Two-parent families	0	0	33	39	28	100
One-parent families	0	42	34	16	9	100
Multi-family households	0	0	0	24	76	100
Other multiperson households	0	60	24	10	0	100
One-person households	100	0	0	0	0	100
2021 (percent)						
Single-family households containing:						
Couple without children families	0	95	4	1	0	100
Two-parent families	0	0	34	39	26	100
One-parent families	0	52	30	12	6	100
Multi-family households	0	0	0	24	76	100
Other multiperson households	0	50	24	17	9	100
One-person households	100	0	0	0	0	100

2-bedroom units

3-bedroom units

Note: Owing to rounding, individual figures may not sum to give the stated totals.

Table 4.3: Types of residential unit sizes required by single-parent families and two-parent families.

Source: (Statistics New Zealand, 2004, p. 49)

A housing complex that provides 2-bedroom units and 3-bedroom units will cater for the majority of single-parent families and two-parent families in New Zealand. The following calculation determines the percentage of each unit size the new housing complex should adopt, in order to cater for both family types equally.

Percentage of SPFs with a household size of 2 people = 52 = w

Percentage of DPF with a household size of 3 people = 34 = x

Percentage of SPFs with a household size of 3 people = 30 = y

Percentage of DPF with a household size of 4 people = 39 = z

$$\text{Percentage of 2-bedroom units} = \frac{w + x}{w + x + y + z}$$

$$= \frac{52 + 34}{52 + 34 + 30 + 39}$$

$$= 55\%$$

$$\text{Percentage of 3-bedroom units} = \frac{y + z}{w + x + y + z}$$

$$= \frac{30 + 39}{52 + 34 + 30 + 39}$$

$$= 45\%$$

If the new housing complex has around an equal ratio of 2-bedroom units to 3-bedroom units, both single-parent families and two-parent families can be catered for fairly equally. 2-bedroom units and 3-bedroom unit sizes are also suitable for the elderly, whether they are single or have a partner. Therefore, this ratio would cater for all three types of households – single-parent families, two-parent families and the elderly. A few wheelchair accessible apartments will also be provided for residents who may be physically impaired. Car parking will be provided onsite for residents and visitors.

In support of an affordable lifestyle, the floor area of residential units should be kept compact in order to minimize operational costs (i.e. heating, cooling and maintenance). The actual size of each unit will vary according to their location on the site. Adjusting to the various conditions of different areas on site can affect the size of a unit.

The programme spaces outlined will be sized according to the following guides:

- U.S. General Services Administration Public Buildings Service, 2003
- Sport England, 2008
- Littlefield, 2008
- Neufert, 1980
- Britain’s Ministry of Housing and Local Government, 1963

4.5 Building Form

A preliminary building form has been derived to gain a clearer understanding of the sunlight conditions of the site. Understanding how the different parts of the building form reacts to sunlight will assist in deciding where the best areas are for locating different spaces specified in the programme.

This building form has been derived through the following actions. The maximum building volume applicable to the site was inserted (refer to figure 4.21). This was in accordance with the WCC's District Plan maximum allowable building height of 27m.

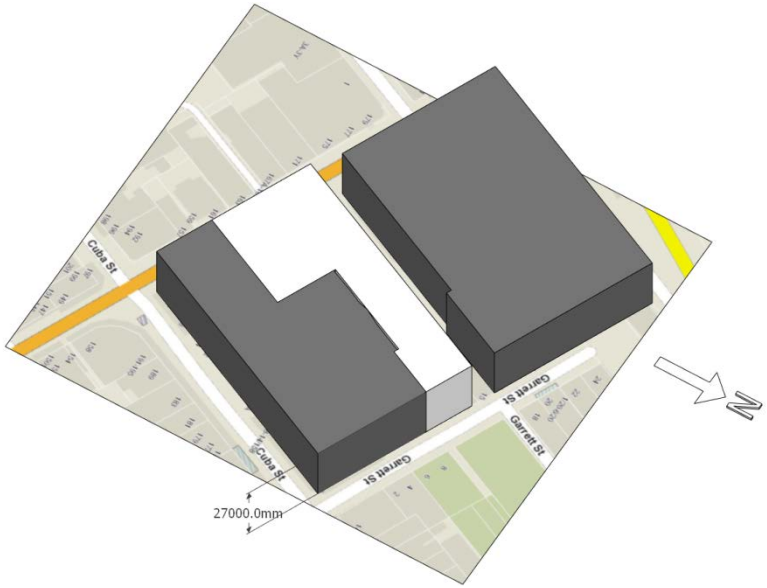


Figure 4.21: Inserting the maximum building volume

Source: Author's collection

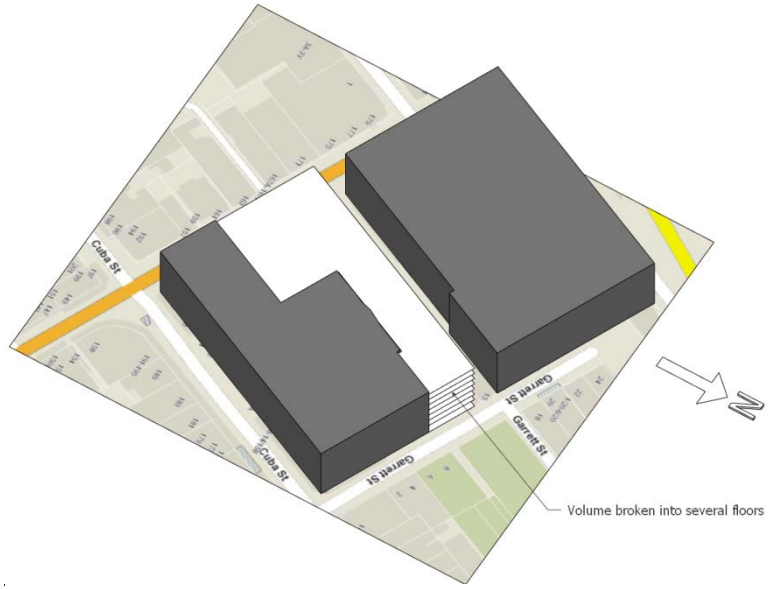


Figure 4.22: Breaking up building volume into seven floors

Source: Author's collection

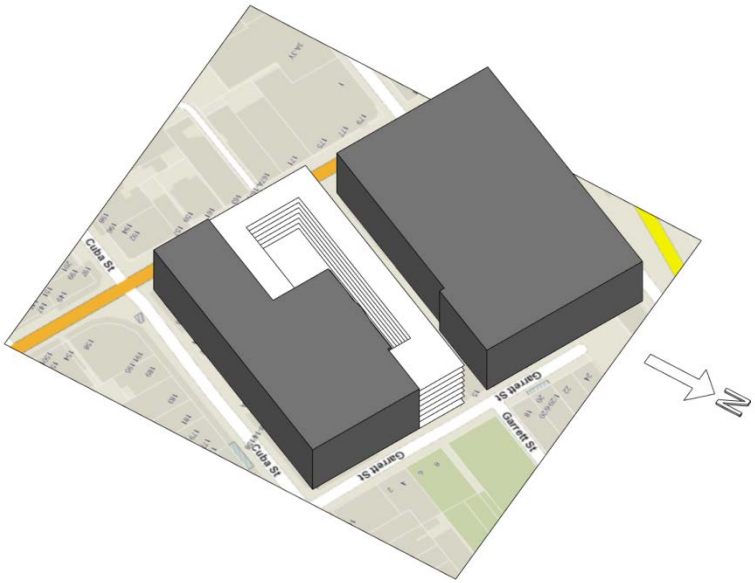


Figure 4.23: Inserting courtyard void

Source: Author's collection

The volume is broken up into seven floors (refer to figure 4.22). The ground level has a floor to floor height of 4.5m to support commercial activity opening onto the surrounding streets of the site. The floor above will mainly support residential purposes, so their floor to floor heights are shorter at 3.5m.

A courtyard void is inserted to bring sunlight into the centre of the building volume (refer to figure 4.23). The thickness of the volume remaining is around 10m. This thickness supports natural ventilation and good day lighting within building interiors (Lindsay, Peterson, & Tinsel, 2005, p. 29).

A sun path analysis of the resulting building form was conducted according to the winter solstice – 21st of June (refer to figures 4.24 and 4.25). The winter solstice provides the most difficult sunlight conditions for the site, since the sun is at its lowest angle in the year during this period. This circumstance in conjunction with the site's long depth makes it difficult for sunlight to penetrate into the site.

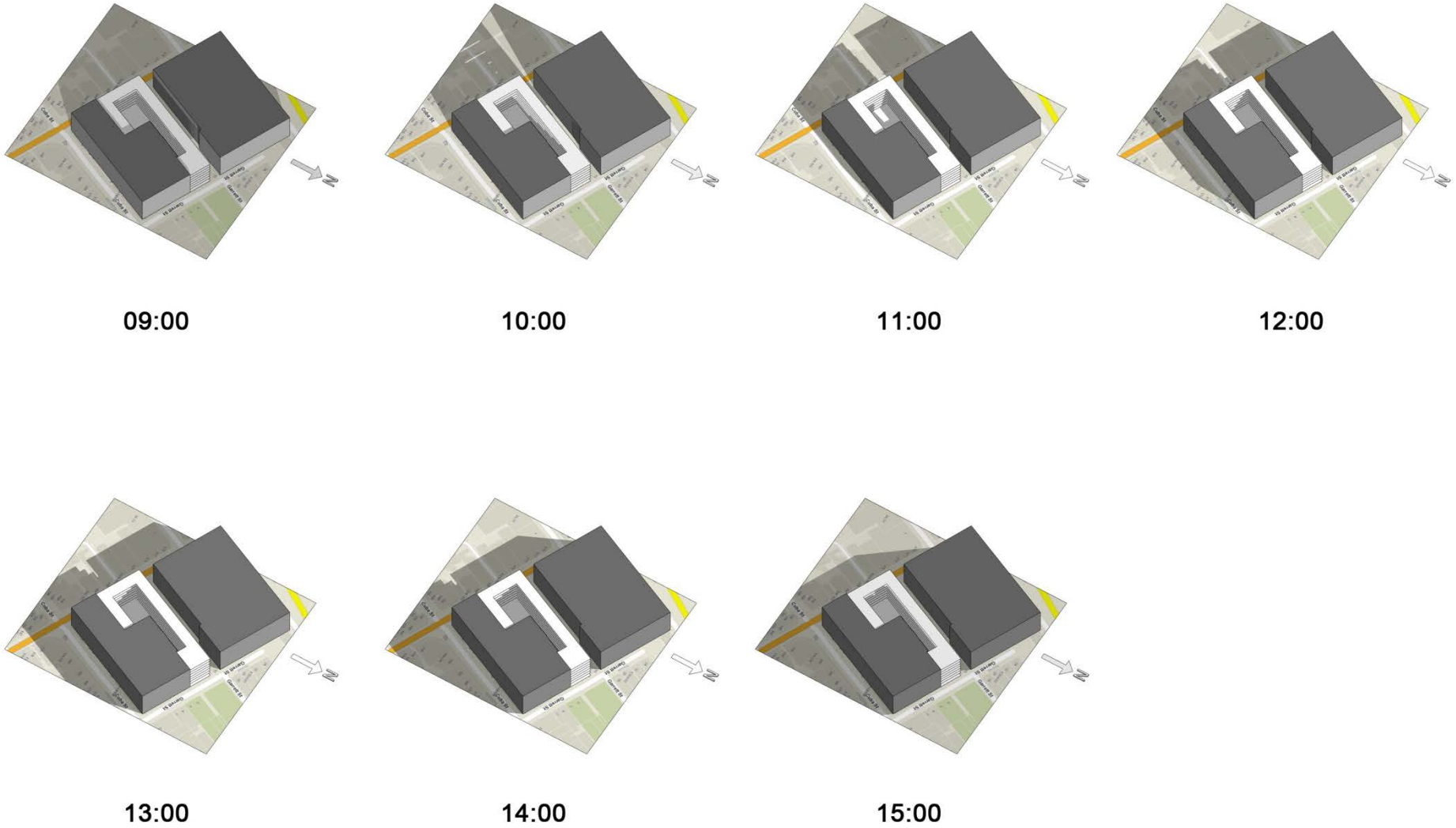


Figure 4.24: Sun path analysis. North-east view of building form.

