
BETWEEN THE GRAIN
ALT

ALT HOUSING: BETWEEN THE GRAIN

Generating multi-scaled community living: Densifying the urban fabric with wood construction to create a flexible and communal housing strategy

by Kayla Murrell
Bachelor of Architectural Science,
Ryerson University, 2015
Master of Architecture, Ryerson University, 2019

A thesis presented to Ryerson University
in partial fulfillment of the requirements for the degree of Master of Architecture in the Program of Architecture

Toronto, Ontario, Canada, 2019
© Kayla Murrell 2019

AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I authorize Ryerson University to lend this thesis to other institutions or individuals for the purpose of scholarly research.

I further authorize Ryerson University to reproduce this thesis by photocopying or by other means, in total or in part, at the request of other institutions or individuals for the purpose of scholarly research.

I understand that my thesis may be made electronically available to the public.

ABSTRACT

Current housing developments are built for one type of user at the time of construction, and neglect core values of community and adaptability. The way we build is a static misrepresentation of a dynamic society, ignoring ever changing patterns of growth, shrinkage, requirements and ideologies. Flexible housing strategies employing wood construction will support social inclusion while creating spaces that will serve all (societies) in a sustainable way. This poly-scalar (XS,S,M,L,XL) thesis will explore our basic understanding of physical spaces (architecture) and behavioral relations (people) to reconsider the "family" dwelling. This thesis aims to find a convivial housing architecture that supports and establishes flexible connections between architecture and community living.

ACKNOWLEDGEMENTS

I first would like to thank Marco Polo for the incredible support and advice over the past year. While I had never worked with you in the past, your passion and admiration for this topic was a driving force behind the success of this project and your encouragement was much appreciated.

Thank you to Paul Floerke for the valuable insights throughout the process. Your input pushed me out of my comfort zone to better my work.

Thank you to my loved ones for the support over the past year. It would not have been possible without you.

To my mother for her love and inspiration.

Table of Contents

Figures

Chapter 1

Chapter 2

17. Methodology: Scale + Layering - Exploded. Image by author
18. Max-Neef Diagram. Image by author
19. Flexibility Diagram. Image by author
20. Parameters and Drivers Explained. Image by author
21. Half a home concept
    Tory-Henderson, N. (2016, February 22). Quinta Monroy [Arcspace]. Retrieved from https://arcspace.com/feature/quinta-monroy/
22. (ibid). Elemental - Quinta Monroy
23. Structural models
    Elemental, Aravena, A., & Iacobelli, A. (Eds.). (2012). Elemental: manual de vivienda incremental y diseño participativo; incremental housing and participatory design manual. Ostfildern: Hatje Cantz.
24. Quinta Monroy floor plans
    Tory-Henderson, N. (2016, February 22). Quinta Monroy [Arcspace]. Retrieved from https://arcspace.com/feature/quinta-monroy/
25. Svartlamoen housing
    Architecture. (2005, October 5). Svartlamoen housing, Trondheim. Retrieved from Arkitektur N magazine website: http://www.architecturenorway.no/projects/dwelling/svartlamoen-2005/
26. Unité d'Habitation
    Wikiarquitectura. (2019). Unite d'habitation of Marseille. Retrieved from https://en.wikiarquitectura.com/building/unite-dhabitation-of-marseille/
27. Large (L) construction approaches . image by author
28. Chicken Point Cabin
    ArchDaily. (2015, December 17). Chicken Point Cabin / Olson Kundig. Retrieved from https://www.archdaily.com/778809/chicken-point-cabin-olson-kundig
29. Rural Idaho home by Olson Kundig
    Kundig, O. (2017). Bigwood Residence. Retrieved from https://www.olsonkundig.com/projects/bigwood-residence/
30. A. Modest envelope flexibility : Amsterdam. 30.b Blow up. Image by author.
31. Housing block in Merano by Holzbox Tirol
    Schittich, C. (Ed.). (2004). *High-density housing: concepts, planning, construction*. München: Basel; Boston, Mass: Edition Detail; Birkhäuser.
32. St. Lawrence Neighbourhood. Image by Author
33. Sherbourne Lanes Massing. Image by author
34. Sherbourne Lanes Aerial
35. Le Corbusier's Radiant City
    AD Classics: Ville Radieuse / Le Corbusier. (2013). ArchDaily. Retrieved 13 December 2017, from https://www.archdaily.com/411878/ad-classics-ville-radieuse-le-corbusier
36. Pruitt Igoe, St. Louis
    Fiederer, L. (2017, May 15). AD Classics: Pruitt-Igoe Housing Project / Minoru Yamasaki. Retrieved from https://www.archdaily.com/870685/ad-classics-pruitt-igoe-housing-project-minoru-yamasaki-st-louis-usa-modernism
37. Pruitt Igoe, St. Louis, site plan. Image edited by author
38. Second level floor plan Quinta Monroy, Elemental

Tory-Henderson, N. (2016, February 22). Quinta Monroy [Arcspace]. Retrieved from https://arcspace.com/feature/quinta-monroy/
39. Housing Donaufelderstraße, Herbert Wimmer
WUP_Wimmerundpartner. (1998). Housing Donaufelderstraße. Retrieved from http://www.wimmerundpartner.com/index.php?seite=projekte&projekt=donaufelder&id=1&lang=en
40. Housing Donaufelderstraße, Herbert Wimmer, Floor plan blow up
Schittich, C. (Ed.). (2004). *High-density housing: concepts, planning, construction*. München : Basel ; Boston, Mass: Edition Detail ; Birkhäuser.
41. Weissenhofsiedlung
Mezzadr, H. (2008). Mies at Weissenhof. *ARQTEXTO*, (13). Retrieved from https://www.ufrgs.br/propar/publicacoes/ARQtextos/PDFs_revista_13/02_humberto%20mezzadri.pdf
42. Weissenhofsiedlung Mobile partitions
(ibid)
43. Switch by Yuko Shibata
Arch Daily. (2010, October 23). Switch / Yuko Shibata Office. Retrieved from https://www.archdaily.com/83661/switch-yuko-shibata
44. Ebenezer Howard's Three Magnets
Howard, E. (1902). *Garden Cities of To-morrow*. Retrieved from http://urbanplanning.library.cornell.edu/DOCS/howard.htm
45. Garden Cities of To-morrow ground plan
(ibid)
46. Garden Cities of To-morrow ward centre (⅙ of the central portion seen on the ground plan)
(ibid)
47. Walk/ Transit/ Bike Score. Image by author
Walk Score. (2019). How Walk Score Works. Retrieved from How Walk Score Works - Methodology website: https://www.walkscore.com/how-it-works/
48. Suburban commute. Image by author.
49. Edward T. HALL's four types of personal distance. Image by author
Hall, E. T. (1990). *The hidden dimension*. New York: Anchor Books.
50. 700 Sussex Dr, Ottawa, ON K1N 1K4
Hanganu, D. (2005). Sussex Mackenzie Multifunctional Complex , 2005. Retrieved from http://www.hanganu.com/index.php/en/projects/44-projets/commercial/2005/153-complexemultifonctionnelsussexmackenzie-en
51. Haarlemmer Houttuinen - Herman Hertzberger
Architecture Guide. (2011). URBAN REDEVELOPMENT HAARLEMMER HOUTTUINEN (HERTZBERGER). Retrieved from http://www.architectureguide.nl/project/list_projects_of_typeofbuilding/typ_id/8/prj_id/332
52. Galley House Backyard by Williamson Chong Architects
Desiretoinspire. (2013, March 20). Williamson Chong. Retrieved from https://www.desiretoinspire.net/2013/03/20/williamson-chong/
53. Open air balcony at Silodam. Image by author
54. Svartlamoen housing, communal floor area, Brendeland & Kristoffersen
Brendeland & Kristoffersen. (2005). Svartlamoen housing. Retrieved from http://www.bkark.no/projects/svartlamoen-housing/
55. Svartlamoen housing, exterior, Brendeland & Kristoffersen

Architecture. (2005, October 5). Svartlamoen housing, Trondheim. Retrieved from Arkitektur N magazine website: http://www.architecturenorway.no/projects/dwelling/svartlamoen-2005/
56. Svartlamoen housing, floor plan, Brendeland & Kristoffersen
57. Bondebjerget common house floor plan in Odense, Denmark. Image edited by author
McCamant, K., & Durrett, C. (2011). *Creating cohousing: building sustainable communities*. Gabriola Island, B.C: New Society Publishers.
58. Importance of central circulation and common spaces for equitable social opportunity. Image by author
59. EcoHeritage by Shape Architects
Union Street EcoHeritage - SHAPE Architecture. (2017). SHAPE Architecture. Retrieved 15 December 2017, from https://shapearchitecture.ca/projects/union-street-ecoheritage/
60. EcoHeritage site circulation
(ibid)
61. Capitol Hill Urban Cohousing gradient, Schemata workshop. Edited by author
Schemata. (2016). Capitol Hill Urban Cohousing. Retrieved from http://www.schemataworkshop.com/chuc
62. Capitol Hill Urban Cohousing, Schemata workshop
(ibid)
63. Modellvorhaben Energieeffizienter Wohnungsbau | Ansbach, Deppisch Architekten
Deppishch, M. (2016). Modellvorhaben Energieeffizienter Wohnungsbau Ansbach. Retrieved from https://www.bak.de/berufspolitik/energie-und-ressourceneffizientes-bauen-1/initiative-besser-mit-architekten/160419-best-practice-3-deppisch.pdf
64. Silodam exterior facade. Image by author
65. On rubbled path in Cinque Terre, Italy. Image by author
66. Greek and Italian enclosures. Image by author
67. Substrate Factory Ayase
AHA. (2017). Substrate Factory Ayase. Retrieved from http://aki-hamada.com/projects/substrate-factory-ayase/
68. Substrate Factory Ayase
(ibid)
69. Substrate Factory Ayase
(ibid)
70. Substrate Factory Ayase
(ibid)
71. Substrate Factory Ayase
(ibid)
72. Substrate Factory Ayase
(ibid)
73. Substrate Factory Ayase
(ibid)
74. Substrate Factory Ayase
(ibid)
75. NLT and DLT image.
Sindhu Mahadevan. (2017, November 17). Mass Timber: A primer and Top 5. Retrieved from http://blog.perkinswill.com/mass-timber-a-primer-and-top-5/

Chapter 3

76. Circularity of wood
    Think Wood. (2018). *100 PROJECTS UK CLT*. Retrieved from https://www.thinkwood.com/wp-content/uploads/2018/10/CLT-100-UK-Projects_Think-Wood-Web.pdf
77. 17th century log farmhouse in Heidal
    Johansen, Ø. S. (2012, September 24). Log house; 17th-century log farmhouse in Heidal, Norway. [Norwegian Directorate for Cultural Heritage]. Retrieved from https://en.wikipedia.org/wiki/Log_house#/media/File:S%C3%B8re_Harildstad_n%C3%B8rdre_stu_2.JPG
78. Stave Church in Norway. Image by author
79. 204-214 King St E
    Alliedreit. (n.d.). 204-214 King St. E [Leasing opportunities]. Retrieved from https://www.alliedreit.com/property/204-214-king-st-e/
80. 204-214 King St E
    (ibid)
81. 312 Adelaide St W
    Alliedreit. (n.d.). 312 Adelaide St. W [Leasing opportunities]. Retrieved from https://www.alliedreit.com/property/312-adelaide-st-w/
82. Common Softwoods and Hardwoods. Image by author
83. Canadian building code illustrations, Image by author
84. Light frame construction, Post and Beam construction and CLT construction. Image by author
85. The Grange Triple Double house by Williamson Williamson (Williamson Chong Architects, 2016)
86. (ibid)
87. Light frame diagram of Williamson Williamson Grange Triple Double. Image by author
88. The Grange Triple Double house by Williamson Williamson (Williamson Chong Architects, 2016)
89. CLT Ply 1 - 3 - 5- 9. Image by author
90. Forté by Lend Lease: Axonometric of CLT . Image by author
91. Prefabricated installation
    Prefabaus. (2018). Lendlease/timbersolutions [Lendlease]. Retrieved from https://www.prefabaus.org.au/members-list/lendlease
92. Forté by Lend Lease
    Victoria harbour. (2012, December). FORTE. Retrieved from https://www.victoriaharbour.com.au/live-here/forte-living
93. Barretts Grove - Groupwork and Amin Taha
    Think Wood. (2018). *100 PROJECTS UK CLT*. Retrieved from https://www.thinkwood.com/wp-content/uploads/2018/10/CLT-100-UK-Projects_Think-Wood-Web.pdf
94. Barretts Grove, exterior - Groupwork and Amin Taha
    Think Wood. (2018). *100 PROJECTS UK CLT*. Retrieved from https://www.thinkwood.com/wp-content/uploads/2018/10/CLT-100-UK-Projects_Think-Wood-Web.pdf
95. Substrate Factory structural axo. Image by author

Chapter 4

96. Percentage of multigenerational households by region. Image by author
97. Arial View to North. Image by author
98. Travel time map. Image by author
99. Yesterday: 1910 Map of Toronto
    Ng, N. (2014). 1890 Toronto Fire Insurance Map [University of Toronto Map & Data Library]. Retrieved from http://goadstoronto.blogspot.com/2012/03/goads-atlas-1890-toronto-fire-insurance.html
100. Yesterday: Former site of The Girls' Home - View from the North , 1915.
    The City of Toronto. (1906). Fiftieth Annual report of the Girls' Home 229 Gerrard St. East. Retrieved from https://archive.org/details/annualreportofgi1906girl/page/n5
101. Site plan . Image by author
102. Formal decision making. Image by author
103. (ibid)
104. (ibid)
105. (ibid)
106. (ibid)
107. (ibid)
108. (ibid)
109. (ibid)
110. 227 Gerrard St. E. Image by author. Image by author.
111. Site Programmatic Massing. Image by author.
112. Site Perspective Section. Image by author.
113. Outdoor Space gradient. Image by author.
114. Axonometric of public space. Image by author.
115. Level 1 - Open. Image by author.
116. Level 1 - Closed. Image by author.
117. Chosen material image. Image by author.
118. Post and beam, Panelized System and light frame construction. Image by author.
119. Site 2 level 1 framing . Image by author.
120. Site 2 Level 2 framing . Image by author.
121. Building structure site 2 . Image by author.
122. Building System and assembly. Image by author.
123. Design variations. Image by author.
124. Level 2 - Fixed. Image by author.
125. Level 2 - Furnished. Image by author.
126. Module Construction . Image by author.
127. Neighbourhoods . Image by author.
128. The Module. Image by author.
129. Designing the service cores and larger grids . Image by author.
130. Module types . Image by author.
131. Units. Image by author.
132. Units. Image by author.
133. Units. Image by author.
134. Unit division plans for 3 bay units. Image by author.
135. Module Components. Image by author.
136. Unit component diagrams for modules. Image by author.
137. Window configuration development. Image by author.
138. Window configuration. Image by author.
139. Section Layering. Image by author.
140. Bedroom created using small scaled furniture. Image by author.
141. Bedroom opened to secondary space. Image by author.
142. Partial building axonometric - Open. Image by author.

CHAPTER
01

INTRODUCTION

The focus of this thesis is on collaborative urban housing solutions and building with wood to create flexible spaces that increase affordability, individuality and living standards for people from all walks of life.

In Toronto alone the number of young adults (aged 20 to 34) living with a spouse or partner has decreased by 7.2% between 2001 and 2016. This means that more individuals are looking to live alone, but given the high cost and limited supply of housing there is currently less availability within the affordable price range for singles, as they fall behind in the race to home ownership (Powell, 2018). This is resulting in many singles living with their parents for longer than anticipated. 34.7% of young adults were living with their parents in 2016 (Statistics Canada, 2017).

Seniors are also living longer and in better health, demonstrating increased macro levels of life expectancy. In Canada, seniors (aged 65 and older) represented 14% of the population in 2009, with a projected growth to 24% in 2036 (Statistics Canada, 2016) and in 2011, 92% of these seniors lived in private dwellings (Statistics Canada, 2018).

Simultaneously, families are also changing away from the nuclear family to a significant mix of other living arrangements including single parenthood, cohabitation, LGBTQ relationships, polyamorous relationships, extended/multigenerational, blended, skip-generational etc. and as standards change so do structures that result from custody, social services, and child support (Florida Family Law Clinic, LLC, 2015). Many more people are consequently part of one individual's life, and because social change affects our spatial needs, we must consider how new homes are to be built.

Housing that is inclusive and supports the needs of all people of different ages, ethnicities, sexualities and the resulting spatial implications should be acknowledged and respected. It is clear that this is not the case in today's housing market. Whether living with grandparents, or with two mothers and one father, as a student, as a child with a single parent or simply alone and in a mobility device, there should be the understanding that everyone is part of a community and that there are people who now make up a larger body of what could be called an extended family. Housing that supports these relationships and structures can make the case for a more humane housing market that is able to adapt to all needs.

Chapter 1.1

NEEDS + RESPONSE TO CONTEMPORARY DESIGN

HOME

Housing shortages have become a significant problem for 21st century cities. New York, Toronto, London, San Francisco, Vancouver, Hong Kong and Sydney are all experiencing rapid population growth that is rendering urban living more difficult, resulting in social exclusion and a widening gap between those who have and those who do not (Carozzi, London School of Economics, Hilber, & Cheshire, 2017). Some argue that land use policies are what have hindered the free market, however the single most important factor is the mentality of home ownership; both developers and citizens look at home ownership as an investment model, a tool to capitalize on a very hot housing market. While this is understandable and rather logical to those who have, it neglects the underlying notion that housing is still, and very much always has been, a need and a right, and not a commodity. This race to home ownership has resulted in social exclusivity and forces buyers to make decisions based on financial feasibility over their well being.

> *Housing is the basis of stability and security for an individual or family. The centre of our social, emotional and sometimes economic lives, a home should be a sanctuary; a place to live in peace, security and dignity... Housing has been financialised: valued as a commodity rather than a human dwelling, it has become, for investors, a means to secure and accumulate wealth rather than a place to live in dignity, to raise a family and thrive within a community... Deprivations of the right to adequate housing are not just programme failures or policy challenges but human rights violations of the highest order, depriving those affected of the most basic human right to dignity, security and life itself. - UN Rapporteur for the Right to Housing 2017 (Hearne, 2017)*

Innovative design and planning solutions become pivotal in restoring a healthy equilibrium between housing as a means of shelter and equity-generating housing that is becoming a way of excluding shelter from the equation for many. Communities are changing faster than ever, as are families. While Canadians generally have a great standard of living compared to other places around the world, there are still too many who are being left out, and others who are barely staying afloat with their mortgages. Statistics Canada shows that 2011, for the first time since 1971, marks the decline of home ownership (Statistics Canada, 2011). There is greater demand for rental properties with unaffordable housing rates which has further stressed the rental market and potential renters.

Design strategies and housing advocates are needed to push for a system that puts dwellers first.. and investment second.

In the Canadian context, condominiums, single family homes, and apartment buildings are the most typical housing models. This project attempts to determine design requirements for people of different ages and living structures to explore their effect on architecture. Although single family homes are relatively more flexible to adapt over time than condominiums, they require a lot of money and time to adapt the space to new needs as well as being distant from the urban, transit-oriented lifestyle (Kalinowski, 2019). Should the dweller require more space, often, they move homes. This is due to the system being ingrained in people to strive for something new, bigger and better, but it is also based on land policies that are not very flexible in allowing for single family growth. Ongoing immigration to Canada has brought a high degree of cultural diversity and dynamism, with a wide range of family structures and traditions of dwelling. This cultural dynamism is one of Canada's greatest strengths that is often overlooked and underappreciated when it comes to available housing stock, which is largely constructed by developers who do not care to design for housing variety.

Every family is different. Why are so many family homes the same?
- Alex Bozikovic (Bozikovic, 2018)

This thesis seeks to investigate whether moving neighbourhoods is the only and ultimate answer to changing households structures. Couples with children make up 51.1 % of the Canadian population, meaning the nuclear family is becoming less of a dominant model (Statistics Canada, 2017). If families -- that word now to be used very loosely-- are choosing to live together in different ways and are inherently always in a state of fluctuation, how can we design a community that is adaptable to this change?

This new form of collective housing values and establishes connections between architecture and convivial community living. By limiting isolation and increasing security and optional support, this investigation will contribute to the overall satisfaction that high -rise building models do not currently support. This life fulfillment is for the individual (members of individual families), and the collective which indicates that housing does not end at the front door, but rather that it can go as far as a healthy neighbourly scale allows. This philosophy of a community that supports home is a key component to this thesis.

Ecosystems are characterized not only by their parts but also by their interaction among these parts. It is because of the complexity of the interactions that it is dangerous to take a fragmented view, to look at an isolated piece of the system. By concentrating on one fragment and trying to optimize the performance of that fragment , we find that the rest of the system responds in unsuspected ways . Such simple but large scale interventions as urban freeway programs, urban renewal, and rent control, leads to large-scale unexpected consequences and a high likelihood of failure even with respect to the narrow objective of the intervention. The first two-rent control and residential urban renewal- represent simple and direct approaches to housing lower-income people. The third is freeway construction. Without it, freeway programs are bound to have an effect opposite to that desired (that is, creation of traffic congestion rather than alleviation of congestion.)
- Chris Reed & Nina-Marie Lister (Reed & Lister, 2014)

Cities and urbanizing regions are open prototypical complex adaptive systems. They are characterized by frequent and novel disturbances. Stressors have multiple causes: the threshold between public and private, between my space and yours, between open and closed, between light and dark.

This thesis proposes an architecture that is not only the physical threshold but also the interstitial space, the in-between necessary in connecting disconnection. By exploring spatial necessities we investigate diverse communities at different scales with the intention of suiting the needs of the inhabitants in a series of adaptable forms that could comfortably host them. Allowing for liminal thresholds in buildings to support life between programmatically defined spaces at physical different scales can allow for the spontaneous and meaningful interactions that would significantly benefit the user experience.

This thesis aims to find the poetry in daily living of people of all ages through investigating their interactions within the built environment, to understand the need for built form at different scales: (atmospheric (XS), the living (S), the protective (M), the structure (L) and the neighbourhood (XL)) and varying in liminality (public, common, private) so that there are options for physical and spatial adaptability when needed at each point in a person's life.

SOCIAL: WHO ARE THE PEOPLE AND WHAT DO THEY NEED TO LIVE COMFORTABLY

Architecture vs. Isolation

According to Emiliana Simon-Thomas, PhD, Science Director of the Greater Good Science Center at The University of California, Berkeley, humans are an extremely social species- and the human nervous systems expects to be in the presence of other beings. This is true according to biology, neuroscience, psychology, and asserts that being alone is linked to physical and emotional detriment and lower levels of well being. In the 1970s, research proved this connection between social networks and death rates, supported by recent explorations, across 148 studies including over 300,000 participants, that also suggest that one's well-being is increased by 50% when there are stronger social ties (DiGiulio, 2018).

There are a few reasons why:

1. Physiologically being around other people makes us healthier
2. Our brains work better when we work together
3. Psychologically, we prefer to go through life not alone
4. When we are around people who drive us crazy, we grow (DiGiulio, 2018).

Human beings crave social interaction and although this article suggests that even negative interactions can be beneficial, it is arguable that there is a difference between negative connection and a false sense of connection. False connection is what occurs when people are engaged in interactions on their mobile phones. E-mail exchanges and excessive cellphone use is focusing our attention on looking down (Peper & Harvey, 2018). We are no longer immersed in our surroundings and appreciating what we can see when we look up. We enjoy text conversations and forget how refreshing a face-to-face with a good friend feels. Our places of residence now have to take this into consideration and aid in creating spaces for interaction and spontaneous engagement in order to form lasting bonds.

Well-being

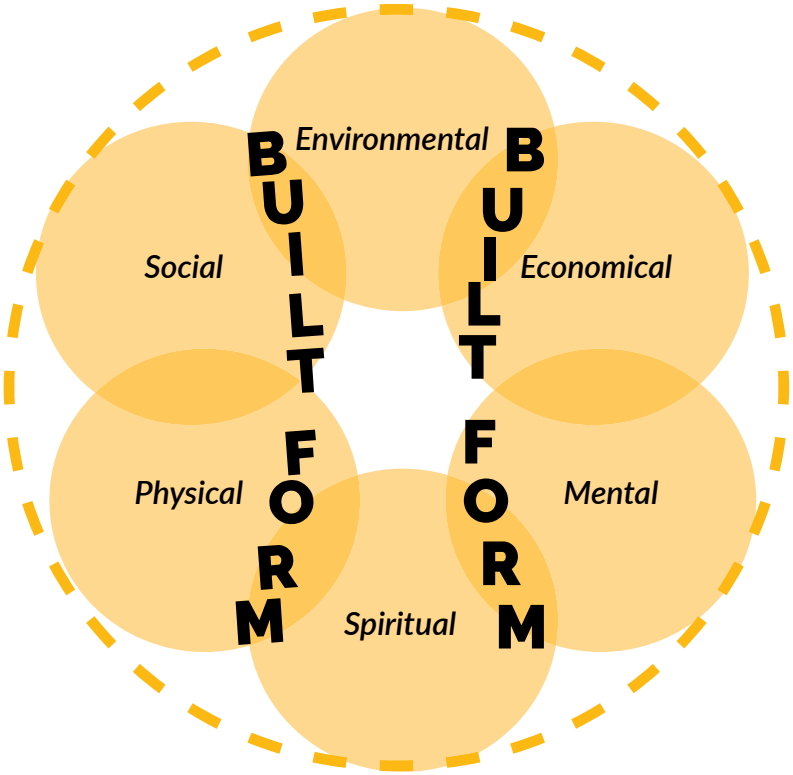


Fig 1 - Well-being diagram showcasing the 6 categories of influences that inform the operation of built form

Human well-being is described by four primary elements—basic human needs, economic needs, environmental needs, and subjective well-being. These elements can interact in a myriad of ways to influence overall well-being (Summers & Smith, 2014).

Well-being, comfort and lack of isolation go hand in hand. Once you maintain two on the list then all three are achieved. Since these elements are agreed upon as necessary for healthy and happy living, we should incorporate them into the foundational place where we live our lives, start and end our days and create lasting memories: home. The Government of Canada and the U.S. Council on Social Work Education describe well-being as a multi-faceted state characterized by health, happiness, and prosperity (Fox & Moyser, 2018). At a micro level (i.e., individuals, households, and families within households) not all Canadian individuals presently enjoy sufficient levels of economic well being which is hindering other aspects of their personal well-being. When well-being is insufficient this means that there is a lack of the sense of security and satisfaction with one's quality of life (Fox & Moyser, 2018). The fundamental concerns include food, clothing, housing, health care, transportation, education and paid taxes, but too often the segregation and separation between the housing unit and a person's well being is the basis for one's state of discontent (Fox & Moyser, 2018). First we need to understand the users of such a housing project to understand what is needed socially and programmatically.

This highlights the direct and indirect implications of the built world in relation to people. A design decision is as much a physical form as it is a social construct that could encourage or discourage interaction. Design can influence one's mental state and have detrimental effects on the environment. This thesis will aim to find a balance between these factors by digging deeper to understand how to create a built form that supports change over time while doing no harm in these 6 categories.

Social Diversity - Key user groups + Dolores Hayden

If well-being is the key to realizing happiness and user satisfaction for the largest number of users, then architecturally we must look at how to provide sufficient options to support this. The first step is to examine and define those affected. *Redesigning the American Dream: The Future of Housing, Work, and Family Life* by Dolores Hayden discusses the historical issues with the lack of housing supply in the United States and the implications for people (of all walks of life) in the 19th century. Inspired both by the works of Shadrach Woods (her teacher at Harvard GSD) and John Habraken (the head of the Architecture Department at MIT when she was an Assistant Professor there), Hayden discussed affordable housing, social strategies for family gathering and support, the gender implications of living in a time where there was much less opportunity and finally the notion of the American Dream of living in a perfect family and in a large home of one's own.

Hayden spells out these phenomena in three sections,

1. The Evolution of the American Dream
2. Rethinking private life and
3. Rethinking public life

In the first section Hayden discussed the American Woman's house and the role that women played at home. She tries to understand why people invested in new housing strategies. In section two Hayden discusses the role men assumed in public that consequently left women at home to care for children. This led to very little domestic male participation and women were left to carry out the unpaid work of taking care of family affairs. She follows to say that this phenomenon had been left unchanged even as women began to become more and more active in the workforce. The understanding of the effect of worker parents became acknowledged and this chapter illustrates small to large scale community designs that we know today as condos, garden cities and courtyard homes. Hayden discusses housing stereotypes as she concludes with a fascinating look at the development of congregate models of housing to meet the needs of singles, the elderly, and families. Hayden is able to dissect much of the structural/ organizational debris that resulted from design of this time, highlighting the economic, social and physical changes that need to be made to the built environment to design beneficial spaces for basic human needs. This book discussed in great detail three major groups that will be addressed in this project: singles, families and the elderly.

Singles

Toronto hosted 60% of the single person households in the GTHA in 2016 (Statistics Canada, 2017). In the current housing market this is the group for whom condominiums are mostly built. Though not well designed and executed, the aim is to produce a large number of units by designing smaller more compact apartments with little optionality and community.

Many work, and meet in the city, a place with bright lights and never-events. Singles do not want to drive home to an empty house in the suburbs, they want to be in a safe and accessible transit oriented neighbourhood - a place that is alive and vibrant. The younger singles are also looking for a place that is trendy yet affordable, a place that is personalized and beautiful.

The unfortunate truth is that the scarcity and cost of housing is resulting in another change in market behaviour; young adults staying in their parents' place of residence. Although the average number of people per household in 1901 was five, in 1951 four, in 2001 2.6 , in 2011 2.5, from 2016 this trend is changing as singles are staying in their family residences because they lack the means to afford accommodations in the current market (Statistics Canada, 2018, May 17). This is contributing to the reestablishment of larger extended families, beyond nuclear families. In a rapidly growing area such as Toronto, there will need to be a larger focus on providing housing options at affordable rates. Options for flexibility will provide more opportunity to own the preferred space.

Family Types

Families

The way theorists such as Dolores Hayden have thought about housing is arguably not the way bankers, developers and contractors have gone about building communities and single family homes. The single family home was built for the nuclear family and once times changed and dual income became prevalent the cost of homes, as well as size, began to rise with two people now able to pool resources for a large home. Over the past few decades, households have decreased in size, some have increased to blended families or multi generational households, but the way we use homes has not changed enough to justify these tiny box units or single family mansions. As a result, many

individuals, families, and seniors have all had tremendous difficulty in finding housing that meets their particular needs (Hayden, 1986, p 43). Developers like William Levitt produced two or three designs and provided everyone a home within those models. Levittown was designed in the 1950s as a way to embrace a new suburban lifestyle that valued the single family home, large privately owned properties, the vehicle and privacy. This development consisted of six housing types with open floor plans that focus on cost efficiency due to minimal design variation. This design did not originate in anticipation of becoming one of the world's largest developments, however that was the result. The postwar housing boom exploded with Levitt and Sons designing single family homes all over the country.

Fig 2 - Levittown

Over time designers, workers, feminists, and theorists have all discussed the decline of the nuclear "traditional" family. The family with one working head of the house and the supporter (usually the woman) who stayed at home and minded the children. In the *American Woman's Home* Catherine Beecher developed an idea where she believed that in the division of labour the housewife would be responsible for all nurturing tasks. According to German Marxist August Bebel in his book *Women Under Socialism* (1883) the most traditional household work was to be transferred into the factory, saying "The small private kitchen is just like the workshop of the small master mechanic". This transferral would consequently abolish the domestic role of women entirely allowing for more time for other practices. Finally, Hayden highlights the ideologies of material feminists like Melusina Fay Peirce. Their ideology was in support of socializing housework -- although critics focused on the inability of the strategy to address male participation-- under the control of women. This meant women would come together and while creating a community, they would continue to provide the "Home, Mom, and Apple Pie" in a more comfortable and communal environment. This idea is particularly interesting because it called into question the notion of community. These ideas are what Hayden call the haven, industrial and neighbourhood strategies of how to address home (Hayden, 1986, p 68).The first strategy is associated with one person who stays home all day to nurture and care for the family, separating the income generating duties. The second strategy requires the nurturing tasks such as meal preparation as something that could happen collectively within a factory redefining

Fig 3- The Richmond

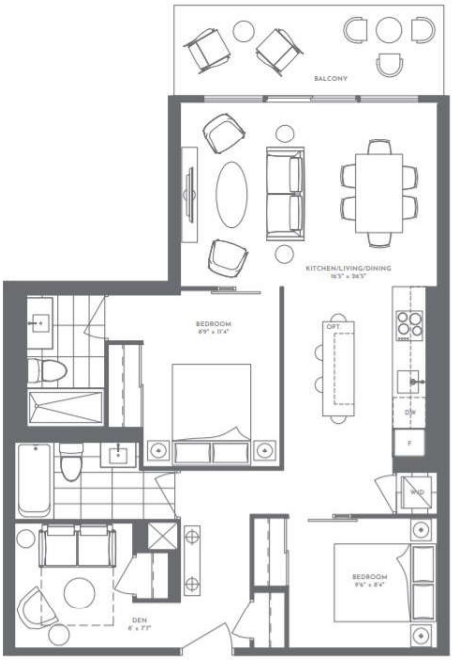


Fig 4- Wonder 2

what would consequently occur in the individual home. In the latter family/housing strategy both parents would be at work, which then creates a new form of housing organization where nurture is assumed to be provided to the family after work hours by both parents.

Additionally, Charles Fourier, other socialists, and feminists including Edward Bellamy, August Bebel, Charlotte Perkins Gilman, Karl Marx and Friedrich Engels agreed with looking for new solutions to these new issues with housing structure (Hayden, 1986, 85). The Phalanstère by Charles Fourier was designed with two issues in mind. First Fourier believed that the traditional house was a place of exile and oppression of women. By designing a new community he could therefore shape new relations. Second there was a need to integrate urban and suburban ideals into a new built form. Buildings were arranged in a u-shape with a wing on either side and included large meeting rooms, private rooms, inner courtyards and recreational gardens supporting 1,620 people living and working together (Spatial Agency, 2017). He considered the inclusion of social amenity space such as co-operative shops, a wash house, nurseries, schools and a theatre in common areas. This concept took shape in America with Albert Brisbane (1809- 1890). He established the North American Phalanstère in New Jersey in 1843. Everything was designed in sevice of community. The spaces, programs and design was done in such a way that would encourage spontaneous social interaction and positive engagement as the members themselves would construct spaces when they were needed (SpatialAgency, 2017). Here the notion of social cooperation and progressive design are two strategies that contribute significantly to the development of this thesis project as it shows the direct lineage between how architecture could accommodate social behaviour and how different modes of thinking could change present circumstances.

New housing options for families in the city centre are scarce. When looking for a three bedroom condominium that can sleep a couple and two children, pure luck can often be the primary determinant of success. The Toronto Growing Up housing guidelines have only recently started to recommend housing diversity in the form of a critical mass of 10% of units that contain two bedrooms and 15% of units that contain three bedroom, in hopes of supporting the delivery of family-suitable units (Nasr, Oppedisano, Zonena, Floro, & Bogdanowicz, 2017). This is a noble ask

of the free market, but the following example at The Richmond (Toronto Realty, 2018) demonstrates what happens when the city asks for good design. Because of the building configurations we have become so accustomed to, the only way to design a three bedroom unit is to have a very "generous" amount of frontage. A three bedroom unit including living and dining rooms, would mostly require a 4 bay unit or a building corner that uses glazing to advantage. The former is not very profitable for builders, which is why it is not common practice.

It has now become standard practice to provide bedrooms with no direct access to daylight. Internalized bedrooms receive light through glazed sidelights and sliding glass doors. Daylight can penetrate through living and dining rooms to supply secondary light to the third bedroom towards the unit entrance. In Wonder, units 2D-E are sold as two bedroom units, but the plans show the potential for 3 and none of the three spaces have access to natural daylighting.

Contemporary design that is based on land economics include narrow units with many washrooms, lightless studies or generous laundry facilities making use of dark spaces because there is simply not enough light penetration for anything else. Bedrooms with adjoining concrete shear walls, designs without consideration of differing scales and micro apartments are not ideal. People with the means are buying two condo units and adjoining them for an amplified amount of square footage, but this is not ideal if the standard material selection does not allow for flexibility as concrete construction and shear walls are not the most forgiving with openings.

Single parent

As of 2018 the United Nations has said that 55% of the world's population live in urban areas and that is expected to increase to 68% by 2050 (United Nations, 2018). In 2005 43% ofthe world's children were living in urban cores (Unicef, 2012). In 2016, 20% of the population of Toronto was 19 and under (Statistics Canada, 2019), and the growth rate of lone-parent families in the GTA has growth at a fast rate of 10.9% between 2011 and 2016 (Statistics Canada, 2017). This calls for continued action for cities and housing developments at all scales to find better design solutions and livable places for children to grow up in urban centres. Sustainable urbanization is key to successful development that includes the lives of everyone that will live in the city, not only a few within a given housing structure.

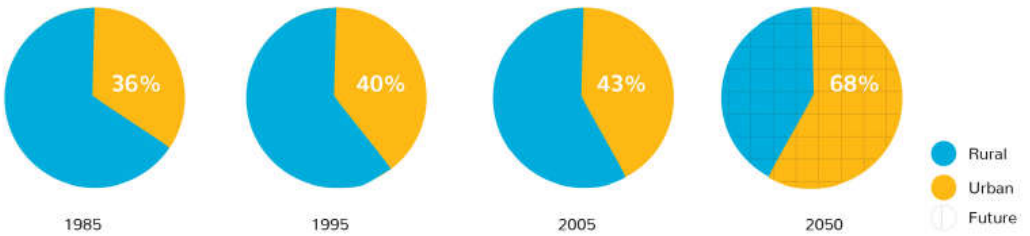


Fig 5- Almost half of the world's children live in urban areas, Unicef

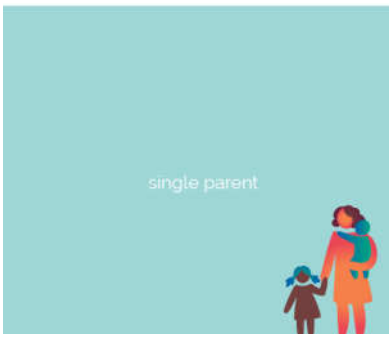
Today males still dominate the workforce but less so than in the 1960s, especially regarding the participation of wives and mothers of young children. Now with more opportunities and (relatively) reduced gender disparity, women have found themselves in more positions of power and not only are working but also are becoming the primary financial contributor (the "breadwinner") but women have retained a disproportionate share of housework, childcare and eldercare, contributing to their heightened vulnerability to financial insecurity, particularly in the event of conjugal-union dissolution (i.e., separation, divorce, or widowhood) and in old age (Fox & Moyser, 2018). These events should lead designers to consider a new architecture, one that allows for family growth and shrinkage.

" Single parents need Infant care, day care, after school care, public transportation so that older children can move about independently, closeness to stores and health services, are almost always lacking in neighbourhoods where the housing was originally designed for households with a full time wife caring for husband and children"
- (Hayden, 1986)

In 1971 a national day care bill was passed in the United States by both houses of Congress only to be vetoed by President Richard Nixon. Consequently mothers who were not lucky enough to work in places that provided subsidized day care were required to opt for commercial child care services that ate a third to half of their pay; the same is true for parents today (Hayden, 1986). In present day Toronto, and many other cities, finding appropriate, affordable and timely child care solutions is difficult. With a myriad of reasons for delayed childbearing age in Canada there is also a serious difficulty for parents, usually the mother, to bring their children to a daycare near them. Distance is supplemented by a rising day care cost that we see in the image below. On average full-time child care costs over $800 dollars per month for almost 40% of parents in Canada excluding Quebec. Data shows that this is a factor that young people are considering when thinking about starting a family, and it is one reason why people are waiting longer and longer. However this also contributes to challenging the notion of domestic spatial relations. Is the traditional condominium or single suburban family home sufficient to meet the needs of this household?

"Being a single mom is exhausting. When you parent alone, you are the breadwinner, the bread maker, the police, the comforter, taxi driver. Not to mention all the things that go along with owning a home and an automobile."
- Heather Funk (Andersen, 2012)

When single parenting is not a choice the inability to depend on others to help when they are in need becomes particularly taxing (Andersen, 2012).