Source: Author's collection

Figure 4.25: Sun path analysis. North view of building form.

Source: Author's collection

This analysis shows that the north-western areas will receive the most sunlight during the day, providing a good location for apartment units, The south-eastern areas will receive the least sunlight, meaning these areas may be more suited to a communal space that requires little to no sunlight to operate, such as the multi-purpose sports court. The lowest areas of the building volume received little sunlight due to the overcast shadows of the surrounding buildings. This area will be suitable for the location of work-live units, where their commercial spaces do not require direct sunlight.

Figure 4.26: Office Building and Logistic Centre

Source: (Dezeen, 2011)

Figure 4.27: Honeycomb Apartments

Source: (Arthitectural, 2010)

4.6 Façade development

The exterior facades of the new complex extend the linear horizontal rhythms of the Watkins Building's southern façade. As the new facades compliment this surrounding visual context, it expresses its identity through its own interpretation of the horizontal rhythm. Unlike the Watkins Building, where the horizontal dominates, the new facades adopt a grid pattern that challenges this rhythm, through vertical lines.

The development of the facades has been inspired by the geometric façades of the *Office Building and Logistic Centre* by *Modostudio*, and the *Honeycomb Apartments* by *OFIS arhitekti.* The new complex's facades break free of the flat grid into a series of rectangular protrusions that act as bay windows, flat windows or balconies.

Initial inspiration for the color scheme came from two projects: *Tetris: Student Housing in Paris* by *Koz Architects* and *Myer Bourke Street Redevelopment* by *NH Architecture.* Essentially, the color scheme aims to embody a notion of 'richness,' with two metallic colors and another color as the highlight. The highlight color is placed on selected edges to enhance the visual dynamic of the facades.

Figure 4.28: Tetris: Student Housing in Paris

Source: (KOZ Architects)

Figure 4.29: Myer Bourke Street Redevelopment

Source: (Kritiana, 2012)

The facades are designed through gradual refinement. An irregular grid of rectangular modules is sketched onto the exterior of the south elevation with reference to the elevation sizes of the rooms behind them (refer to figure 4.30). Then the first color scheme iteration is added (refer to figure 4.31).

Note: The southern elevation of the Watkins Building used in this research is provided by the following source:

Wellington City Archives
[00078:764:42501]

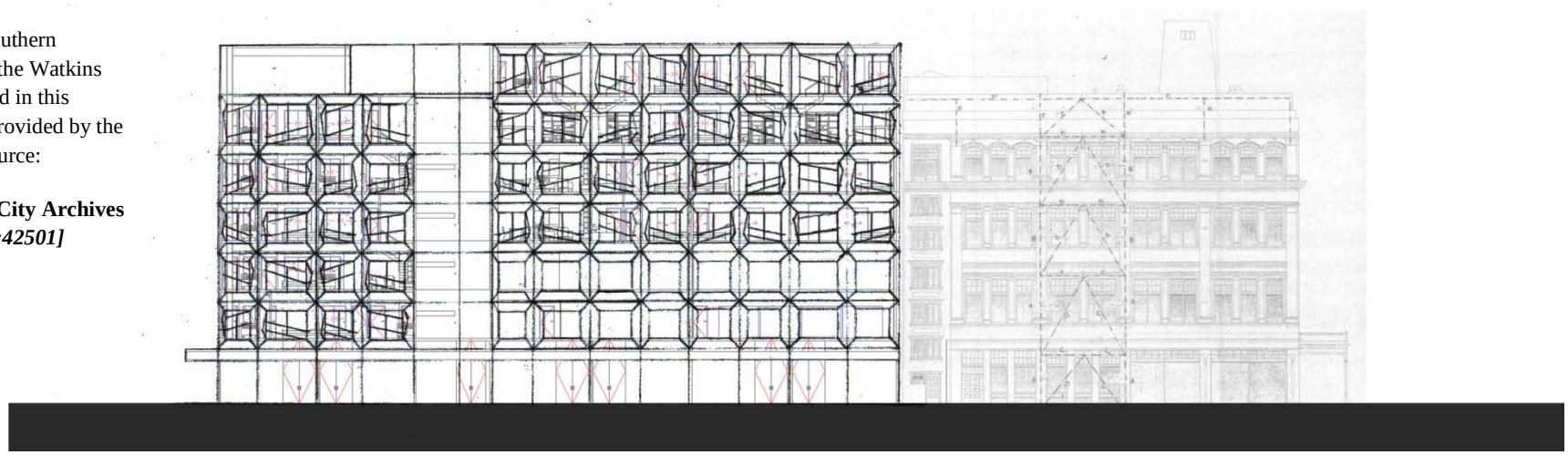


Figure 4.30: Irregular grid of rectangular modules sketched onto the exterior of the southern elevation. Watkins Building to the right.

Source: Author's collection

Figure 4.31: Adding the first color scheme iteration.

Source: Author's collection

The rectangular protrusions underwent a series of iterations. Angled modules are simplified and several color schemes are explored (refer to figures 4.32, 4.33 and 4.34).

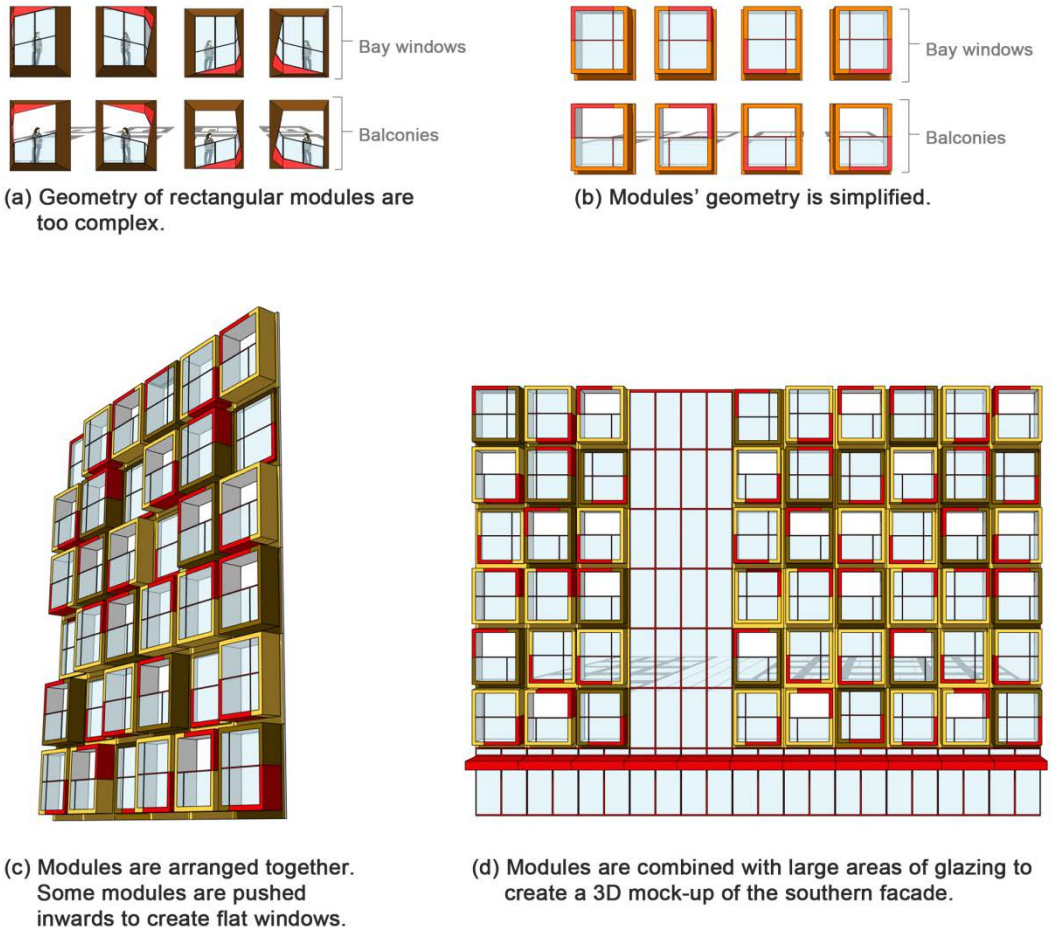
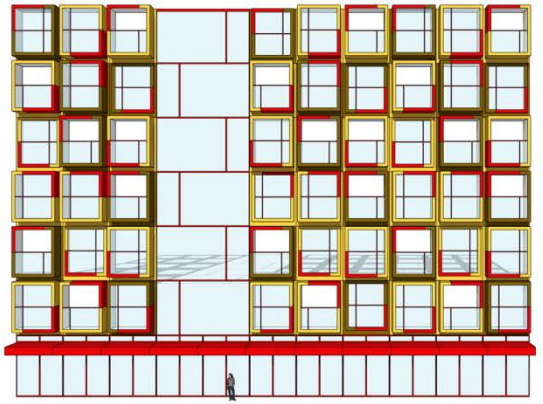


Figure 4.32: Exploration around the design of the rectangular protrusions

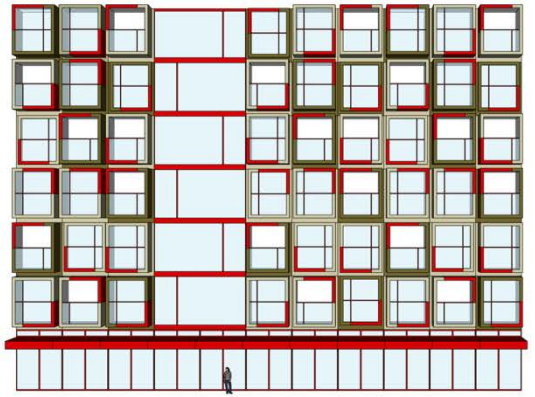
Source: Author's collection

(e) Exploring with the geometry created by the mullions within the large areas of glazing.



(f) Further exploration with the geometry created by the mullions within the large areas of glazing.

(g) Thickening the mullions within the large areas of glazing to help its geometry tie in more closely to the surrounding grid pattern. The dramatic contrast between the three colours is visually hectic, drawing attention away from the variations in depth of the protrusions.



(h) Less variation in colours. Color combination is too military like.

Figure 4.33: Exploration around the design of the rectangular protrusions

Source: Author's collection

(i) To support the notion of 'richness,' the colour purple is incorporated to bring an association of royalty to the building's appearance.

(j) The purple is darkened and a 3D mock-up of how two facades may join at a corner is created.

(k) A lighter shade of purple and dark grey is added to compliment and bring a stronger visual emphasis to the blue toned purple.

Figure 4.34: Exploration around the design of the rectangular protrusions

Source: Author's collection

Figure 4.35: Final north and south elevations

Source: Author's collection

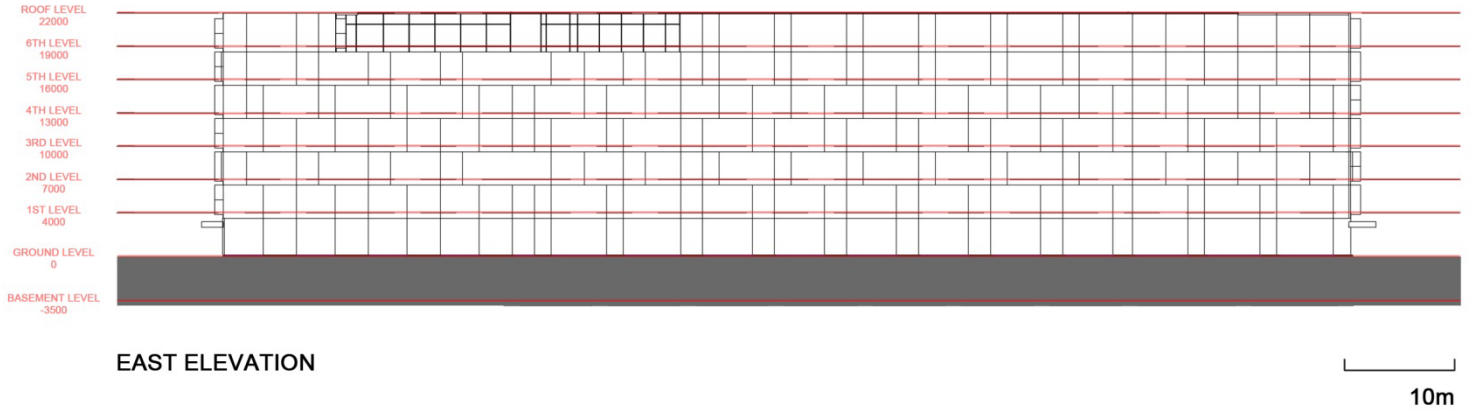


Figure 4.36: Final north and south elevations

Source: Author's collection

The facades are finished with aluminium composite panels to support a low maintenance building exterior with a clean appearance.

Figure 4.37: View of building's exterior from Garrett St during the day

Source: Author's collection

Figure 4.38: View of building's exterior from the intersection of Vivian and Bute Streets during the evening

Source: Author's collection

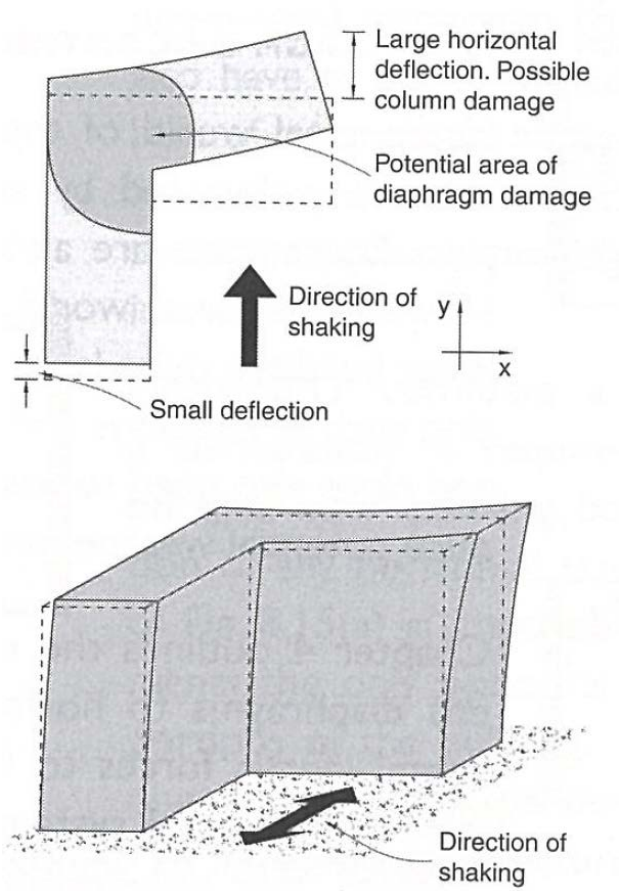


Figure 4.39: The dynamic response of a re-entrant L-shaped configuration and potential floor diaphragm damage area.

Source: (Charleson, 2008, p. 133)

4.7 Structure

The overall building form of the complex is ‘L’ shaped. This creates a re-entrant corner between two wings, a structural hazard in regards to seismic design. The diagram in figure 4.39 illustrates how this shape can suffer floor diaphragm damage in the event of horizontal shaking. If the building form is shaken in the y-direction, the left wing will experience only minor horizontal deflection under the stiff support of its large depth. The right wing is significantly shallower, so it will respond to the movement by swing about the corner, with the potential of generating damage in the floor diaphragm of this junction. Any columns on the far right-hand side of this wing may also suffer damage. When shaking is experienced in the x-direction, the left wing is likely to suffer the same form of the damage. In response to this problem, the building is separated into two independent structures – structure A and structure B.

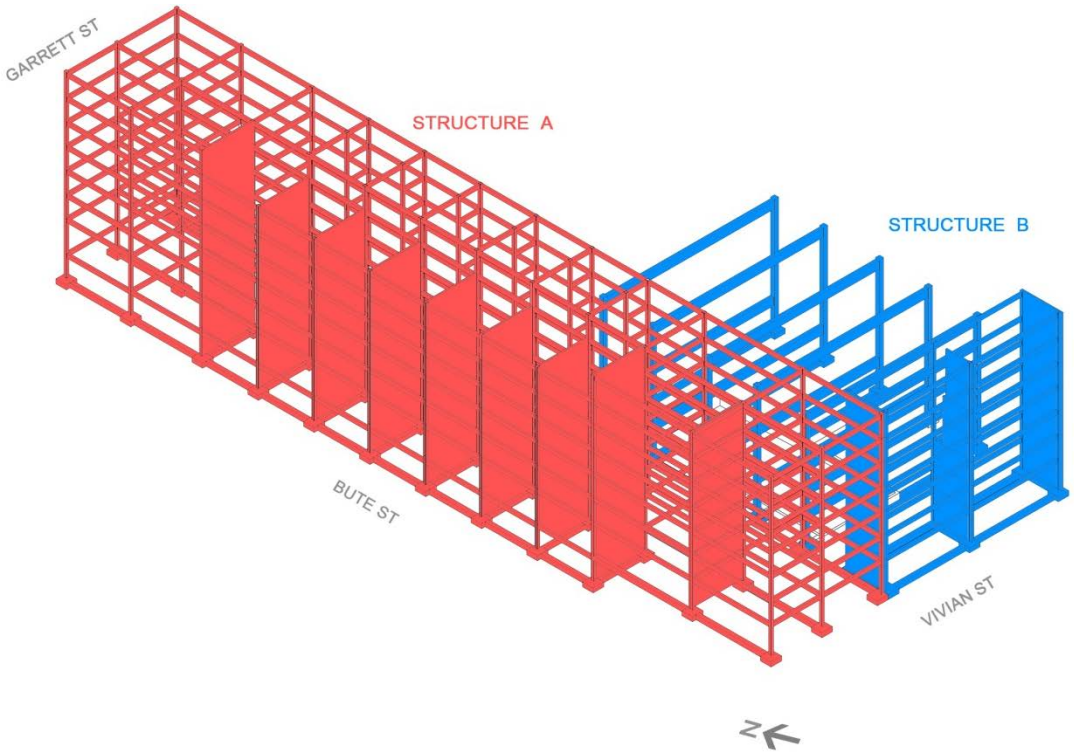


Figure 4.40: Structural arrangement

Source: Author's collection

The seismic components of structure A is composed of steel moment resisting frames in its longitudinal direction (along its length), and reinforced concrete shear walls in its transverse direction (along its width). The seismic components of structure B is composed of reinforce concrete shear walls in its longitudinal direction and steel moment resisting frames in its transverse direction. Additional steel beams and columns have been included, to provide gravitational support. These components have been distributed to minimize the distances between each structure's Centre of Mass (CoM) and Centre of Resistance (CoR), to prevent the potential of severe torsion on each structure. Metal tray deck floor diaphragms will span across both structures.

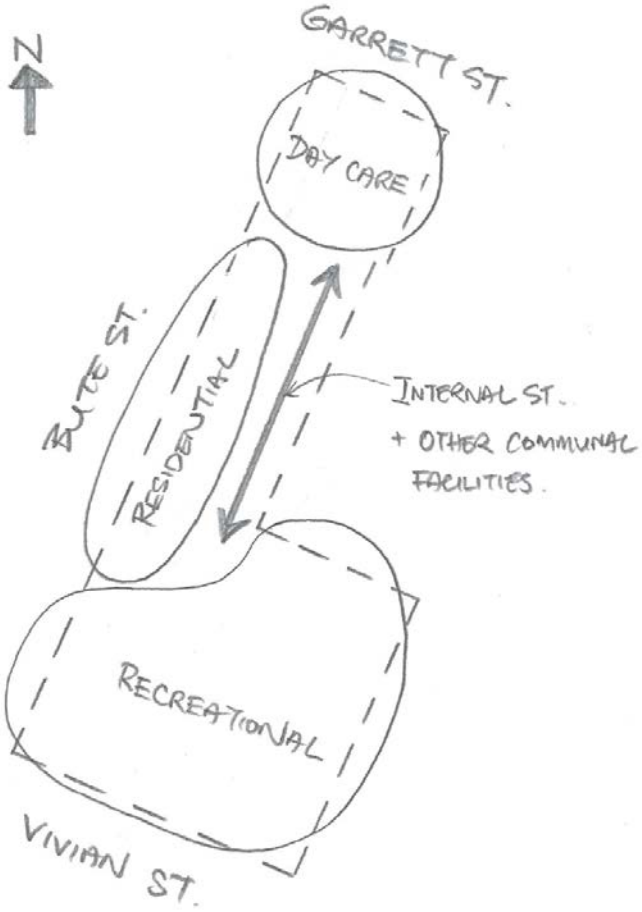


Figure 4.41: Bubble diagram showing overall programme arrangement

Source: Author's collection

4.8 Interior Arrangement

Analysis of the building form suggested locations for the apartments, the multipurpose sports court and the work-live units. The location of the major programmatic areas including recreational, day care, residential and other communal facilities were determined based on this analysis.