Single parents, if they are working, need to spend more time away from children, and consequently more money to raise the children. An old African proverb says that it takes a village to raise a child, and given the amount of people that directly or indirectly have the ability to reach the lives of young ones this is absolutely true. Who cooks dinner? Who plays games with your child? Is it the parent, the cousin, the neighbour? And how often? Do you always have time to do homework with your child, or do they have a tutor? Who is this person? And when the child ages, the

question then becomes in relation to who the child has now decided they want to be a part of their present lives, so how does that factor manipulate the spatial requirements? Single parents in urban areas are finding it difficult to raise their children alone, not only due to the lack of social and communal support but also with the financial pressures of making ends meet. **This thesis project aims to provide a structure that could aid those in need though society and design so that the homeowner as a person has their needs met on a deeper level.**

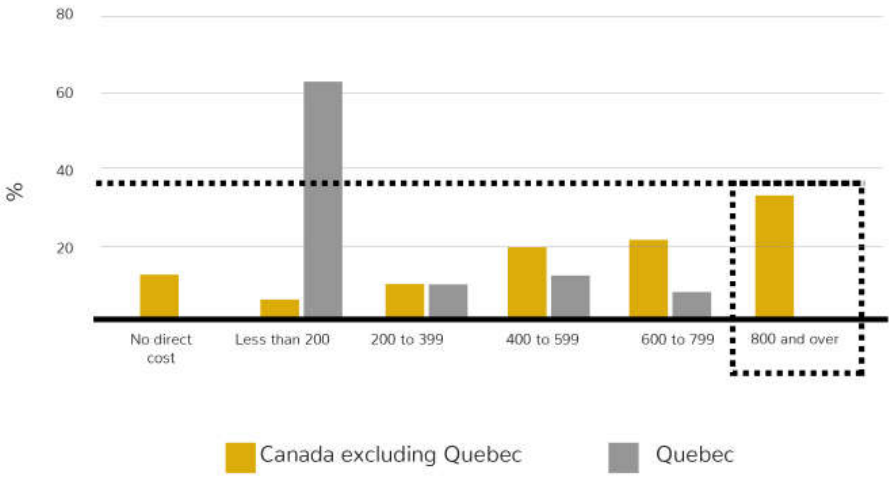


Fig 6 - Percentage of parents using full-time care

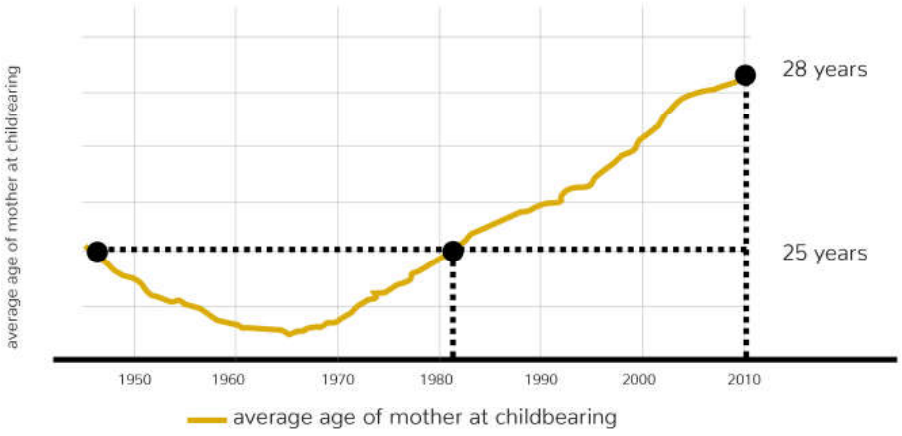


Fig 7- Average age of mother at childbearing

The Elderly

Two demographic shifts are affecting current design approaches. The first is urbanization and the second is the effect of a rapidly aging population (Statistics Canada, 2016, Ot. 7). If we are to serve the needs of the largest number of people, we will need to make a shift towards age friendly design. As people age, requirements and tastes change, tolerance levels change, and things that were once accepted can be completely infuriating. One of the main things designers need to ask themselves is how to design for the elderly. Do they need the same level of privacy as everyone else? Are they sensitive to sound; do they require brighter lit rooms to see clearly? These challenges are not discussed as they should be other than in the design of nursing homes and long-term care facilities, but the home should be just as adaptable to these situations.

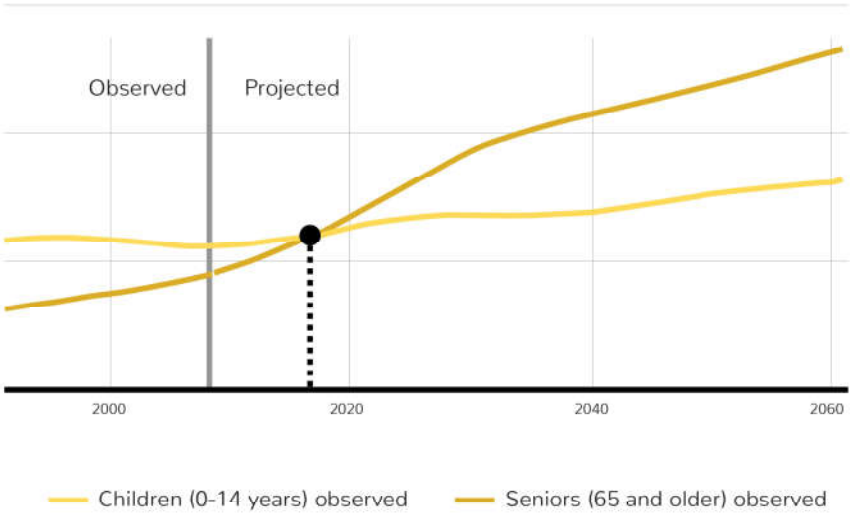
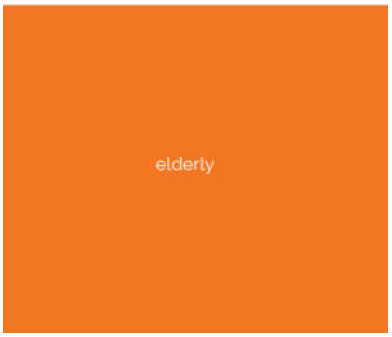


Fig 8 -Population projections, children and seniors

Consideration for physical, psychological and age friendly design factors will prove key in designing spaces for everyone. The elderly often face a higher level of physical challenges that will set a high standard that middle aged adults with or without children will reap benefits from.



Aging takes a toll on the health and integrity of a lot of the functions and abilities needed to carry out our day to day lives, and poor design should never

inhibit people with inabilities to become fully integrated or to feel as though they belong to a community because of exclusion. This exclusion only adds to further deterioration, sadness, and isolation that is too common in those of the aging population (George, 2017). Through consideration of the following problems faced by aged individuals listed below, the project/design portion of this thesis will aim to improve the living opportunities through the creation of a suitable housing alternative that provides choice as well as a more convivial and pleasant living experience around others.

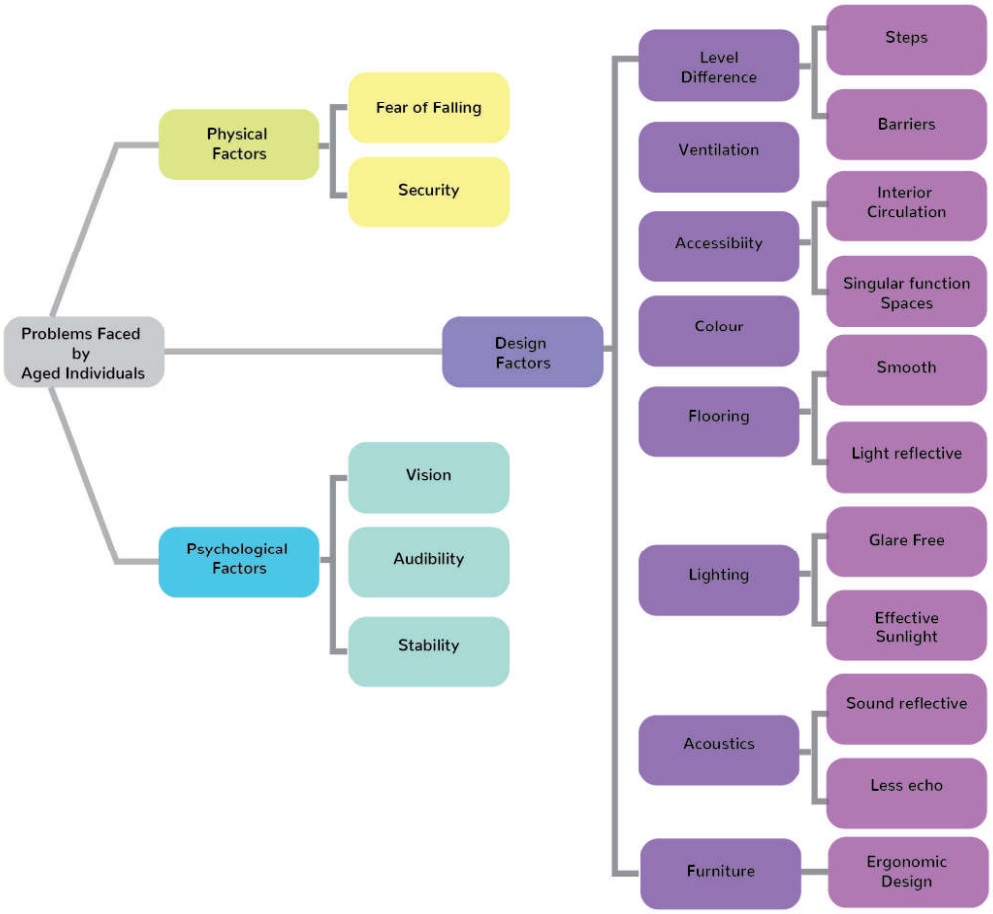


Fig 9 - Elderly needs (George, 2017)

In addition to this required ability to adapt space, the understanding of the limits of fluctuation must be explored. This adaptability is not only for interior spatial requirements but also to better understand that households may want different levels of privacy, may want to join units together, and because households are becoming smaller in size (Statistics

Canada, 2018, May 17), the ability to grow and shrink unit sizes will also be beneficial to unit owners, as some become empty nesters and others encounter situations that change the course of their lives.

Seniors have spent their working lives caring for others, working hard, and paying bills. At an older age, seniors are not looking to physically care for others nor are they looking to clean a large home and spend time on household chores. Rather, independent seniors are looking for smaller spaces, something that can welcome their friends, and a quaint hospitable place to call home (Hayden, 1986).

The elderly who will make up the largest percentage of the Canadian population have much power over the housing market. They have often possessed what families require today, large spaces that allow for individuality and control. This is found today in single family homes, but this document argues that this is not the best solution. Regardless, seniors are hesitant to move homes because they are not willing to invest in a new property, and would rather live in a home that is too large than leave the home and community they have come to love (Hayden, 1986). The challenge between the pursuit yet inability to own what is desired, has resulted in people coming together to find new solutions to the housing crisis (Wood, 2017).

In conclusion, diversity is significant in big cities but the issue is that there are two types of housing that constitute the majority of the market. The first is single family detached housing that is too expensive for new homeowners to purchase. These homes are also too large for young couples and seniors, and this model does not use land very efficiently. The other type of housing is the condominium which is too rigid in structure to expand over time with the size of the family or cohabitors who have joined to secure urban home ownership. Condominiums also greatly lack in social opportunities that allow residents deeper connections. Accommodation of singles, singles in families, couples, and the elderly will produce a stronger relation between design and the neighbourhood. All groups would be able to help each other create a strong base of interdependence not otherwise found. This highlights the need for adaptable living forms to support successfully diverse community urban living through flexibility, variety and complexity.

THE BUILT SOLUTION: HOW TO BUILD FOR SOCIAL DIVERSITY

Needs: According to Maslow and Max-Neef

Life is a spectacular series of events through a journey that is independent and solely one's own. What makes this journey so purposeful is the ability to accomplish the things one has set out to accomplish, based on their skills, natural abilities, and/or desires. Eleanor Roosevelt said that "The purpose of life is to live it, to taste experience to the utmost, to reach out eagerly and without fear for newer and richer experience" (Fahkry, 2017). One take is by Scott Adams who says that the following order is how humans operate: first on ourselves and our finances, then our family and friends, followed by country and society. He says that we cannot go from one level to the next without the previous rung (Adams, 2013).

1. Work on/for you and financial situation
2. Work on/for your family and friends
3. Work on/for your country and society

Taking this a step further, American psychologist Abraham Maslow developed a diagram outlining human needs organized in 5-8 categories (Maslow, 1943). This diagram is read from the bottom up, requiring humans to address deficiency needs (bottom solid colours) before the ability to achieve self-actualization (McLeod, 2018).

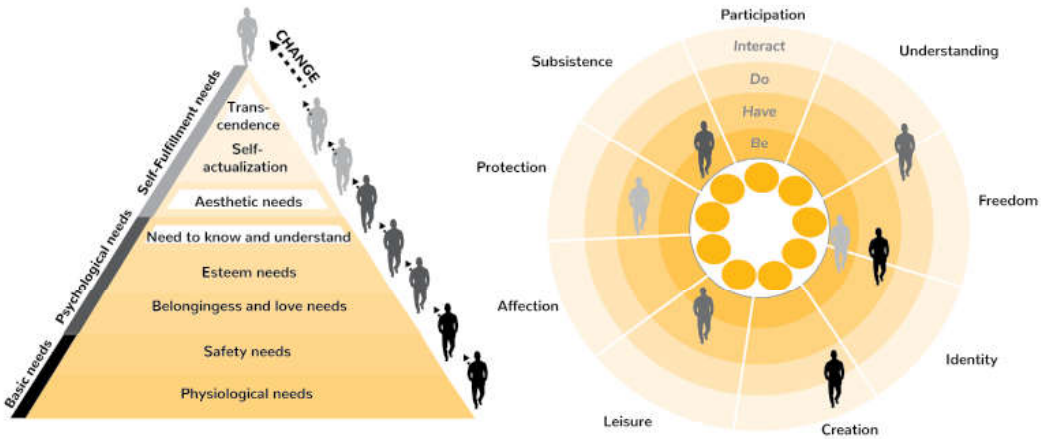


Fig 10 - Maslow's Hierarchy of needs versus Manfred Max-Neef

The first row includes physiological needs such as food, clothes and sleep. Logically, it is very hard to focus on living, working and paying bills if hunger is a matter of concern. The

next rung is safety needs. This is about peace of mind knowing that there is no immediate threat to the acquired physiological needs, or to oneself, as these are the basic fundamental requirements of living. Is there financial security and is there any immediate threat against one's life? If so on the former and not on the latter, there is a progression upwards to find the next level of concern/need (Maslow, 1943).

Next are the psychological needs. These are the needs that bring the second level of happiness to one's life: the feeling of belonging and love. This level includes affiliation whether that be in one's family, friendships with people of similar interests or new friends of friends. It allows for one to be respected by others, allows individuals to become a part of a group, to share interests, and consequently to suppress negative feelings of isolation and anxiety (Maslow, 1943).

These first two rungs are the most important for this thesis. They focus on providing the most basics of physical needs for life sustenance, and complement those with psychological satisfaction. In doing so, there can be a great opportunity to design for unexpected interactions and owner contentment. It is a lot to expect of architecture, but it is clear through design precedents that will be examined in chapter 2 that there is a correlation between the built environment and well-being. This correlation must be acknowledged before we design simply for superficial financial reasons.

Maslow's pyramid illustrates principles to consider if we are to build for change over time. There is an inherent element of change, as seen in the diagram but his assumption that this change is linear is incorrect. Change in the built environment and in the person (in this case the homeowner), is not accounted for in current housing models.

Taking a step beyond Maslow's pyramid, Chilean economist Manfred Max-Neef, in contrast, developed a model of fundamental human needs in his *Human Scale Development: Conception, Application and Further Reflections*, a critique of many of life's poverties which we usually consider only from a financial (income) point of view. Unlike Maslow's hierarchical theory that speaks to fulfilling needs, Max-Neef argues that due to the discrepancies between haves and have nots, there are, in fact, no linear and restricted relations between needs as seen in Maslow's hierarchy, an approach that focuses on living and its unpredictable complexity. This is consistent with what we see in real life. Max-Neef believes that human needs can be classified within many criteria and in two categories: existential and axiological. The axiological categories are: Subsistence, Protection, Affection, Understanding, Participation, Creation, Leisure, Identity and Freedom, and based on this classification, unlike the assumption of Maslow's Physiological needs being fulfilled to reach safety, food and shelter is not a given but merely part of the required needs that work towards satisfying the need for subsistence. Max-Neef calls these items satisfiers, and actions can meet many needs at once highlighting the undeniable dichotomous relationship between deprivation and potential of these needs. The existential categories or the actualization of needs are of Being (qualities), Having (things not objects, i.e., principles, laws, etc.), Doing (actions), and Interacting (setting) (Max-Neef, 1991).

Max-Neef is interested in the quality of life as dependent on the satisfaction of these fundamental human needs. Where the most needs are satisfied is where one will find the best solution.

Flexibility & participation - Cedric Price + John Habraken

Cedric Price and John Habraken are two architects who have discussed flexibility and participation. Cedric Price, an English architect, focused his work on non-planning. This element of non-planning would take design control from the hands of architects and redistribute this power to the individuals who occupied the space. Price, Reyner Banham, Paul Barker, and Peter Hall published an article in *New Society* magazine in 1969 about this very concept with the hope of creating a non-architecture that allows people to control their environment (Hughes, 2000). This system was an open space system that was supported by a frame that was flexible in itself and allowed for change. Architecture was able to adjust in time and space. The steel system was formed by mobile prefabricated walls, platforms, floors, stairs, and ceiling modules, all assembled by cranes (Murrell, 2018). Price's 1961 Fun Palace illustrated the ease of prefabricated modular construction and its variability over time (Glynn, 2005).

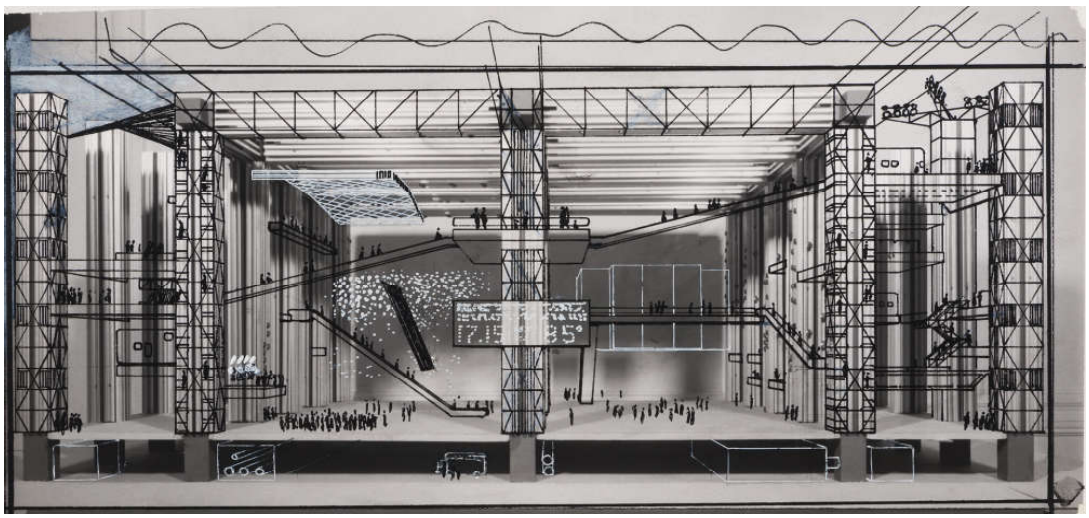


Fig 11- Interior perspective of the Fun Palace, precursor to the Pompidou Centre, 1964. (Glynn, 2005)

Dutch architect N. John Habraken studied at the Delft Technical University in the Netherlands. Interested in the development of innovative solutions to adaptable housing design and construction, he wrote a book in 1962 titled *Supports: An Alternative to Mass Housing* in which he suggests the separation of 'support'(or base building) from 'infill' (or interior fit-out) in residential construction and design, otherwise known as loose fit (Nascimento, 2012).

Against the notion of mass housing Habraken believed that there was a need for more personalization in design, that people needed the opportunity to transform the space they lived in with ease. Something like this is not done very well with the use of commonly used material, and developers are said to be fully aware of this. Developers have been said to admit the inflexibility of housing as it results in the occupant having only one option: to move, which is in the best interest of the developer (Schneider & Till, 2005). People move to find something more suitable to their needs, which means more individual movement equating to reasons to build more which means more developer profits.

According to Tatjana Schneider and Jeremy Till, flexible housing is defined as a housing structure that is designed for choice at the design stage, both in terms of social use, and construction. Its second definition is a housing structure that is designed to accommodate change over its lifetime stating that addressing flexibility in housing makes for a more sustainable (economically and environmentally) structure that can be used until its potential end life (Schneider & Till, 2005).

Flexibility for Schneider & Till is addressed in four main ways:

1. Financially; arguing that in the long run flexible housing is more economical and sustainably advantageous;
2. Participation; stating that flexible housing encourages user involvement in the design process;
3. Use: the way that flexible housing adapts to different uses over time;
4. Technology: explaining that the logic of construction and provision of services allows for a higher degree of flexible configuration.

This can otherwise be understood to mean that to construct sustainable housing, there must be a supporting spatial and social flexibility. One suggests that the layout of the building allows for the change in use over time through careful design planning, and consequently that said flexible structure supports individuals on their journey through life.

John Habraken's *The Structure of the Ordinary: Form and Control in the Built Environment*, illustrates the physical complexity of the built environment, stating that it inherently has a direct effect on individuals and thus defines, controls or limits our extent of control over the environment (Nascimento, 2012). Habraken lists 3 orders of operating within the built environment, supplemented by ways in which they can be achieved and these are supplemented by Robert Schmidt III and Simon Austin in their book *Adaptable Architecture* to create a master list of important adaptability types. They are as follows:

Fig 12 - Habraken's Orders

Adaptability Types

1

"Physical Order" - all physical properties governed by gravity and the properties of materials. The following entail the flexibility principles that may be used within this order.

a. Modularity (reversible, movable stuff functional separation)
b. Design in time (extra components, multifunctional composition, configurable stuff)- Dynamic construction methodologies that enable flexibility in design over time - some units would be alterable from others because the infill system would be separate from the support (structural system)
c. Long life (durability, good craftsmanship)
d. Simplicity and legibility (standardised components, standardised composition locations, off-site construction simple construction method)

2

"Territorial Order " - the comprehensive control of space. This order is not about the physical items but more so the effect that space have over people. The following entail the flexibility principles that may be used within this order.

a. Loose fit (open space, support space oversize space, typology pattern, joinable/ divisible space, modular coordination)
b. Spatial planning (connect buildings, standard room sizes spatial variety, spatial ambiguity, spatial zones and proximity, simple plan, simple form, standard grid multiple ventilation strategies, shallow plan depth)
c. Passive techniques (Building orientation , Good daylighting)
d. Unfinished design (Space to grow into at different phases of time, user customization, multifunctional spaces, use differentiation)
e. Maximise building use (mixed demographics, multiple/ mixed tenure shared ownership, isolatable, multiple access points)
f. Increase interactivity (physical linkage, visual linkage(views))

3

"Order of Understanding" - describing the way in which we attribute the preferences of style, type, patterns and systems we choose to implement (Nascimento, 2012)

a. Character
1. Aesthetics (attitude and character, spatial quality building image quirkiness)
(Schmidt, 2016)

This master list shows how design is not strictly based on the physical or the spatial but how it is directly in relation to the users/ inhabitants through their active participation in making design decisions concerning their space over time. This understanding that there are constant transformations to the built environmental system is what creates a strong notion of flexibility and layering of variety and complexity. Within a given system, users can manipulate their space as they deem fit in an economically, ecologically and socially appropriate point of view which is a rarity in housing design.

Robert Kronenburg, an advocate for flexible and adaptive architecture supports this idea by suggesting the reasons why we should design flexible architecture:

1. Buildings remain in use longer
2. Fit their purpose better
3. Accommodate user' experience and intervention
4. Take better advantage of technical innovation
5. Economically and ecologically more viable
6. Remain relevant to cultural and societal needs (Kronenburg, 2011)

Kronenburg defines flexible architecture as "fluid architecture that becomes complete once people inhabit it and use it." (Kronenburg, 2011). This flexibility aids in supporting families and people of different sizes, ages, incomes, and the inherent building structure should allow for different sized and scaled unit options just as we see typologically in smaller builds such as townhouses, duplexes, or triplexes and single family homes. There are layers to building that provide their own level of adaptability and when designing a system for change, the understanding that their hierarchical system can be designed to accommodate static dynamism, where families grow and change along with their needs, as does the building structure, yet the home does not.

Introduction to Drivers

Habraken and Hayden complement each other in the search for design understanding. Habraken lists an order to the built environment saying that it is defined by orders of physical, territorial and understanding nature. Habraken's approach is a top down approach while Hayden on the other hand views the issue from the bottom up. She looks at precedents and theories to define how the woman's relation to home has been altered through example. Hayden's approach greatly informs this research in relation to the needs of specific groups (singles, families, seniors etc).

The resulting question from this investigation is, then, what constitutes a successful design? This thesis proposes that a successful model, based on an understanding acquired through research, is design that accommodates easy, and affordable adaptability. It is a design that provides essential social opportunities. Habraken, Hayden, and Max-Neef all have time tested theories that speak to the power of such design and its relevance in response to people and their needs. If the need is to create adaptable living forms to support diverse community then the creation of a flexible housing system that promotes opportunities for human-scaled development which are all implicitly or explicitly highlighted in these three main theories require discussion. Quotes one and two advocate for a human-scaled development that will grant the resident the power (participation and interpretation) over their own space, their residential domain. This power cannot be given, however, without designing for it. In the same way, this thesis layers these three key ideas to create an architecture that supports diverse interpretations of space and spontaneous interaction better supporting human-scaled development.

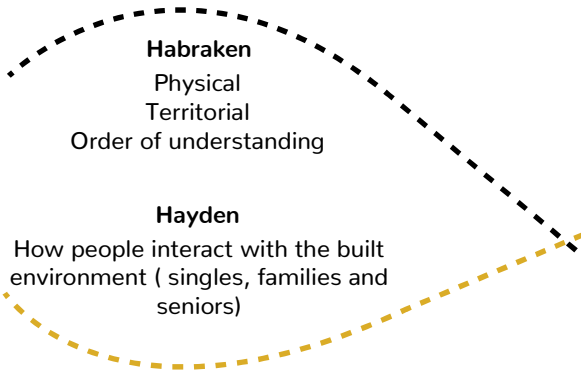


Fig 13- Habraken vs Hayden's theoretical approach

1. "If people are to be the main actors in Human Scale Development both the diversity as well as the autonomy of the spaces in which they act must be respected... It is necessary to analyze to what extent the environment represses, tolerates or stimulates opportunities. How accessible, creative or flexible is that environment? The most important question is how far people are able to influence the structures that affect their opportunities."

2. " Development geared to the satisfaction of fundamental human needs cannot, by definition, be structured from the top downwards"

- Max-Neef , Human Scale Development

The approach of this project is to create successful adaptive housing that operates within the five identified scales using a flexible material to achieve collective well-being and to achieved desired outcomes expressed in Max-Neef's theory.

Subsistence
Protection
Affection
Understanding
Participation
Leisure
Creation
Identity
Freedom

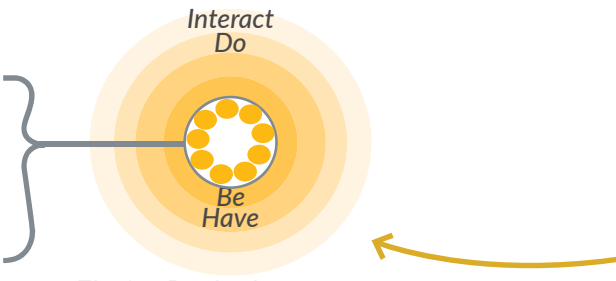


Fig 14- Desired outcomes to address + Layering

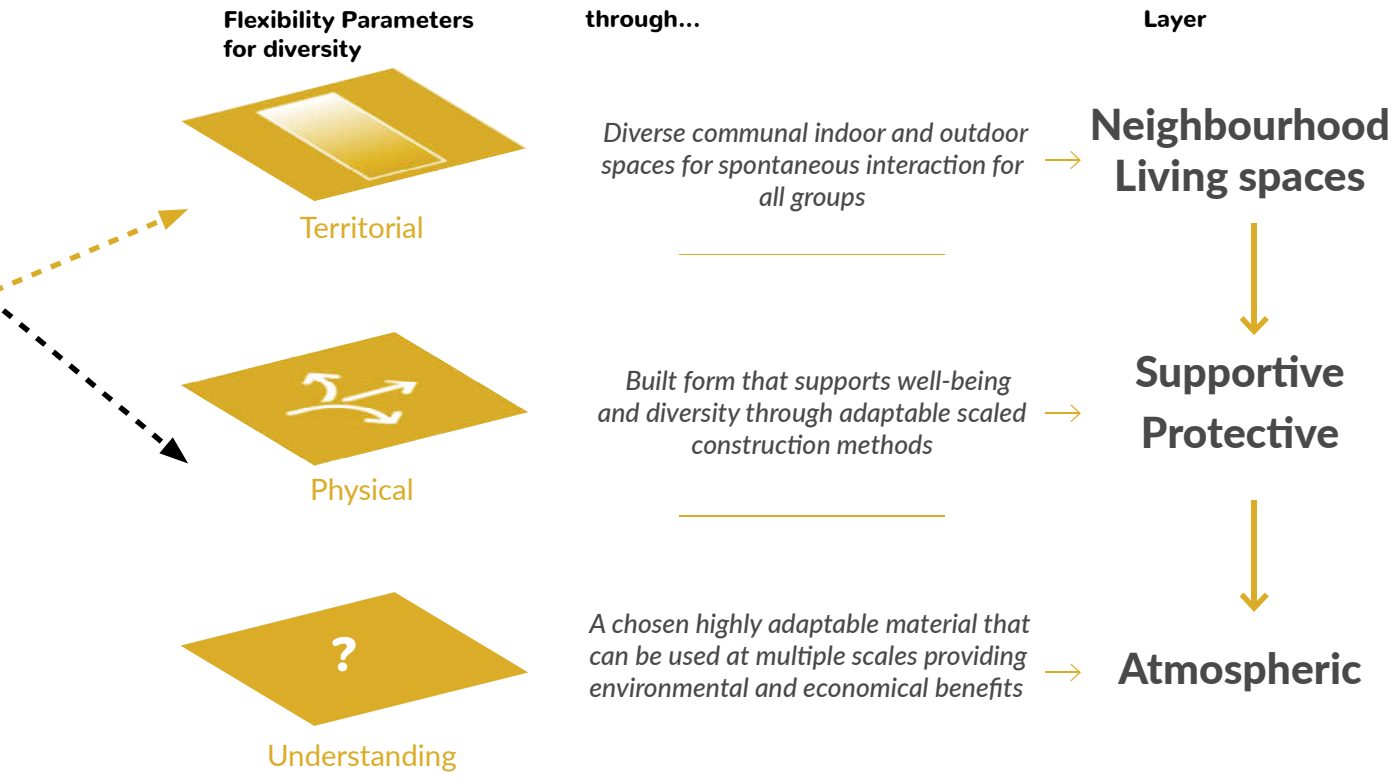


Fig 15 - Flexibility Parameters + Layering

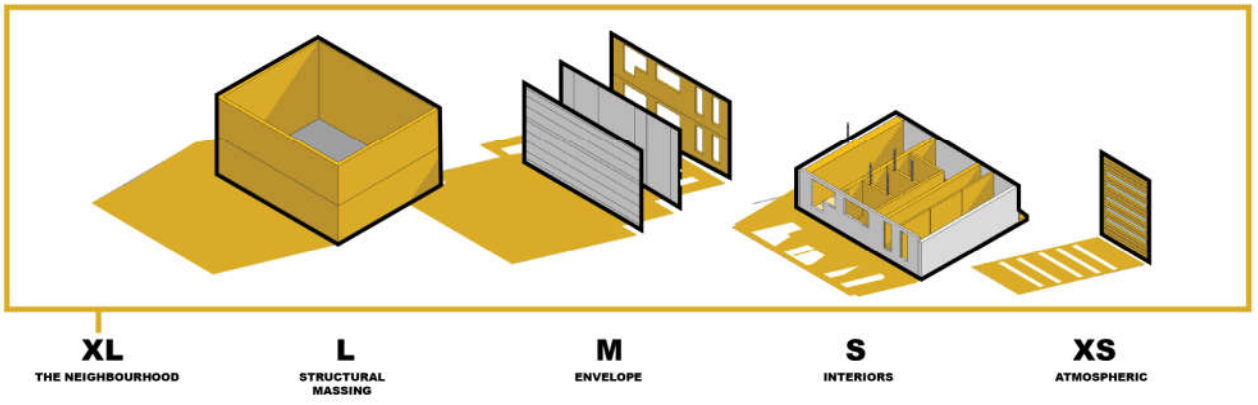


Fig 16 - Methodology: Scale + Layering

Chapter 1.2

ASSUMED OWNERSHIP FOR THE VISION

HOUSING AS A RIGHT

Ownership models - community in support of involvement and affordability

> *The various forms of tenure suited to the narrow-front rowhouse community include freehold, co-ownership, and condominium. In freehold tenure where individual residents each own their unit and lot, and in co-ownership tenure where a group of residents enters into an agreement to share ownership of their units and lots, the public space accessed by all residents is owned by the city. In condominium tenure the residents own the structure of their respective units while the lots and common open spaces are owned in unison*
> *-Avi Friedman (Friedman, 2001)*

If potential owners are unable to afford single-family homes, they consider other options, but tenure is also a significant factor. Tenure outlines how one owns their home/unit/space and the terms in doing so. Freehold tenure, cohousing, and condominiums have their advantages and disadvantages; however, cooperatives may be a good middle ground, providing individuality in home ownership in a potentially affordable way that is also fundamentally driven on the notion of collective participation. Achieving a resilient and communal residential community like those spoken of by Habraken, Max-Neef and Hayden in their respective works discussed in this chapter can be through the selection of, though not limited to, this form of home ownership model that promotes a tight-knit community that supports each other when needed.

Cooperatives

Developed in Europe as an alternative to the rental model (Cameron, Wood, & Thorogood, 2012), the cooperative apartment house was pioneered by Hubert in order to create an alternative method of financing as well as to ensure their sound construction, which unfortunately was an issue before building codes were heavily enforced. A cooperative is a corporation that owns the entire building and its members receive stock certificates in proportion to their down payment, as well as participate in governance of the cooperative. This certificate entitled them to a lease an apartment in perpetuity. Co-ops offer quality, affordability, community-oriented housing but are not very sought after because of their name and associated confusion with the model (Cole, 2008).

Co-operative Principles

* Voluntary and open membership
* Democratic and member control
* Member economic participation
* Autonomy and independence
* Education , training, and information
* Cooperation among cooperatives: Concern for the community (Cole, 2008)

A cooperative housing model was developed to encourage long-term affordability by restricting the appreciation of share value when membership shares are sold. Known as "limited equity cooperatives", these cooperatives were usually built with some private or public subsidy and required a low initial membership fee (Wisconsin Center for Cooperatives, 2018).

Some may perceive the decision-making process as a downside of cooperatives versus condominiums; however, it is the collective decision-making process that acts as a way to lower maintenance cost associated with expensive board of directors and budgeting. Who better to manage your neighbourhood than yourself and like-minded people? Each unit is entitled to a vote, regardless of size. Bylaws and policies govern issues of membership, regarding shares transferral and rules, which are all consensual (Wisconsin Center for Cooperatives, 2018).

Cooperatives also very often serve diverse communities (Canadian Co-operative Association, 2015). They house welcoming environments for new Canadians such as:

* Immigrants (new Canadians) : 20% of housing co-op units in Canada occupied by immigrants;
* Families: 62% of housing co-op units are occupied by parents with children; and
* Mixed income communities – about 30% to 50% of all co-op households in Canada receive direct assistance with their rent.

"A strong sense of community, participation, identity, and conviviality is important to support a sense of safety and comfort within a neighbourhood."
- Peter Calthorpe (Calthorpe, 1995)

In using the cooperative model as the basis for the thesis project, the assumption is that the project will provide a "controlled" urban densification as a means for affordable housing and social inclusivity supplementing the overpriced urban housing market. Housing should be viewed as not only a method of wealth accumulation but also as a right, and by merging the two there is great opportunity for the creation of flexible, adaptable, inclusive, secure, stable, and affordable community-oriented living.

End of Chapter 1

CHAPTER
02

Chapter 2

AN ORDERED COMPILATION OF PRECEDENTS

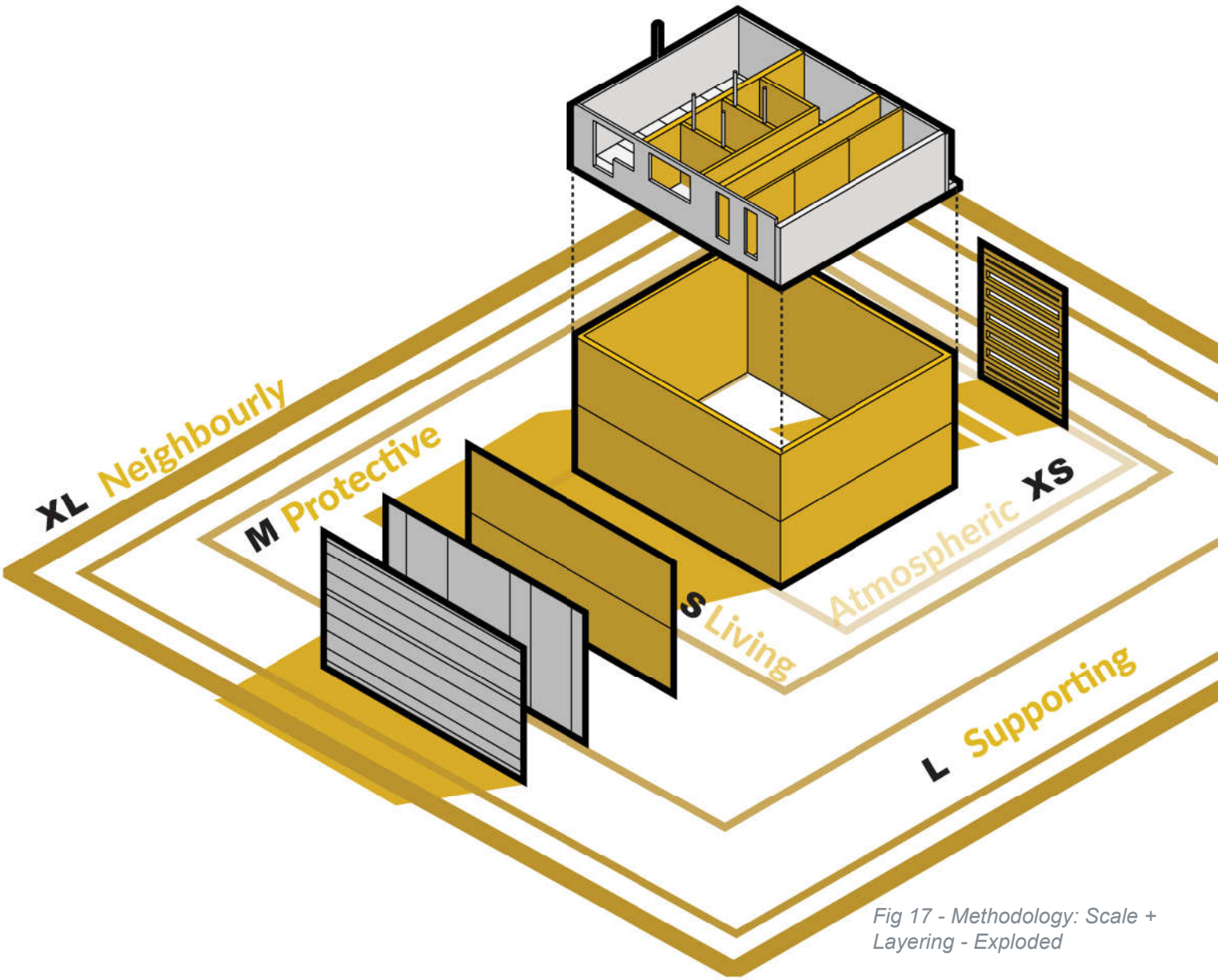


Fig 17 - Methodology: Scale + Layering - Exploded

ORDERED PRECEDENTS

This chapter is organized according to its three flexibility parameters, identified in Chapter 1 (see Figure 15) and organized in categories derived from Habraken's orders (Physical, territorial, and understanding). The aim is to analyse visited and researched projects from around the world based on a set of criteria derived from Hayden and Habraken to create a system that may collectively contribute to an adaptable residential building. This will support various generations and values as well as people from different walks of life.

Each of the three parameters contains within it the driver of flexibility, which is a central tenet of this thesis. Other drivers operate within a more clearly defined order category. The thesis, and the case studies, are understood at a variety of scales: extra large, large, medium, small and extra small, which are explained below.