The day care and recreational areas will flank Garrett and Vivian Streets respectively, acting as social anchors on two sides of the residential programme. This will create an internal street connecting all three areas. Other communal facilities will be placed along this circulation zone to provide areas of activity and rest (refer to figure 4.41).

The anchors and spatial continuity of the street with its areas of activity and rest will encourage pedestrian flow through the street, as well as providing opportunities for inhabitants to linger. This will help to support a sense of community by fostering social interaction.

Design Data	
Plot of land	2939m^2
Property area	2785m^2
Usable floor space	13851m^2
Number of 2-bedroom apartments	30
Number of 3-bedroom apartments	25
Total number of apartments	55
% of 2-bedroom apartments to 3-bedroom apartments	55% to 45%
Area of communal space	5874m^2
Area of apartment space	7787m^2
Area of retail space	190m^2
% of communal space	42%
% of apartment space	56%

Table 4.4: Design data

Source: Author's collection

Note: Area of communal space includes the space for circulation, the swimming pool, the multi-purpose court, the roof garden, the day care, the lounge, the library, the I.T. space, the laundry, the communal dining room and kitchens, and the car park. Six of the 3-bedroom apartments are wheelchair accessible. Two of the 3-bedroom apartments have one extra room. They can act as a study or another bedroom.

The following axonometric sections and plans show in detail the relationships and the variations in scale between different programmes of the design.