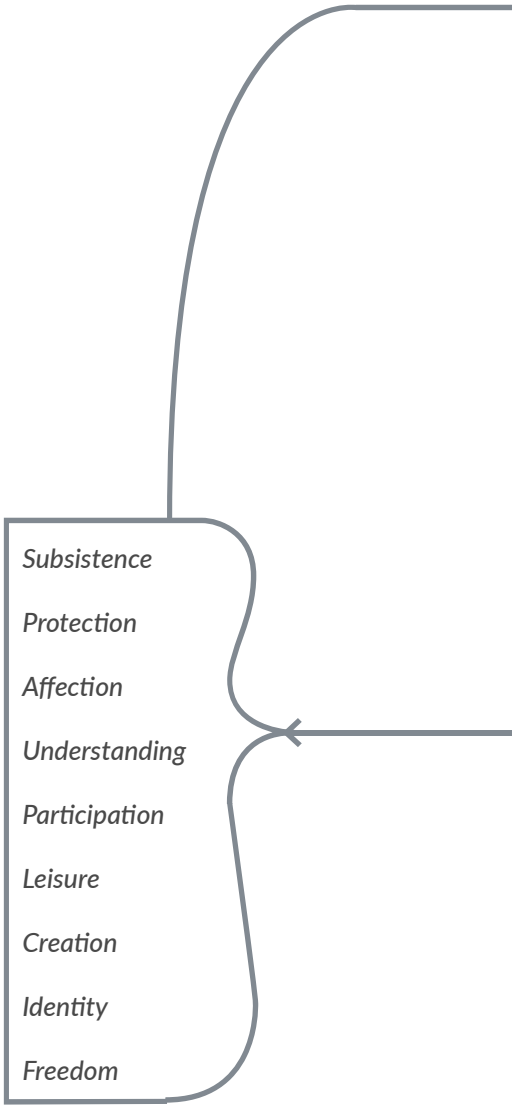
The extra large scale addresses context, which cannot be controlled or designed through a single architectural act, but can be accommodated. The extra large scale of the neighbourhood can be responded to but it exists as a precondition of design.

The large scale refers to the physical structure that holds the building together. It is the macro level logic behind how spaces are built to create adaptable spaces that suit the needs of many over time.

The medium scale addresses the envelope of the building, acting as the link between the large scale and the small that allows for human manipulation. It is the shell that conceals the smaller spatial entities.

The small scale is represented by the items within the unit. The hierarchical construction allows for control over the manipulation of interior space, whether it is to divide or extend space. This micro level scale is achieved through careful placement of interior walls and services in the unit configurations.

The extra small is the ability to materially control space and atmospheric environments from the textural and the sensual, to lighting and shading opportunities through architecture. The aim of this scale is to provide atmospheric variability when needed. Some people are sensitive to light



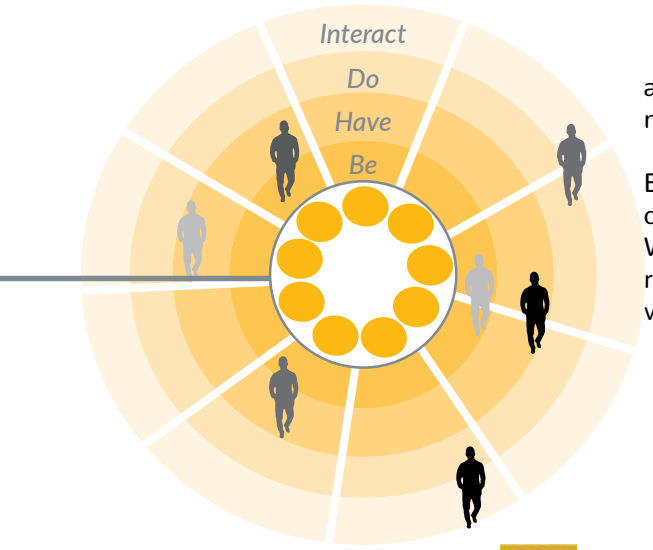


Fig 18 - Max-Neef Diagram

and an architectural feature addressing this would create a more comfortable place of habitation.

Buildings operate across many scales. Components of different scales work together to form the built environment. When communities are designed cohesively at all scales residents are given agency over their residential desires, which will make for a more comfortable place to live.

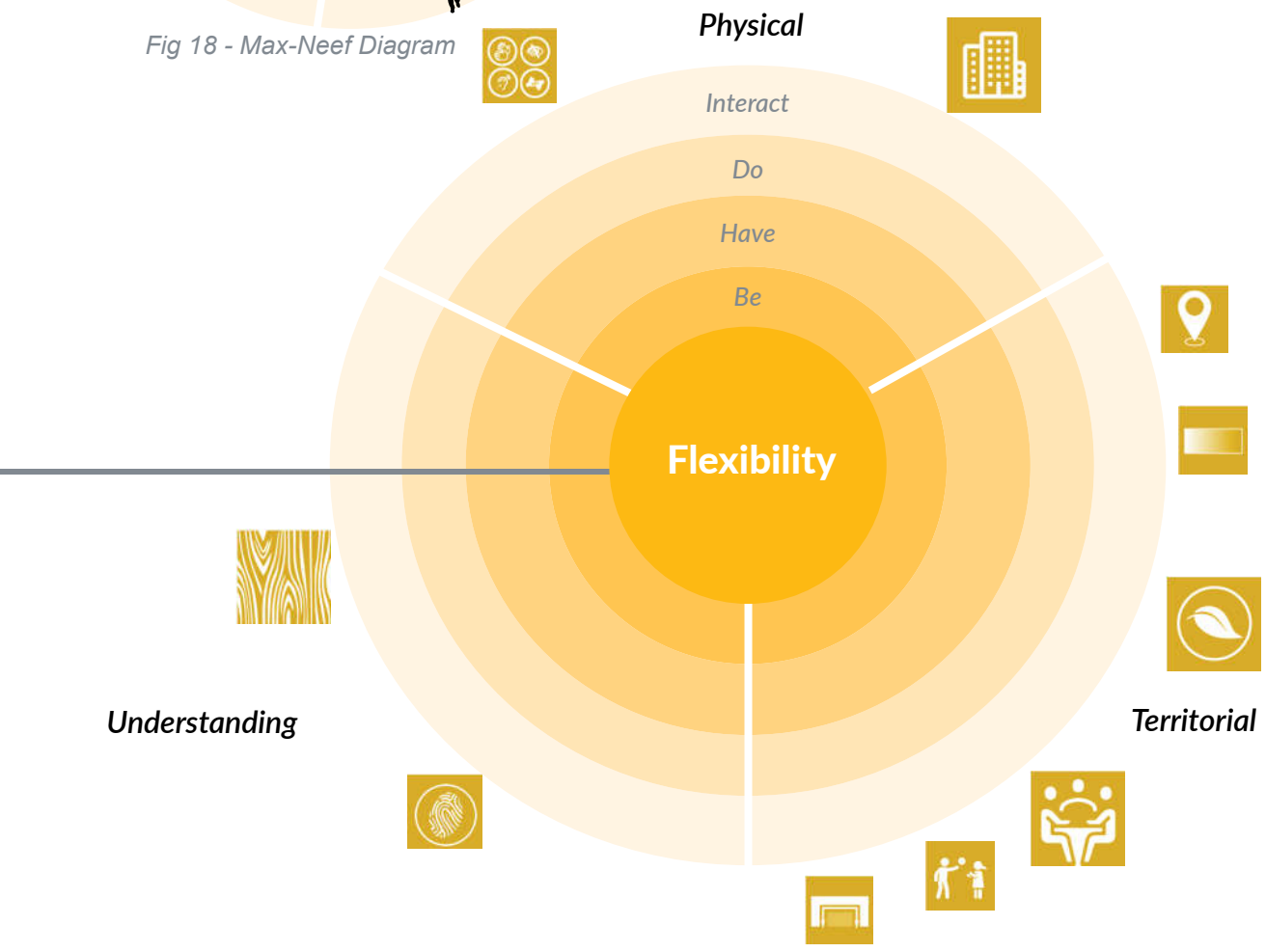


Fig 19 - Flexibility Diagram

Flexibility Parameter	Drivers and considerations	
Physical	**Flexibility and Building**	
	Building	
	Accessibility	
Territorial	**Flexibility and Community Diversity**	
	Indoor Communal Space	
	Outdoor Communal Space	
	Location	
	Child Space	
	Central Communal Circulation	
	Spatial Gradient	
Understanding	**Flexibility and Materiality**	
	Materiality	
	Community Identity Indicator	

Fig 20 - Parameters and Drivers Explained

THE PHYSICAL

The physical represents the items and materials that can be touched. This chapter will illustrate through precedents how good physical form can be used to create successful community and adaptable places for future use.

Flexibility

Design Flexibilities at L scale: Structure

Building for structural flexibility can be especially important and achievable through the following approaches:

* Modularity (reversible, movable functional separation)
* Design over time (extra components, multifunctional composition, configurable stuff) Dynamic construction methodologies that enable flexibility in design over time - some units would be alterable because the infill system would be separate from the support (structural system)
* Long life (durability, good craftsmanship)
* Simplicity and legibility (standardised components, standardised composition locations, off-site construction simple construction method).

Incremental growth in housing modular and dynamic construction

Massing to connect multiple storeys for maximum flexibility is a very important concept. It changes a building and a personal space from one fixed space to something more similar to the desired two storey detached single family homes. In order to support these theories of expansion and flexibility the following ideas provide ways in which flexibility at the large structural scale has been approached over time through design. There are developments where design has adapted to the needs of residents by accommodating alterations to buildings. This level of exterior building flexibility can maintain the existing quality of a neighbourhood while supporting new residents and densifying responsibly. This however may require an overall master plan to take this approach on a broader scale.

The initial building must provide a supporting, (rather than a constraining) framework in order to avoid any negative effects of self-construction on the urban environment over time, but also to facilitate the expansion process."
- Alejandro Aravena, ELEMENTAL Founder (arcspace, 2016)

Designing within the grid

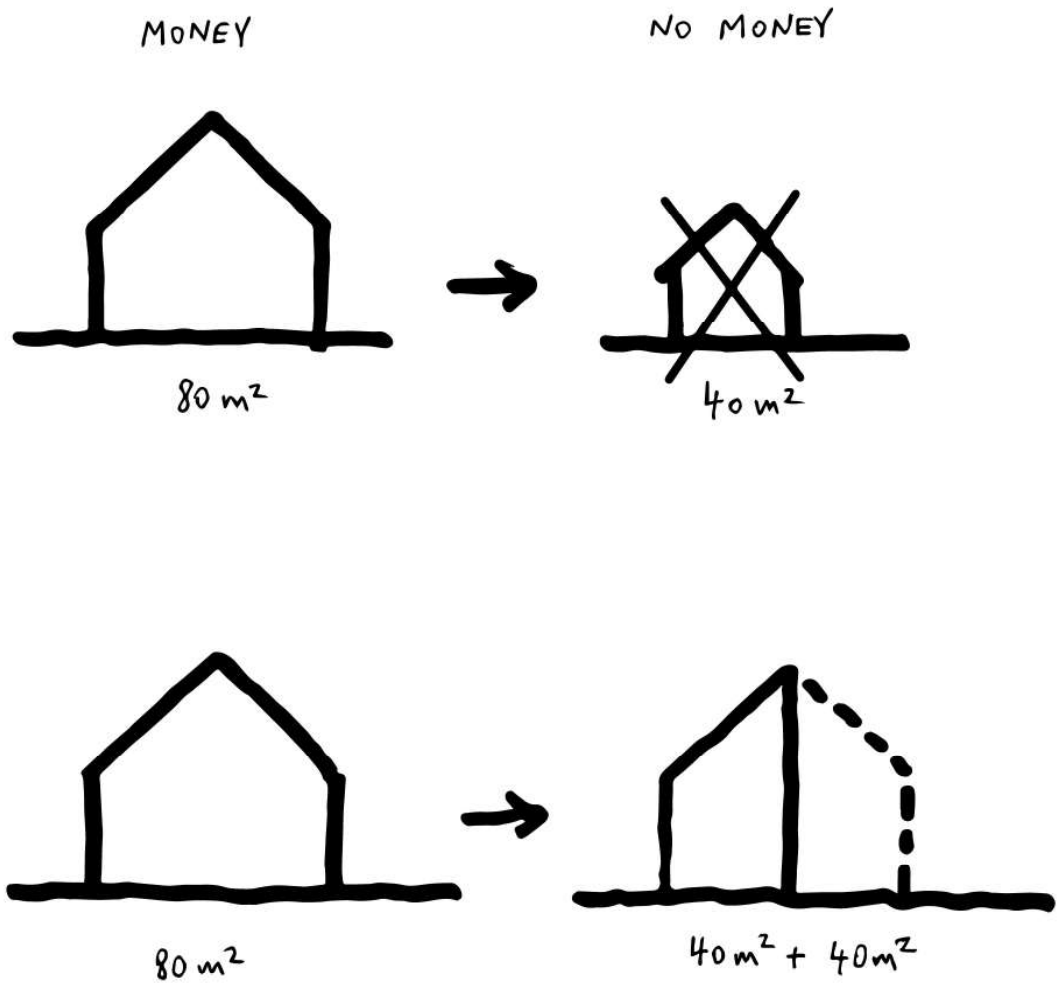


Fig 21 - Half a home concept (Tory, 2016)

Alejandro Aravena realized that the people of Iquique, Chile did not have the financial means to securely build their own houses all at once, but they also had a very specific way they envisioned their future home to be. Aravena's firm, Elemental, decided the solution would be to build on a site near town and address the monetary restrictions by building half of a home. Residents would build the remaining half when additional resources became available, as the construction facilitated future expansion. This initial design included the bathroom, kitchen, living and dining (Elemental, Aravena, & Iacobelli, 2012, pg 112). An internal timber stair connects the second level to the third should the owner choose to build upwards in time.

HOUSING IN QUINTA MONROY

ARCHITECT/ELEMENTAL
LOCATION/ QUINTA MONROY. CHILE
PROJECT YEAR/ 2003

Fig 22 - Elemental - Quinta Monroy

Fig 23 - Structural models

Designing within the grid is also used in Elemental's Quinta Monroy project where incremental growth was accomplished through modularity and planning for expansion. Elemental used a 9m x 9m lot with an initial building volume of 6m x 6m in plan with 2.5m high ceilings. Developers use the strategy of narrow and deep lots to maximize land use efficiency, but Aravena was not able to achieve regular building lots with a rectangular form, so he opted for square lots (Elemental, Aravena, & Iacobelli, 2012).

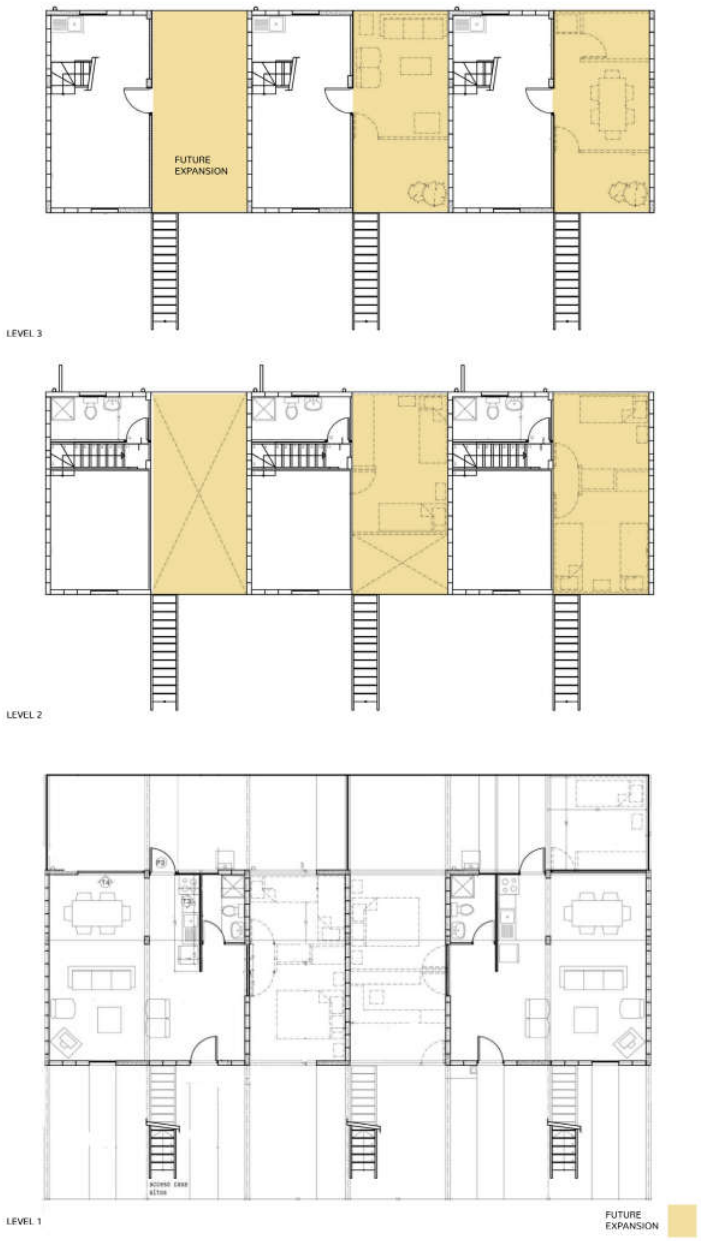


Fig 24 - Quinta Monroy floor plans

This approach is very relevant to this design project as in its incremental approach there is a modular sensibility that over time the user of each structure can utilize a limited and determined amount of resources towards the growth of their home within the framework provided to create a space that works best for them. Elemental found a site and then found a module size that enabled modularity. From there they were able to find an adaptable rhythm that provided the bones (base structure) and allowed for future expansion. This will be a useful tool in creating structural hierarchy and adaptability in the design project.

SVARTLAMOEN HOUSING

ARCHITECT/ BRENDELAND & KRISTOFFERSEN ARKITEKTER
LOCATION/ TRONDHEIM, NORWAY
PROJECT YEAR/ 2005

Fig 25 - Svartlamoen housing

Completed in 2005, Svartlamoen housing in Trondheim, Norway by Brendeland & Kristoffersen arkitekter is a 5 storey community housing project that utilizes a similar construction robustness to Quinta Monroy. In this project however, it is accomplished through CLT wall panels that are spaced to accommodate flexible infill floor expansion in the future. A CLT floor panel can be erected in this 4.5m space in the future and possibly demolished, making for a highly adaptable material system (ArchitectureNorway, 2005).

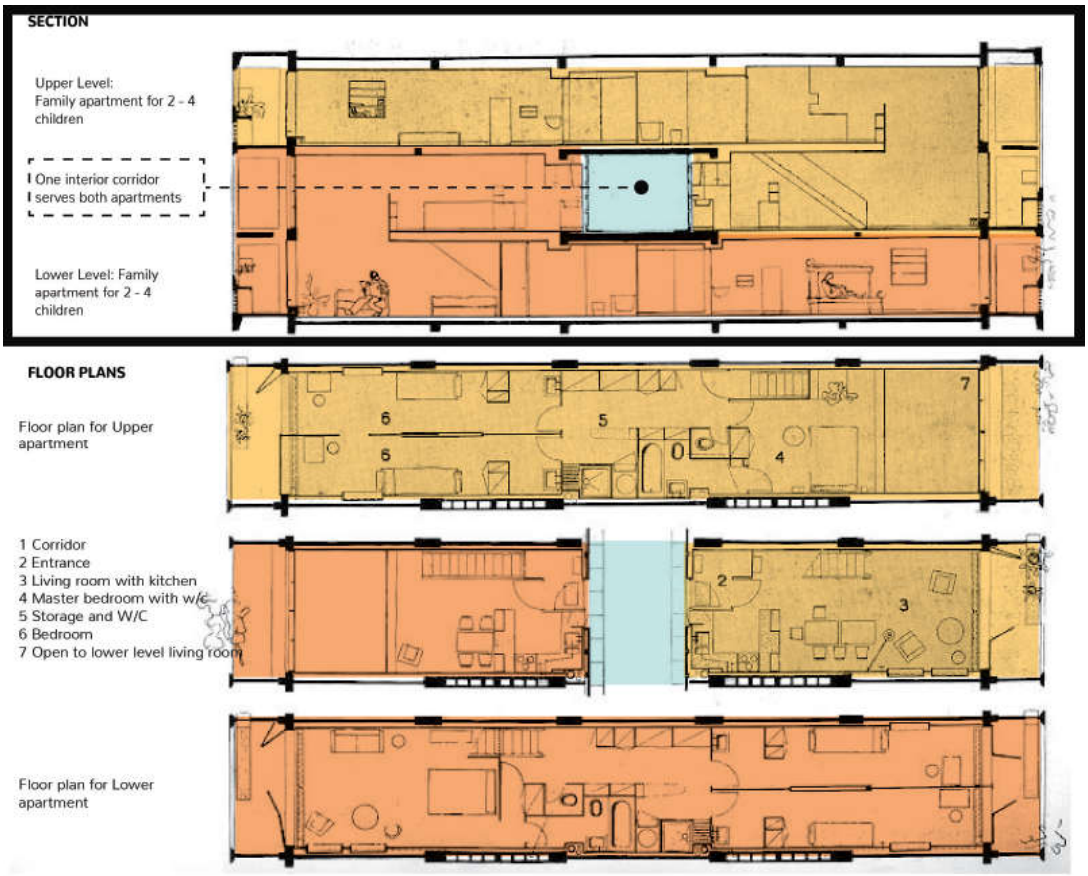
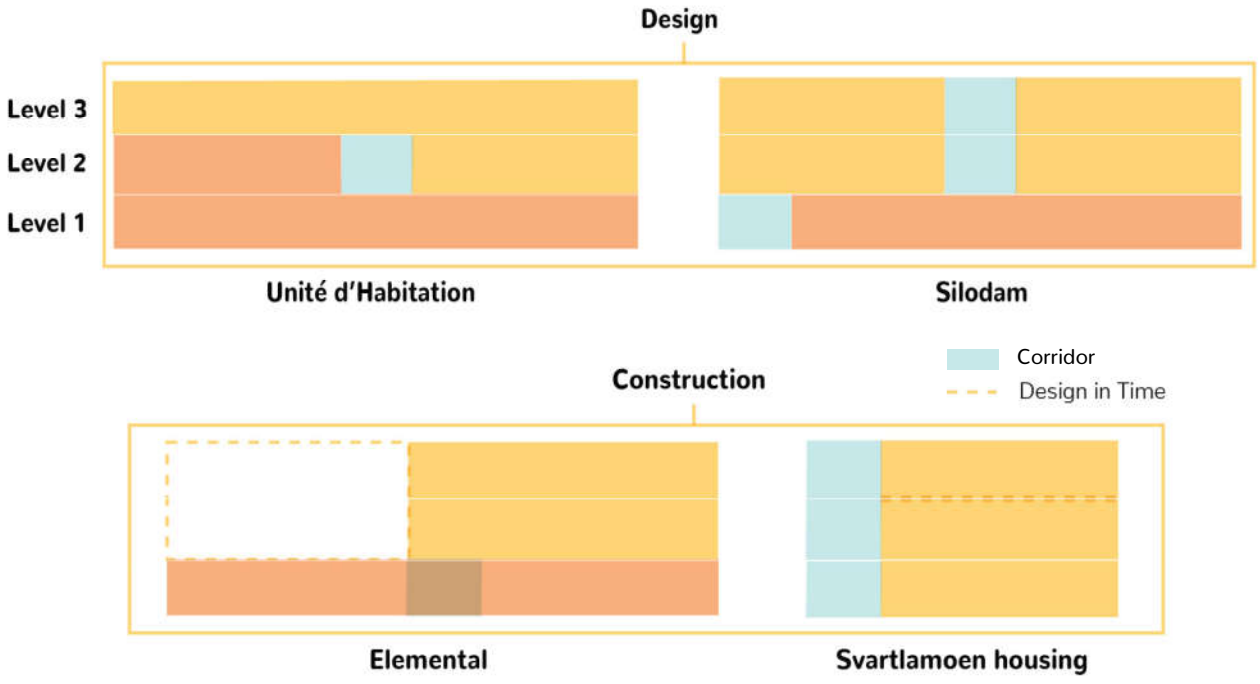


Fig 26 - Unité d'Habitation

UNITÉ D'HABITATION

ARCHITECT/ LE CORBUSIER
LOCATION/ MARSEILLE, FRANCE
PROJECT YEAR/ 1952

On the other hand, there is the highrise in Marseille, France that uses a similar modular construction, but this time to accommodate affordability and mixed unit forms. The provision of different unit forms ideally permits people of all ages, groups, or housing preferences to find a suitable living arrangement that caters to their needs. The plans for the Unité d'Habitation by Le Corbusier are designed using skip stop units, and regular single level units. Skip-stop units are designed with corridors every second or third floor so that these units require internal stairs leading to an upper or lower level. This configuration provides access to light on two sides of the same unit (as seen in both units in Fig 26 - section). There are opportunities to grow because there are units of different sizes and there is sufficient cross ventilation and solar access because of the opportunities for through units. Although this building had been criticized for its lifeless corridors, inaccessible shops, and narrow flats, many subsequent buildings imitate the layout of this ingenious design, sometimes with little success (Förster, 2006). Opposing the single-family de-



(Silodam discussed later in the chapter)

Fig 27- Large (L) construction approaches

urbanizion Le Corbusier designed high-rises that contained 58 duplex apartments per floor and many communal spaces within the building including roof communal areas, a gym, nursery, social space, a health centre and laundry services.

The configuration at Unité provides something that is of value in single family dwellings but rarely come with ; the ability to open to double height spaces. Carefully understanding spatial implications within a determined grid will help create delightful spaces.

In conclusion, the challenge with mid-high rise buildings described in a few of the precedents illustrated above is the choice of construction material. Flexible construction over time can easily be accomplished with a determined grid, but with a material that allows for easy mounting and deconstruction should there be a need. Concrete does not allow for this, however timber does as seen in Quinta Monroy. Timber allows for future large and small scale flexibility. The use of a more flexible material in conjunction with a new modular form would support the notion of adaptability through user participation over time.

Flexibilities at M scale: Envelope

Medium flexibility is the protective layer that can be flexible elementally (the use of a single window design that can be installed in a rotated fashion) or as a buildling extension, blurring the line between inside and outside.

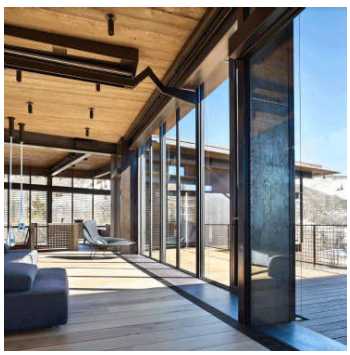
In Olson Kundig's 2017 project Bigwood Residence a 23-foot door pivots upwards toward the sky like a bird flapping its wings offering an interactive moment with the exterior envelope. There is flexibility in the retractable window system that transforms indoor spaces into transitional spaces. This is a nice feature within the building and supports transformable spaces at the human scale. The same can be said for their 2002 project Chicken Point Cabin in Idaho that similarly pivots open. The pivot point here is offset towards the middle to allow for the semicircular mechnicanism to crank open the door with user participation (Kundig, 2017). The mechanism is said to be manipulated with little effort, encouraging user participation across different age groups which is the aim of flexibility overall. These transformable walls can be great features for communal areas. At the medium flexibility scale this notion of moving elements starts to illustrate the hierarchical and planned dynamism that a building of this form could achieve.

Traditionally, buildings in Amsterdam used to include a pulley system that allowed residents to hoist items to upper floors. These houses were of modest construction, building to an average mid-rise scale (6 storeys), but window openings and exterior fixings gave the envelope an extra level of flexibility. Figure 30 illustrates an example of a common building in Amsterdam that exhibits this quality.

Another element of envelope flexibility is shading. Shading techniques should be used to promote user satisfaction. This can be through extra small approaches as seen in the housing block in Merano by Holzbox Tirol which achieves sun shading and visual screening with the use fabric panels. This prefabricated solid timber construction provides individual units with terraces that are shaded by these panels, making for a flexible and comfortable environment through the envelope (Schittich, 2004).

Fig 30b - Blow up

28- Chicken Point Cabin by Olson Kundig



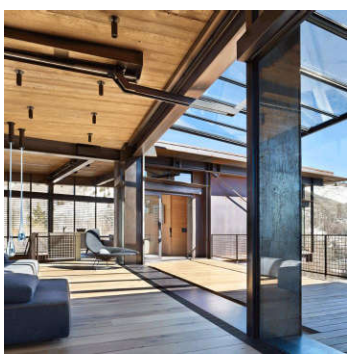


Fig 29- Bigwood Residence by Olson Kundig

Fig 30a- Modest envelope flexibility : Amsterdam

HOUSING BLOCK IN MERANO

ARCHITECT/ HOLZBOX TIROL
LOCATION/ MERANO
PROJECT YEAR/ 2004

Fig 31- Housing block in Merano by Holzbox Tirol

Buildings

Place: Density and Height

Buildings move the conversation from the extra large scale where the focus is on external factors, to the large and medium scale where the user is now introduced to the building project. Where possible the main entrance of the building should be inviting and interesting. Where possible, there should be spaces that connect the interior activity to the sidewalk be it sidewalk patios or commercial at grade. This will give the building an inviting street presence and aid in determining place.

In *The Death and Life of Great American Cities* written in 1961, Jane Jacobs criticizes many of the planning principles of the Modern movement. She observed parts of North American cities that needed to be re-examined and was an advocate for building upon the existing city fabric. She showed disdain for movements such as The Radiant City by Le Corbusier and The Garden City by Ebenezer Howard. She highlights 4 main planning principles that have proven successful in many projects for their simple ingenuity.

Principles

Mixed Uses

In order to support livelihood and dynamism in the community, buildings of mixed use are needed. Buildings with ground floor activation by grocers and other shops are pivotal. This constant influx of different people on the sidewalks will effectively maintain what Jacobs calls "eyes on the street", providing a greater sense of security for dwellers of the area (Jacobs, 1961).

> *"The district, and indeed as many of its internal parts as possible, must serve more than one primary function; preferably more than two. These must ensure that presence of people who go outdoors on different schedules and are in the place for different purposes, but who are able to use many facilities in common." - Jane Jacobs*

Short Blocks:
The second imperative is about designing reasonably short blocks. This means blocks should be around 400 ft. to ensure walkability, allowing easy circulation in and around them. This idea can be seen particularly in Europe where there are successfully human scaled streets, blocks, and corners that accommodate stores and opportunities for economic yield.

Aging Buildings:
Buildings of differing ages, conditions and styles are necessary in that they provide the opportunity to host non-profits, artist studios, and affordable housing units as well as more

affluent building users. This will allow people with lower means of income to continue to contribute and grow within society. Gentrification was a main concern for Jacobs and diversifying building ages was one way which she felt would contest such actions.

Population Density:
Finally population density is to be considered as a way to build cities for people and not for cars. She advises densities greater than 100 dwellings/acre with a 60-80% ground coverage as not to create suburban scaled neighbourhoods (Jacobs, 1961).

A great example of mixity, density and short blocks of differently aged buildings within Toronto is the St Lawrence neighbourhood. It is flexible in its community, its density and affordability which subsequently provides homeowners enough choices to support social difference. This project was built in response to the poorly planned communities nearby such as the old Regent Park and St. James Town and remains a great success (Perkins & Zizys, 2005).

St. Lawrence neighbourhood followed an entirely new model that provided high density, socially mixed communities and affordable housing to approximately 10,000 people. It is home to housing, commercial space, public garages, parks and roads. Community facilities such as schools, health clinics, grocery stores, hairdressers, cleaners, a recreation centre, a library, and restaurants are scattered around the site (Planning & Hulchanski, 1990). This neighbourhood is regarded as a successful representation of an appropriate social mix reflecting diversity of income, class, age, and household size. Not only does it consist of varying family types - for single persons, couples, families with children, and senior citizens - but it too provides of a mix of tenure types. St. Lawrence neighbourhood (SLN) is comprised of 39% condominium apartment units, 30% non-profit co-ops and private non-profit rental units, 27% municipal non-profit rental units and 4% ownership townhouses. Central to SLN is David Crombie Park, an East-West green corridor that hosts open area for the community. Directly to the North and South are three storey family townhouses, and medium rise seven to ten storey apartments (Planning Q. U., 2001). This neighbourhood illustrates how important variety is to the success of a project.

Another Toronto example is Sherbourne Lanes (Dundas Sherbourne infill housing). In 1971 developers saw an aging block and were attracted to the site's potential for densification in the urban core. They envisioned the existing block to be demolished and replaced with two 28 storey apartment towers (Seno, March 03).

Fig 32 - St. Lawrence Neighbourhood

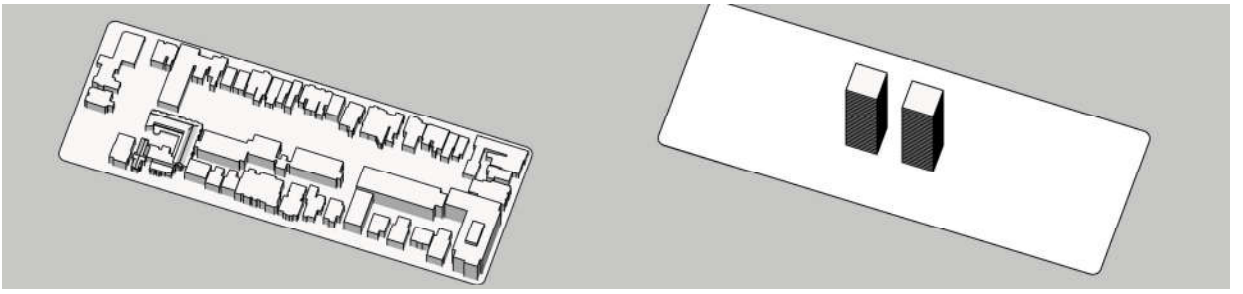


Fig 33 - Sherbourne Lanes Massing

Fig 34 - Sherbourne Lanes Aerial

SHERBOURNE LANES

ARCHITECT/ JACK DIAMOND & BARTON MYERS

LOCATION/ TORONTO

PROJECT YEAR/ 1976

Sixteen houses were slated for demolition but the residents of the Dundas-Sherbourne area neighbourhood decided they would do everything in their power to halt this new development from destroying the community they happily lived in. Over the next few months the developers would create new schemes and challenge zoning but the community and governing authorities including then Mayor David Crombie and Jane Jacobs, fought for this community (Bébout, 2001). Finally, Crombie hired an architectural firm then A.J. Diamond and Barton Myers, to develop an alternative scheme that preserved the lower rise streetscape while increasing density and they responded with a mid rise scheme that proposed renovating the existing Victorian houses and adding a six-story "infill scheme"at the rear of the house lots. This scheme provided the community the same number of accommodations that the two 28 storey towers proposed, at an appropriate scale consistent with that of the neighbourhood (Seno, March 03).

"We can maintain the neighbourhood, preserve the streetscape as important social facts, and we won't traumatize surrounding blocks as high-rise would," Diamond maintained. "The key is to make the environment of greater significance rather than replacing it." - A.J. Diamond and Barton Myers (Seno, March 03)

Midrises are still favourable because they favour microclimatic conditions, they are better protected from the wind, the cast less shadows, on the ground and neighbouring properties, they are suited for a wide range of income levels, self policing creates security for occupants - Schoenauer (Schoenauer, 2000, pg 460).

There are also things to learn from unsuccessful precedents. Le Corbusier's Radiant City illustrated an aspiration for high density and the inclusion of nature. Stemming from various iterations of Garden cities, Radiant City would contain prefabricated apartment buildings, known as "Unités" (Guiton, 2000). A single Unité would accommodate 2,700 inhabitants and function as a vertical village. They would include ground floor catering and laundry facilities, a rooftop kindergarten and a pool.

He labelled this city an "artificial" garden city as it is vertical instead of horizontal, however it fails to address zoning in a way that allows appropriate city movement. The design is laid out in separate divisions: commercial, business, entertainment and residential. The business district alone reaches heights of 200 meters accommodating 500-800 thousand people. Circulation around these units would situate greenery and parks as Le Corbusier feared his previous iterations provided insufficient amounts of natural daylight penetration. What is interesting about this project apart from the spatial arrangement, is that when the idea was proposed to Paris the city immediately refused it, however city planners across the world decided they would attempt to recreate this vision. Examples include Pruitt Igoe in St. Louis and Robert Moses's tower blocks in New York (Guiton, 2000).

VILLE RADIEUSE (THE RADIANT CITY)

ARCHITECT/ LE CORBUSIER

LOCATION/ UNREALIZED

PROJECT YEAR/ 1924

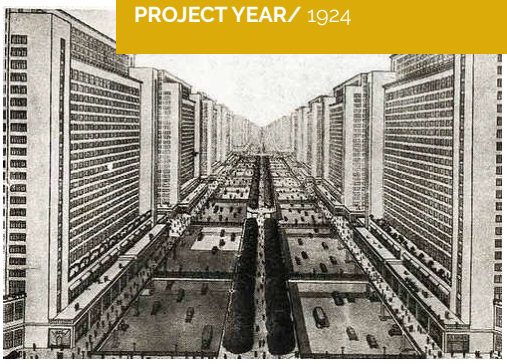


Fig 35- Le Corbusier's Radiant City

Pruitt-Igoe a 2,740-unit public housing project completed in the mid-1950s, was partly demolished in 1972, prompting Charles Jencks to declare the death of modern architecture (Hayden, 1986, p 123). Based on Le Corbusier's Radiant City principles, Pruitt-Igoe consisted of high-rise apartment towers with the ground floor free for community activity. In addition to ground floor communal areas, communal corridors occurred every three floors to house a laundry, communal room, and a garbage chute (Newman, 2008).

Overall this project, occupied by single-parent, welfare families never achieved more than 60 percent occupancy. Notably, the walkways and spaces originally intended to facilitate social interaction became detrimental factors in this project, providing isolated spaces of danger and crime that not completely but in part could have been overcome through design (Newman, 2008). The relation between entrances and sidewalks need to be understood at reasonable scales and areas around the building to avoid areas of lower visibility.

The designers failed to understand the context in which the building was erected. Pruitt Igoe had a different social context and isolated nature and in urban areas this is a key factor. The buildings were all the same with no identity, there was very little in the way of planned spaces of varying privacy and ownership (i.e. no backyard), the rear side of the buildings were dangerous pedestrianized zones, blocks were too large, the project was poorly lit, and it did not account for similar high-rise tower density.

PRUITT–IGOE

ARCHITECT/ LEINWEBER, YAMASAKI & HELLMUTH

LOCATION/ MERANO

PROJECT YEAR/1954

Fig 36 - Pruitt Igoe, St. Louis

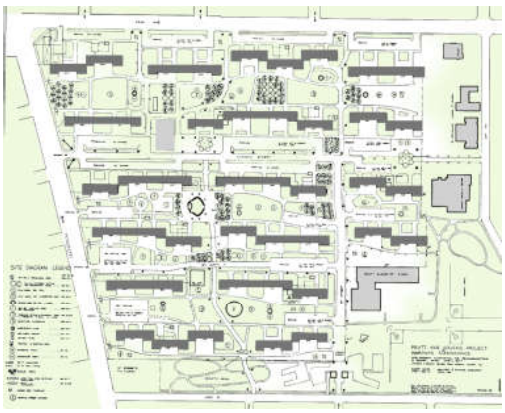


Fig 37- Pruitt Igoe - private and private definition makes a difference as to how the building is used

Accessibility

Physical, psychological and design factors

The main priority in ensuring the safety of aged individuals is to acknowledge that there are difficulties that they may face that others do not. The first is the fear of falling and security. Simple acknowledgement of this in building design can eliminate the feeling of fear or loss of security with semi-public courtyards, and central stairs at the pedestrian scale (Hayden, 1986). These can be addressed through building design, and access to the building itself, and through materials to aid in preventing slips and falls. This comes in addition to the overall building being compliant with accessibility guidelines (parking, ramps, stairs etc.).

Distance is a primary consideration for the most satisfying user experience. Centralized paths of travel from outside to the main building entrance, the main circulation core, and the unit will help to minimize the distance between where users are starting their journey to their destination. There should be limited parking space as this is an expensive feature that is not supported in this thesis project, however it is not to be entirely excluded. A few parking spots will allow for car sharing and a convenient place for the elderly to access their units. This should be supplemented by exterior lighting and an entrance canopy for weather protection.

Secondly, material selection will also aid in minimizing obstructions and hindrances that will complicate paths of travel for those with disabilities. Psychological factors including vision, audibility and stability play a part in establishing peace of mind. Disorienting corridors or spaces that are too bright with reflective surfaces or glare can create unsafe situations. Daylight helps to regulate circadian rhythms, and daily sleep cycles. A variety of lighting levels is key to individual comfort (HOK, 2019). There must also be spaces of differing sound levels, because the hearing impaired may find uncontrolled spaces distracting and unpleasant which will detract from the use of common spaces in the building by this group.

All new construction must be accessible to individuals with mobility restrictions; this sometimes takes the form of different options for entering the building. Quinta Monroy is a good example because there are two stacked units with one on the ground floor and the other above. This ensures that people who have difficulty climbing stairs do not need to go through this uncomfortable experience.

THE TERRITORIAL

The territorial represents a precise sense of control over space that surrounds the built form. This chapter will illustrate through precedents how good territorial manipulation can be used to create successful community and adaptable places for future use.

Flexibility

Building flexibility through services - S scale : Interior spaces

Building for internal flexibility is achievable through the following approaches:

* Loose fit (open space, support space oversize space, typology pattern, joinable/divisible space, modular coordination)
* Spatial planning (connect buildings, standard room sizes spatial variety- bay sizing, spatial ambiguity, spatial zones and proximity, simple plan, simple form, standard grid multiple ventilation strategies, shallow plan depth, consolidated service location)
* Passive techniques (Building orientation , Good daylighting)
* Unfinished design (Space to grow into phased, user customization, multifunctional spaces, use differentiation)
* Maximise building use (mixed demographics, multiple/ mixed tenure shared ownership, isolatable, multiple access points)
* Increase interactivity (visual linkage (views), physical linkage)

Spaces need to be adaptable, extendable, and able to anticipate growth and shrinkage over time. The current condo market fails to address this because units are developed for one household type, and only the illusion of choice is given. Elemental would call this establishing families in a consolidated urban area with incremental construction without neighborhood deterioration (Elemental, Aravena, & Iacobelli, 2012, pg.98). The home is central to the majority of interactions between family members. Members have different rooms of preference because we all are individual beings. By integrating flexibility into design, units will be able to cater to the needs of all individuals over time (Friedman, 2001).

Whether we require “Media rooms” or “great rooms” or family rooms, offices, or nurseries, at different stages of life, values and viewpoints start to change. At one point, bedroom sizes might be of importance, for others a jacuzzi is something of interest, for the young parent second bedrooms for children and privacy from loud conversations or games might be of particular interest. Adaptability is a cost reducing strategy allowing residents to modify their spaces along with their evolving needs (Friedman, 2001).

Built form has different lifespans. Structure has the longest, but there are services, finishes, and everything in between that have their own timelines. By deigning to their lifespans flexibility becomes easier for residents with respect to spatial planning and maximizing building use which is accomplished by providing different access points if enough space can be reallocated at a later date. In Quinta Monroy, the services were set up acknowledging that there would be the possibility of future expansion. The bay sizes were intentional and

made for the placement of fixed services and stair orientation that became the basis for the unit flexibility.

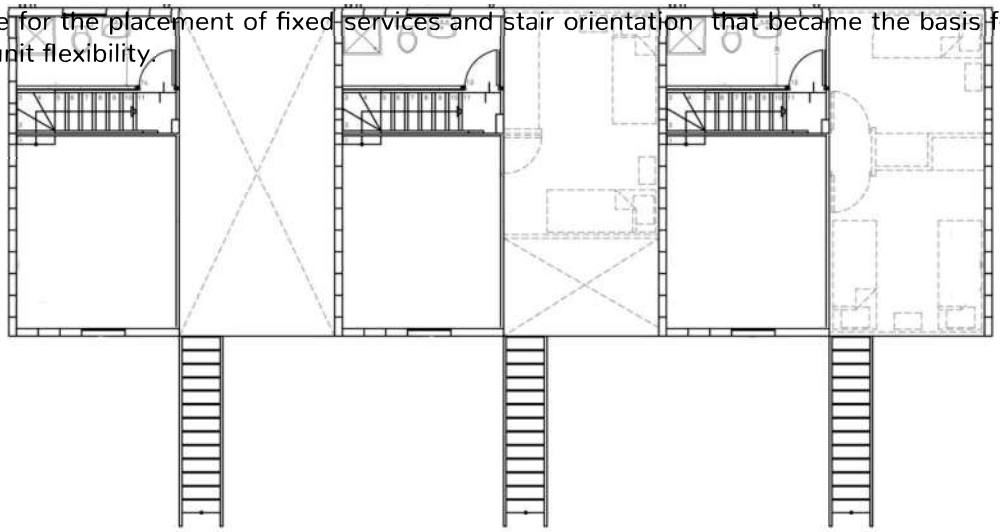


Fig 38- Second level floor plan Quinta Monroy, Elemental

Other precedents

Building services are the core elements that allow for the variability of space. This is true because supply and return air ducts need to be placed in order to circulate air throughout the building (mechanical), water also must be supplied to kitchens, bathrooms and laundry units through wet walls. If these are all placed randomly, this will significantly hinder the success of a flexible scheme as more time will be used trying to determine where rooms could fit that would avoid service walls. The key here is to maintain a design that supports the stacking of units vertically for economic and spatial efficiencies. This layout must be determined at the beginning of the design as was done in NEXT 21 as the mechanical systems were developed by a single contractor at all levels prior to the design of the base building mechanical system.

Fig 39- Housing Donaufelderstraße, Herbert Wimmer

WEISSENHOFSIEDLUNG

ARCHITECT/ MIES VAN DER ROHE
LOCATION/ STUTTGART
PROJECT YEAR/ 1927

DONAUFELDERSTRASSE HOUSING WOHNBAU

ARCHITECT/HERBERT WIMMER
LOCATION/ VIENNA
PROJECT YEAR/ 1998

This 1998 construction of Donaufelderstraße in Vienna is very flexible in layout. Forty-three apartments are accessible through front yards and winter gardens, but the interior floor plan is neutral. Services are placed centrally within the unit that allow for variability on the outer extents towards the exterior windows. Users can interpret their spaces as they wish, resulting in user satisfaction (WUP_Wimmerundpartner, 1998). Twenty Niagara by architectsAlliance, is a 22-unit slab building that replicated the front and rear sided relationship found in single detached homes. Unlike Donaufelderstraße , the core is internal and away from the exterior walls, which allows for a greater level of flexibility because exterior wall surfaces can be utilized for living spaces (Goodfellow & Goodfellow, 2010).

Nowadays economic reasons demand the rationalization and the normalization of the construction of rental dwellings. On the other hand, the growing differentiation of our dwelling needs demands greater freedom in the form of use. In the future it will necessary to do justice to both aspects. The construction of a frame is the most appropriate structural system for that. It allows rational execution and leaves complete freedom to divide interior space. If we limit ourselves to shape bathroom and kitchen as constant spaces, due to their installations, and we choose to divide the rest of the dwelling surface with mobile walls, I think we can satisfy any dwelling needs.
- Mies van de Rohe (Mezzadr, 2008)

Mies van der Rohe designed a building as part of the Weissenhofsiedlung housing exhibition in Stuttgart in 1927. It was a 4 storey steel column dwelling that used some of Corbusier's 5 points (Le Corbusier, Baudouï, & Dercelles, 2013), in which enclosures can be arranged differently to allow for changing spaces and different schemes. The structure allowed for different layouts and the interior wall systems (mobile partitions) allowed for variability over time. The only defined spaces are the kitchen and bathroom and all other rooms are unassigned.

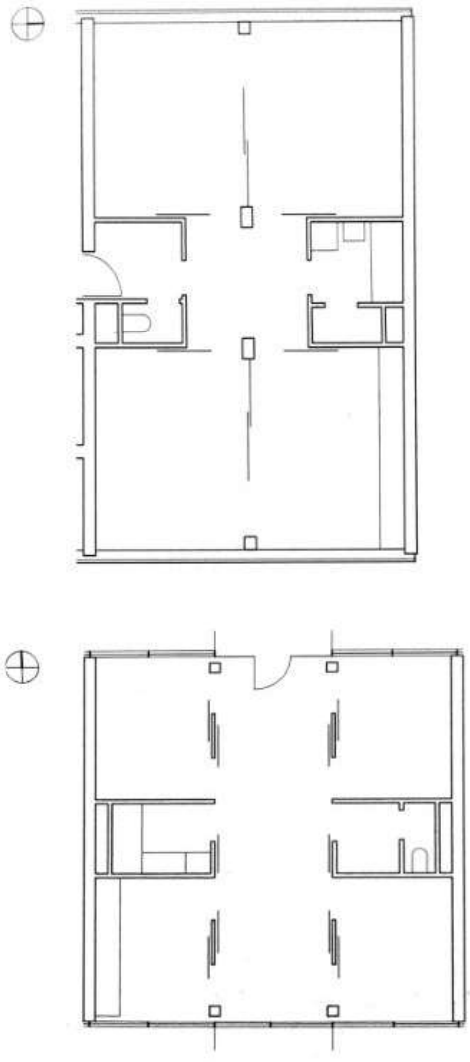


Fig 40- Housing Donaufelderstraße, Herbert Wimmer

Fig 41 - Weissenhofsiedlung , Floor Plans

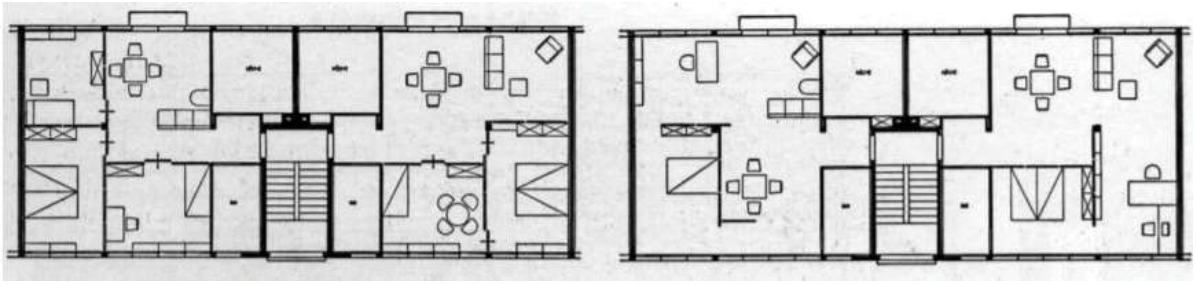


Fig 42 - Weissenhofsiedlung Mobile partitions

Mutifunctional interior space is how designs in Japan have come to adapt to a fairly expensive residential market (Carozzi, London School of Economics, Hilber, & Cheshire, 2017). By using the same standard sized room differently throughout the day, rooms can be versatile spatially for user flexibility and customization. Switch by Yuko Shibata proposes a transformation of user experience between home and office, and day and night (Dirksen, 2015). Shibata needed work space but was limited by the apartment's solid reinforced concrete structural core. Inspired by the Japanese Shoji screen that

SWITCH

ARCHITECT/ YUKO SHIBATA
LOCATION/ TOKYO, JAPAN
PROJECT YEAR/ 2010

Fig 43- Switch by Yuko Shibata

opens smaller partitions to create larger spaces, Shibata decided to partition home from work. A library work space is connected to the main bedroom through a swinging bookcase. Similarly, a meeting room is separated from a smaller library that is opened through a sliding partition which moves across the room providing access to a concealed bookshelf to the rear. The bedroom works because the library and the working room both have access to daylight and the assumption here is that when there is no need for light, the bedroom is then to be used for sleep, meaning no daylighting is required. This brings up one noteworthy consideration, understanding that there are certain rooms that have been stretched to their largest dimensions. Examples include oversized bathrooms and bedrooms that individually contain workspace, storage and space to sleep. There may consequently be merit in creating definable spaces that have the ability to fluctuate based on needs of the resident, allowing for the possibility of dual use zones. Shibata may be able to use the meeting room while her partner uses the library, or the study room may be used while she is taking a nap. This way space is better utilized and supports the conjecture that more space is not always the answer.

Proximal Location

Country - Car - City: The neighbourhood and the building: transporting between the two

Building neighbourhoods calls for the creation of urban strategies, the inclusion of buildings of different tenure and housing variation. Depending on land size, thoughtful intervention is key towards creating communities that support change.

Peace and quiet, greenery, connection to parks and natural landmarks: the suburban dream has offered years of contentment to many households. It all comes down to the values of the times and technology. Millennials are a generation who value pedestrian and transit-friendly housing structures (Nielsen, 2014). Housing needs to be developed appropriately in close proximity to means of travelling that is less dependent on personal vehicles. By creating safe means of alternate forms of travel such as bike lanes, proximity to subways, buses and streetcars, and overall walkability, there will be much more success in forming community and user satisfaction for all age groups.

A simple way to determine whether a home provides the ability to depend less on personal vehicles is through the Walk Score. This is a method for determining whether housing is situated in a location that makes sense to the user. A score chart is determined as seen below .

The ideal would be to have the ability to access all the places that support everyday living within a 15-20 minute walk

* Metro station (transportation hubs)
* Grocery store
* Bike station
* Car sharing location
* Work (ideally)
* Schools
* Park
* Community offerings such as daycares and community centres, restaurants

Studies from Japan suggest that the average adult should walk 10,000 steps daily for health and weight loss, while the average adult walks 5000-7000 steps per day (verywellfit, 2019). Not only is walking or cycling better for your health when making shorter trips which would make up the majority of ones commute should they live near their most frequented destination, it also facilitates something that most people forget or do not notice: meeting others. When stuck in the car, there is very little interaction that enables drivers to access a situation or people in their neighbourhood or street. All drivers see are the road signs and the cars around them. There are a series of spontaneous interactions that develop the overall character of the neighbourhood over time. This cannot be said for driving in large shielded machines experiencing daily doses of banality.

Score	Quality		
	Walk Score	**Transit Score**	**Bike Score**
90-100	Walker's Paradise Daily errands do not require a car	Rider's Paradise World-class public transportation	Biker's Paradise Daily errands can be accomplished on a bike
70–89	Very Walkable Most errands can be accomplished on foot	Excellent Transit Transit is convenient for most trips	Very Bikeable Biking is convenient for most trips
50–69	Somewhat Walkable Some errands can be accomplished on foot	Good Transit Many nearby public transportation options	Bikeable Some bike infrastructure
25-49	Car-Dependent Most errands require a car	Some Transit A few nearby public transportation options	Somewhat Bikeable Minimal bike infrastructure
0-24	Car-Dependent Almost all errands require a car	Minimal Transit It is possible to get on a bus	

Fig 47 - Walk/ Transit/ Bike Score (Walk Score, 2019)

Outdoor space

Public, Common, Private

Housing must connect to the outdoors. Public and private space definition is key to understanding what exterior/interior spaces and connections need in terms of access and scale. Unit type, circulation and public/private open spaces need to be designed so as to create definable spaces for varying degrees of satisfaction.

Undefinable space results in lack of responsibility which leads to the deterioration of space. We have to understand proxemics in order to address how this space could suggest ownership. Outdoor space should be large enough and distributed along the entrances and playground spaces to allow for variability of size. If there is not enough space on the main level, the goal is to find opportunities through design to add spaces through different levels of the building. Where possible, the project needs to harness differently sized exterior spaces. Learning from Edward T. Hall's four types of personal distances. In his book *The Hidden Dimension*, Hall identifies four types of personal distance (Intimate, Personal, Social, and Public). This construct can be used to hierarchically distinguish spaces that provide residents with the ability to choose where they naturally gravitate towards in the moment.

The first level of exterior space would be the public exterior space that is open to others that are not part of the immediate building. Second is the semi-private level that is shared amongst building residents. This can be semi-private personal balconies to social communal interior courtyards. This provides opportunity for neighbours to come together at different scales and enjoy their interaction at the preferred size. Lastly there are intimate spaces where the individual is to be unbothered in their personal space, seen in juliet balconies and private balconies.

As discussed briefly in this chapter, the ability to host choice regarding personal distance to others is invaluable. People whether introverted or not are not always in the same frame of mind. Sometimes people prefer a more social gathering and at other times they value loud and enjoyable spaces. One thing that comes at a great service to building spaces for people within a framed community, is the fact that people hate small talk. Talking to people who each have no idea who the other person is and where they are coming from is not an enjoyable activity for many (Granneman, 2017). What these outdoor and indoor communal spaces provide however, are spaces to engage in deep talk; talking with others you know on a deeper level, enough to generate meaningful conversations when in a social mood (Kim, 2017). The following projects exemplify outdoor space at the 4 different levels.

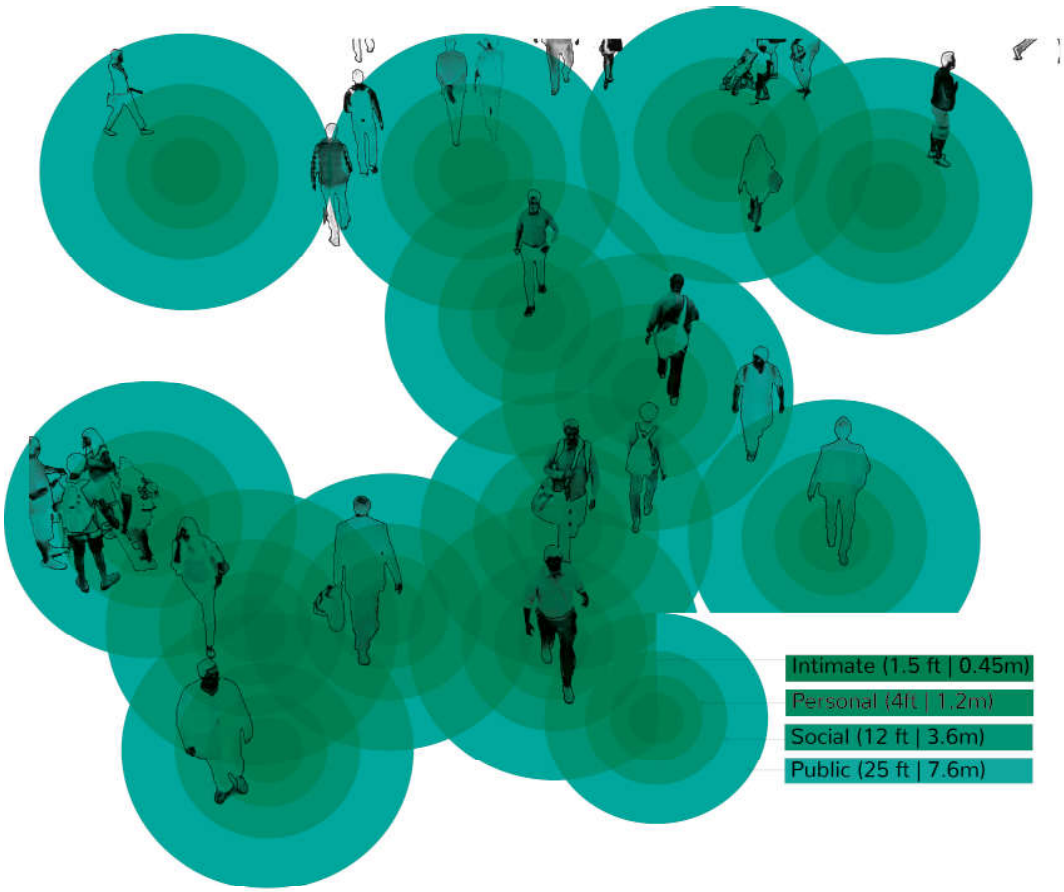
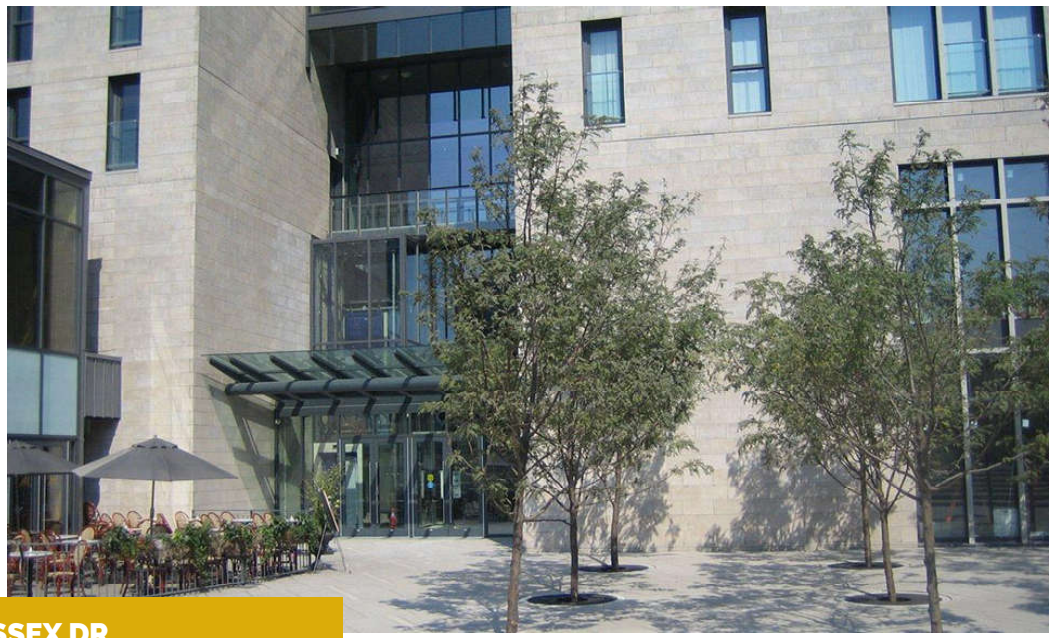


Fig 49 - Edward T. Hall's four types of personal distance



700 SUSSEX DR.

ARCHITECT/ DAN HANGANU
LOCATION/ OTTAWA
PROJECT YEAR/ 2005

Fig 50 - 700 Sussex Dr, Ottawa, ON K1N 1K4

Public zone – (POPs)

RAIC gold medal laureate Dan Hanganu designed this mixed use complex in 2005. This project is in the heart of Ottawa near the American embassy, and was designed to revitalize the city centre with the supply of housing and commercial functions at grade (Hanganu, 2005). On 700 Sussex Dr. in Ottawa, a semi public zone or Privately-Owned Publicly Accessible Space (POPS) is open to the public in a way that defines its boundaries through a glazed wall to the east and stairs that lead to a recessed level below grade. This is another subtle way to highlight boundary in an open fashion. Here the access is open directly to the public. The neighbourhood also has the ability to be exclusionary or welcoming. By creating common spaces of access, resting, and play, the building community and the surrounding community have the ability to share

space and create lively interactions between each other.

Social - Common - Semi public connection

An example of a successful social project is the Haarlemmer Houttuinen Housing in Amsterdam by Herman Hertzberger. The project consists of two blocks, one to the north and one to the south. These projects are located between a busy vehicular route and a railway with a quiet pedestrian path designed between the two. This pedestrian path provides a central social corridor that is used to access all maisonettes. What makes this project special are the piers that support exterior balconies that look into the 7 metre wide pedestrian street (EUMiesaward, 2019). Stairs lead up to the terrace and easily define what is public from what is private but they do so in a subtle way, allowing visual and auditory connection between these realms. Residents can easily meet their neighbours as they enter their units, or see their children play on the pedestrian street, which encourages social connection and healthy activity. Here a more private living street or 'woonstraat' is developed. In the Netherlands street furniture such as bicycle racks, lights, fencing and public benches are distributed within private neighborhoods to allow for community. What makes this project particularly interesting is the fact that it begins to illustrate how buildings need not be oriented towards the front. If the building does not have plenty of space at the front or it is dedicated to commercial space, then the rear of the project is another way to start to reintroduce community. With various entry points along the facade inherently providing a human scale, they give everyone equal access to what is occuring at grade through exterior balconies. This project successfully demonstrates high density community living (EUMiesaward, 2019).

GALLEY HOUSE

ARCHITECT/ WILLIAMSON CHONG ARCHITECTS
LOCATION/ TORONTO
PROJECT YEAR/ 2010

HAARLEMMER HOUTTUINEN

ARCHITECT/ HERMAN HERTZBERGER
LOCATION/ AMSTERDAM
PROJECT YEAR/ 1987

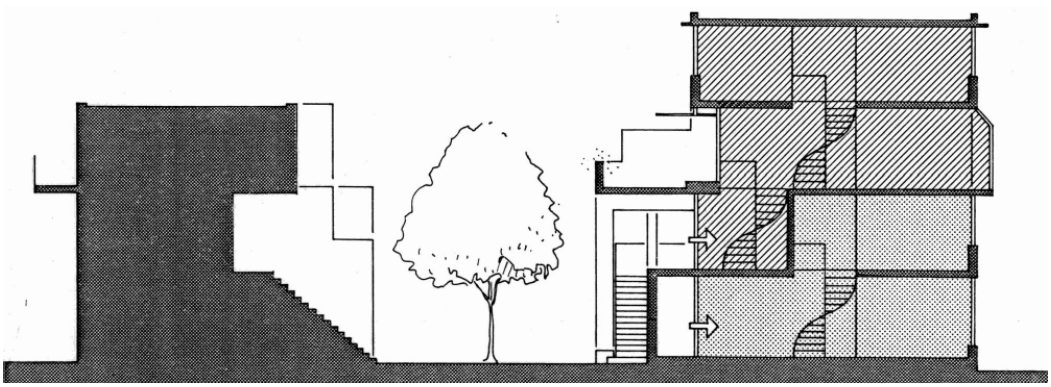


Fig 51 - Haarlemmer Houttuinen - Herman Hertzberger

Fig 52 - Galley House by Williamson Chong Architects

Personal - Garden connection

The front porch is a coveted concept, embraced by many homeowners. Aristocratic villas and city palaces of the 16th and 17th century used porticoes as mediating spaces that drew connections between the indoors and the outdoors (Murrell, 2018). Derived from the word *porta* meaning "gate" and latin *porticus* for " a colonnade with covered ambulatory", the word references the space in between, a place neither inside nor out. Personal space can be a large semi private space as we see in MVRDV's 2003 project Silodam. Silodam's exit corridor strategy utilises single loaded exterior paths that guide people from residences to the exterior. These corridors/porches facilitate semi-private conversations while providing occupants access to daylight and ventilation.

Porches and winter gardens, like patios and yards provide a break from building, a link to a natural and visually appealing environment, a quieter place away from busy circulation and a place for spontaneous encounters. A post occupancy evaluation by people living in medium to high density housing in Britain, the US, Canada, Australia, New Zealand and Ireland indicated that the majority of households with children preferred a house with a yard for the children to play in (O'Byrne, 2006).

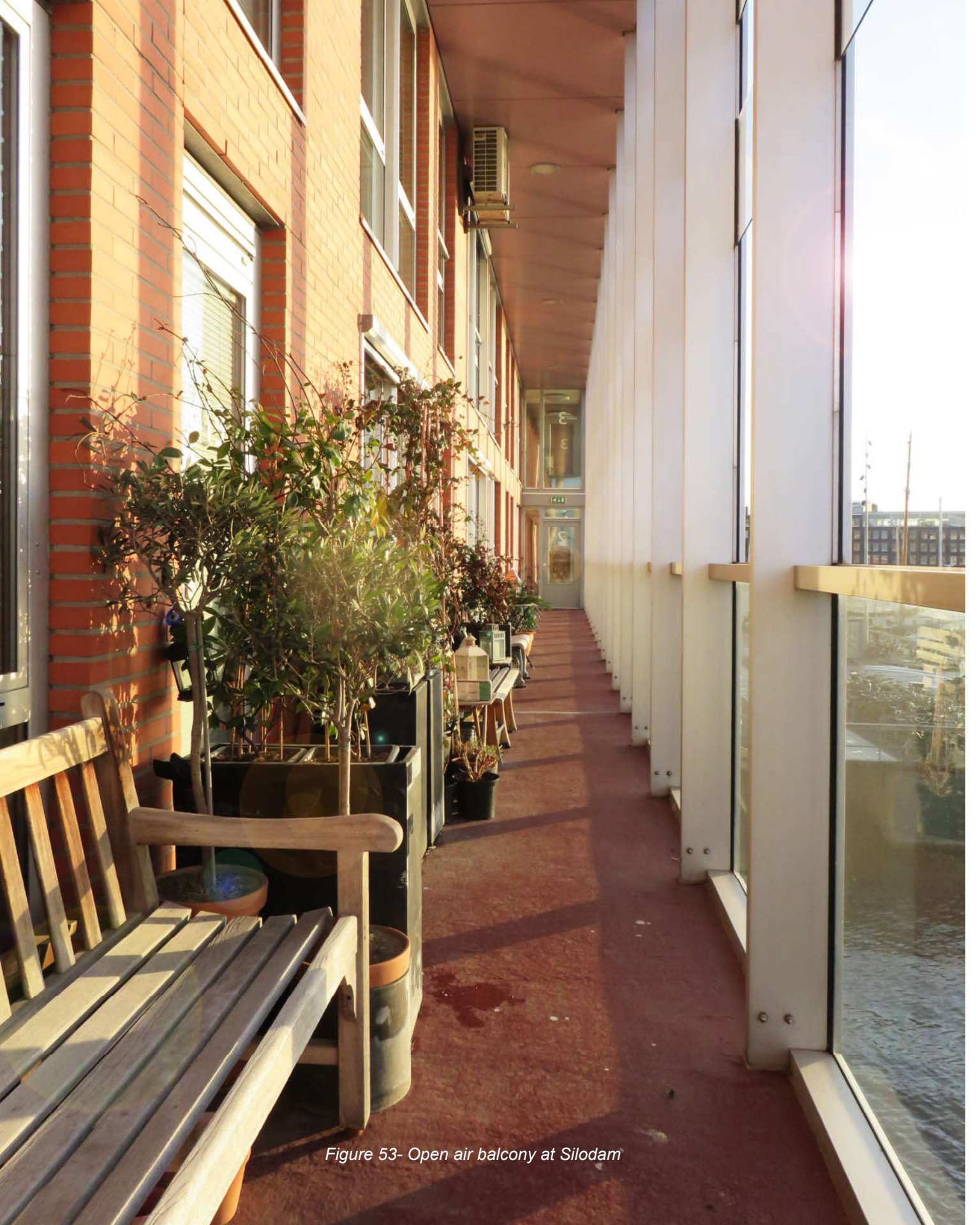


Figure 53- Open air balcony at Silodam

Indoor central common space: Feel-good Factor

Fig 54 - Svartlamoen housing

Fig 55 - Svartlamoen housing

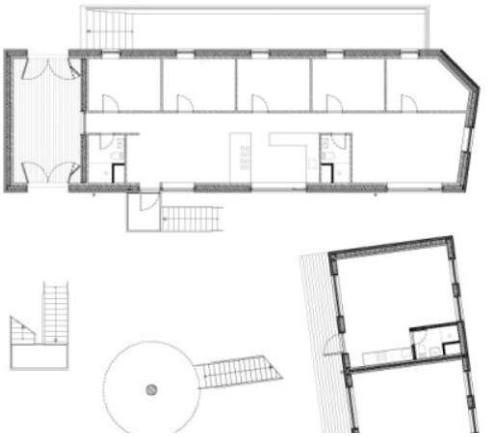


Fig 56 - Svartlamoen housing Floor Plan

Interior amenity space often takes the form of pools and fitness centers. But this neglects what should be the fundamental purpose of these spaces. They should first and foremost be at the service of creating and supporting social communal space and they should be thought of with the understanding that they do not work in isolation. This means they can be great spaces but need to be used in conjunction with circulation to work successfully. Interior common space is a space that facilitates spontaneous encounters among people.

Svartlamoen housing by Brendeland & Kristoffersen rethinks the way housing is designed from the ground up. Access to building foyers are from main level staircases, that lead at different levels to different buildings and they aim to increase the quality of life while decreasing the amount of square footage per resident. They do this by designing communal flats with shared bathrooms, kitchens and shared living rooms (ArchitectureNorway, 2005). These shared activities bring people together. The 2010 General Social Survey reported that Canadians were likely to spend at least one meal alone, at home or at restaurants, and spent one quarter of their waking hours on food-related activities (eating, cooking or washing), but another study mentioned that 55% of Canadians spent 15 minutes or less preparing a meal (Fieldhouse, 2016).

> *"Eating together, whatever and wherever that may be, can help build and strengthen bonds between family members. " (Fieldhouse, 2016)*

Communal kitchens in the city have proven to be excellent examples of how food can unite people. Depanneur is a storefront on College street in Toronto that hosts collaborative cooking nights to unite people through food. A recent wave of Syrian refugees arrived in Canada, with very little. Drop-in Dinner Depanneur nights help to re-establish a sense of community through cooking traditional meals.

Cohousing

In *Second-Wave Cohousing*, Lucy Sargisson starts off by stating that Cohousing provides a new form of living that priorities individual proprietorship and the benefits of living in a community that shares some of its space and activities (Sargisson, 2007). People join this form of community because they dislike the available market options for various reasons. Looking to develop a better alternative, cohousing communities have organized domestic life differently through enforcement of entrance and exit rules and formalized internal activities and codes of behaviour. Characteristics of cohousing communities based on McCamant and Durrett's book include:

* A balance of private and community
* A safe and supportive environment for children
* A practical and spontaneous lifestyle
* Intergenerational neighbourhoods
* Environmentally-sensitive design emphasizing pedestrians and optimizing open space
* A Participatory process
* Residents that participate in the planning and design of the development so that it directly responds to their needs
* Neighbourhood design
* A physical design that encourages a sense of community
* Private homes are supplemented by extensive common facilities
* Each household has a private residence-complete with a kitchen- but has access to all of the common facilities. The common house is designed for daily use and also supplements private living areas.
* Complete resident management occurs by residents who take complete responsibility for ongoing management, organizing cooperatively to meet their changing needs
* A Non-hierarchical structure, while there are leadership roles, responsibility for the decisions are shared by the community's adults(McCamant & Durrett, 2011)

Nordic European communities of the 1970s explored this type of community. They were named "centraal wonen" in the Netherlands, "kollektivehuser" in Sweden, and the "bofoellesskaber" in Denmark. According to Sargisson they all exhibited a difference in form, scale and social intent. The kollektivehuser were medium to high rise developments and driven by a feminist agenda aimed at relieving the tensions between work and parenting, while the bofoellesskaber were low rise and part of wider social changes rooted in communalism (building deeper social relationships through closer communities). There are many questions that come out of this form of community such as: are these utopian in nature, are there areas/ conditions for increased success, and what are the implications for an intentional community of death and succession of ownership. The intention is very noble and many will agree with the principles, but these questions highlight the fact that there are issues with this tenure specifically with the way buildings are currently built in Ontario and this would create too big a challenge for the current market. (Sargisson, 2007)

There is something to be said about the model that we can learn from. For one, Bondebjerget in Odense, Denmark shows that the people come together and choose to work with designers to build their own intentional communities are often those who value togetherness. When

they design their own communities they ensure that there are gradients that transition from being alone to communal spaces. Each cohousing community is different but some have communal gyms, kitchens and dining rooms where people can take turns alternating between who makes dinner for those who want to take part in the meal. Communal activities are not obligatory but they can provide support to individuals in need, whether single parents or tired young adults looking for a home cooked meal after a long day. There are also communal tools, workshops, guest rooms, pools or shared gardens that the elderly, adults and children are all able to take part in and share. This common house floor plan is particularly attractive because the central dining/meeting room which is adjacent to the kitchen provides access to a playroom for children. This allows parents or older siblings to be with the children and know that they are in good care, and good company.

BONDEBJERGET HOUSING

ARCHITECT/ FAELLESTEGNESTUEN
LOCATION/ ODENSE, DENMARK
PROJECT YEAR/ 2004

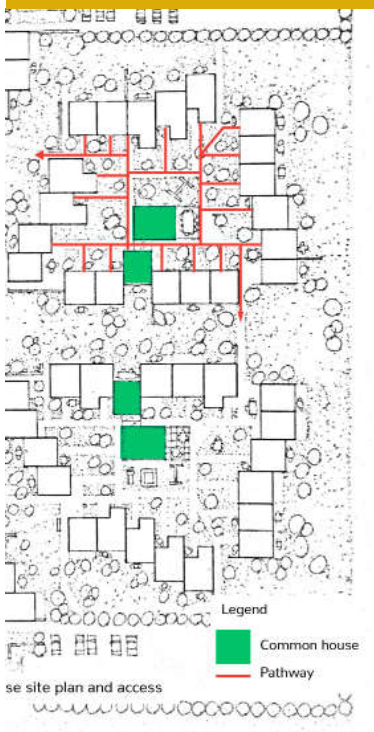


Fig 57 - Bondebjerget common house floor plan in Odense, Denmark

Cohousing common houses are as seen in fig 57 and spaces for meal preparation are the key ingredients to spaces where social interactions spring. The second key to making this work is division of labour, but residents prove that if there is a will there is a way. Alternating groups cook dinner for the community who signs up to join for a free meal, under the expectation of cooking for the group weeks later. Capitol Hill Urban Cohousing residential project by Schemata in Seattle Washington is a multi unit residential building with commercial at grade (a 15 person architectural practice) and residential above. There is a group of 28 people who live in the building and each family/unit who is part of these meals, are to cook every 6 weeks. This supports community but also begins to alleviate the stress of knowing that you don't have to cook a meal at the end of a long day, or eat at a restaurant, most likely alone. Sometime isolation is desirable, but when there is no option, that is the real problem. Common houses and communal kitchens, provide a way of knowing that the people who live around you will come back home, and be able to enjoy a meal with you should the need arise (Kim, 2017). CHUC is an intentional, intergenerational urban building with great central circulation organized through a central stairwell and elevator, a pedestrian spine that opens to a small exterior walkway that bisects the building.

Similarly, retirement home Humanitas in Deventer Netherlands allows university students the opportunity to live rent-free alongside 160 elderly residents. In exchange the care centre ask the students to spend at least 30 hours per month acting as "good neighbors". According to a 2012 report by the National Academy of Sciences of the United States, both social isolation and loneliness are associated with increased mortality (Andrew Steptoe, Aparna Shankar, Panayotes Demakakos, and Jane Wardle, 2013). To support residents and deter these negative feelings, students enjoy shared dinners, teach residents skills, create works of art and/or use social media (Jansen, 2015). Instead of living in the traditional renters market these students avoid small, cramped and unlivable dormitories and shared dens by exchanging time. This has proven to be an excellent way of providing multigenerational living that benefits all parties.

Circulation

Lively circulation /orientation/proportion/daylight /wayfinding

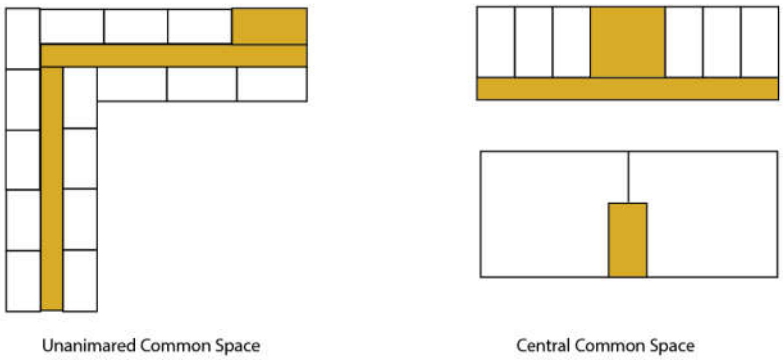


Fig 58- Importance of central circulation and common spaces for equitable social opportunity

For community at the building scale, the first thing that needs to be understood is that community in high rises is more difficult to achieve because the values of said developments prefer unit maximization over comfort that lower densities may more easily enjoy.

> *"our behavior can be conceptualized as a dynamic sequence of adjustments and readjustments to our physical and social environment" (Baum & Valins, 1977, p. 1)*

The intention here is to activate unit entrances through circulation. Attention to shared space and circulation in addition to adjacencies is key to creating inclusive communities. These spaces are to be designed to increase the quality of living through shared experience. Keeping these spaces central to ensure easy access to all users is important so as not to exclude access and create zones that are very separate from the main communal areas. To do so, corridors should open up onto shared central space.

Union Street EcoHeritage by SHAPE Architecture in Vancouver, British Columbia, Canada is a great example where the architects were able to find a way to encourage high density within a standard heritage property while providing interesting spaces within the courtyard at the rear of the properties for a revitalized space that creates links between properties through its exterior spaces. 7 units over 3 revitalized buildings from the 1890's are accommodated within the existing contextual framework. A clear circulation route easily connects the three buildings and creates a strong social connection by extending the social streetscape from the sidewalk inwards (Shape, 2017). For seniors that live on the same property as their children, this arrangement can help provide appropriate privacy and convenience to children who need to care for senior parents with memory and cognition needs. This design helps to provide convenient access to caregivers as seniors can lose their bearings and require assistance.

Fig 59 - EcoHeritage by Shape

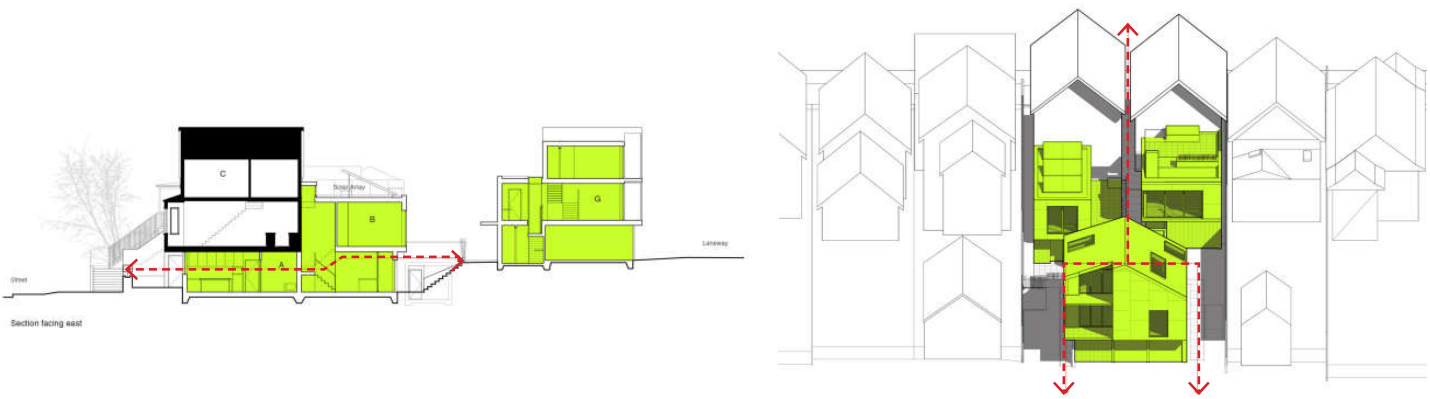


Fig 60 - EcoHeritage site circulation outlined in red

Spatial Gradient

Privacy and community

Circulation does not work alone, it must work in parallel with spatial gradients. Capitol Hill Urban Cohousing (CHUC) shows a linear progression that is different from many units designed today. First, because the typical long single loaded corridor does not exist here, there is a central semi-private courtyard which provides visibility to the units on either side. This is the space of spontaneous encounter as one walks out of the elevator or stairs before making their way to their units. Next is their front door which opens onto the kitchen and provides access to the dining then living then private bedrooms. This progression highlights a privacy gradient from semi-private to private in a logical linear fashion in a way that also provides natural daylighting and cues to who the unit owner is neighbouring, encouraging relationship. Too often units are so isolated that owners have no real clue as to who their neighbours are. By having a single curtain between kitchen and semi-private space, a mere light will begin to provide information and become the beginnings of a conversation. This control and flexibility over enclosure and screening provides a regulated degree of desired interaction. This is similar to the front porch ideals of single family detached homes but in a denser context. People are able to become somewhat accountable and indirectly know when things are okay or not simply by noticing patterns, and hopefully if and when wanted, getting acquainted with their neighbours.