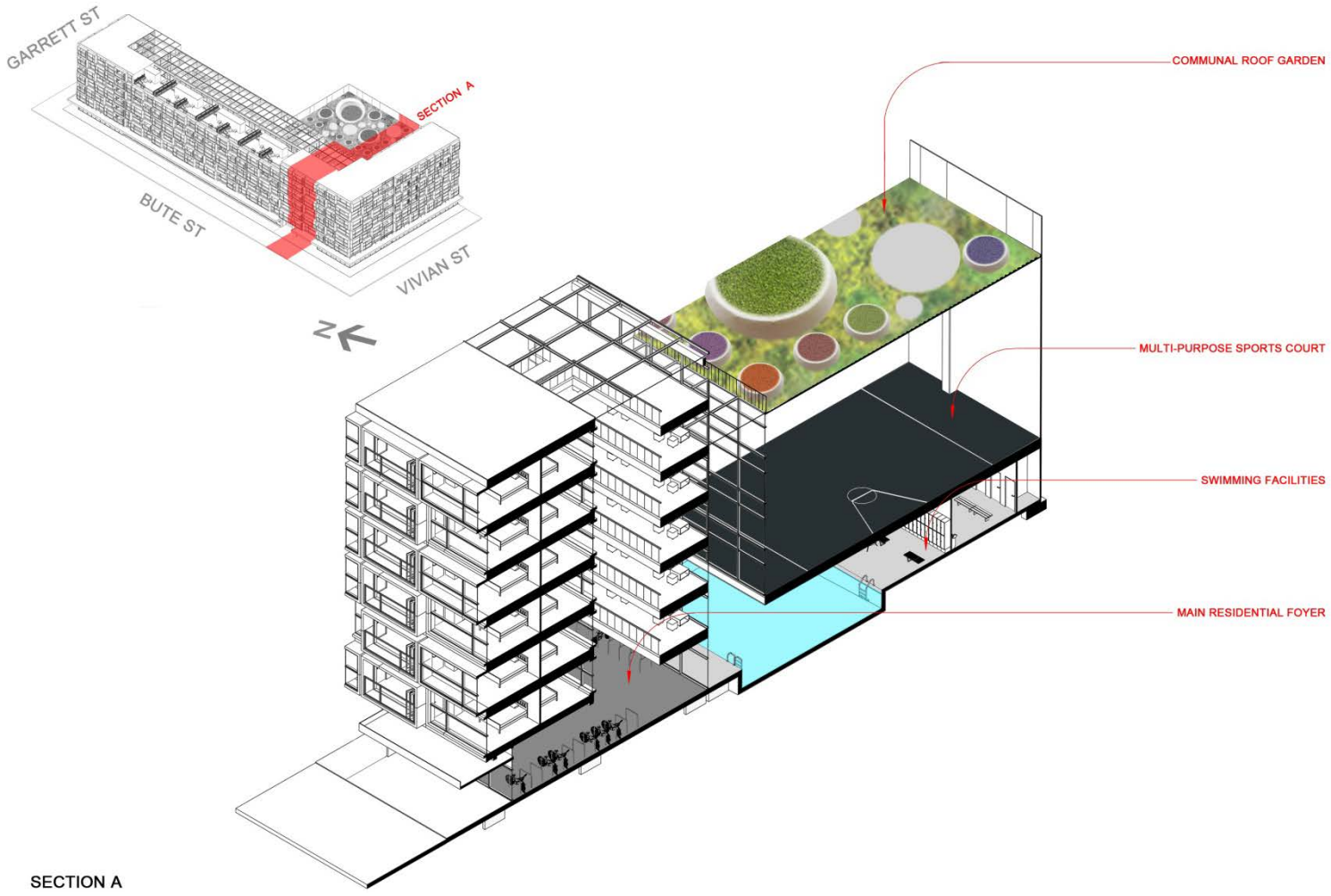


Figure 4.42: Final design axonometric section A

Source: Author's collection

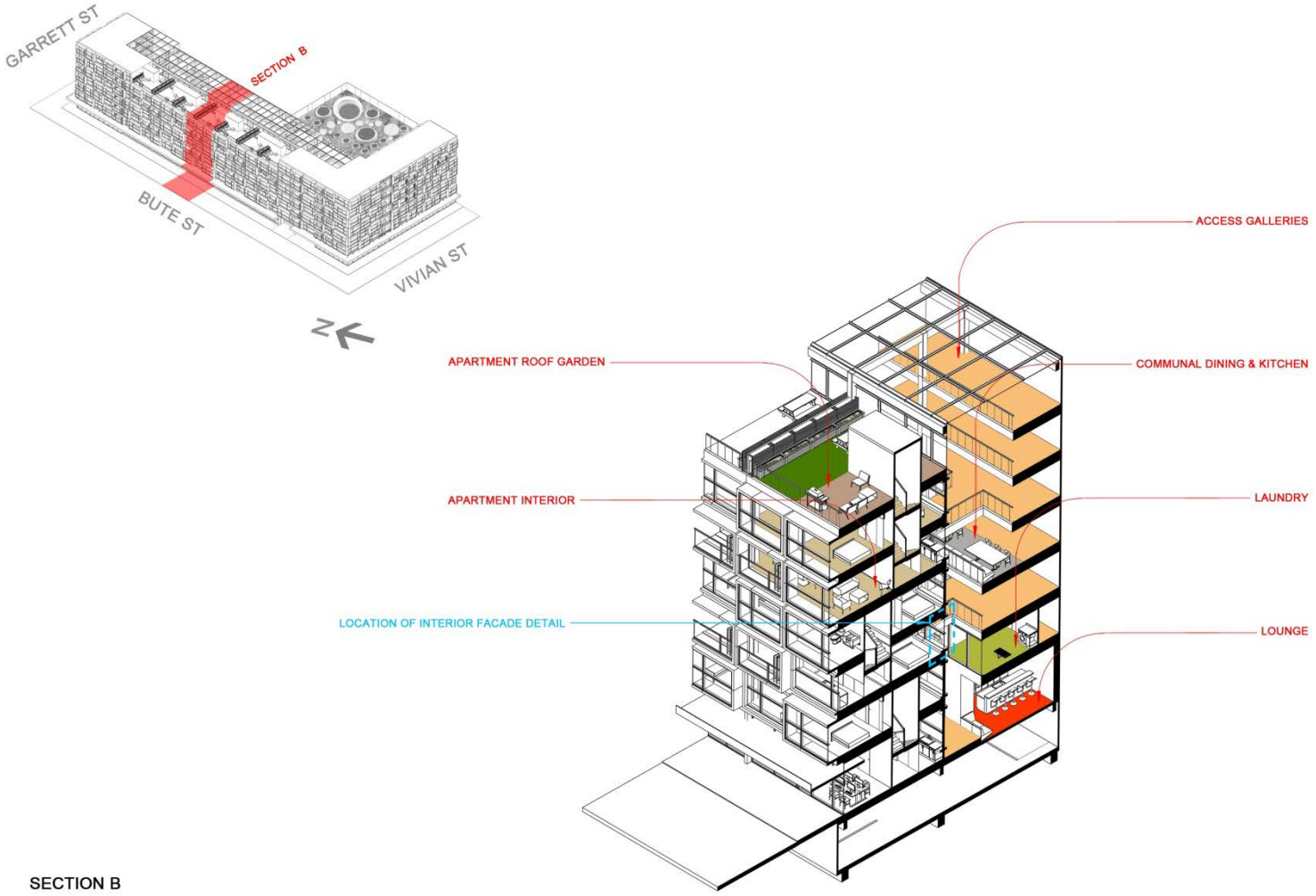


Figure 4.43: Final design axonometric section B

Source: Author's collection

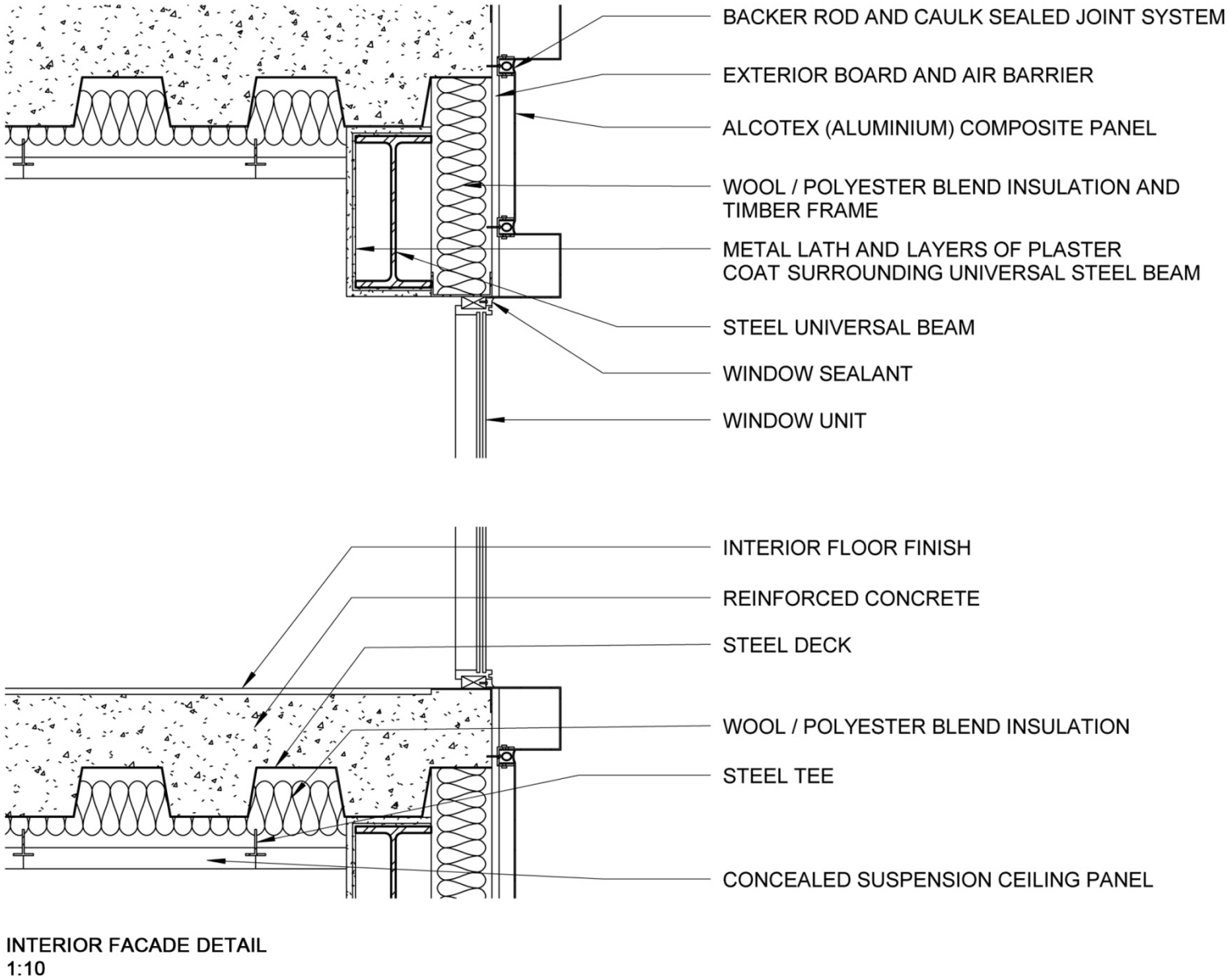


Figure 4.44: Interior facade detail

Source: Author's collection

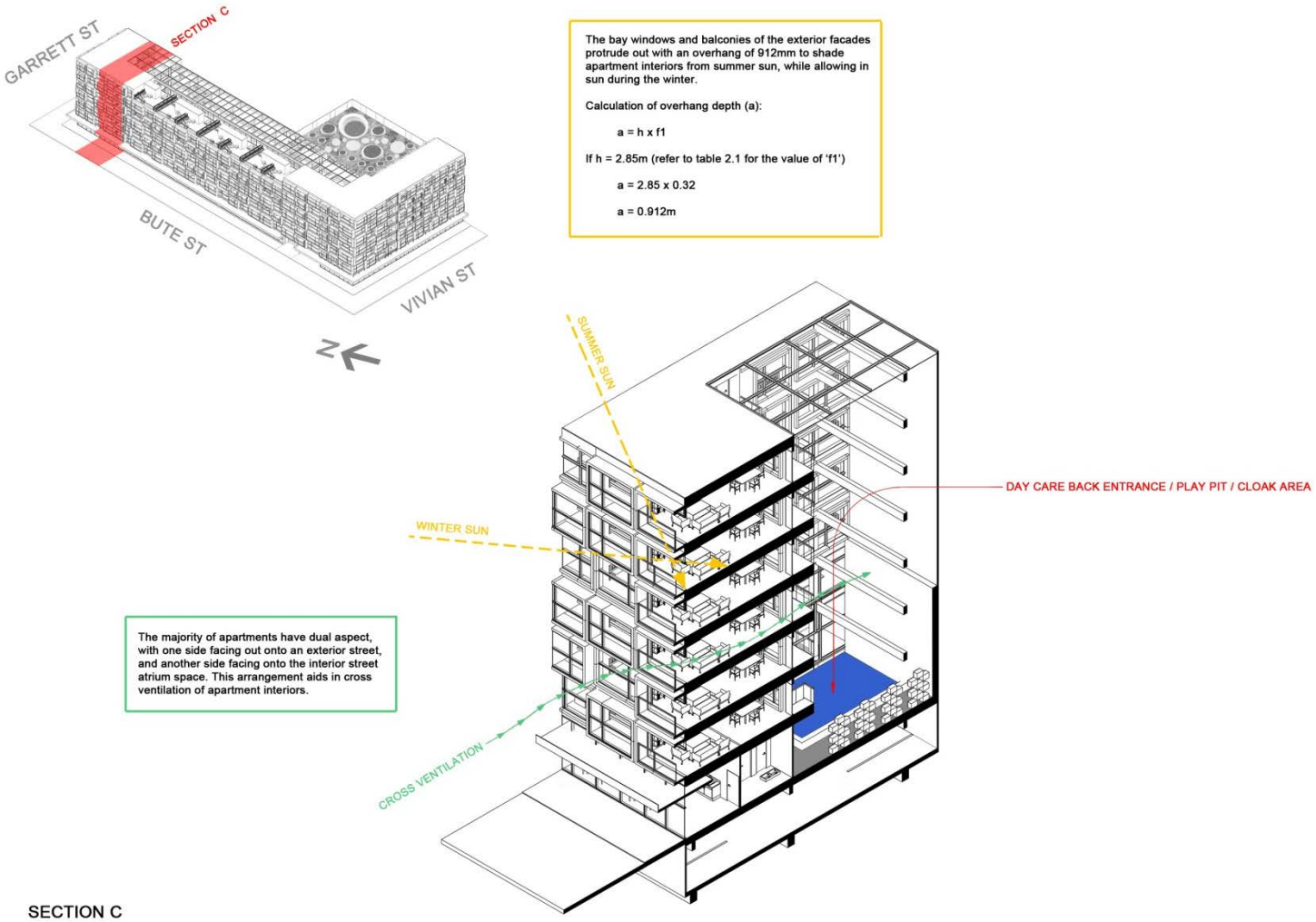


Figure 4.45: Final design axonometric section C

Source: Author's collection

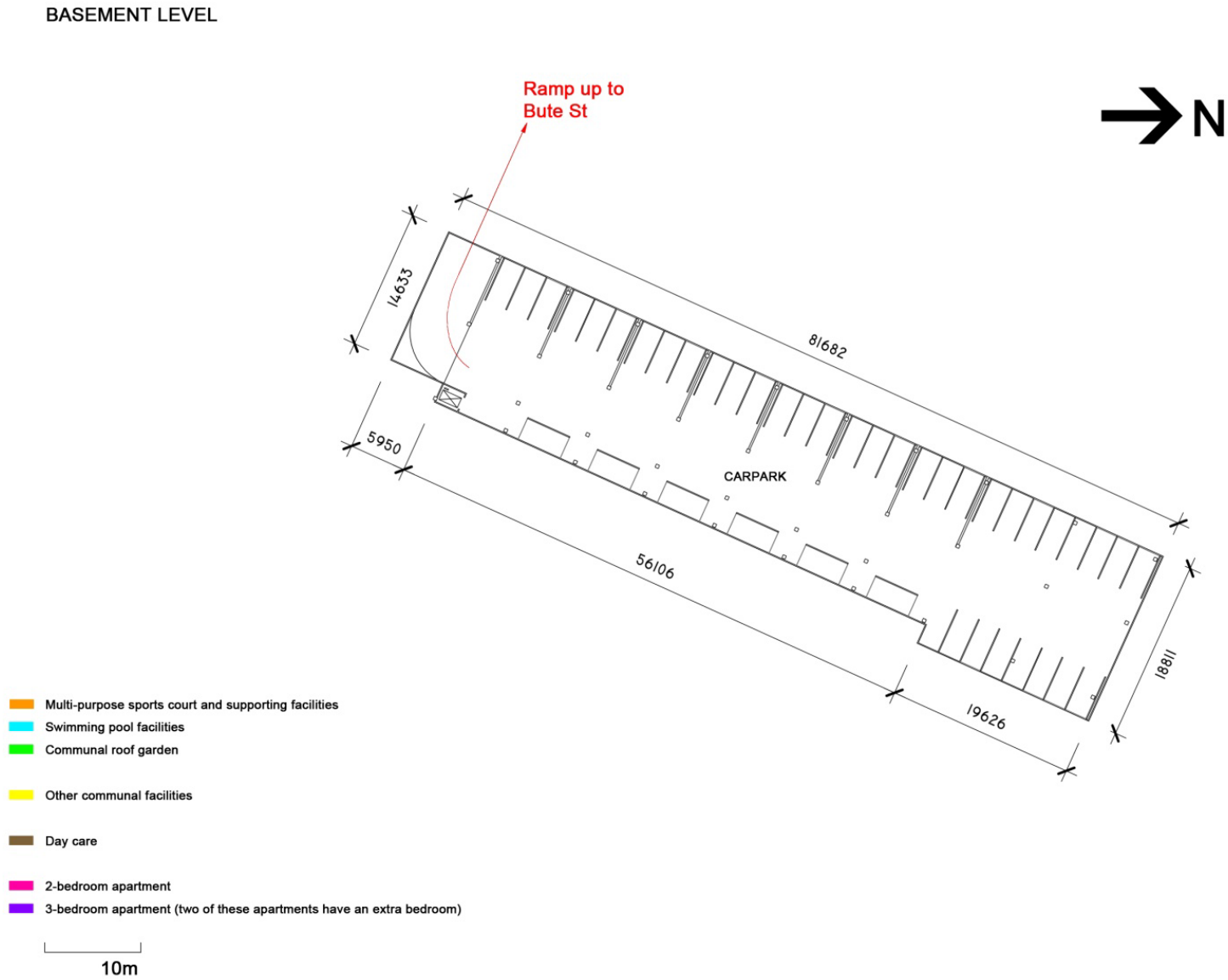


Figure 4.46: Final design basement plan

Source: Author's collection

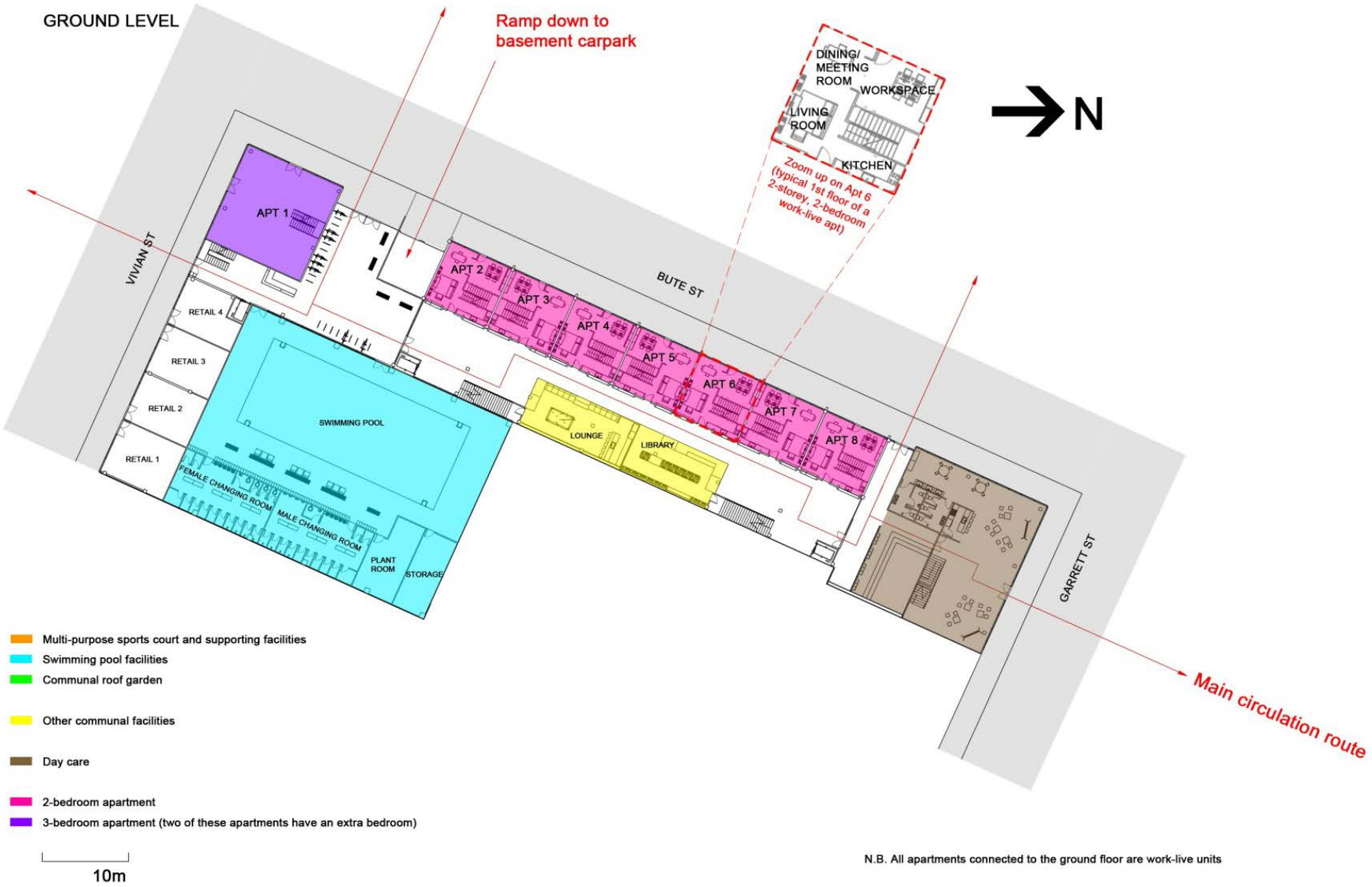


Figure 4.47: Final design ground level plan

Source: Author's collection

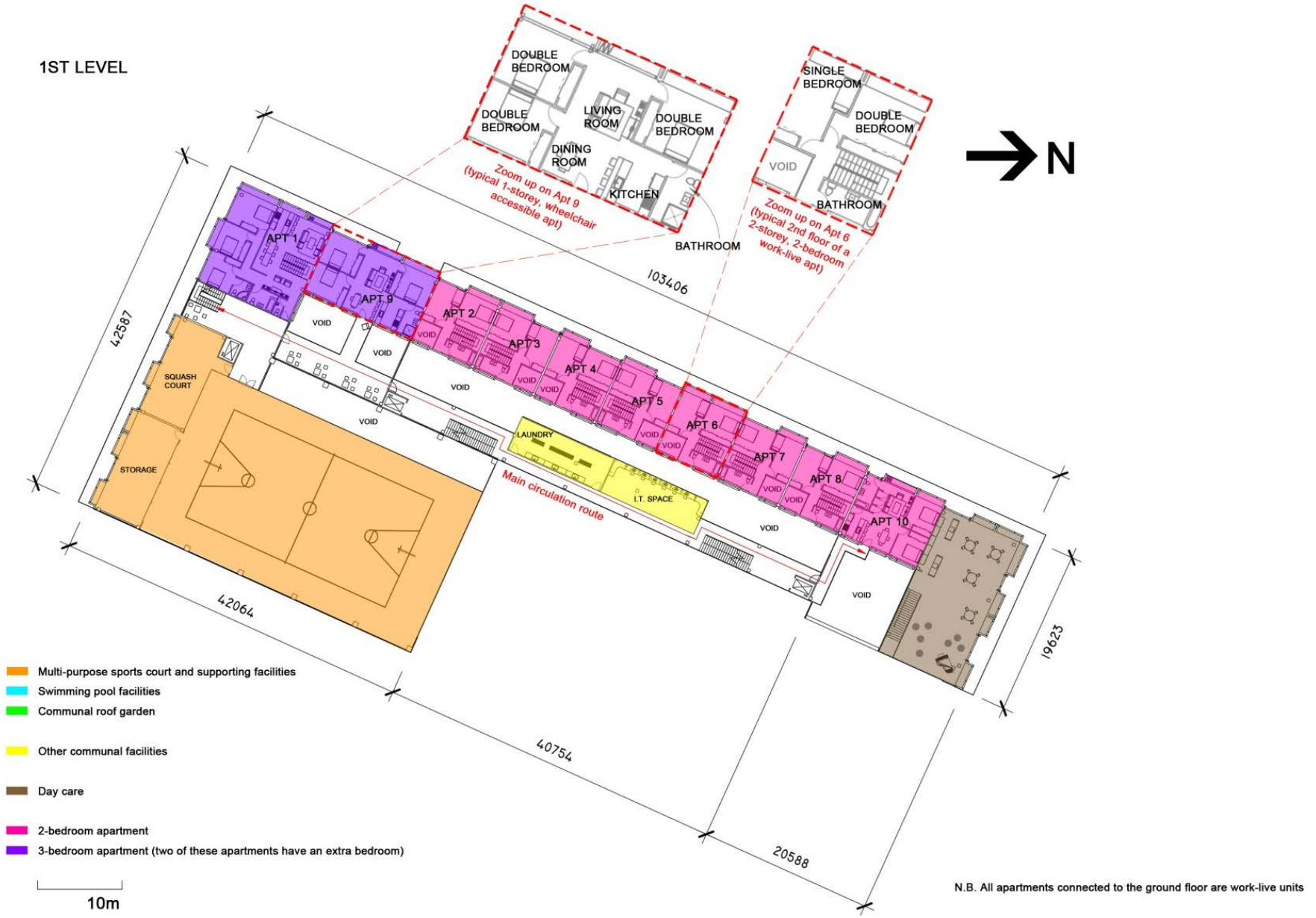


Figure 4.48: Final design 1st level plan

Source: Author's collection

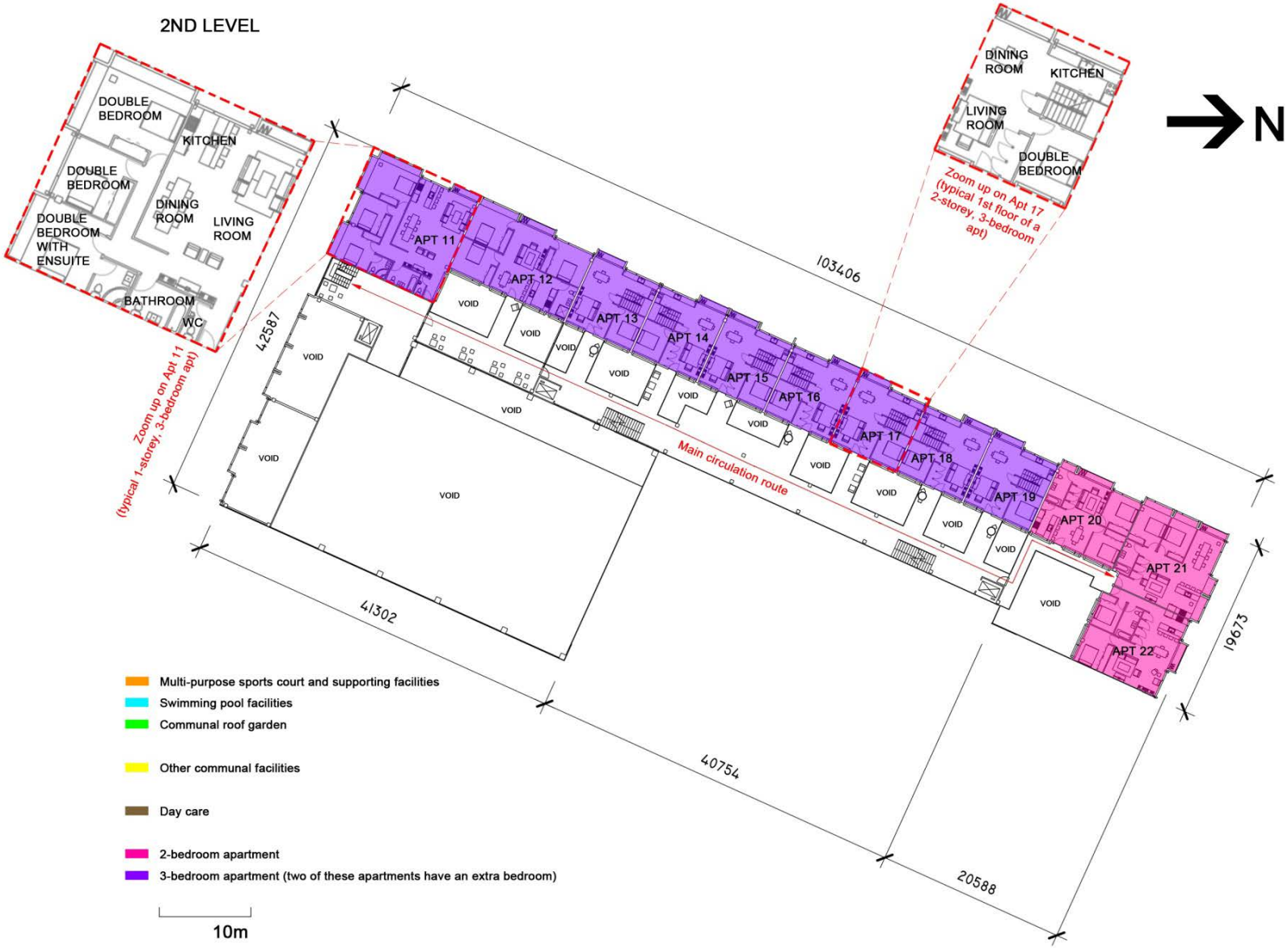


Figure 4.49: Final design 2nd level plan

Source: Author's collection

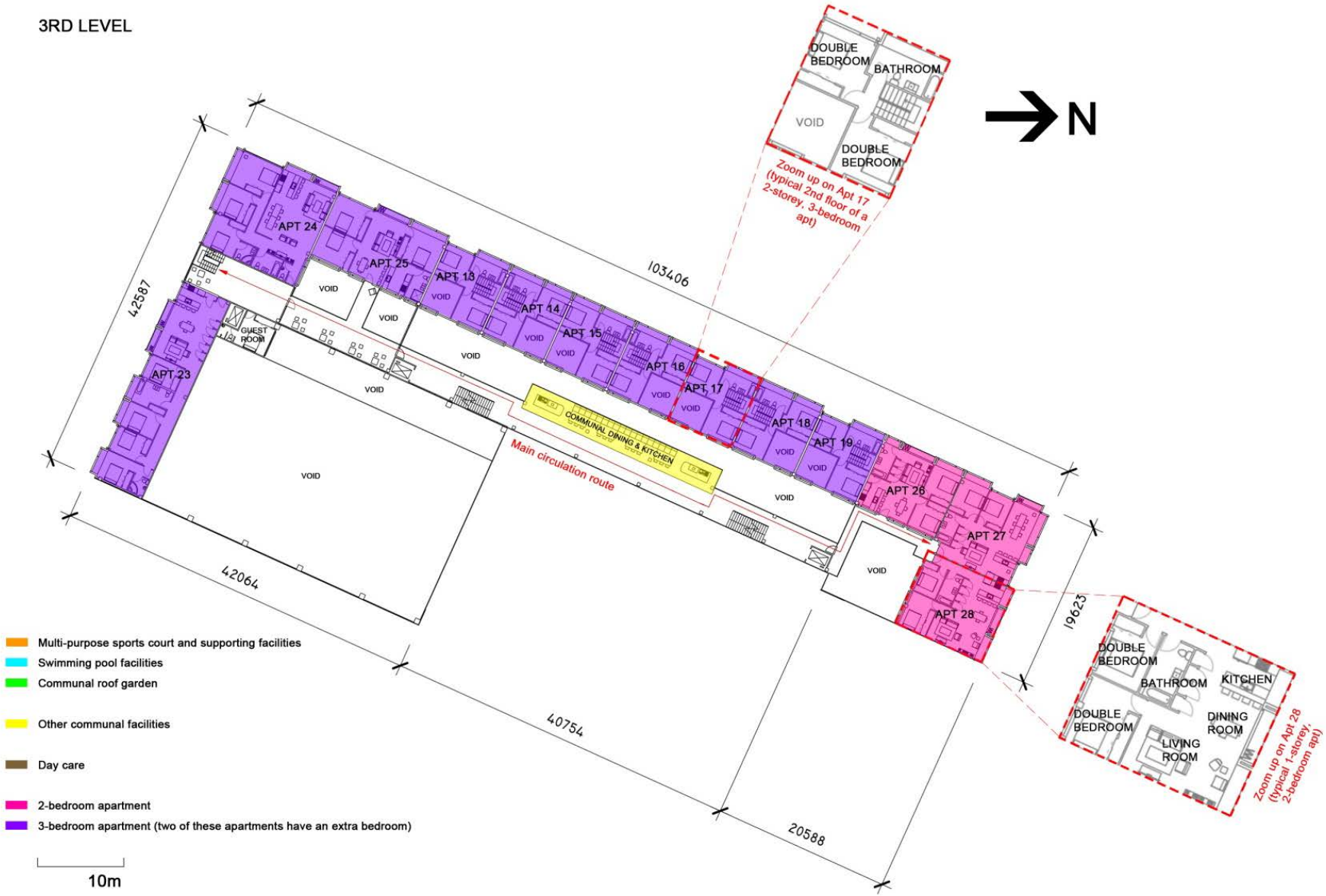


Figure 4.50: Final design 3rd level plan

Source: Author's collection

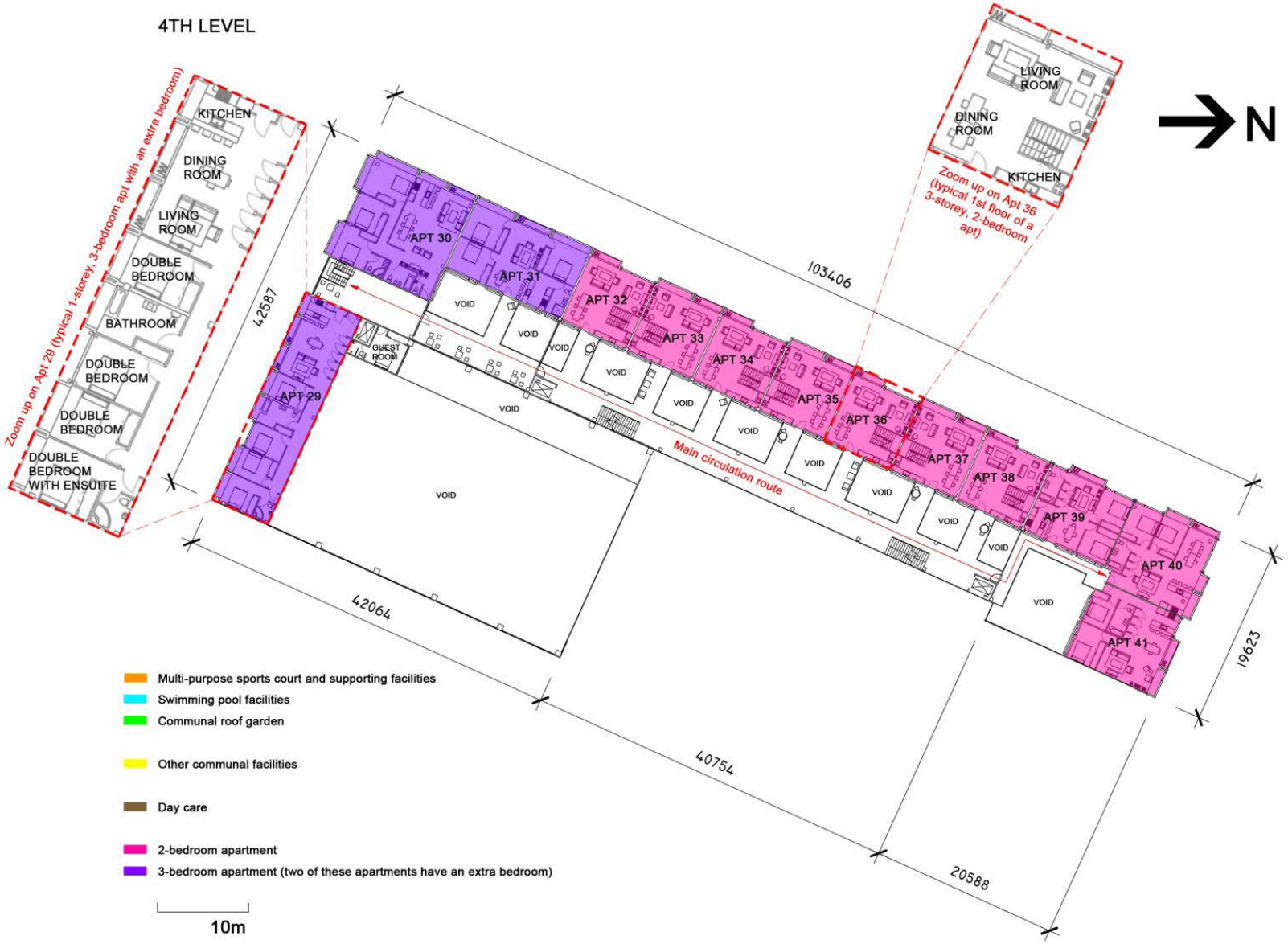


Figure 4.51: Final design 4th level plan

Source: Author's collection

Figure 4.52: Final design 5th level plan

Source: Author's collection

Figure 4.53: Final design 6th level plan

Source: Author's collection

The design's overall interior material pallet, especially with respect to flooring, is chosen with consideration to quality appearance, the maximization of light, durability and acoustic insulation. The interiors of communal and apartment spaces are finished mainly with rubber and vinyl flooring. The variety of tiles and timber textures and colors of these surfaces helps to create a visually dynamic environment that feels spacious, without comprising durability. During the design's development, concern towards the acoustics of the atrium space was raised. As residents occupy the circulation areas and its connecting communal facilities, the large space has the potential to generate a lot of noise, disturbing residents within the apartments. The majority of flooring within the atrium space is rubber based, helping to address this issue by absorbing sound. Walls between the internal street and surrounding apartment interiors are fitted with wool / polyester blend insulation and Alcotex composite panels which minimize the transfer of sound between these spaces (Symonite New Zealand, 2012; BRANZ) (refer to figures 4.43 and 4.44).

Figure 4.54: Kitchen of a work-live unit looking out towards the library of the internal street.

Source: Author's collection

Figure 4.55: Apartment kitchen facing towards an open plan dining and living room.