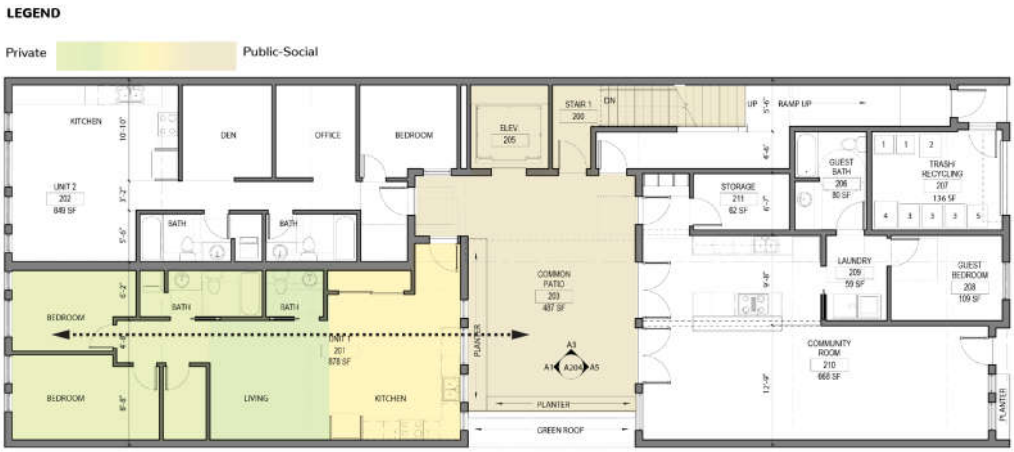


Fig 61 - Capitol Hill Urban Cohousing gradient, Schemata workshop

UNION STREET ECOHERITAGE

ARCHITECT/ SHAPE ARCHITECTURE
LOCATION/ VANCOUVER, BC
PROJECT YEAR/ 2013

CAPITOL HILL URBAN COHOUSING

ARCHITECT/SCHEMATA WORKSHOP
LOCATION/ SEATTLE
PROJECT YEAR/ 2004

Child space

The streets have been a pivotal place for kids to play. Whether it was the children batting on the sidewalks, playing hopscotch or skipping, or riding their bikes along with passing cars, the streets have been present informally, but housing has become so strict and private, that designers have completely removed opportunities for open child space where they could run wild in the city if not on the street. Children need space to be listened to, to be seen and cared for when in trouble, and they need to be able to see (child height is particularly important), and have privacy when needed.

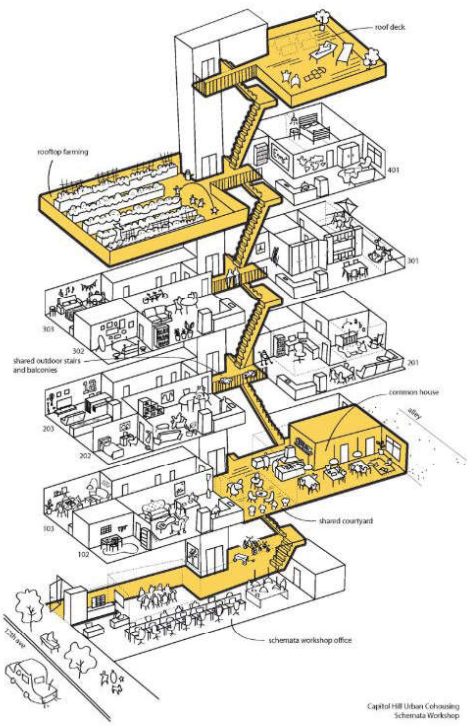
Children need open space

In addition to CHUC's interior communal kitchen, there are also external spaces for kids to enjoy. The bisection that the elevator and central stairwell provide, creates the space for the common patio where kids are able to play and run around during the day and adults are able to enjoy in the evenings. The rooftop garden is a place from which a local restaurant buys some of the produce which engages the larger community, and it is also where school children go on tours to get a sense for the growth and year round food production and planning.

Children need to be able to play in exterior spaces within the environment. Playgrounds that engage children to play outdoors, with rocks and grass, between trees and in slow streams allow kids to feel liberated. Unprogrammed space allows kids to make up their grounds, define space by their rules and their imagination. There they play, and learn to thrive within their microcommunity. Residential communities should operate in the same fashion, bringing child space to support families (Dudek, 2016).

MODELLVORHABEN ENERGIEEFFIZIENTER WOHNUNGSBAU

ARCHITECT/ DEPPISCH ARCHITEKTEN
LOCATION/ ANSBACH
PROJECT YEAR/ 2014



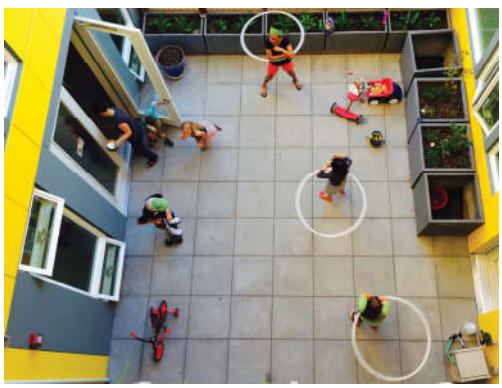


Fig 62 - Capitol Hill Urban Cohousing, Schemata workshop

Fig 63- Modellvorhaben Energieeffizienter Wohnungsbau | Ansbach, Deppisch Architekten

Energy efficient housing in Ansbach by Deppisch Architekten is a two building complex that uses form to create an interior child space. At grade is a central courtyard that combines the residential buildings to the east and west. The ground floor accommodates bicycle storage, private laundry rooms and stroller parking for when children are with parents or are playing in the playground within the courtyard. Building community includes all ages, and by designing child spaces, whether daycares, sitting rooms or outdoor play areas support parents and provide opportunities for other groups such as the elderly to participate in play or communal care for loved ones.

THE UNDERSTANDING

There is understanding in the aesthetics. The understanding firstly of where one home begins, and where another ends. There is also the understanding that residents may have the ability to participate in the selection of the identifying characteristics that make their home different from others.

SILODAM

ARCHITECT/ MVRDV

LOCATION/ AMSTERDAM, NETHERLANDS

PROJECT YEAR/ 2003

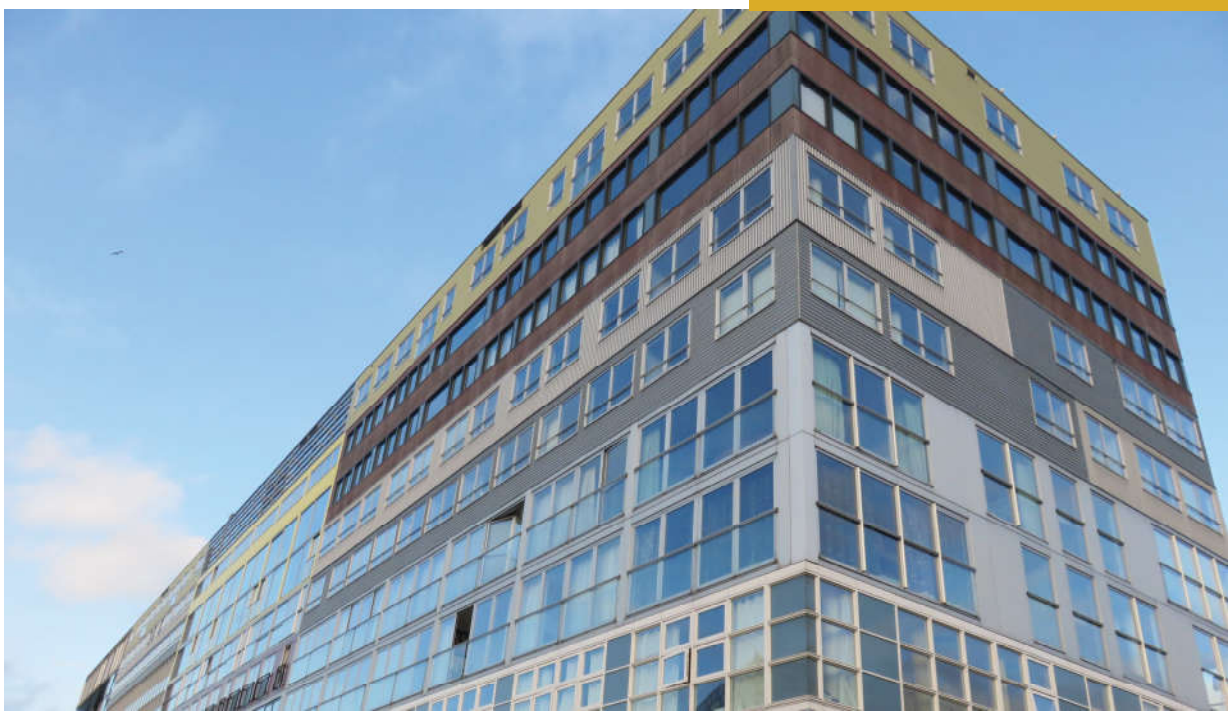


Fig 64 - Silodam exterior facade

Community Identity Indicator

There is a sense of identity when one has the free ability to distinguish themselves from others. In the same way architecture has the ability to do so. We see the versatility in colour, scale, size, element and meaning, age, etc. In Silodam the individuality was derived from the unit types. Fluctuating households that cater to different demographics are represented on the exterior. The colourful facade is an easy demarcation of such planning. The same can be said for European homes that allow for colour variety that easily mark what would otherwise be known as invisible housing boundaries as we often see in condominiums today. Units upon units, all the same with little indication of how the interiors are responding to their external facade. At Silodam, difference is

celebrated. MVRDV use what they call a "function mixer" to find an organizational logic, or play with blocks of different program and unit types, behind their 157 apartments, offices, commercial spaces and public facilities (Schittich, 2004).They grouped 4-8 units of the same kind together to create neighbourhoods and then gave them each an individual facade that was easily distinguishable from a distance. This provides residents with a sense of community, knowing and easily pointing out where they call home. This is seen in Mediterranean facades painted in warm hues that speak to the local foliage. Or it is otherwise seen in painted doors and entryways, shutters and window casing.

Fig 65 - On rubbled path in Cinque Terre, Italy

Fig 66- Greek and Italian enclosures

SUBSTRATE FACTORY AYASE

ARCHITECT/ AHA
LOCATION/ KANAGAWA, JAPAN
PROJECT YEAR/ 2017

Materiality

Atmosphere and comfort

Allowing for difference also provides sensual opportunities. People prefer sensory variability. A lack of sensory stimulation can produce negativity and feelings of anxiety (HOK, 2019). The most productive levels of sensory changes are found in moderated and segregated natural materials, complexity, touch, visual, color, pleasant sounds and odor in designated areas. Colour can be used to evoke feelings, - blue for calming and cooling, orange is to ease emotions and create enthusiasm, while pink is said to lessen feelings of irritation, loneliness and discouragement (HOK, 2019).

Instead of designing with all finishes in concrete or gypsum, wood can be another material to provide the atmospheric qualities to design home. Cool materials such as steel or concrete often provide an institutional feel, whereas wood is associated with the domestic environment. It is a natural and living material that comes in various forms, dimensions and types. Originating from a miniature seed in the forest, a tree grows to be harvested in many forms, broken down into a kit of individualized parts only to be rebuilt back together through human intervention. Part of our attraction to this material is due to its natural qualities; comfort and warmth. Wood comes from different climates and continents, it has a specific colour, textures, grain pattern, fragrance, density, hardness, leaves, pines, moisture content, it can be cut in different ways.

The extra small material/acoustic scale refers to the relationship between design/the environment and its effect on the body. It includes solar adaptability (use of lighting or shading), environmental control (winds), and texture (grain/ pattern). This scale asks that natural elements of atmospheric and material be controlled at the user's volition. This control is the level of atmospheric flexibility hoped for.

Fig 67- 70 Substrate Factory Ayase, AHA

Fig 73-74 - Substrate Factory Ayase, AHA

Fig 75 - NLT and DLT



Lighting/Shading /Texture

Lighting and shading comfort can be achieved through flexibly translucent screens, controlling the amount of direct sunlight into one room. Repetitive wooden materials can be used to provoke a multisensory, emotional response while providing visual complexity. This complexity begins to create texture. This texture affects our bodies and our psyche, it is inspiring and is proven to be experienced positively (Heerwagen, 2017). The Substrate Factory Ayase is a project by AHA built in Kanagawa, Japan in 2017. It demonstrates how the medium envelope scale and small scale flexibility can be altered through a variety of extra small panels to create different enclosures. Partitions slide using wooden panels to create a plethora of warmer spaces or cooler airy spaces giving this project its high degree of flexibility.

Texture can come in many forms. One of the primary ways to create or illuminate texture is through the wood cutting, either across or along the grain. Patterning is another way to achieve this texture. As with any issue of building performance, the acoustic properties of a mixed use wood-frame structure can be designed to meet or exceed minimal requirements, depending on the expectations of the developer, buyers and tenants. Acoustic material considerations are important in communal areas where there would be an expected high traffic area, unit separations and any other areas where social gathering is expected to occur. This is to eliminate echo or mediate spaces that do not provide adequate sound comfort. Different forms of wood construction can accommodate texture and acoustic requirements. Through the soothing patterning of individual wooden slats, both requirements are achieved and can greatly contribute positively to the users experience.

End of Chapter 2

CHAPTER 03

Chapter 3

DESIGNING WITH WOOD

ALL GROWTH - MONOCULTURE

SLOW GROWTH - POLYCULTURE

All growth vs. slow growth

The strongest part of the tree is the base, setting its roots in the earth. Grounded it holds every fiber and living matter together. The forest, however, cannot be made of a single element. For all trees to receive equal parts light provides singularity, sameness. The strongest forests do not grow all trees at once, some take the lead and others follow in sun streaked slow growth forests. They account for difference and age. To slow down the pace of growth creates the time for the tree to evolve into a mature and durable seedling. Travelling to Norway to see first hand the structural ingenuity of aged, well maintained wooden churches and homes was a pleasant experience. It has inspired this work and exemplifies European construction to learn from in the North American context.

Wood is enduring

DESIGNING AND BUILDING WITH WOOD

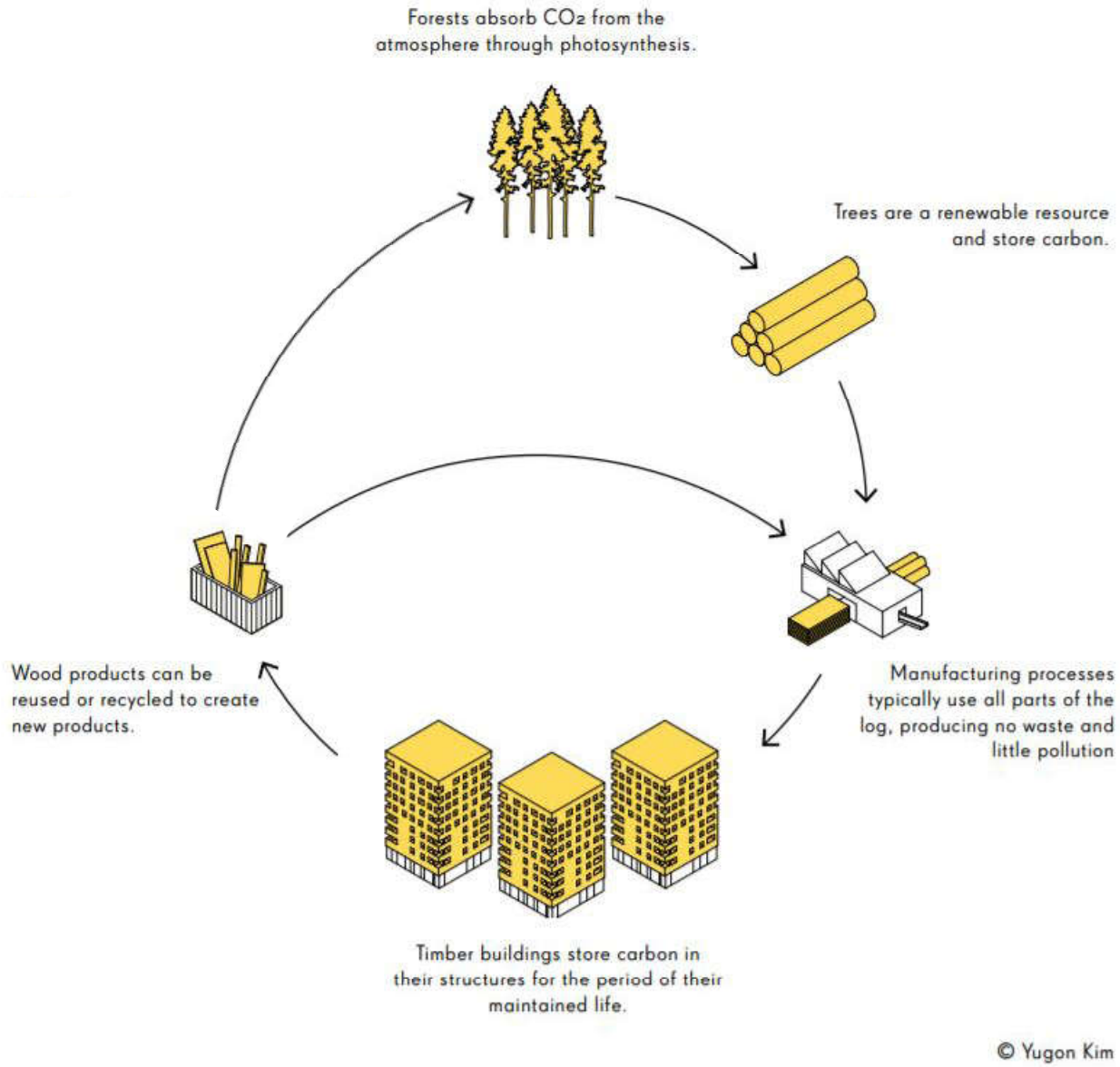


Fig 76 - Circularity of wood

Ecological

* It requires considerably less energy than other building materials when it comes to production, transport, assembly and demolition.
* Those who use wood for construction purposes are making an active contribution to protecting the environment.

Construction

* Structural and seismic performance. Wood is considerably lighter than steel or concrete but it can compete against their strength-to-weight capabilities. This results in lowered building construction costs with the reduction of load improving seismic resilience (Think Wood, 2018)
* CLT construction makes for 20% faster construction times over reinforced concrete builds. Shipped prefabricated modules can be transported to work sites for assembly reducing project timelines and improving safety and accuracy.(Think Wood, 2018)
* The wall thickness to achieve a similar U-value of different materials require more material thickness
* Timber is a noise absorber providing a layer of acoustic protection between the interior space and the exterior
* Its dry construction reduces the risk of physical structural damage due to building moisture
* Wood is more predictable in the case of a fire as large wood slabs char on the outside
* Other than concrete used on lower levels as per building codes and foundational limitations, timber construction does not require any sort of formwork significantly reducing labour hours per floor and miscellaneous supporting materials
* Because of this dry construction, the wet construction drying/waiting period is also eliminated
* Less affected by bad weather
* Trades can begin work at the same time as the CLT structure is being assembled
* Wood is less affected by large movement and impact due to its lightweight construction

Economic

* The wall assembly in timber constructions can be integrated within the insulation resulting in smaller wall assemblies saving approximately 1.4% more rentable space/unit. Timber is often a prefered material choice as it offers a strength to weight ratio that bears 14 time more weight than steel. This becomes important as foundation costs are significant, especially in renovations as this construction will require smaller foundations
* Prefabrication of this material makes for quick and efficient building which results in fewer site disturbances;
* Fewer site staff
* As well as economic benefit for private builders with short construction times meaning owners or renters will be able to move in in less time than other building structures

(Blumer Lehmann, 2019)

DESIGNING AND BUILDING WITH WOOD

Fig. 77 - 17th century log farmhouse in Heidal

Fig 78 - Stave Church in Norway

Wood, one of Canada's most abundant resources is making a huge comeback in the building industry. Appreciated for its tactile, visual and olfactory qualities, wood is distinguished as a natural building material with a strength - to - weight ratio that makes timber ncreasingly attractive in modern construction (Kaufmann, 2018). Light, versatile, and easy to work with, wood is also easy to transport, and lends itself to prefabrication, allowing for quick assembly and a more flexible design process. Wood is in fashion in the building industry at a time of growing concern for the environment. Wood is a construction material that is alive and can store carbon for many years which aids in the fight against climate change. However, regardless of the reasoning, this trend allows for greater, more ecologically conscious designs. For this reason wood will be used in this thesis project to provide for good physical and spatial forms encouraging successful communal design and adaptable building for future expansion or shrinkage.

Tested through time

Firmitas, utilitas, and venustas (commodity, firmness and delight); Roman architect Vitruvius identified these three elements as essential to the creation of a well designed building (UoC, 2011). Wood easily provides all three. For centuries, people have used wood to construct housing, commercial buildings and other constructions providing character, space, and atmosphere that other materials cannot.

In Canada many buildings of all types have been constructed with wood (Kenneth Koo, 2013). The eight storey building at 312 Adelaide Street West in Toronto, built in 1895, the 7 story brick building at 204-214 King Street East built in 1901 as well as buildings in the Distillery District, the entertainment and fashion districts, St. Lawrence neighbourhood and Liberty Village all indicate examples of tall brick and beam construction in Toronto. The First Great Fire of Toronto occurred in 1849, damaging many buildings in the downtown core, but it was only after

Fig. 79- 204-214 King St E

Fig. 80 - 204-214 King St E

Fig 81 - 312 Adelaide St W

the Second Great Fire of Toronto in 1904 that more than 100 buildings were destroyed (Morris, 1978) resulting in more stringent safety laws governing future expansion of the city (Young, 2018). Wood became feared and stigmatized as unsafe and unsuitable for future construction.

> *Population is rising, the climate is changing, the world is warming, pollution is stifling, and buildings are aging or in risk of failure... Designers across the world are becoming more cognisant of their role in inspiring change for others, and being good leaders and stewards of the practice in hopes of doing all they can for a better future. "They try to work not as an integrated organization but as an individual with helpers. In order to take on huge responsibilities of complex projects, you need to be able to grow into becoming an organization and not just an individual with helpers...Even if I practice until I drop dead, when I'm 90, maybe we'll build 200 buildings and that will be a lot. So 200 buildings in a 7 billion people planet is not a lot. So the real way to have an impact on the life of the many is if what you do is somehow , either, scalable or repeatable or inspiring..."*
> *- Bjarke Ingels, (Zatarain, 2017)*

Wood technology has continuously transformed to address changing needs and with the tremendous material flexibility that wood has to offer, it can be used in combination with other structural materials to accomplish any envisioned design. The material is flexible, so using it at different scales allows users to manipulate what they call home more easily than if they were to use other materials such as concrete and steel that have more recently become the norm in larger scale construction.

Wood, health and wellbeing

In her article "*Psychosocial Value of Space*", Judith Heerwagen presented a material argument in a very interesting light. She said that in order to better understand the current phenomenon we must first situate ourselves as observers, outside, in order to understand how someone would be able to see the way we live. Notably, Heerwagen says not to look at buildings for insights on how space should look in order to promote psychological and social well-being, but to look at the behavioural patterns of animals in zoos (Heerwagen, 2017).

Healthy environments as defined by biologist Stephen Boyden are "conditions which tend to promote or permit an animal optimal physiological, mental, and social performance in its natural or 'evolutionary' environment." (Heerwagen, 2017). Boyden is thus arguing for environments that not only allow for "survival" but that also satisfy user "well-being". Pushing Maslow's notion of human needs a step further, the argument is no longer for good enough but for better, asking design to focus on more than the bare minimum and to support joyful environments for everyone to share; giving back the truest sense of the term "housing community".

Wood is a natural material that provides countless advantages to humans and the built environment. It is soothing (Hansen, Jones, & Tocchini, 2017), environmentally friendly, a strong lightweight material, durable thus economical, and its natural qualities resonate with people of all generations. Because we spend as little as 6% of our time outdoors, and the same amount of time in cars with the remaining 88% indoors, we need to ensure that building interiors are finished to a high quality. Just as the outdoors and indoor plants positively affect our health and well being by alleviating stress, so does the presence of wood and natural surface, whether visually or through touch (FPInnovations & University of British Columbia, 2018). The study was initiated by having the same room with differing levels of finish from high wood levels to low. Researchers found that the SNS activation (the sympathetic nervous system - responsible for controlling the release of adrenaline which raises blood pressure and increases heart rate among other factors), was lower in the wood room at all periods of the study.

Characteristics and construction

Apart from its soothing nature, its environmental friendliness, its lightweight strength and its durability, wood is also an adaptable material with quick assembly methods and insulating properties. Broadly speaking, there are two classifications of woods that have many variants and species. Softwoods come from coniferous trees such as pine, spruce and fir, they are soft, lightweight and faster growing that hardwoods which is why they are usually preferred for structural framing. Hardwoods come from deciduous trees like ash, oak, teak, birch, walnut and mahogany and these more expensive woods are known to have a more visually appealing grain pattern, colour and finish. Hardwoods are typically used for furniture, doors and floors (Jonathan, 2017).

Fig 82 - Common Softwoods and Hardwoods

Codes and wood types

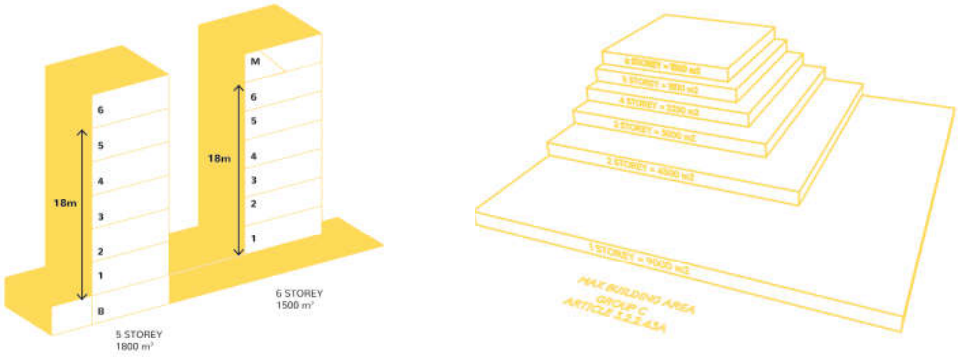


Fig 83- Ontario building code illustrations

The Ontario Building Code has followed the example set by British Columbia to permit wood-frame residential construction to a maximum height of six storeys. Different timber-framed construction systems permit the design typically to achieve different conditions. These conditions include predominantly cost, structural, acoustic and/ or fire safety. Generally the rule is to design buildings up to 6 storeys with light frame construction and up to 10 storeys using CLT for cost-effectiveness, but this also varies with he structural complexity of the design (Wood Works, n.d.).

There are three main types of timber construction used in this project: light frame construction, post and beam construction, and cross-laminated timber (CLT) construction.

Fig 84 - Light frame construction, Post and Beam construction and CLT construction

Light frame construction - Quick manipulation

Flexibility and versatility through wood construction also means inherent support for the community. Because wood is so flexible , various options in terms of housing strategies and designs become limitless possibilities. Williamson Williamson's (then Williamson Chong Architects) Grange Triple Double, was only made possible because it was built in wood, and this technique allows for owner manipulation in the long term (Williamson Chong Architects, 2016). Light framing can be utilized on the interior of the building after project completion to create smaller more private spaces.

"The basic component of contemporary timber construction is no longer the stick - it's the panel." - Andrea Deplazes (Deplazes, Krotsch, & Huss, 2016)

Wood allows for flexible and accessible spaces: knock out walls

With this, the feasibility of a flexible and affordable housing strategy allowing for the combination of multiple families under one roof will be re-evaluated. Interior spaces and rooms should be manipulable to ensure spatial separation/privacy, communication and rental opportunities for income supplementation. The Grange Triple Double house is a great example of adaptable housing. Together, two or more unit-holders create a new living arrangement that allows for autonomy, while taking advantage of the benefits of proximity.

Fig 85 - Grange Triple Double, Williamson Williamson

Through the establishment of a flexible design that is satisfactory to all parties, the provision of housing that fosters independence and comfort is supported. With adaptable housing, spatial requirements may contribute to ease of supervision of grandchildren, while embracing the required social aspects of independent living that many seniors claim are poorly addressed in current seniors' housing. Professional couples (middle aged adults), seniors and children can live in the city of their choosing that supports autonomy and freedom rather than the solitude and resentment often sensed in retirement homes (Murrell, 2018).

Building for long term flexibility can include the notion of knock out walls. Strategies like knock out walls provide small scale adaptability for spatial continuation or separation when needed. This is a level upwards in terms of acoustic and visual privacy than the previous iterations that gives more space left open.

Fig 86- The Grange Triple Double house by Williamson Williamson

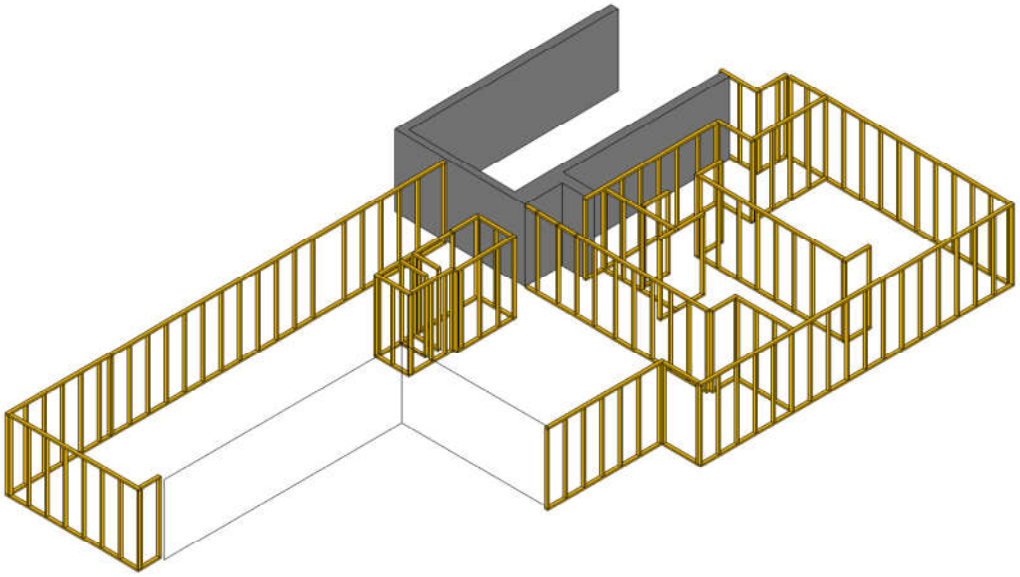


Fig 87- Light frame diagram of Williamson Williamson Grange Triple Double

Fig 88- The Grange Triple Double house by Williamson Williamson

CLT - Long Term manipulation

Mass Timber refers to a form of construction which uses large engineered prefabricated wood members such as Laminated Veneer Lumber (LVL), Laminated Strand Lumber (LSL), and Cross Laminated Timber (CLT) for wall, floor and roof construction. CLT can be used for balustrades, load bearing walls, partition walls, floors, ceilings, it is truly remarkable just how flexible this material is and how well it can work with other wood construction types.

Originating from Central Europe, CLT is an environmentally friendly renewable resource, that sequesters carbon dioxide and can be recovered, reused and recycled. Over the last two decades this emerging product has provided a lightweight strength in comparison to steel and concrete. It is cost effective, allows for fast assembly, provides thermal and acoustic insulation, adaptability, fire resistance, durability, and best of all, it also provides spiritually soothing properties with its natural warmth (Blumer Lehmann, 2019). Its panels consist of alternating perpendicular layers of lumber glued together under high pressure. Panels come in different sizes, usually 3 ply to 9 ply (layers).

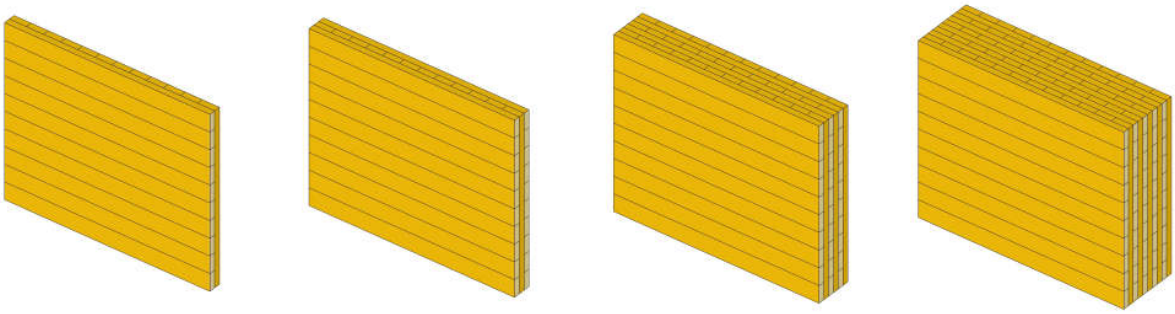


Fig 89 - CLT Ply 1 - 3 - 5- 9

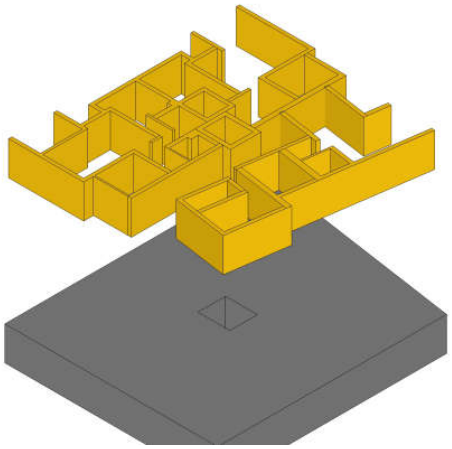


Fig 90 - Forté by Lend Lease: Axonometric of CLT

Fig. 91- Prefabricated installation

Fig. 92 - Forté by Lend Lease

Prefabrication

Designing with wood can provide a great return on investment. Designing buildings with prefabricated components can help decrease labour costs, increasing factory built components that will provide the owner/ builder cost savings, and wood is a very simple material to use to this effect. Whether the whole home or unit is modular or it consists of panelized systems this will aid in changing conventional practice and increase construction flexibility, improving user satisfaction and decreasing costs.

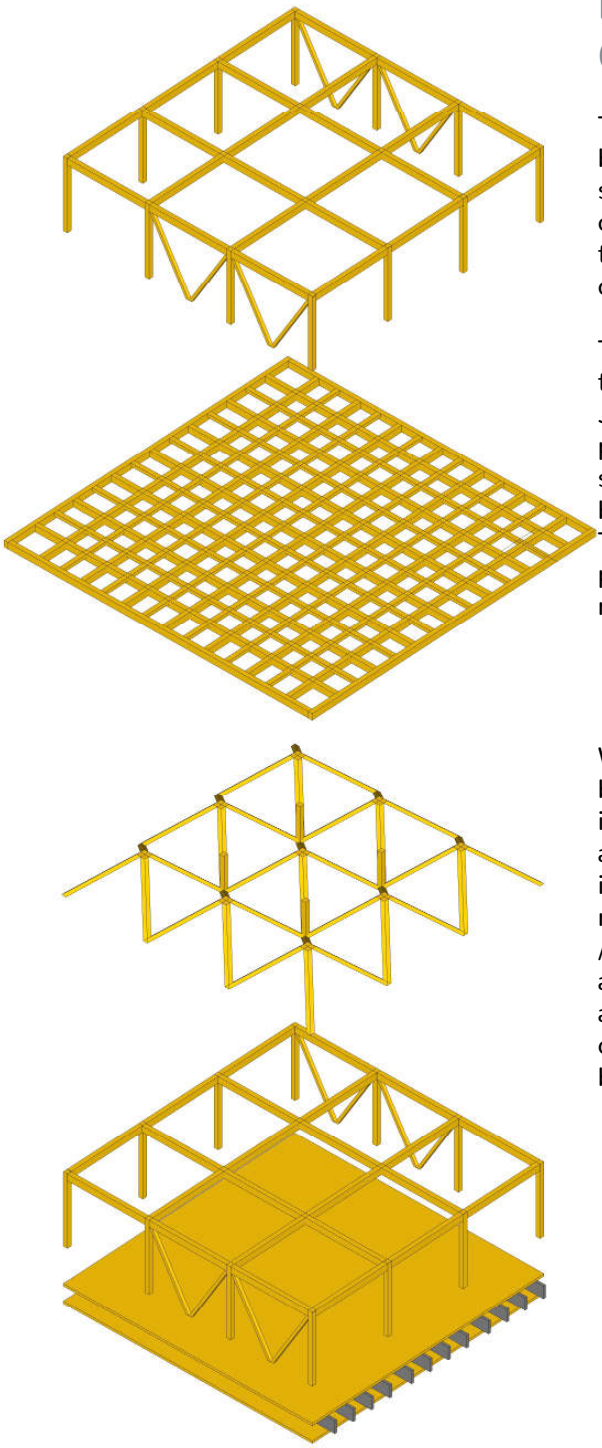
Forté in Melbourne, Australia completed in 2012 is a 10 storey commercial/residential building. Designers/ developer/owner/structural and construction team Lend Lease, highlighted a few challenges that they encountered in the production of this project. They were able to construct with significantly shorter installation times, with offsite CLT cutting (prefabricated bathrooms, and modular components). Forté was the first residential building in Australia to use CLT as a structural solution. Because designers feared the risk of termite infestation, the ground floor is the only one of the buildling's 10 storeys to be built of concrete. The walls, floors, stair shafts and the elevator core are all constructed from CLT panels. Exposed CLT staircases and CLT feature walls aim to showcase their innovative project while being modest in the amount of exposed wood for those with preconceived notions against wood (BSLC, Forestry Innovation Investment, & Think Wood, 2014).

Building to Expose CLT

Designing to expose the natural wooden structure on the interior can be rewarding to residential owners. In the 6 storey CLT London project Barretts Grove by Groupwork + Amin Taha, completed in 2016, services and built-up floors were positioned on top of the floor slab to expose the CLT structure on internal walls and ceilings. This gave the apartments a warm residential character. Insulation and vapour barrier were designed for exterior application and the building was clad with a brick rain-screen (Think Wood, 2018). The embodied energy of this project was also reduced by 15% as the need for interior gypsum finishing, skirting, tiling and paint were eliminated by exposing the structure, which saved around $52,000 per flat, but also reduced the use of carbon intensive materials overall.

Fig 93 - Barretts Grove - Groupwork and Amin Taha

Fig 94 - Barretts Grove, exterior - Groupwork and Amin Taha



Post and beam - Open manipulation

This component driven structural method of post and beam construction can be extremely beneficial as it is held separate from the exterior wall, and can be erected quickly on site due to its stick nature. It also allows for designs that can harness this characteristic with large grids of open floor space and window variability.

The Substrate Factory Ayase is a two storey extension to the existing Ayase circuit-board factory in Kanagawa Japan designed in 2017 by Aki Hamada. It aimed to provide a flexible space for multiple uses. "Open wooden-substructure factory" was envisioned as a mediator between the steel framed megafactories (AHA, 2017). Tracks on the floors and beams above hold the panels in place as they slide throughout the room creating different micro spaces.

Conclusion

Wood is a versatile material that allows for richness on both the interior and the exterior, in furniture and screens, in frames or doors, and floors or ceilings. The possibilities are endless with wood, it can support the notion of incremental growth, provides schedule flexibility, and is readily available in abundance. With the use of organized / determined construction practices, this thesis project aims to design for future expansion opportunities within a mid-rise application to offer the chance to host existing complexity that is demonstrated in the way we live in the built world.

End of Chapter 3

Fig 95 - Substrate Factory structural axo

"If people are to be the main actors in Human Scale Development both the diversity as well as the autonomy of the spaces in which they act must be respected...

It is necessary to analyse to what extent the environment represses, tolerates or stimulates opportunities. How accessible, creative or flexible is that environment?

The most important question is how far people are able to influence the structures that affect their opportunities."