Source: Author's collection

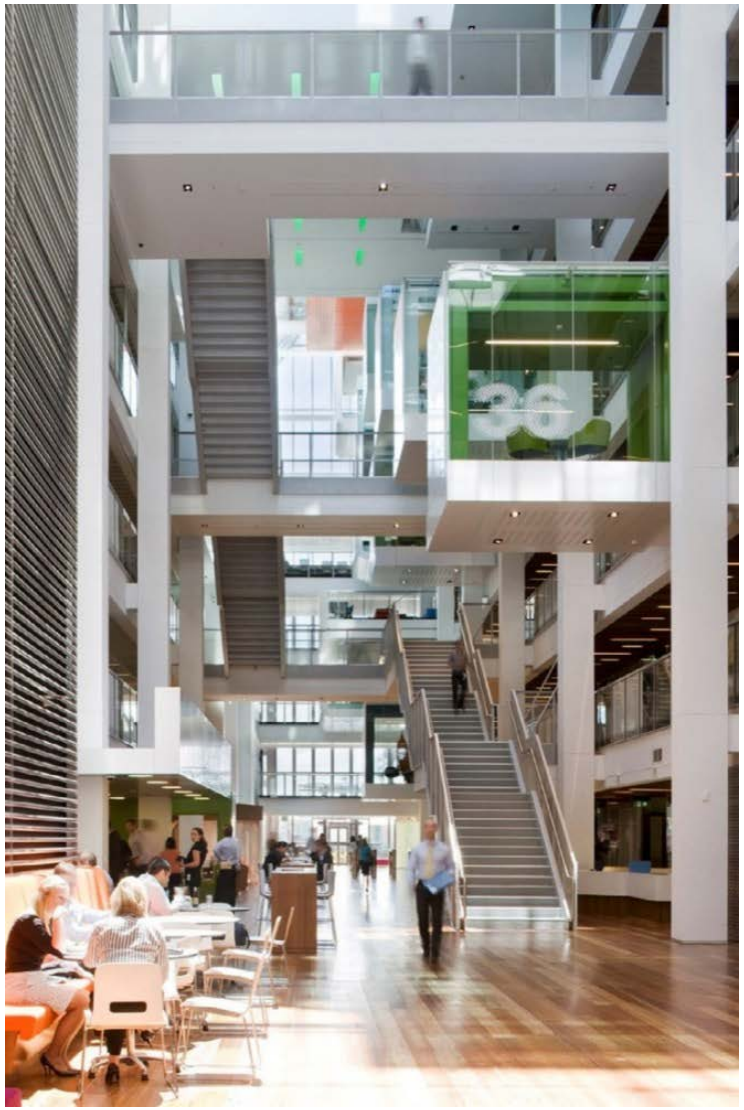


Figure 4.56: Atrium of Macquarie Bank

Source: (Saieh, 2010)

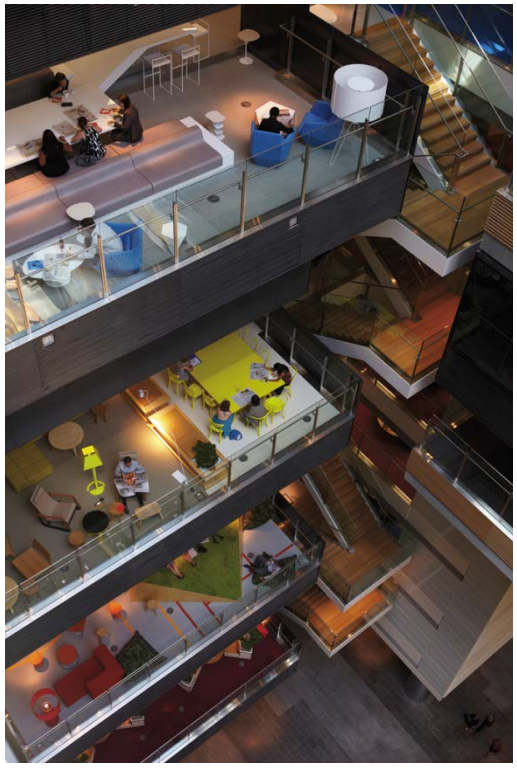


Figure 4.57: View down on ANZ Centre's atrium space and its connected communal spaces.

Source: (The Cool Hunter, 2010)

The atrium spaces of *Clive Wilkinson Architects' Macquarie Bank* in Sydney, Australia and *Hassell* firm's *ANZ Centre* in Melbourne presented visual inspiration for the design of the internal street. The dominating white finish of *Macquarie Bank's* atrium interior maximizes light, and the careful location of bold colors within the communal spaces of both examples created a medley of visual interest (refer to figures 4.56 and 4.57). The final appearance of the internal street demonstrates similar qualities (refer to figures 4.58 and 4.59).

Figure 4.58: Ground level view of overall internal street.

Source: Author's collection

Figure 4.59: 4th level view of overall internal street.

Source: Author's collection

5. Conclusion

Single parent families are a growing household type in New Zealand. Statistics New Zealand forecasts that they will represent twenty percent of all families within the country by 2021. A review of current literature identifies a series of special housing needs associated to this household type. Single parent families have particular requirements for affordability, accessibility to services, a sense of community, safety and security and a positive image. New Zealand's existing housing stock does not adequately meet these requirements. Seventy five percent of the country's current housing stock is detached housing, which is too large for single parent families, has high maintenance costs, and are commonly located in suburbs where accessibility to services may not be high. Apartments are usually closer to services. However most of them cannot provide adequate natural light, and outdoor and indoor play space for children. The research conducted in this thesis explores how housing in New Zealand can be designed to fit more closely to the housing needs of single parent families.

Architectural literature and leading practice have presented a variety of theories and ideas about how these needs could be addressed successfully in architecture. Ideas include alternative housing strategies (i.e. work-live arrangements, cohousing, mixed-use and integrated living), concepts for the creation of social space, Crime Prevention Through Environmental Design (CPTED),

guidelines for designing safer homes for children, methods of creating barrier-free design and approaches to reducing operating costs in housing. Some housing theories and concepts respond to multiple needs, while others respond to a single need. In other situations precedents outside of housing are explored as they present clear reflections of the concepts being researched. The final design creates an exemplar housing hybrid to address the housing needs of single parent families in Wellington City.

Taking the architectural position that the client is the end user of the housing and not necessarily the owner, the research considered affordability in terms of reducing operating costs. The design provides housing that is efficient and inexpensive to operate and live in. Apartments have dual aspect with an orientation towards the sun and the prevailing breeze permitting passive heating and cooling. Eaves are positioned to shade interiors from summer sun, while allowing in winter sun. Even through room sizes are small, consideration towards layout, lighted coloured finishes and large windows convey a spacious atmosphere. Interiors are finished with durable materials making them easy to maintain, and the common areas within the design permit the collective use of space, sharing the costs of these areas with neighbours.

Accessibility to services is about bringing the daily destinations of residents closer to home (affordability is also improved as a result). Considering the single parent family is the key focus, the location of the design is selected with consideration to destinations of employment facilities, schools, sports facilities, cultural facilities, parks, supermarkets and public transportation. Siting the design within the centre of Te Aro provides its residents with many of these facilities within a five minute walking radius. To enhance proximity (and the added security of access) of these

services, two-storey work-live units, day care, swimming pool, sports court, communal roof garden, library, lounge, I.T. space, laundry and communal dining room with two fully-equipped kitchens have been provided onsite. Work-live units connect onto the ground floor level of the site's surrounding streets, providing commercial exposure to support both retail and office-based businesses. By combining work and living spaces as one entity, these units can also conserve on the cost of amenities by sharing one kitchen, dining room and bathroom between work and living space. These units promote additional savings, as both workplace and home can be financed under one mortgage, and home-based businesses can apply for tax deductions. Clear acoustic and visual separations combined with a public and private entrance per unit maintain privacy between workspaces and living areas.

Fostering social interaction is a key ingredient to generating a sense of community. While the design of space cannot ensure that when people meet they will find common ground, but it can influence the probability of chance encounters. The design presents an atrium streetscape as the spinal connection between all its programmatic spaces. The semi-outdoor and indoor nature of the atrium space is both accessible yet intimate. The varying concentrations of light, provides areas of visual focus and areas to gather. Layers of access galleries adorn multiple levels of this void to connect communal facilities and residential units. Many of the communal facilities follow the length of these galleries, providing places of rest and activity alongside the circulation. The major communal facilities of the day care, pool and multipurpose sports court anchor the two ends of this circulation spine. The wide width of access galleries connecting to the front doors of apartments provides opportunity for residents to inhabit these spaces as forecourts to their home

through the placement of personal furnishings such as plants and furniture. This furniture introduces additional social anchors into the atrium space. As residents and visitors circulate between and use the various programmes, the mixture of traffic and incentives to linger generates many opportunities for social interaction.

The concern for safety and security relates to the overall design, as well as children's safety within the home. Multiple entry thresholds mark a sense of territoriality that provides residents with a clear understanding of the areas that belong to them. Changes in flooring texture highlight gradual transitions between public and private space. With a clear sense of ownership, residents can challenge with authority any criminal behaviour within and around their housing complex. Informal surveillance is supported by the daytime activity of the ground floor commercial spaces and morning and evening activity of the residential spaces above. Additional support of informal surveillance over access is maintained through open visual communication between the access points to residential units and communal spaces. Low maintenance materials are fitted onto surfaces that experience high wear and tear. These are balanced by the placement of softer materials on intimate tactile surfaces. Kitchens within residential units are positioned to have open visual communication with the dining and living room. This allows parents to simultaneously overlook children playing within these spaces while working within the kitchen. Large windows extend this open visual communication of the apartment interior onto the atrium space permitting parents to keep an eye on their children playing within the internal street from the interiors of the their dwelling. The fall of stair flights within dwellings are prevented from becoming too long through 'U' shape configurations reducing the length of any potential falls.

Positioning barriers around the bottom and top of stairs can also protect children from reaching them, so falls cannot occur. To prevent children from reaching hazards within the kitchen, the kitchen is configured with no traffic running through them – possessing an entry no wider than 1.5m.

Positive image refers to a housing environment that is desirable and supports a mixture of family types. The clean, shimmering appearance of the purple and dark grey aluminium facades of the design personifies an air of affluence. The powder coated aluminium panels of the facades resist deterioration, ensuring an ongoing positive building image that can be easily maintained - deterring crime. The daycare, sports facilities and communal roof garden occupy children by providing spaces of learning and play. This encourages an active and healthy lifestyle as well as providing parents support into employment. The close proximity of the design to a wide range of services and its provision of work-live units assist parents in the juggle of both work and family responsibilities. Within the apartments themselves, the design responds to the desire for a mixed tenancy through the provision of two and three bedroom residential units, with some configured to support wheelchair access. The close 1:1 ratio of two to three bedroom units allows the design to equally support the majority household sizes of single parent families and two parent families in New Zealand. It is also envisaged that these units would be suitable for the elderly. The commonalities shared between these three groups towards the rearing of children have the potential to catalyze mutual support amongst them, strengthening the mixture of family types beyond physical arrangement to social dependency.

The proposed scheme presents an example of housing that is more suitable to the housing needs of single parent families than the majority of existing New Zealand housing stock. It is not the only solution to addressing the housing needs of single parent families, but it exists to stimulate critique and debate towards how architecture can begin to service this household type.

The scheme has a number of underlying assumptions. It assumes that the Wellington City Council has dominating control over the design's site, even through their exact portion of ownership over the site is unknown. Under this control, the design assumes changes in the shape of the site's northern area and the extension of Bute St onto Garrett St. It also assumes that there is local demand for a new residential complex of this size, but more importantly that the supporting communal facilities would be sufficiently desirable to warrant a fair market rent. The design encourages a lifestyle with a community focus, through living locally and the sharing of resources. With the majority of New Zealand's existing housing culture immersed in detached housing, it is expected that the ideas presented in the design will take some adjustment for existing cultural expectations. However, the literature and leading practice from overseas has shown that these cultural juxtapositions can successfully shift into closer alignment. This is important as the number of single parent families continue to rise, and the country's awareness towards their needs increase.

To really test the ideas of this research, the next step would be to find a sponsor such as Housing New Zealand to further develop and fund the construction of a housing complex with similar contextual parameters and ideals as the presented design. The feasibility studies and post-occupancy evaluations as a result, would provide a new platform of critique for the thesis' research ideas beyond the realms of theory.

List of Figures

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