- Manfred Max Neef , Human scale development (1991)

CHAPTER 04

Chapter 4
DESIGN SOLUTION

The described design pertaining to successful housing is to be addressed with respect to its' **LAYERS** in hopes of creating a design that can aid in giving residents the opportunities to fulfill desired outcomes as per Max-Neef's theoretical platform for improved well-being. It is important to note that this thesis focuses on flexibility of architecture from a human point of view (formal flexibility, human and material complexity), and thus everything else is in service of this goal.

FLEXIBILITY

Flexibility Parameters

Territorial + **Physical** + **Understanding**

COMMUNITY DIVERSITY | **BUILDING** | **MATERIALITY**

Scaled Design Layers

Neighbourhood Living spaces | Supportive Protective = | Atmospheric

XL **L** **M** **S** **XS**

Design Parameters

Design Considerations

Desired Outcomes

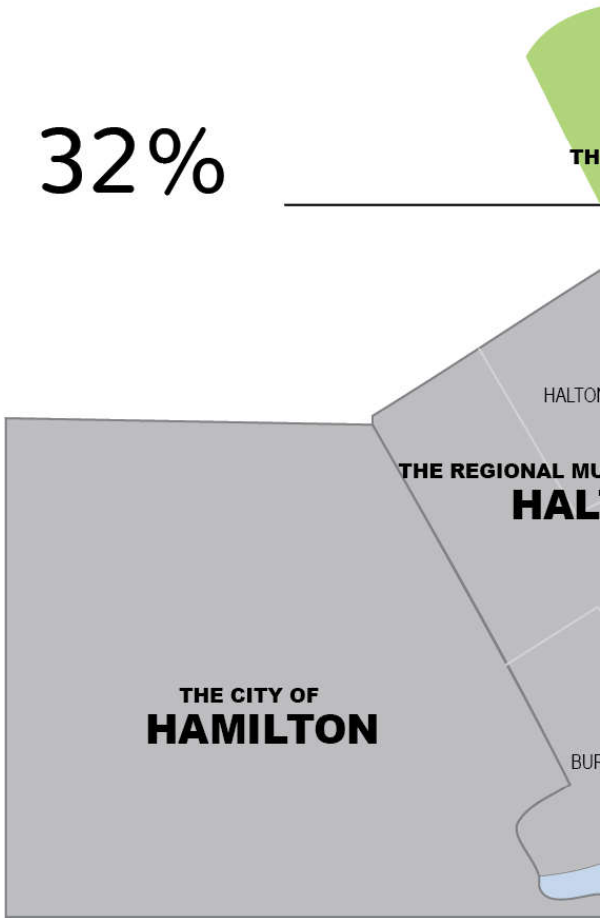
Subsistence | Protection | Affection | Understanding | Participation | Leisure | Creation | Identity | Freedom

XL
The Neighbourhood

If we want to design adequate housing in the city we have to step past only addressing the problem from the age or square footage perspective to one that also accounts for the complexities in which we live. Torontonians live in one of the most diverse cities in the world, and living structures have changed. No longer is the nuclear family standard. There are multigenerational families, blended, skip-generational, co-living and more which make the case for a thorough investigation on how to design for this.

In 2016, Statistics Canada showed that multigenerational households – which include three generations of the same family – were the fastest growing type of household in the country: between 2001 and 2016 all household types grew by 21.7 per cent, while multigenerational homes grew **37.5 per cent.**

By 2016, **2.2 million people** lived in a multigenerational setting. One size does not fit all. According to Statistics Canada 32% of families in Peel, 20% in York and 31% in the city of Toronto are living in multigenerational households. This number has been the fastest growing number for family types in the past few years, but housing design does not account for this. This project will aim to find new alternatives that better support aging in place in the urban core which while not as profitable for developers meets this project's primary goal of overall resident satisfaction for all. Finding ways to house and unite the greater community and their differences operates at the XL scale.



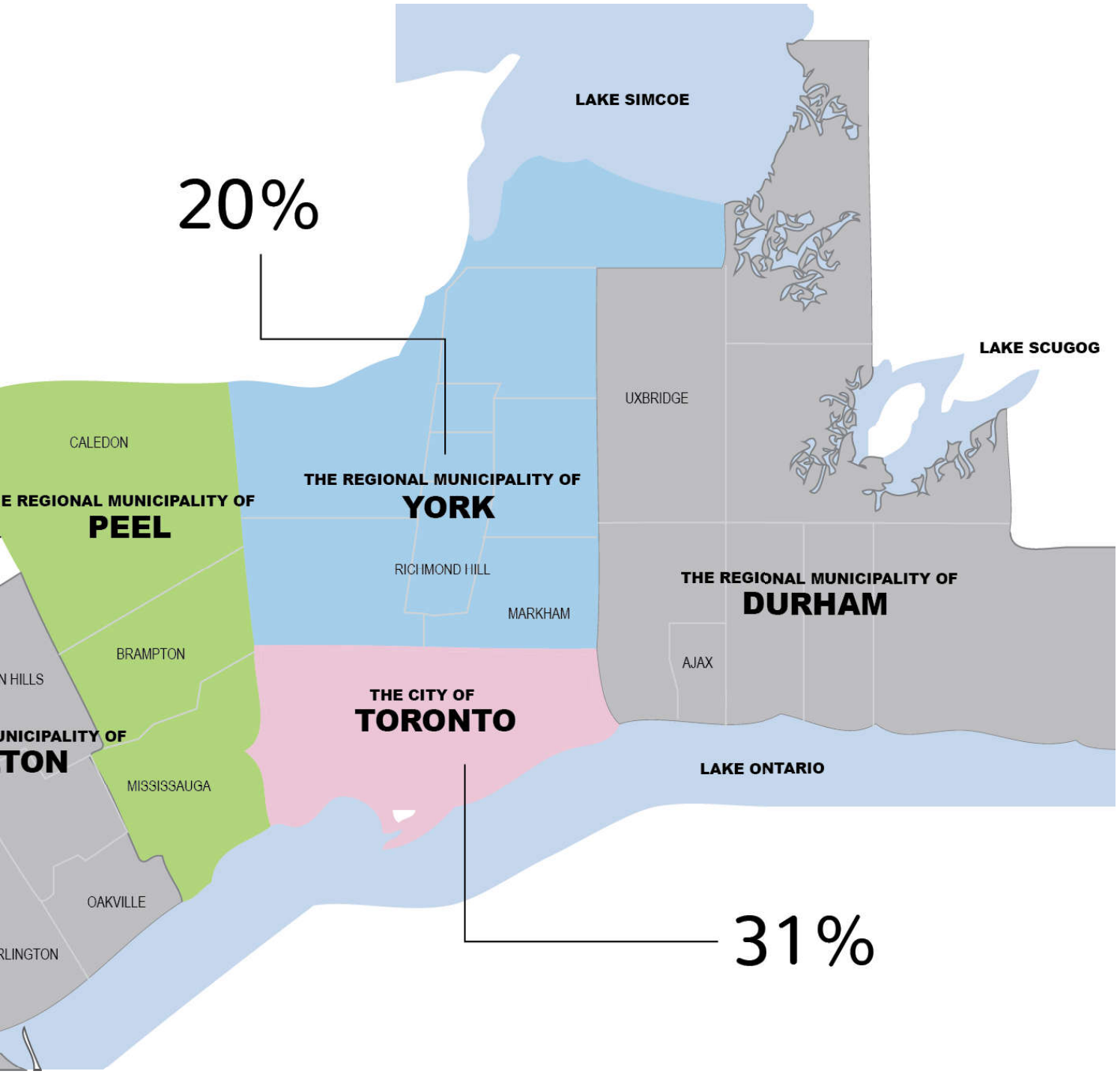
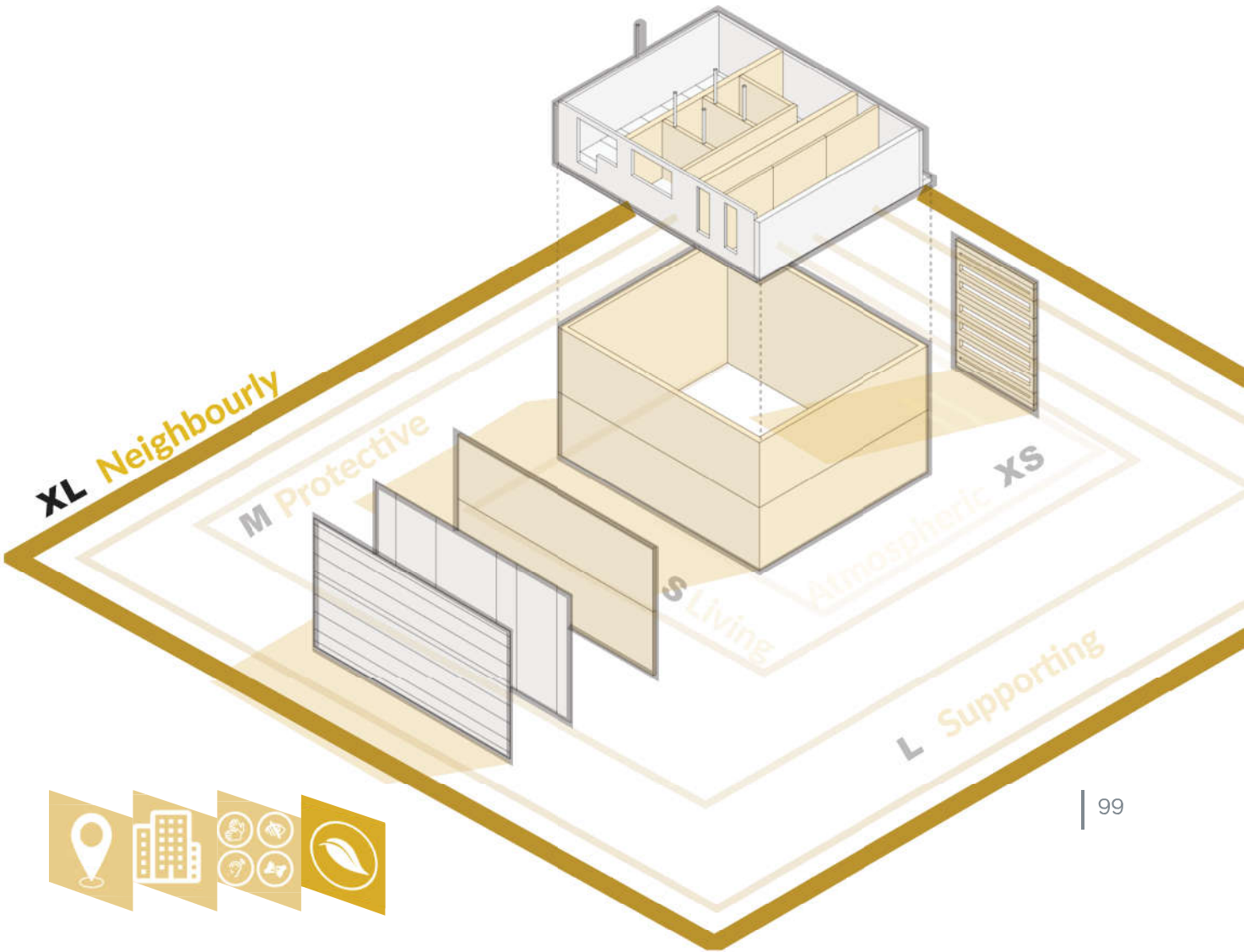


Fig 96 - Percentage of multigenerational households by region

XL

The Neighbourhood Layer


XL Neighbourly
M Protective
S Living
Atmospheric
XS
L Supporting

Location + Proximity

Site selection is not the main focus of this project but the importance of location is that the building works in context with the surroundings and that it is able to support the broader community. It needs to be within a 20 minute walking distance to a major transit hub or connections (be it a subway station, a bus or streetcar stop, a car sharing lot or bike lanes). The chosen site is in Toronto and provides a central example of a 20 minute commute to the downtown core illustrating great urban conditions. There are many resources and services in the selected neighbourhood and it supports many age groups, ethnic diversity and income variation.

Figure 97 - Aerial View looking North


Gerrard St.
Sherbourne St.

Travel Time Map

20 minutes - 1.6 km radius (centre at the location marker)

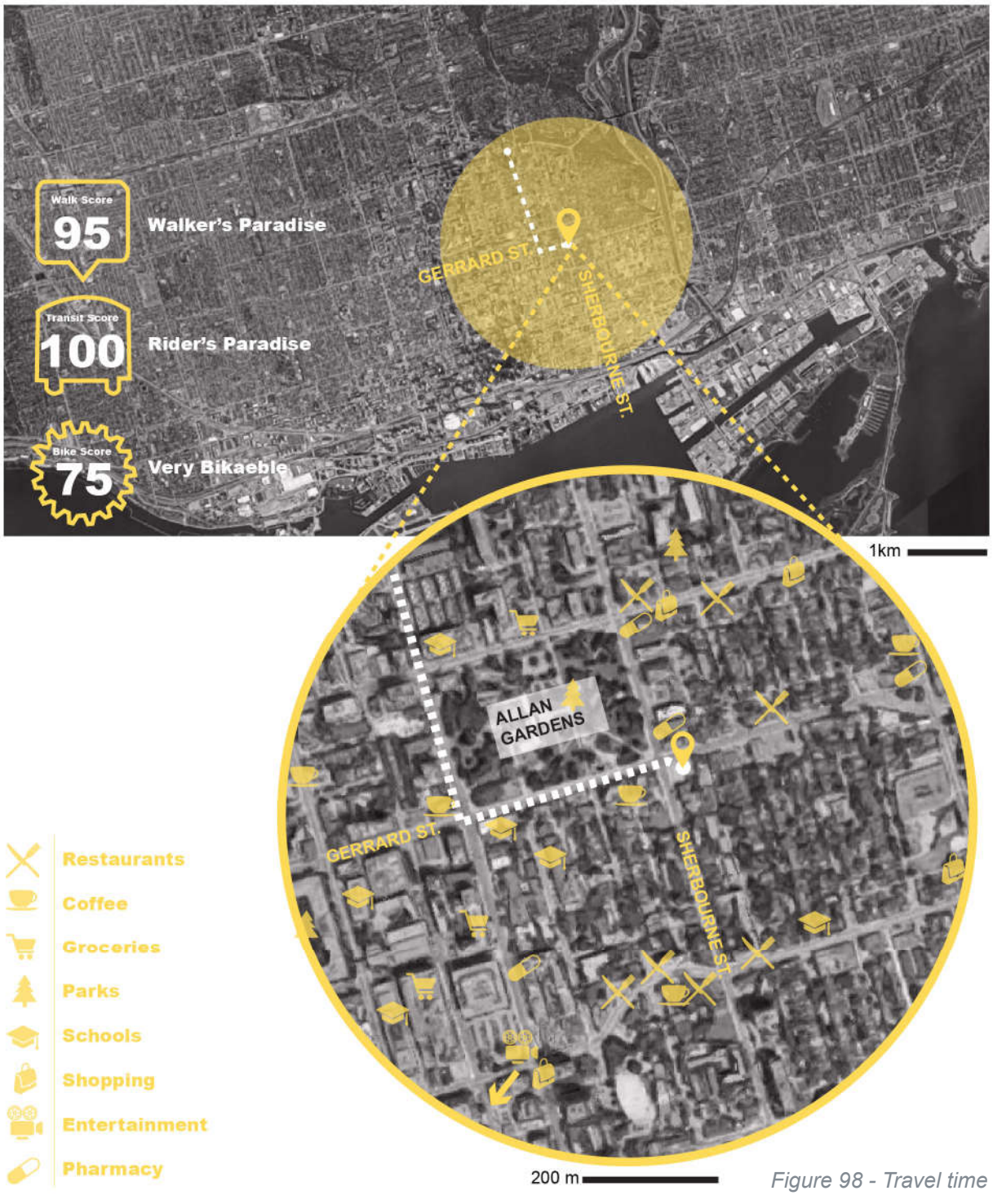


Figure 98 - Travel time map

History + Description

Two sites were initially chosen to understand how the building module and principles could be applied to sites of different proportions. This design project can be applied in different site conditions (wide and long vs. square and compact), supporting the notion of an adaptable system.

The first site is located at 307 Sherbourne St. in the Church and Wellesley Garden district of Toronto. What is a now a vacant lot stands at the corner of Sherbourne and Gerrard, diagonally across from Allan Gardens. There have been informal uses and urban food markets with vendors on site in the past. This was a great corner lot to show how the chosen drivers can be applied.

The chosen site however is a few metres down the road from 307 Sherbourne St., located at 227 Gerrard St. The former Girls' Home and Public Nursery was the first development on this site in the late 1860s. The Girls' Home was designed to help disadvantaged children of parents who lived in the core, unable to sufficiently care for some or all of their children (Neff, 2011). Prior to this Home, seen in figure 99, a public nursery for Girls and Boys was erected in 1856 but it was unable to service the children sufficiently. These spatial limitations were resolved through financial benefactor Mr. William Gooderham in 1868. Later the infirmary wing was built in 1885 and the school wing in 1890 (The City of Toronto, 1906). This Home and Public Nursery provided shelter for girls up to 14 years of age, while girls 12 and up could be apprenticed until the age of 18. When the number of families started to decrease indicating the need was becoming less apparent, the building was transformed to a men's hostel in 1947.

This site was once the pivotal demonstration of strangers who through caring for each other became family. Today, unfortunately, the site is occupied by a single storey Beer Store with extensive surface parking, having lost all the communal values it once held for a building that is now in horrible shape and hard to enjoy with the much stronger presence of law enforcement officers than a local community. I am proposing a communal built form to revive the interdependence of its historical past, one that is adaptable to the changing dwellers it will inevitably host.

This site offers an opportunity to create a food-centric and child-centric design that incorporates the broader community through its location.

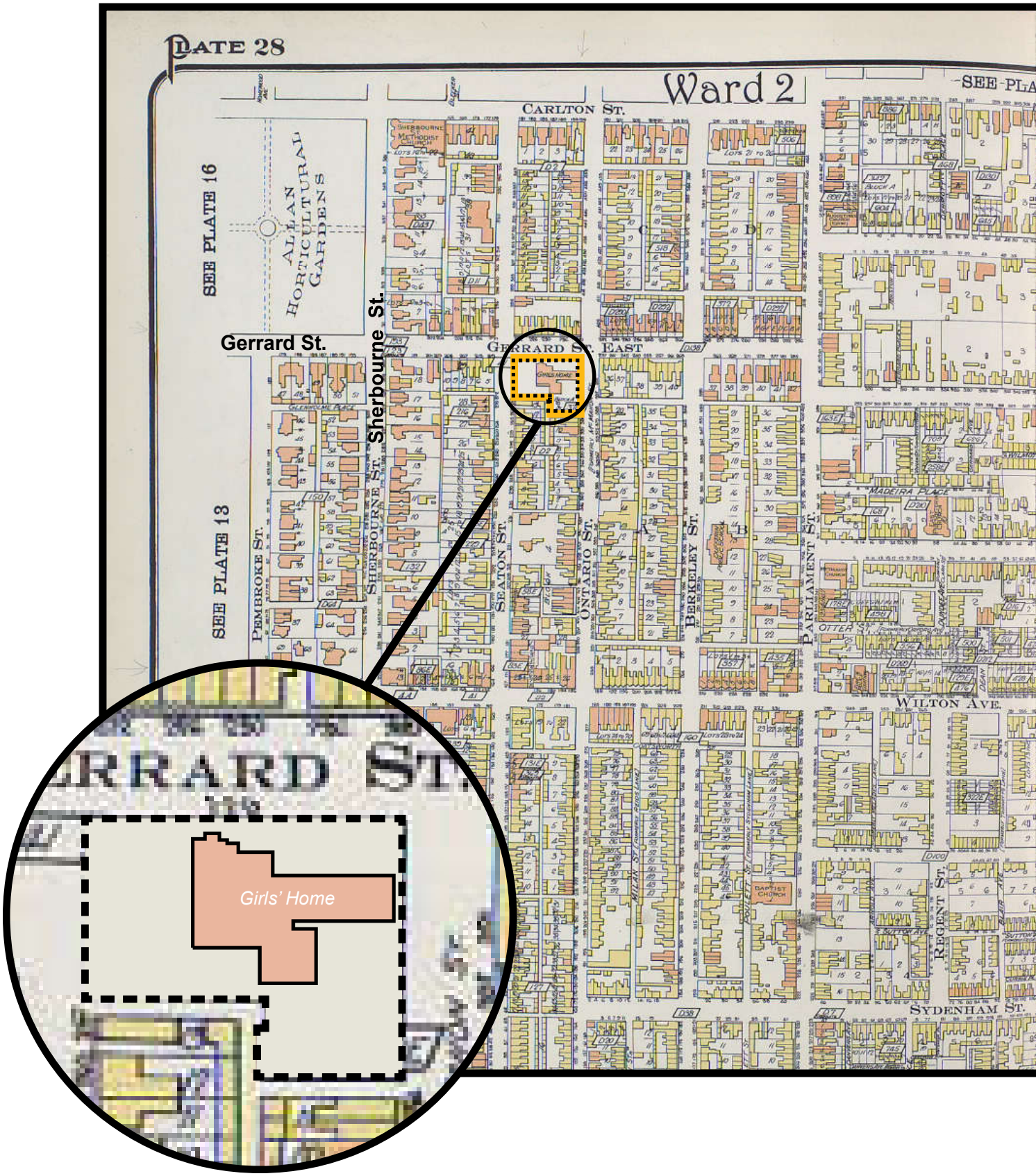


PLATE 28
Ward 2
CARLTON ST.
SEE PLATE 16
SEE PLATE 13
ALLAN HORTICULTURAL GARDENS
Gerrard St.
GERRARD ST. EAST
Sherbourne St.
PEMBROKE ST.
SHERBOURNE ST.
SEATON ST.
ONTARIO ST.
BERKELEY ST.
PARLIAMENT ST.
MADEIRA PLACE
OTTER
WILTON AVE.
REGENT ST.
SYDENHAM ST.
Girls' Home

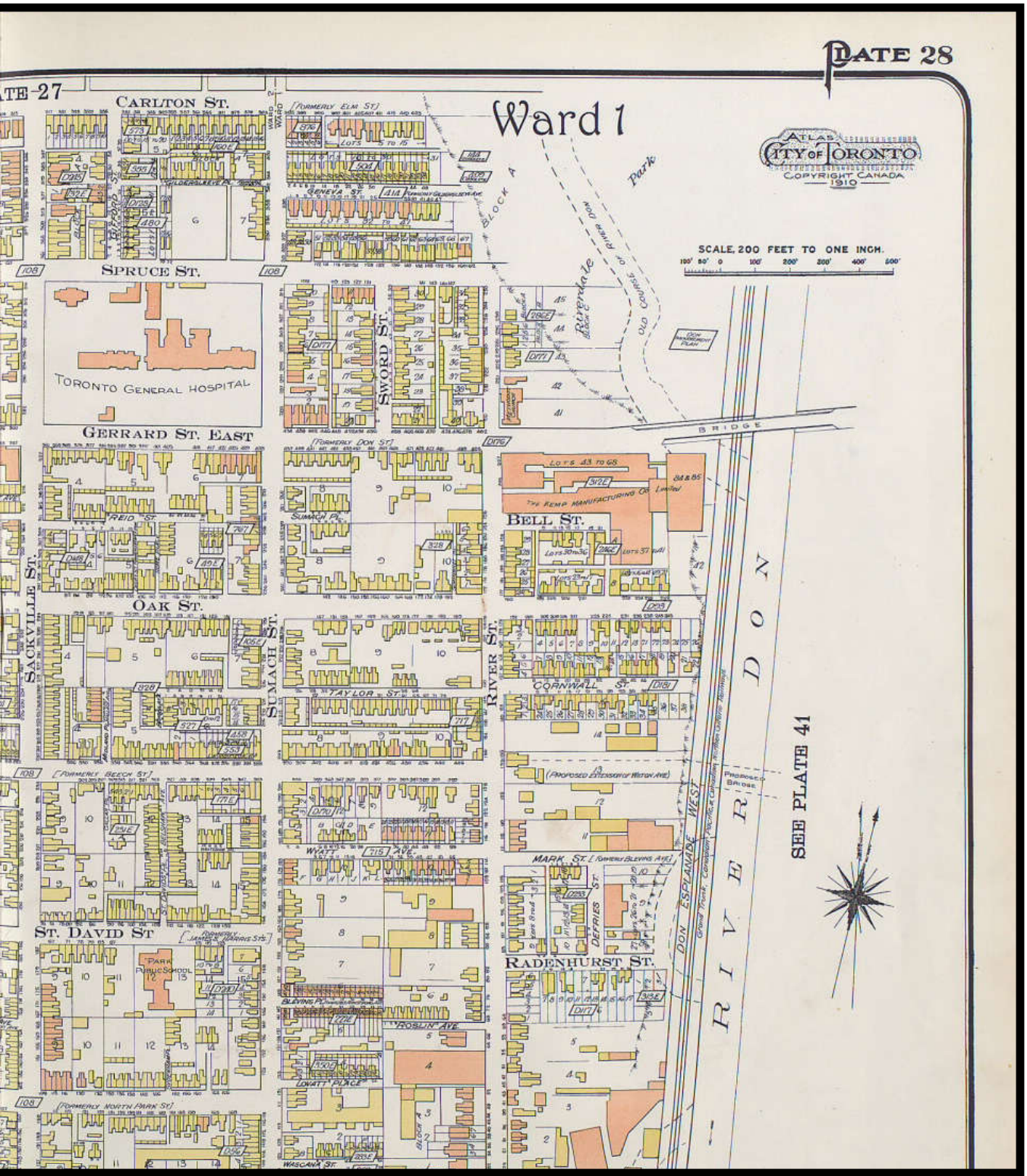


Figure 99 - Yesterday: 1910 Map of Toronto

Figure 100 - Yesterday: Former site of The Girls' Home - View from the North , 1915.

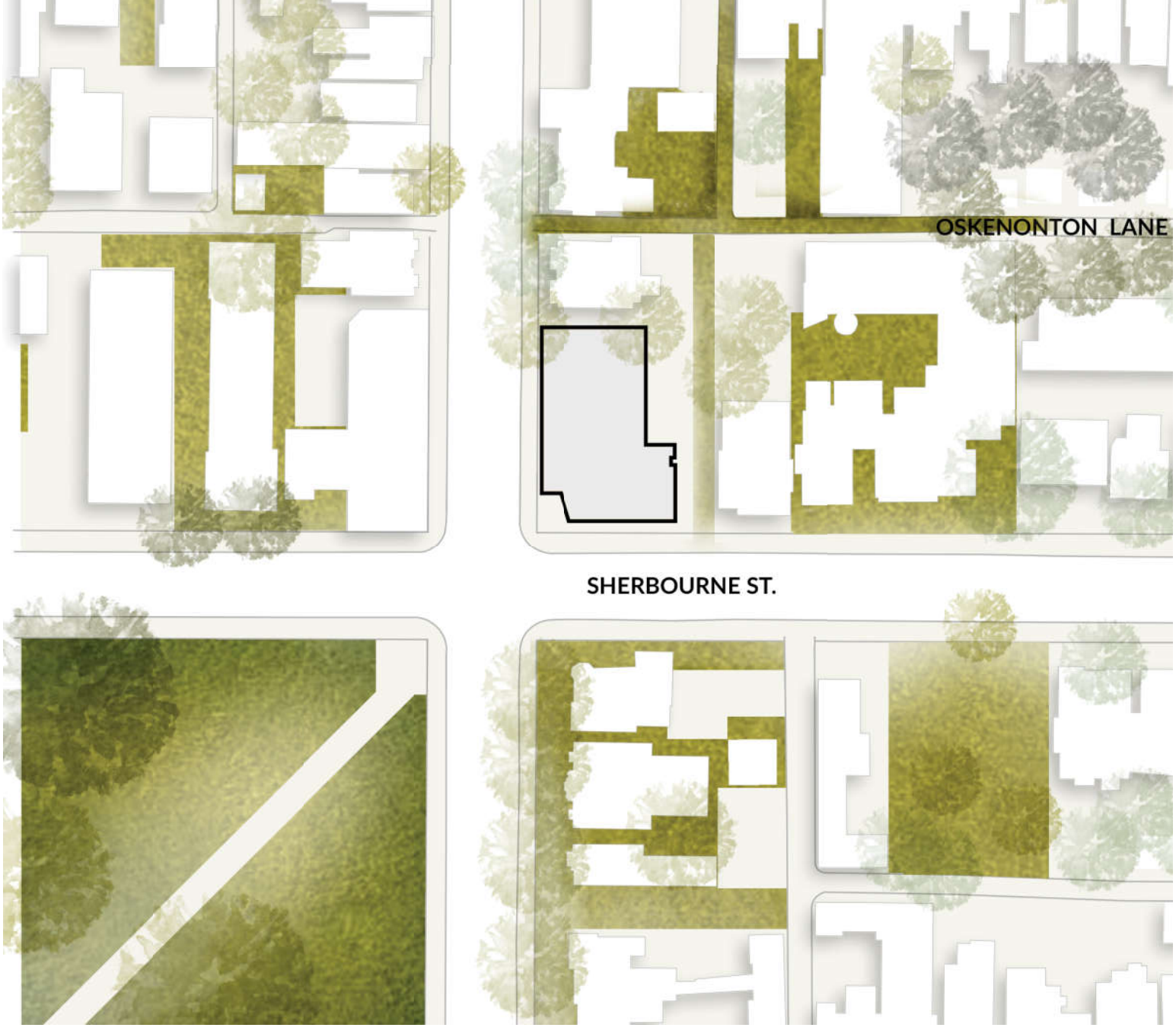
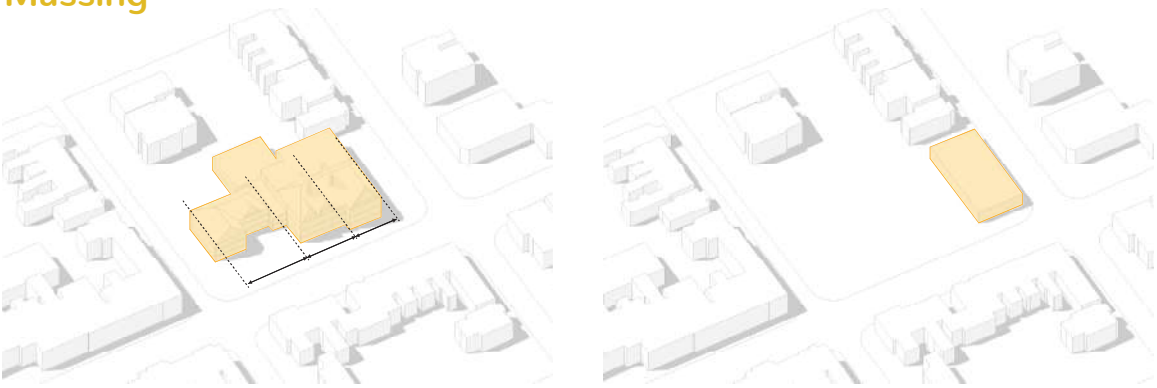
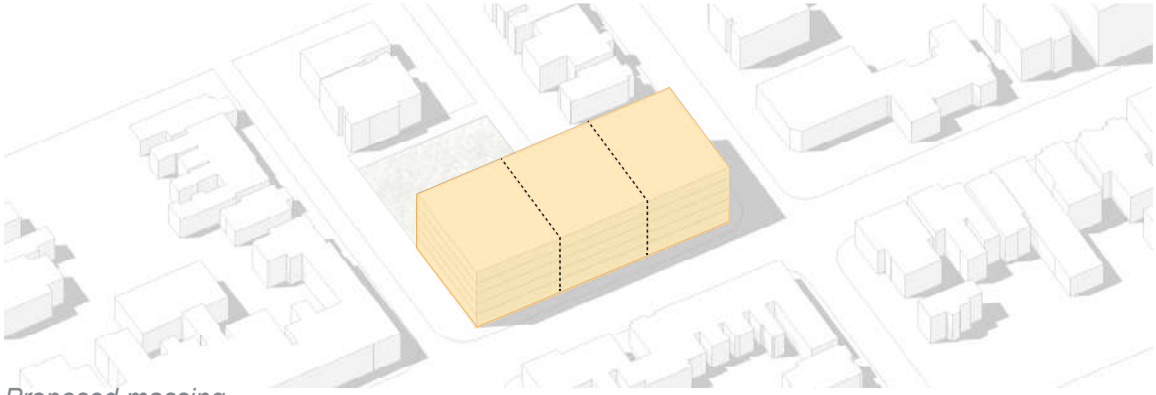

OSKENONTON LANE
SHERBOURNE ST.

Fig 101- Today : Site Plan

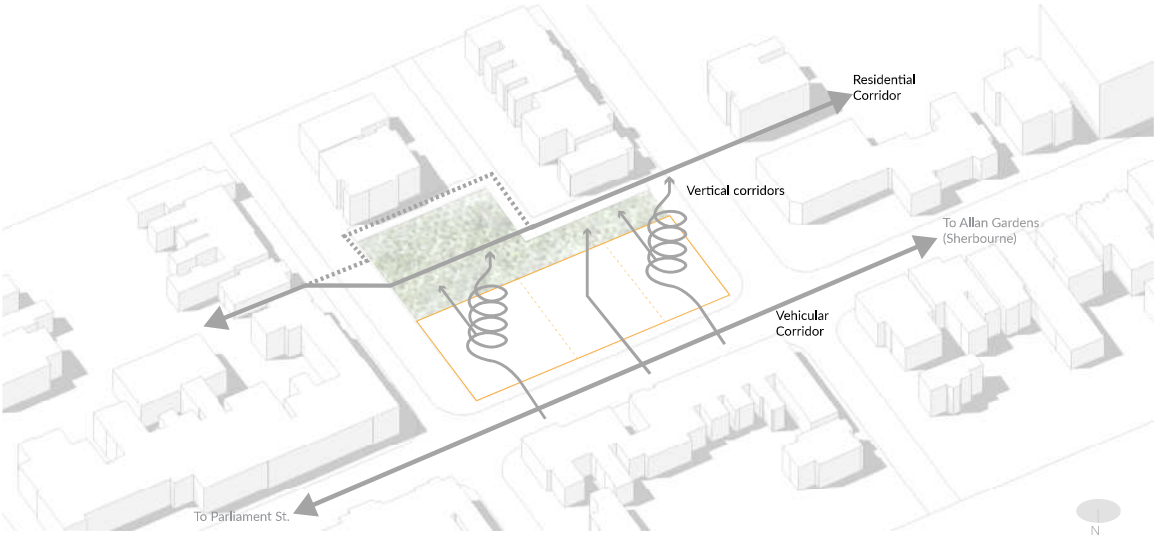
Massing



Past and Present Massing: Former Girls' Home and the Beer Store

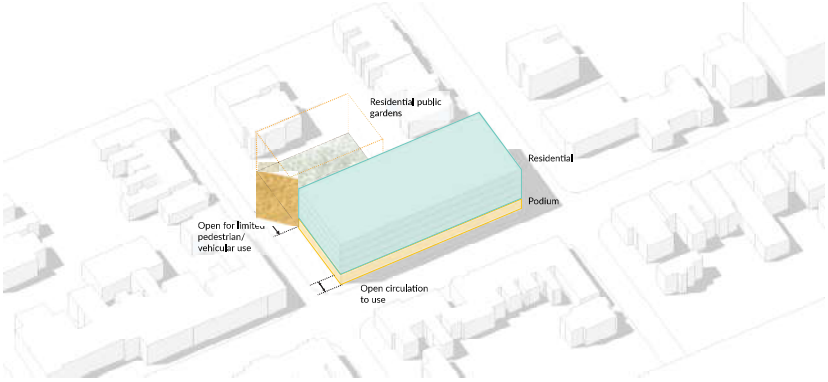


Proposed massing

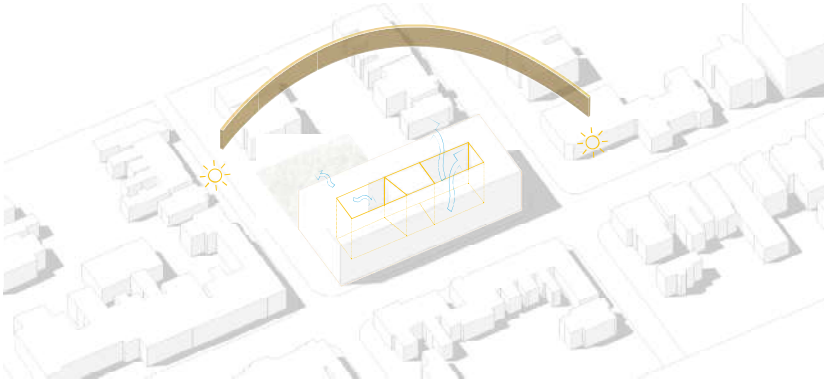


Site Circulation

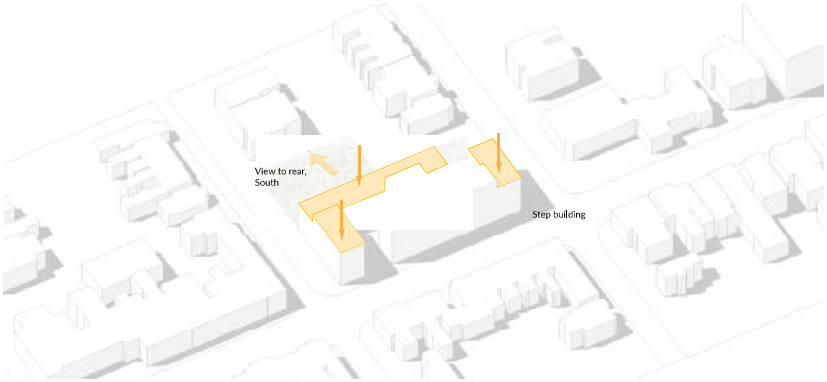
Figure 102 -105 - Formal decision making
Figure 106 -109 - Formal decision making



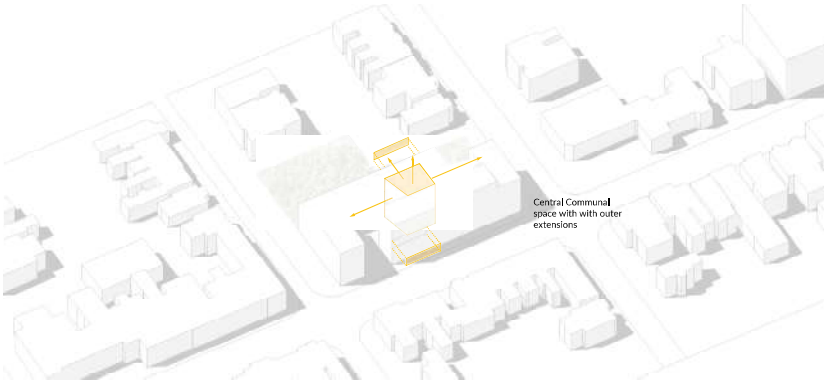
Massing



Central Space



Two Block definition



Staggered Communal Space within blocks

Overall design

227 Gerrard St. E

Urban residential design does not make sense at the standard 2 storey low rise height, nor do the high rise buildings at 78 storeys. There are a few mid-rise buildings along Dundas street, College Street, St. Clair Avenue, and Bloor Street West typically built of concrete construction sacrificing flexibility for convenience. They are so rare that this proposal aims to reintegrate them into the fabric seamlessly. The current Building Code allows for 6 storey buildings in wood frame construction, so this will be the target height. This site will demonstrate a socially, environmentally, and economically sustainable mid-rise timber framed structure. It will provide residents a cozy residential feel unencumbered by high rises peering over gardens and balconies.

As per Jane Jacobs' principles regarding density and buildings, it is important to note that the thesis proposal is for mixed used buildings. The main level is, where possible, commercial, with residential above. The chosen site is also within a well scaled neighbourhood that surrounds the sites with heritage buildings. This provides a context that supports the principle of maintaining a street that is visually definable and differentiable as aging buildings that are well kept with different activities bring life to the street.

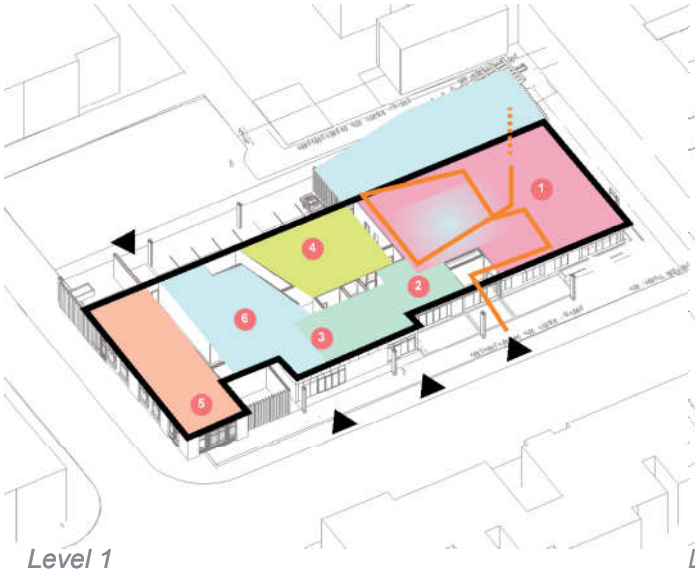
Covered canopies provide shelter to visitors or residents. Access is provided from any side of the building to allow for easy circulation. Though it is easy for the public to access the south side of the building, resident security is achieved through a centralized corridor that directs residents to either side of the building. Lastly this central circulation is designed with zero to low slopes for safety in addition to building lighting around the building at all times.

Fig 110 -227 Gerrard St. E

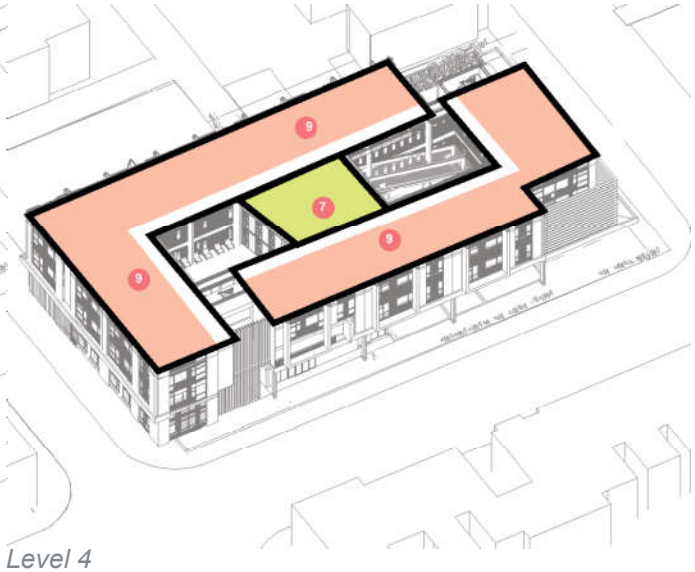
The main entrance is conveniently accessed from Gerrard between Seaton and Ontario Street. This structure is an example of a very responsible scaled design, providing increased density and community without defaulting to a high rise.

This design will accommodate a 6 storey building that is formed of two L shaped blocks connected centrally through a communal space. This layout provides a central communal space on level one and a half. The windmill form of the building allows for a dynamic quality to the interior corridors as well as the floor plans. A Communal landscaped terrace sits on the east side of the courtyard while a skylight to the daycare to the west provides a playful interaction between residents and neighbourhood children which will provide delight to people of all ages. The children will have fun running up the ramp and the spontaneous interaction with the community space is a desirable residential quality families and others encourage. Typical double loaded corridors do not support community, so this building uses single loaded skip stop corridors that allow all individuals visibility and access to the central courtyard, promoting high density and interaction. A rooftop greenhouse is provided as a secondary link between the outer community and the building. The food grown here will filter to local community restaurants and the remaining will be granted to building residents, in addition to pleasant rest and play opportunities above. Community is also achieved through shared energy resources and car sharing. This community will thrive sustainably though the use of geothermal heating and cooling, built to connect to and share with new developments. Additionally, car sharing in the covered area access from the South will be used to decrease the required parking on site as this thesis does not believe in the suburban notion of every household owning two vehicles.

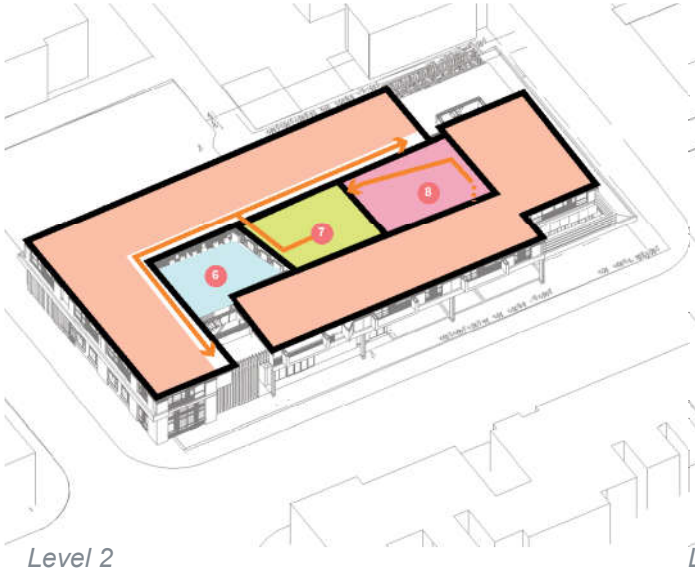
1. Daycare + Courtyard
2. Workshop
3. Bakery
4. Shared support space
5. Bicycle parking + Storage
6. Shared outdoor courtyard
7. Communal Kitchen and Dining
8. View to Daycare below
9. Residences
10. Rooftop Garden
11. Community Greenhouse



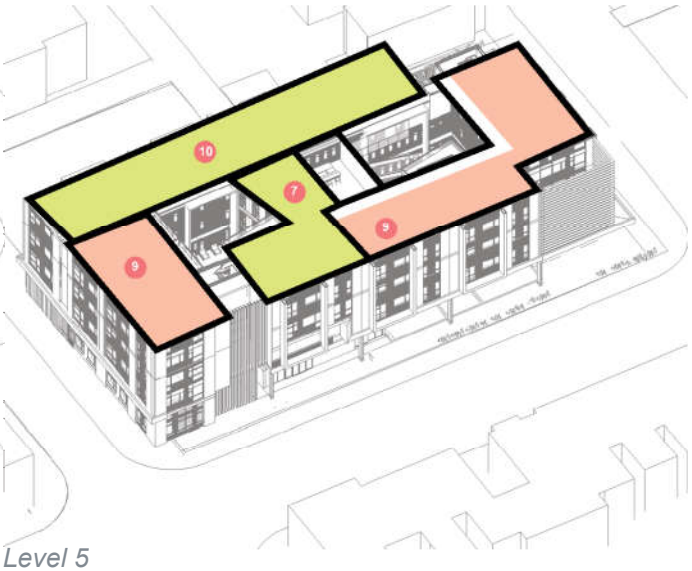
Level 1



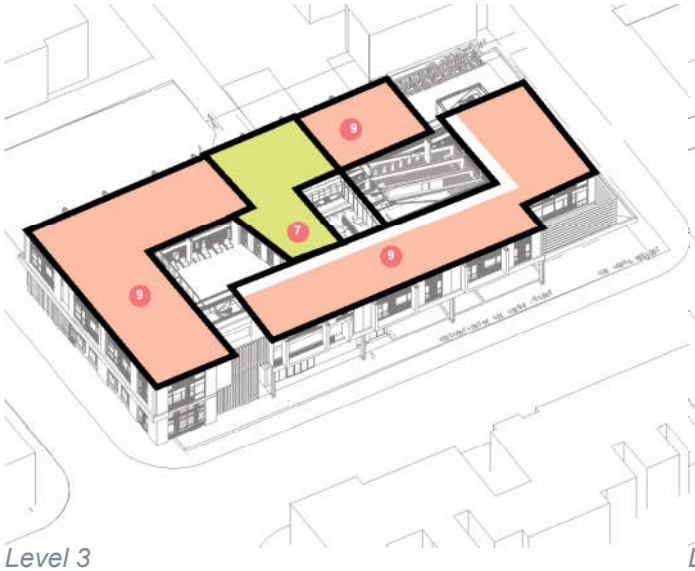
Level 4



Level 2



Level 5



Level 3

Level 6

Fig 111 - Site Programmatic Massing

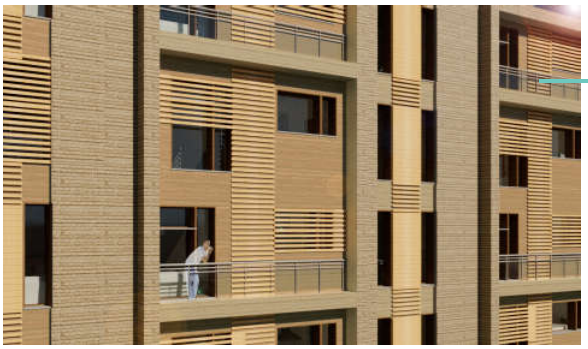
Fig 112 - Site Perspective Section

Outdoor Space

Gradient (Intimate - Public)

Outdoor Space is used at the XL scale to connect private residents to the public realm. It becomes the threshold between scaled communities providing opportunities to connection through a shared space. This project investigates ways in which outdoor space can be used to support community while understanding that there is a strong need for varying levels of outdoor space. These spaces are dispersed throughout the building creating pockets of social liveliness as well as quieter spaces for reflection.

Intimate



Personal

Social

Public

Fig 113 - Outdoor Space gradient

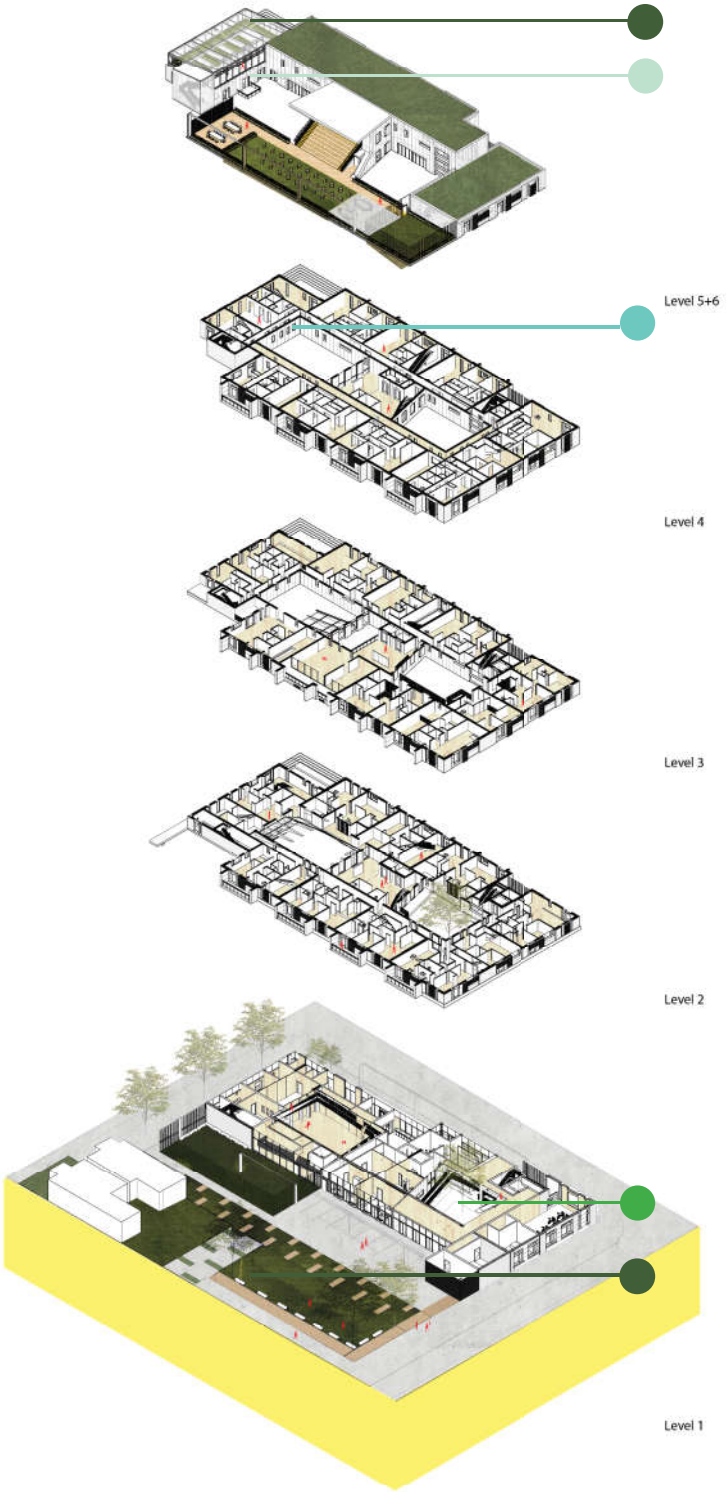
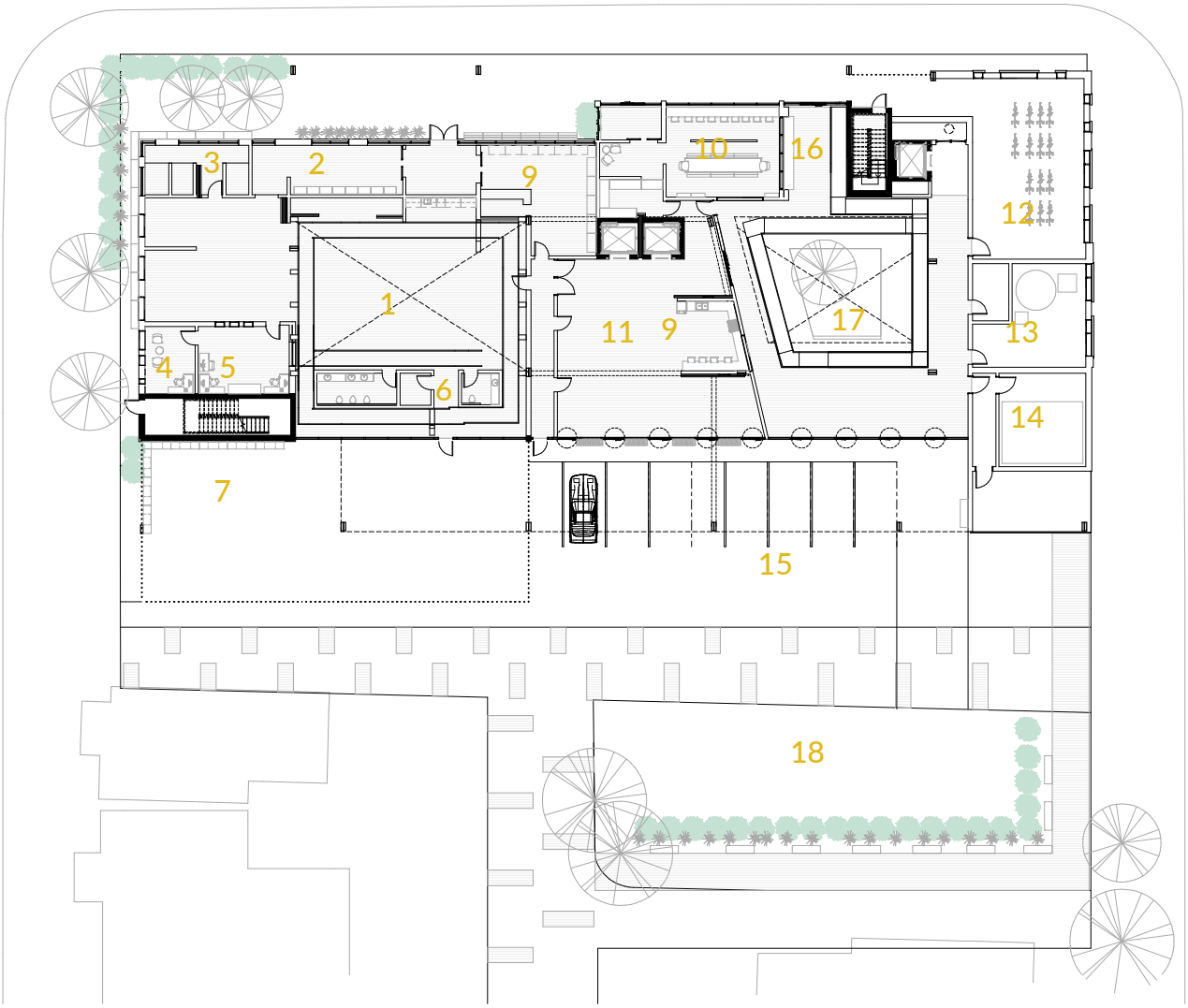


Fig 114 - Axonometric of public space

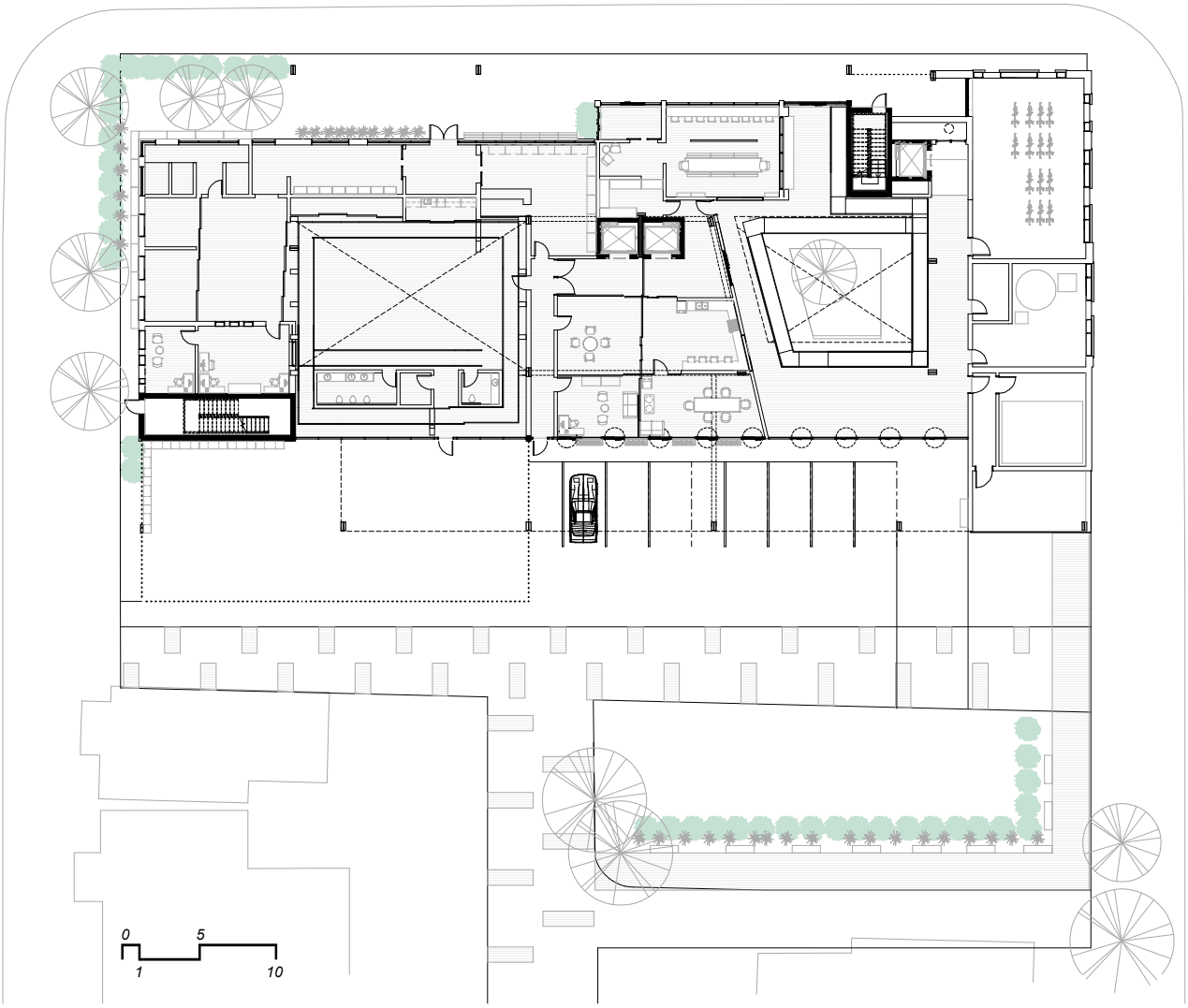


Level 1 - Open

Fig 115

Legend

1	Daycare Activity space	10	Shared kitchen
2	Stroller parking	11	Communal room
3	Equipment room	12	Bicycle parking
4	Family Support room	13	Mech
5	Supervisor Room	14	Waste
6	W/C	15	Parking and covers entrance
7	Daycare outdoor space	16	Residential Lobby
8	Bakery	17	Residential Courtyard
9	Workshop	18	Outdoor public space



Level 1 -Closed
Fig 116

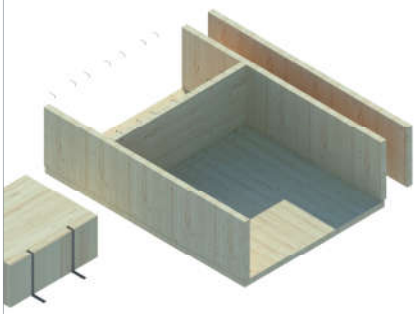
L

Supportive Layer

MODULE SIZE FOR UNIT ADAPTABILITY HANGER PLUG IN AND OUT FLOOR (DFD) - WITH HIDDEN NOTCH DETAIL ADAPTABLE CLT WALLS

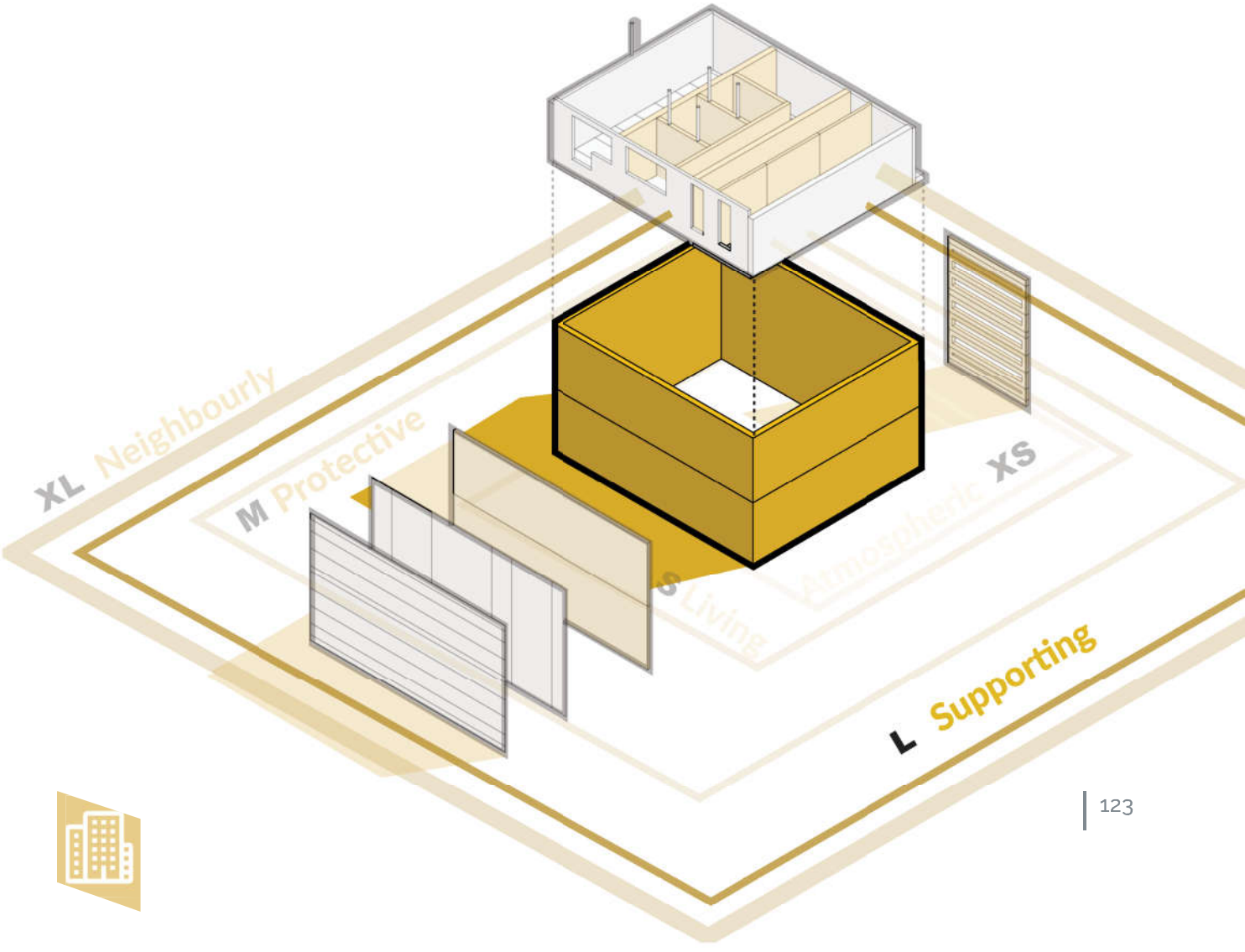
Flexibility Items

01



02

03


XL Neighbourly
M Protective
S Living
XS Atmospheric
L Supporting

L
Structural | Material + Assembly

Adaptability over time

Structural flexibility is achieved through hierarchy of the built form. The starting point is to choose a material. Typically there are 3 main ways of constructing wooden enclosures; post and beam, panelized system and light frame construction. Each have their advantages and disadvantages. The post and beam system facilitates larger spans and openness while CLT demonstrates an innate flexibility and aesthetic qualities. For the purposes of this project since the 12m CLT wall will become the standard residential material, any span required to be larger than this will be constructed using post and beam construction. Light frame construction provides a level of simplicity and everyday user constructability. This lumber can be found at retail building supply stores, allowing for a greater level of flexibility for the dweller.

The form of the building directly impacts affordability and construction. Simplifying unit configurations will reduce materials and heat loss which will result in construction, cost and time efficiencies. Complex building forms require more corners and a greater perimeter, which in turn requires more envelope, meaning higher construction costs. By limiting the amount of projections, multiple-storey buildings will provide efficiencies through savings on the cost of roofing and foundation as well as savings in lot area and exterior wall perimeter (Smith, 2010). Dimensioning the building to accommodate a modular form, size and configuration, will also make for a simplified construction. Designing to standard dimensions for structural framing members and to 4-foot (1.2 metre) modules with a 24 inch (610mm) stud spacing can reduce lumber used by 8% as compared to standard stud spacing practice of 18 inches (457mm) (Smith, 2010). That being said, this project will optimize all construction based on this rule to facilitate construction and efficiencies. Exterior building materials, structure and interior framing all will receive the same approach. This will allow for unlimited floor heights which will easily satisfy ground floor commercial requirements set by the City of Toronto's Performance Standards for 4.5m floor to floor heights (City of Toronto, 2010). Reasoning for the 12 metre logic will follow in the next section.

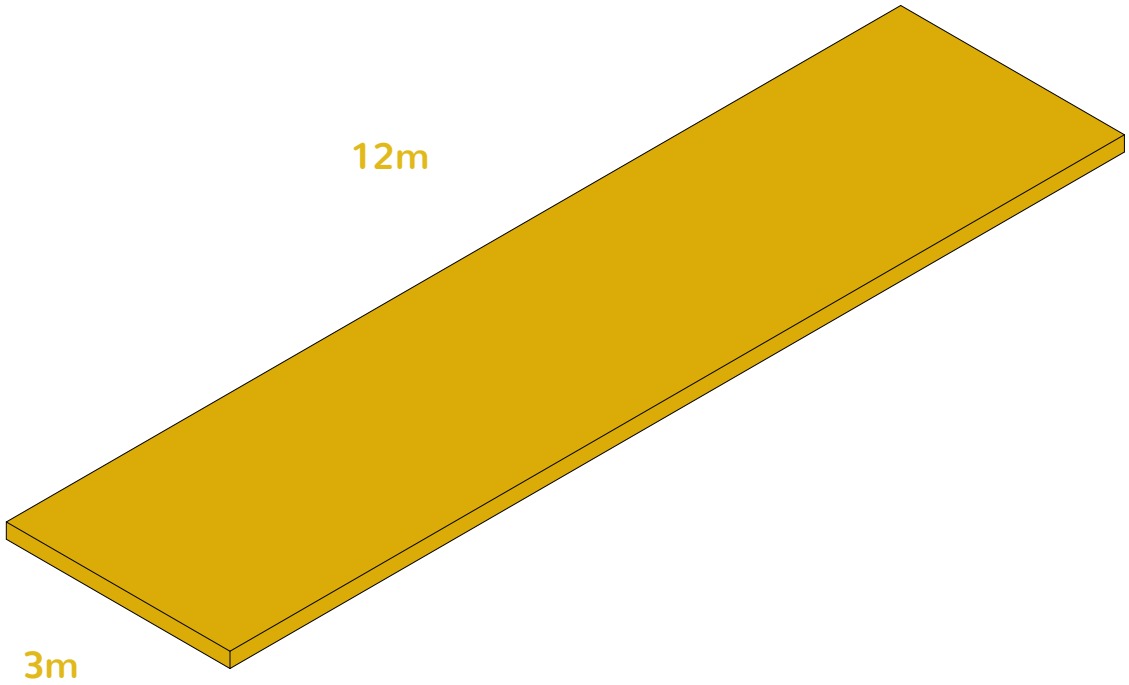


Fig 117 - Chosen material

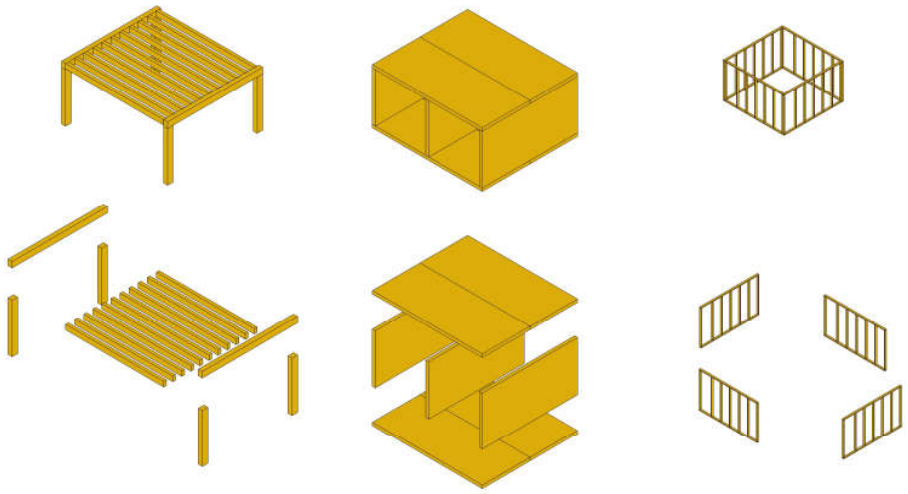


Fig 118 - Post and beam, Panelized System and light frame construction

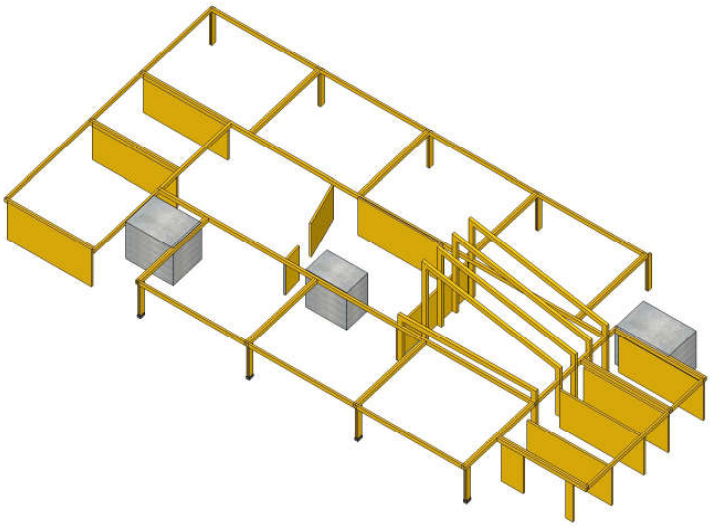


Fig 119 - Level 1

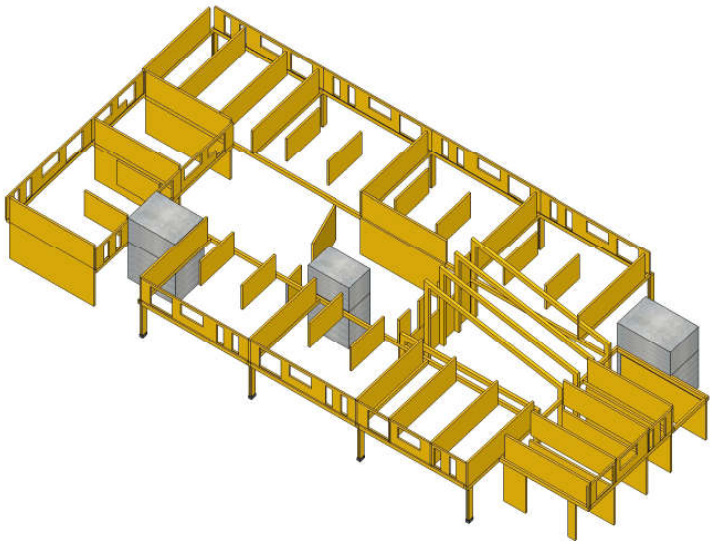


Fig 120 - Level 2

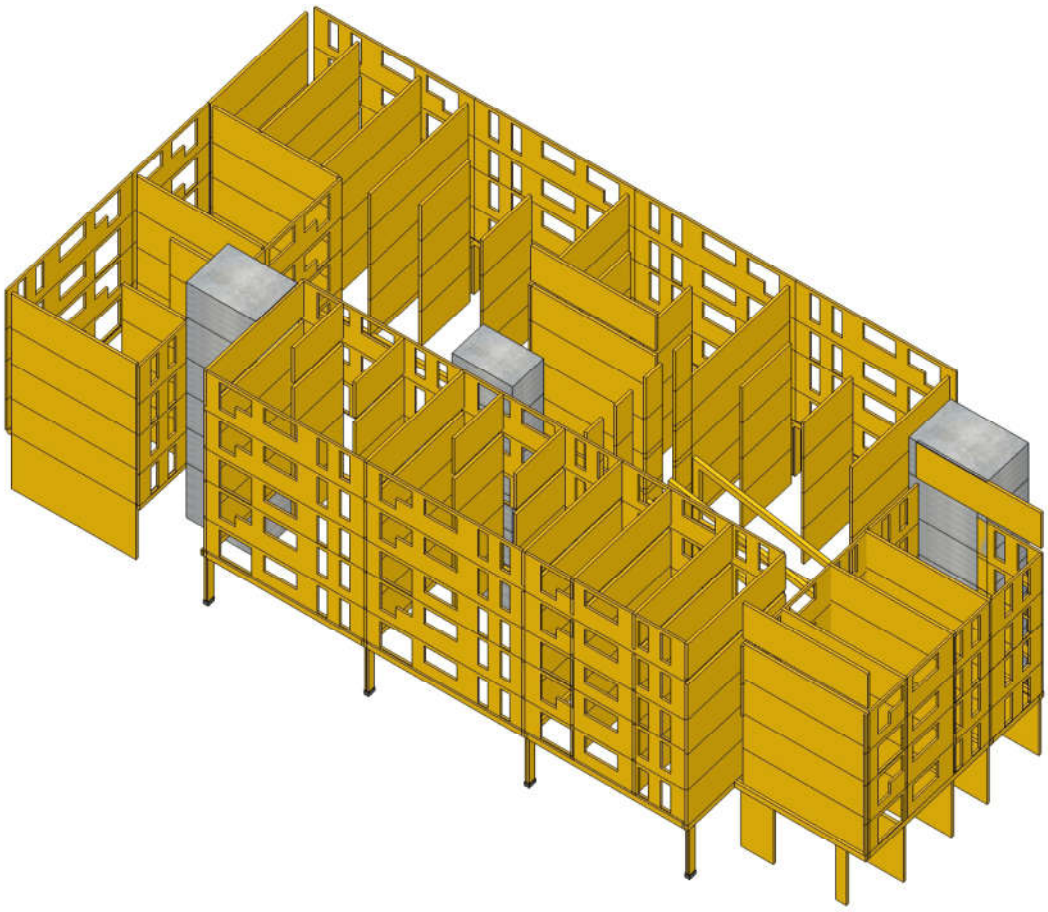
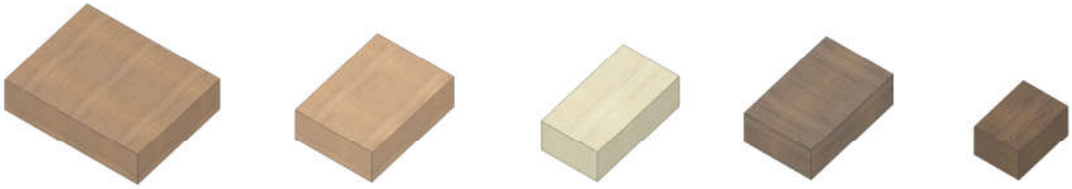


Fig 121 - Buildling structure

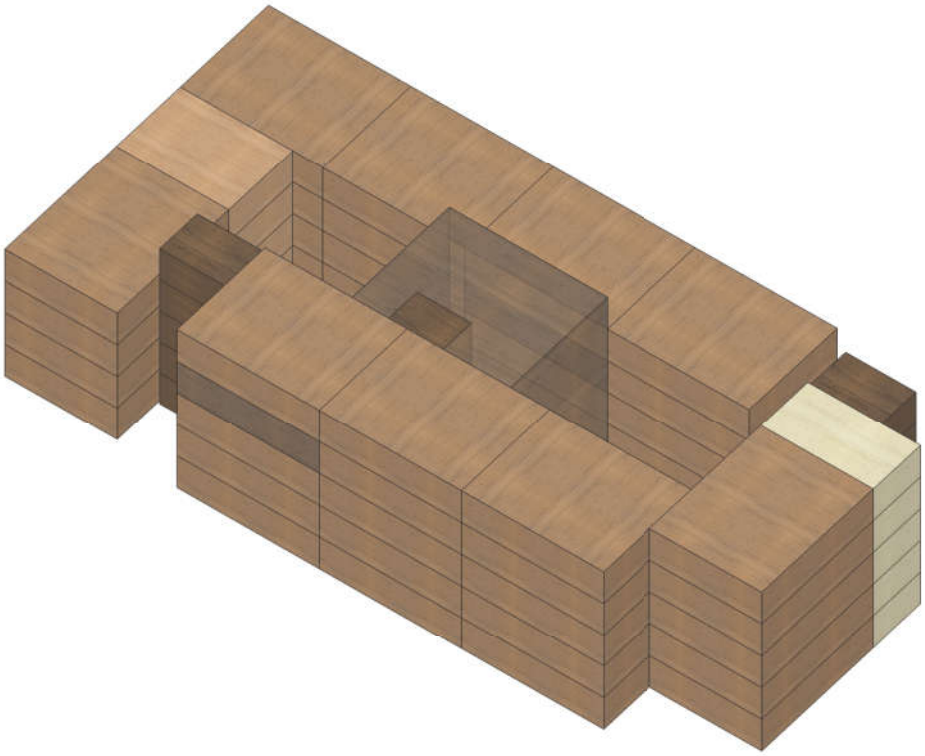
System



3 Bay **2 Bay** **1 Bay** **ComS.** **Core**

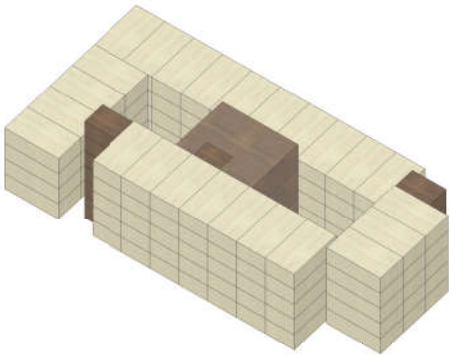
Assembly

6.



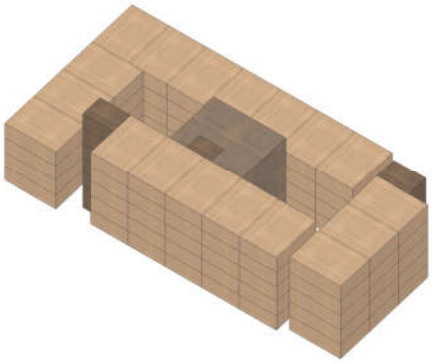
Inserting internal community space
Fig 122 - Building System and assembly

1.



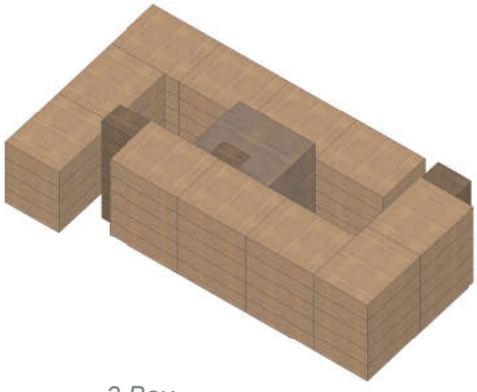
1 Bay

2.



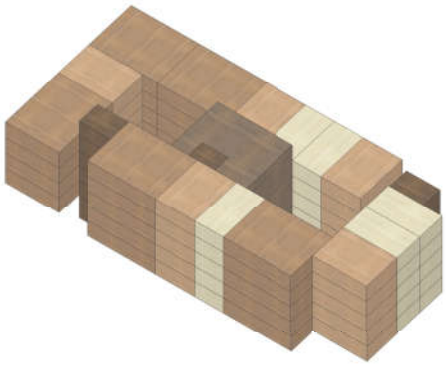
2 Bay

3.



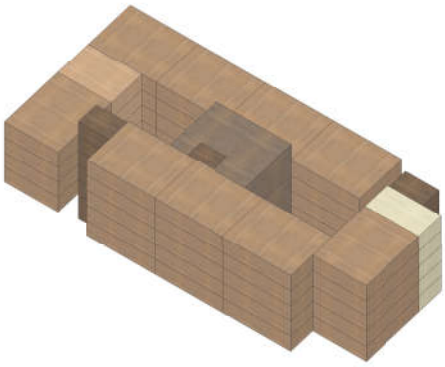
3 Bay

4.



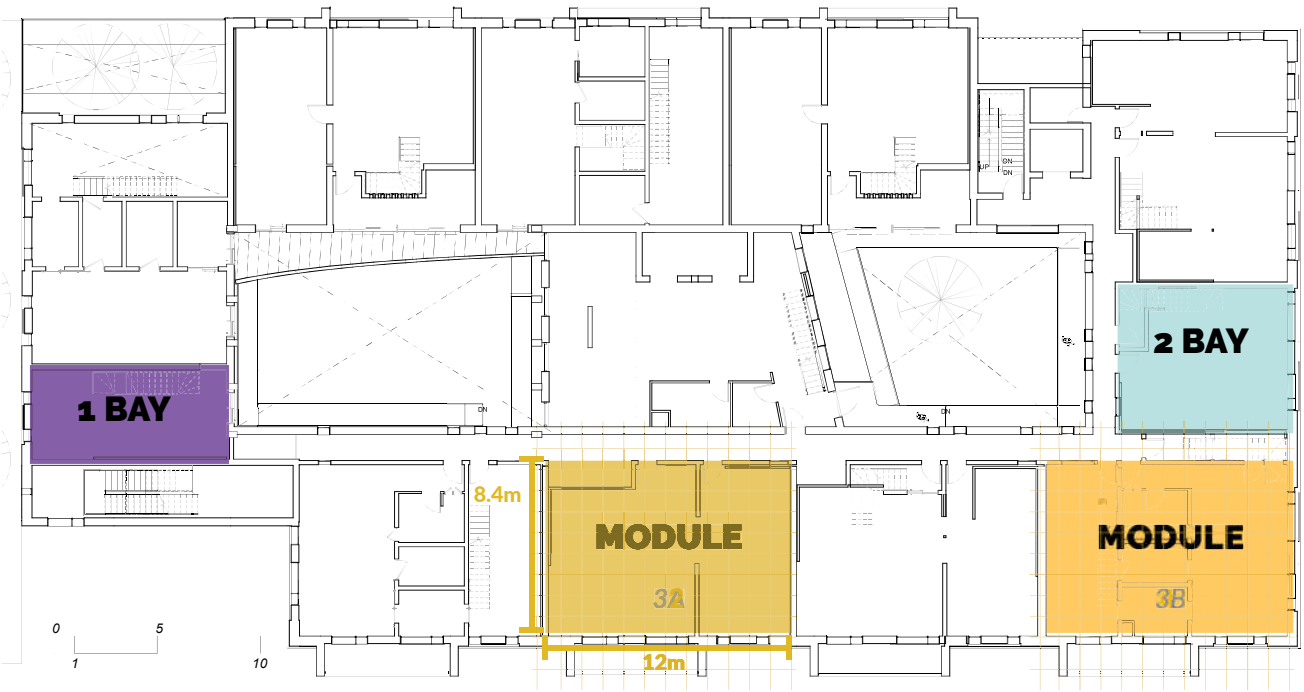
Finding variation

5.

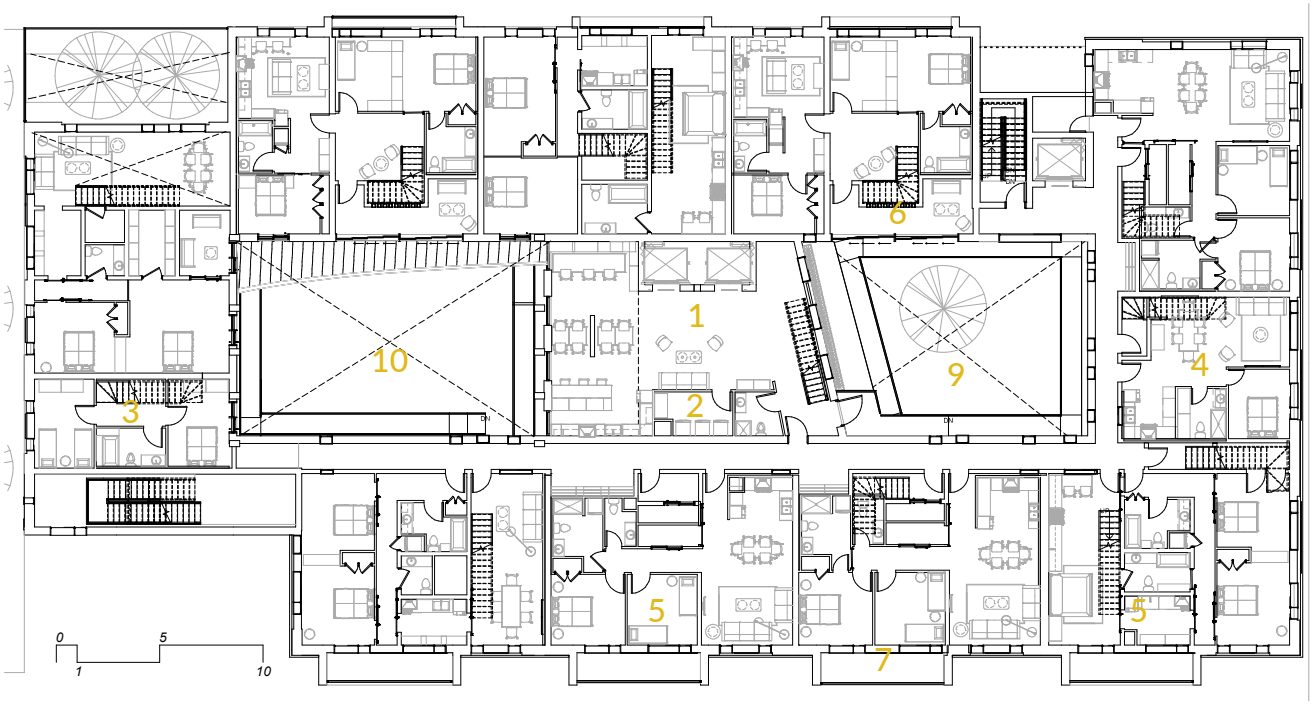


Adjusting 3 Bays to site

Fig 123 - Design variations



Level 2 - Fixed (Unfurnished)
Fig 124



Level 2 - Flex

Fig 125

Legend

1	Central Communal Kitchen
2	Laundry
3	Single Bay Units
4	Double Bay Units
5	Triple Bay Units
6	Shared Balcony
7	Private Balcony
8	Public Balcony
9	Open to Garden below
10	Open to Daycare below

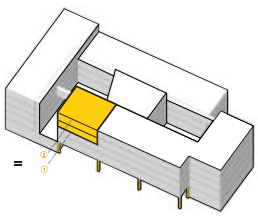
The Module

Adaptability over time: Layered Flooring

Units are designed with the understanding that the module will be superimposed with a similar unit that is thus extended above the corridor (skip stop corridors) allowing spatial flexibility that enables users to open secondary level space to the existing primary unit through an interior set of stairs. This flexibility provides the opportunity for each unit to add one to four potential spaces. Floors to secondary levels have been designed to allow for future expansion. Structurlam CLT panels come in 2.4 or 3 metre widths and this building will provide flexibility through designing to the standard 1.2 metre grid to streamline construction and future floor installations. That being said, future floor installations (as seen in pale yellow in Figure 126) will be approached with the understanding that the 2.4 m panels will be ordered and divided in 2 before shipping to the site. Once shipped, they will be hoisted to the appropriate level through the flexible window configuration.

The structure has been layered as well to provide a hierarchy of flexibility for residents as they utilise their units over time. Light framing will be used for interior partitions that may require more frequent alteration, allowing materials to be sourced from building and hardware stores. CLT will be used for the main structure and post and beam construction will be used in spaces that require large spans.

Slow flex : Post-construction installed timber floors would require a higher level of organization and planning and thus as this level requires a level of structural strength it is higher on the flexibility curve, rendering it slow flex.



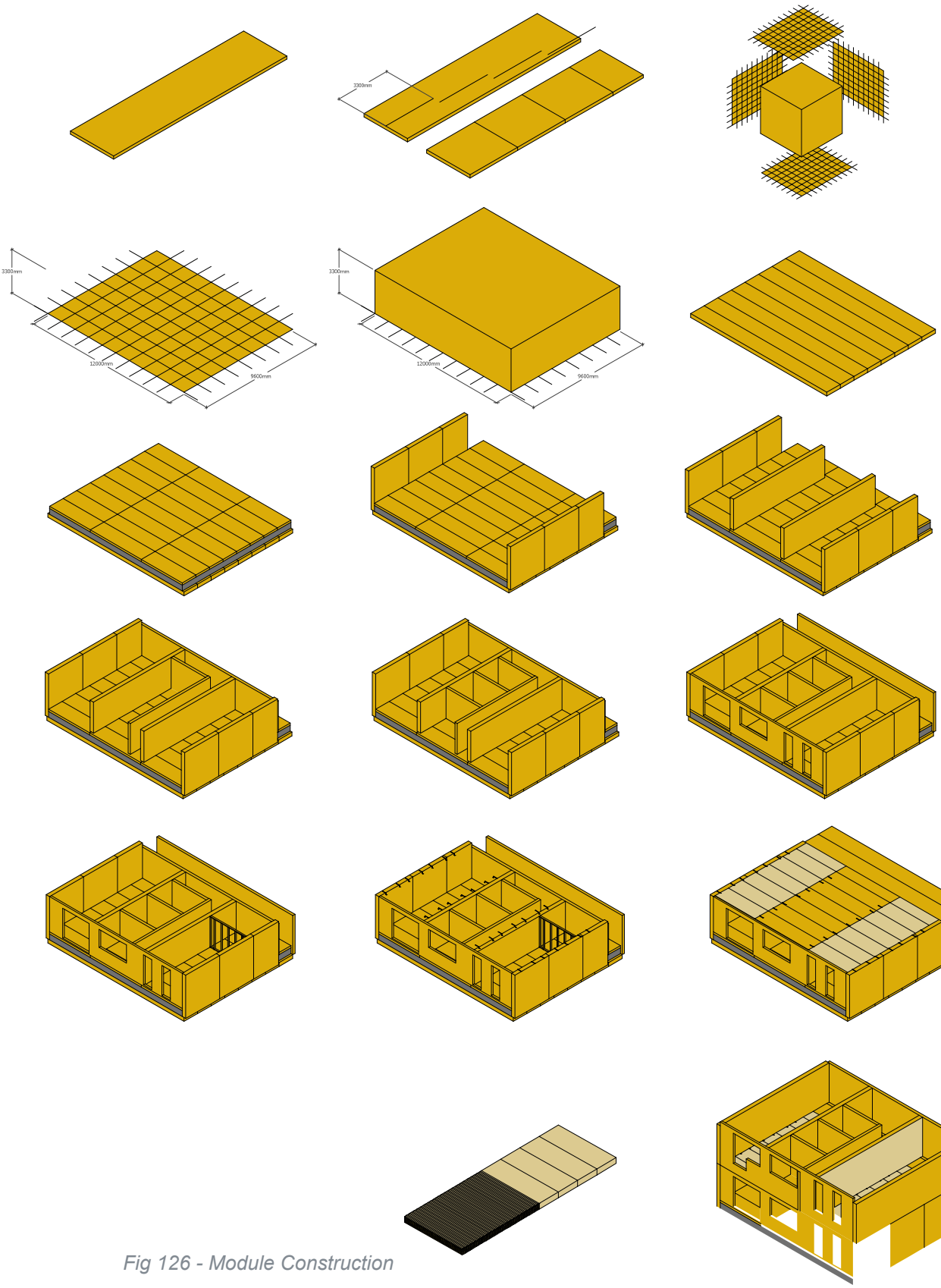


Fig 126 - Module Construction

Neighbourhoods

Adaptability over time for diverse Unit Types

Building materials whether exterior facade panelling or gypsum wallboard also come in standard 1.2 metre sizes. Knowing this, the project will do the same to streamline the construction process. Neighbourhoods in this project refer to the combination of two levels within the buildings that come together. Every other level will host a communal floor that hopes to support all users thanks to its flexibility. The notion of neighbourhoods is important as it speaks to the dual storey construction of each module. Each neighbourhood will be configured to potentially accommodate any form of family structure with the future option of expansion or shrinkage of unit size for the present and growing future diversity requirement seen in Figure 128. The expectation for the near future is for the young adult group percentage to decline, and the large family and senior to rise, but this does not mean that these predictions would be fixed, so design of these neighbourhoods require inherent unit adaptability.

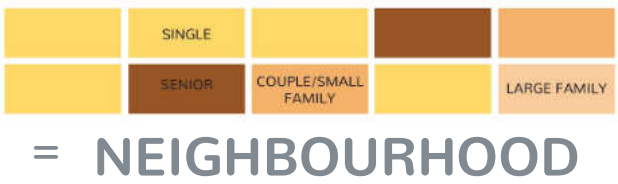


Fig 127

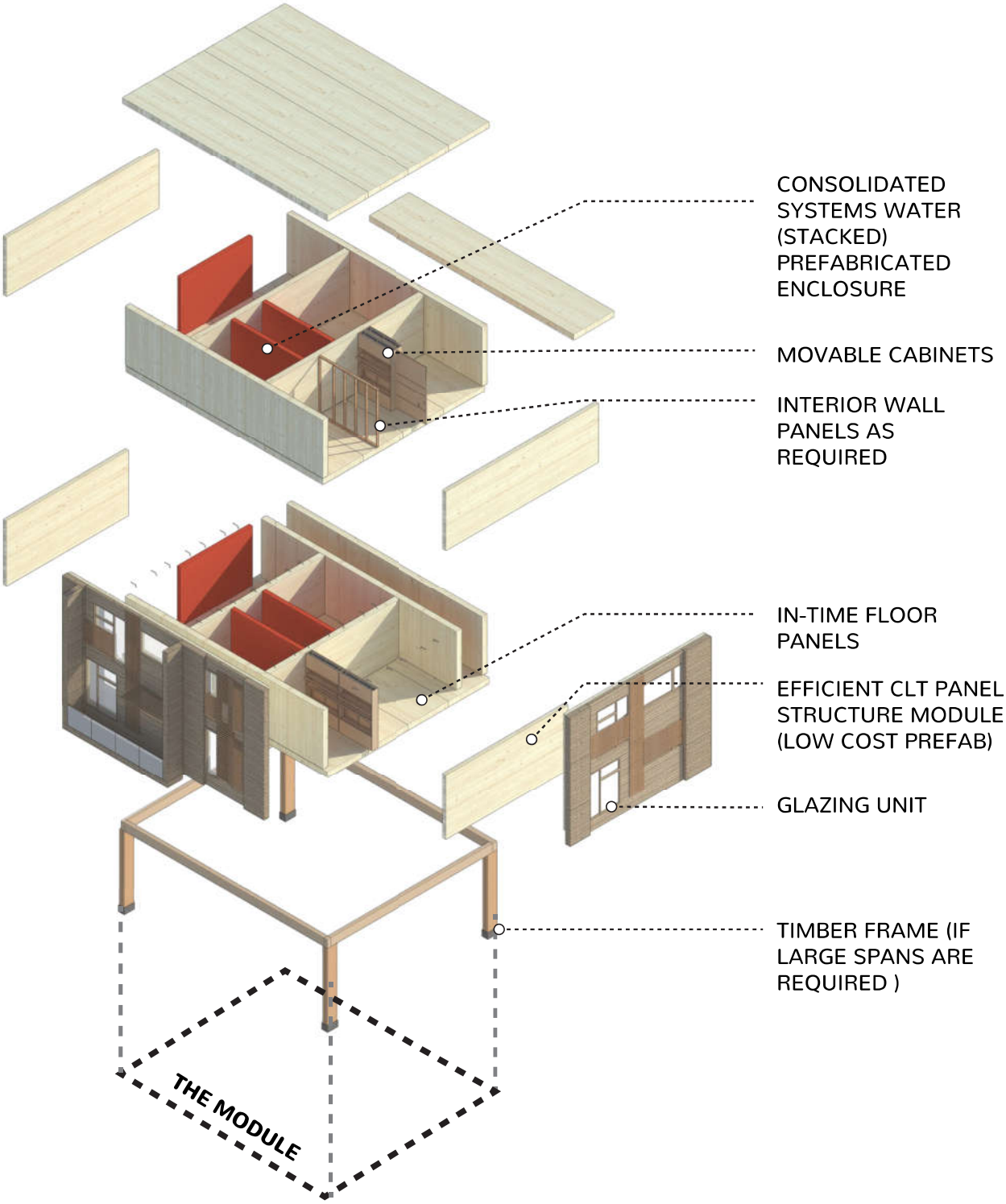


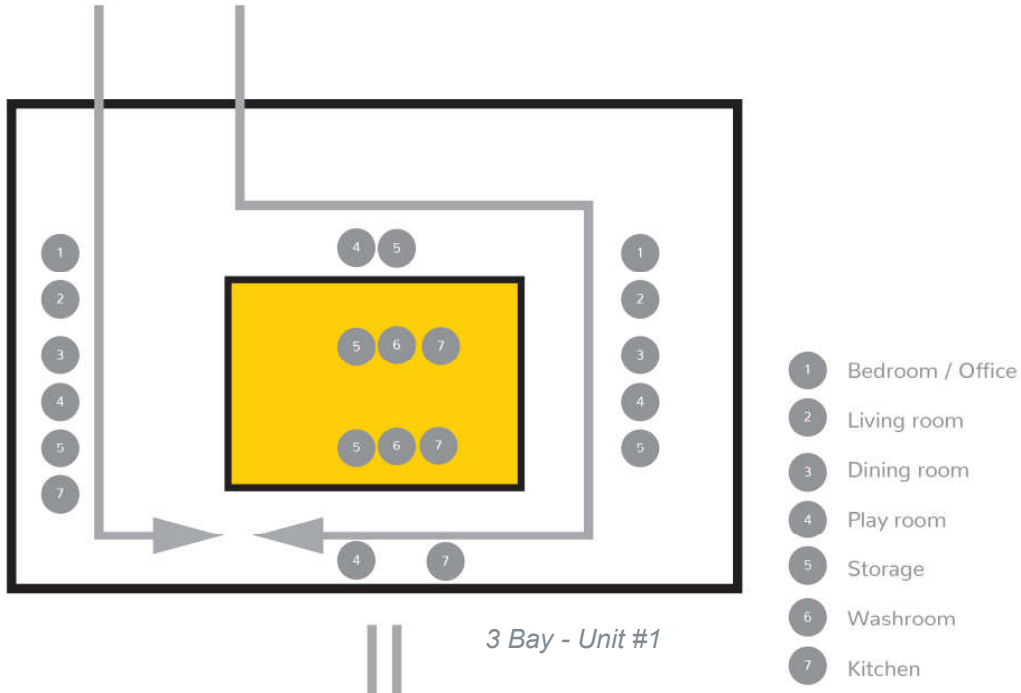
Fig 128 - The Module

Module Methodology

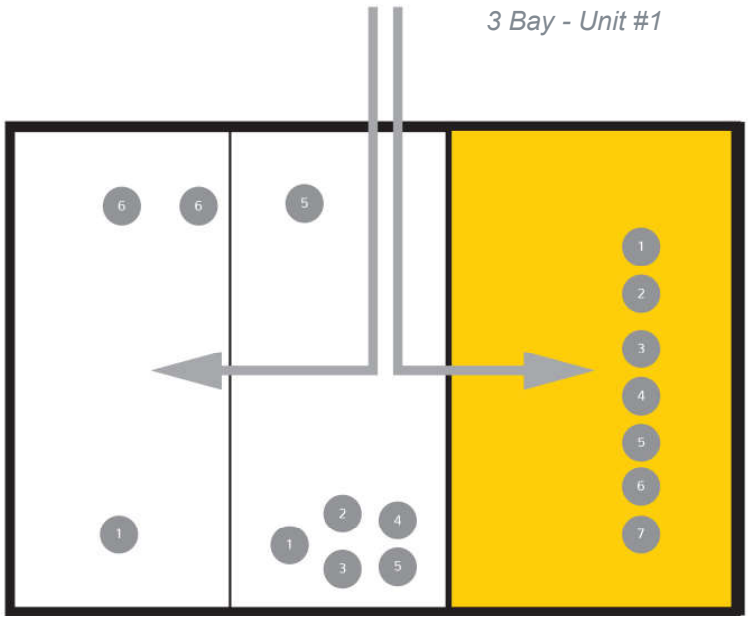
Spaces between the cores

The advantage of designing units such as these is that there is a level of variety. Versatility of large and smaller spaces that can be distributed according to the owner's wishes. Opportunities to open / fold walls, or remove floors to provide a larger loft-like space provide versatility in these 3 bay units. If the grid is 1.2m then an increment of 3 would make 3.6, and an increment of 4 would make 4.8, which would be too large for a private space. If the module is 12m, breaking it down into 2 grid line blocks would give two sections of 3.6m and a remaining section of 4.8 m, which is a respectable size for a large semi-private space. It will generally be used for living, dining and kitchen spaces. It can also be used for single bays, as the large width will allow for 1.2 m for circulation. This means that a 3.6 m bay will thus be used for private spaces.

Unit #1 + 2 provides this versatility through its service cores. The larger 4.6 metre bays are coordinated to provide a wider space for social gathering. With a central wet or circulatory core, both sides of the module can be used differently to support this level of adaptability. Figure 121 illustrates this phenomenon.



3 Bay - Unit #1



3 Bay - Unit #2

Fig 129 - Designing the service cores and larger grids

The module defined above will be the primary unit of the building but understanding that sites are not always optimized for a specific dimension as noted in chapter 2, this project has also developed smaller modules to account for this. These smaller more standard modules will be used when the larger module is not possible (site dependent). These bays work on grids within the predetermined system (1.2m grid). Many designs that were investigated in chapter 2 showed that for a flexible residential construction layout, a 3 m wide bay that allows for spatial transition is generally required in combination with other flexible wall elements and strategies. Figure 130 begins to hint at the single bay and double bay confirurations designed to accommodate the skip-stop layout in a way that allows for the adaptability required.

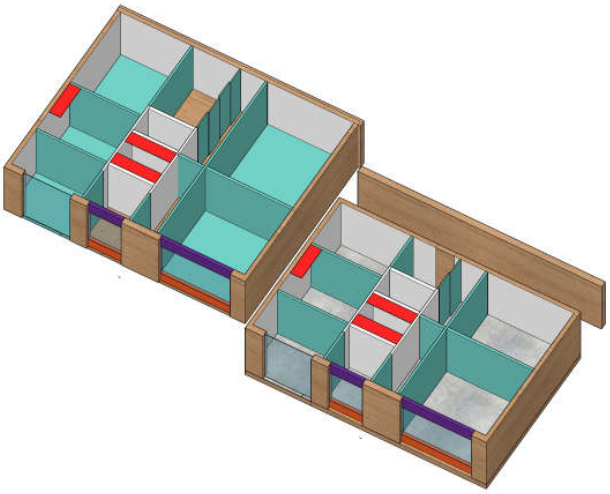
Unit flexibility

- Bathrooms planned to give access to WC and bath
- Low window sills
- Adaptable walls
- Identified space for temporary entrance level bedroom
- Living or family room at the entrance level
- Accessible thresholds - Turning circles for wheelchair on ground living spaces
- Accessible washrooms

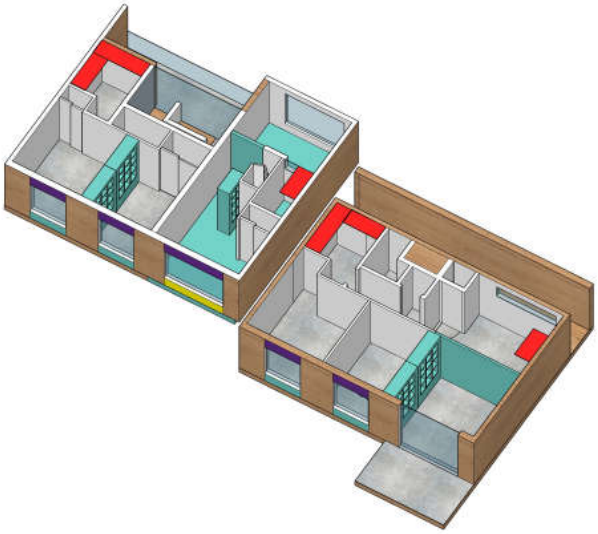
Module flexibility

- Minimum/ intentional planned partitions
- Flexible Spaces through free floor plan, mobile furnishings, stair
- Locations and entrance vestibules
- Horizontal growth opportunities
- Vertical growth opportunities
- Repetitive Prefabricated modules
- Kitchens and bathrooms located on wet walls
- Wiring and piping services such as ventilation, water supply and electricity are arranged along the wall backing the corridor through raised floors or suspended ceilings.
- Wall components are based on a modular system and can be placed anywhere on the predetermined grid

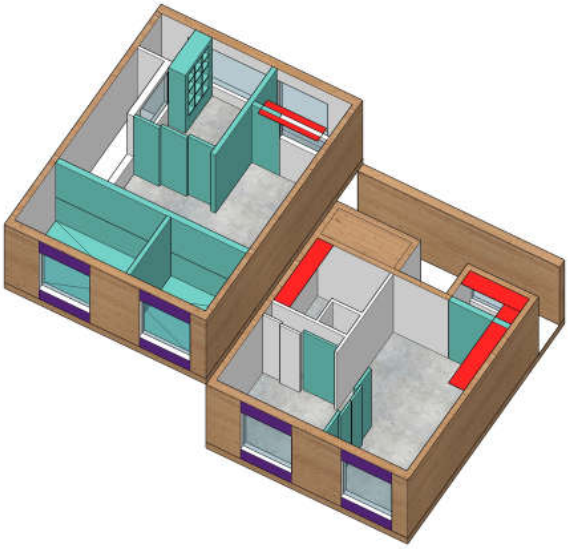
(Lifetime Homes, 2008)



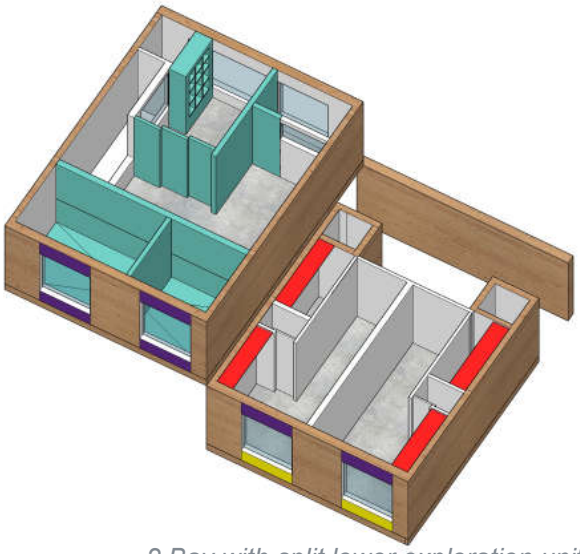
3 Bay module



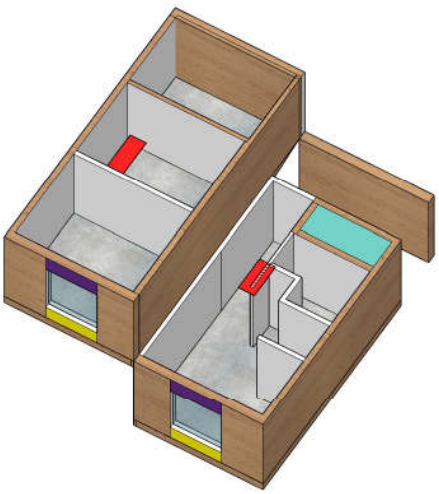
3 Bay module



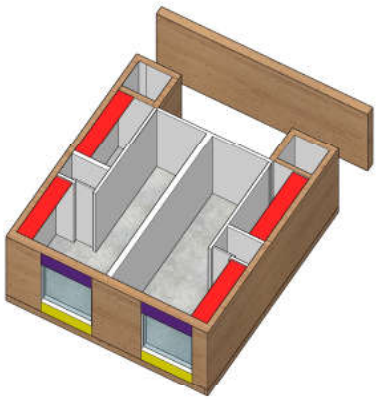
2 Bay Unit



2 Bay with split lower exploration unit



1 Bay Unit



2 Bay Lower unit exploration unit

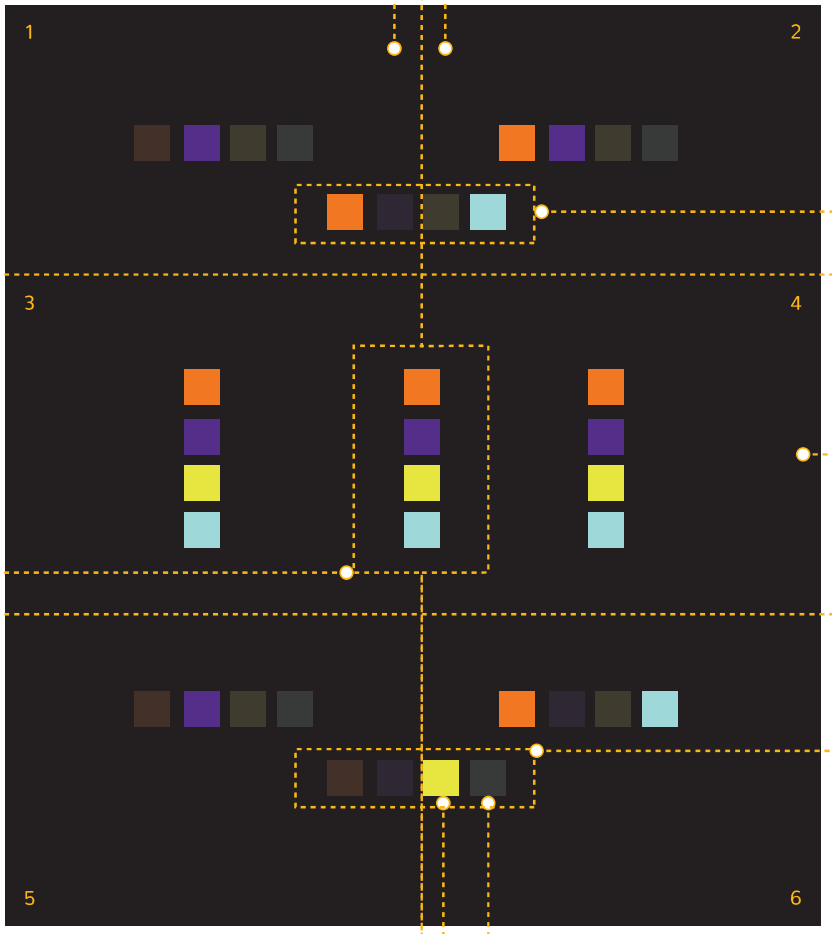
Fig 130- Module types

Diagrams explained

How to read the icons

A COLOUR THAT IS IN THE LEFT SIDED QUADRANTS REPRESENT A HOUSHOLD THAT IS DEEMED APPROPRIATE FOR THE GIVEN UNIT TO THE LEFT (WHEN SEPARATED FROM THE RIGHT SIDE OF THE MODULE)

A COLOUR THAT IS IN THE RIGHT SIDED QUADRANTS REPRESENT A HOUSHOLD THAT IS DEEMED APPROPRIATE FOR THE GIVEN UNIT TO THE RIGHT (WHEN SEPARATED FROM THE LEFT SIDE OF THE MODULE)



A COLOUR THAT IS AT 100% OPACITY SIGNIFIES A HOUSEHOLD THAT IS DEEMED APPROPRIATE FOR THE GIVEN UNIT

A COLOUR THAT IS AT 20% OPACITY (FADED OUT) SIGNIFIES A HOUSHOLD THAT IS NOT DEEMED THE MOST APPROPRIATE FOR THE GIVEN UNIT

A COLOUR THAT IS CENTRED BELOW THE TWO UNIT COLOURS REPRESENT A HOUSEHOLD THAT IS DEEMED APPROPRIATE FOR THE GIVEN UNITS WHEN JOINED HORIZONTALLY (SIDE BY SIDE UNITS TOGETHER)

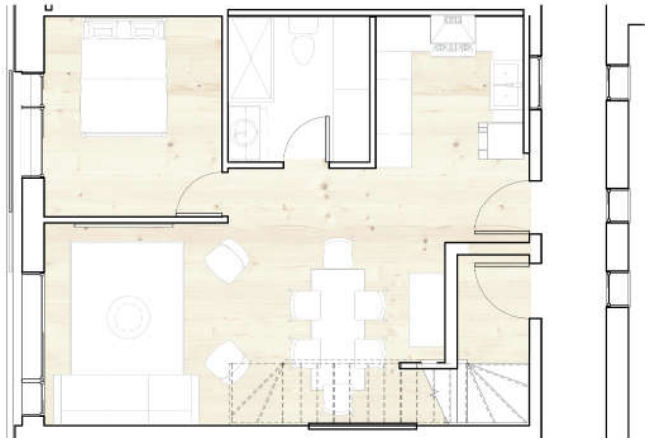
A COLOUR IN QUADANT 3 AND 4 REPRESENT A HOUSEHOLD THAT IS DEEMED APPROPRIATE FOR THE GIVEN UNITS WHEN JOINED VERTICALLY (ABOVE AND BELOW UNITS TOGETHER)

THE SECTION BETWEEN QUADRANT 3 AND 4 REPRESENT THE HOUSHOLD DEEMED APPROPRIATE FOR THE GIVEN UNIT IN ITS ENTIRETY (ABOVE AND BELOW)

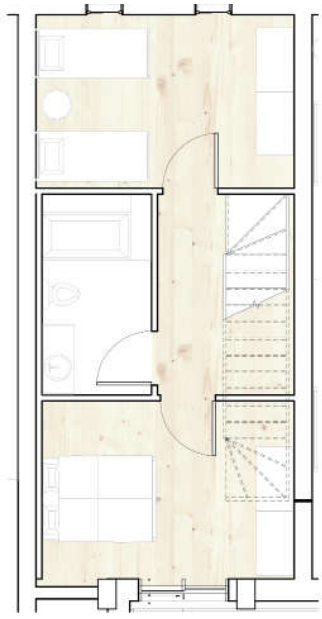
1 Bay Units

2 Bay Units

PRIMARY LEVEL



SECONDARY LEVEL



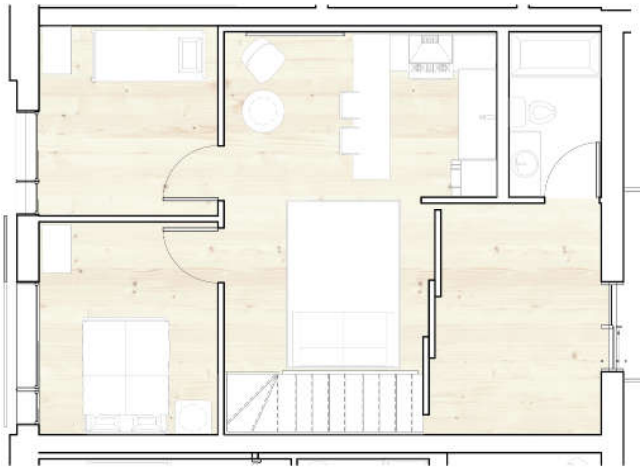
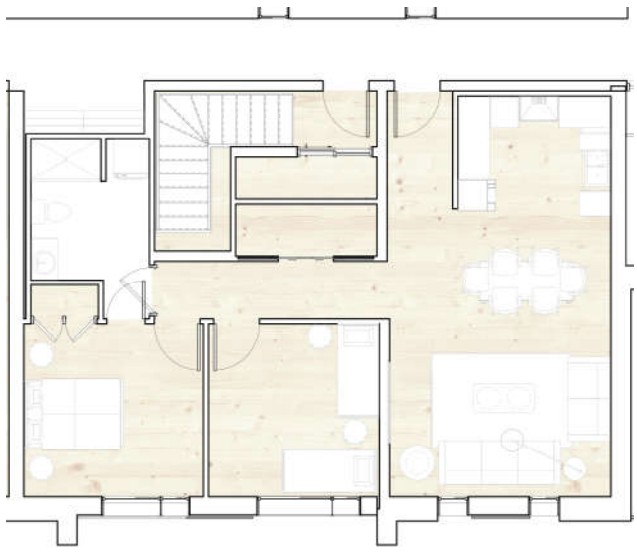
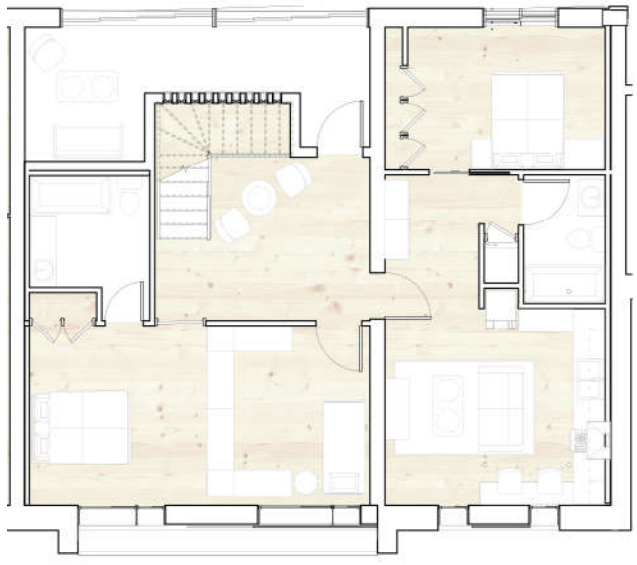


Fig 131

3 Bay Unit - #1

PRIMARY LEVEL





SECONDARY LEVEL

= flexible

elderly

young adult

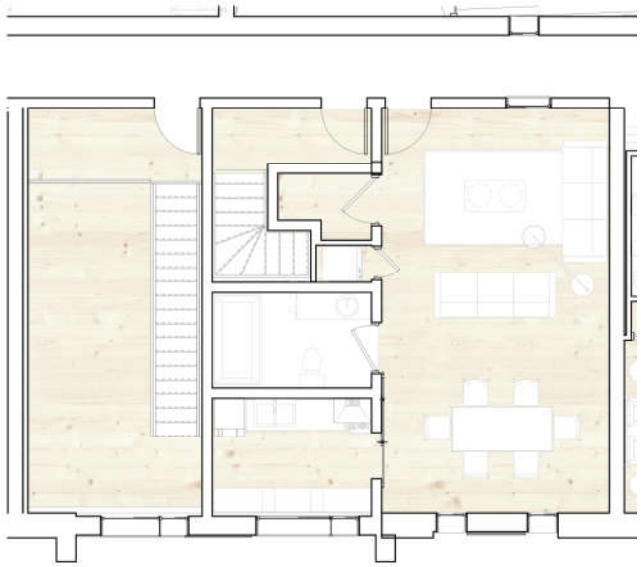
large family

single parent

Fig 132

3 Bay Unit - #2

PRIMARY LEVEL



SECONDARY LEVEL

= flexible

elderly

young adult

large family

single parent

Fig 133

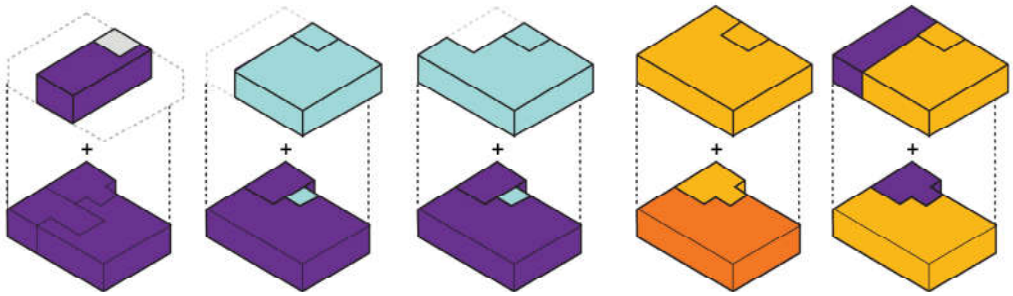
Unit Flexibility

Alternatives 1-5

Alternative 1
Friendly Students

Alternative 2
Couple /

Fig 134- Unit division plans example



Secondary Level

Primary Level

Alternative 3
Family/

Alternative 4
Multigenerational

Alternative 5
Large Family

Figure 134 begins to illustrate how these units are imagined to operate. Starting off potentially with two strangers.

Let's say that there are two friends who want to invest in a home. They buy this module. One friend could own the southern portion of the lower level and the other the northern portion. Over time they find someone who wants to use the secondary level. So a single mother accesses the secondary level and raises her child.

This mother has recently found true love and marries her partner who has a child of his own. They now need more space. So they renovate (using light frame and small furniture) to add another bathroom to the unit, a secondary bedroom and a living space at the northern side of the unit. Below on the primary level, these original students have also decided they'd rather live together so they have altered their space to create a master bedroom and a smaller secondary room.

A few years later, the family on the secondary level have decided they want to buy out the primary level from the couple below to host their new addition to the family (her husband's parents). They have trouble with stairs, so they take the primary level, and when they want they can share space above.

If grandparents or children or adults move out at some point, this space will be used for different purposes, and the cycle continues.

Figure 135 begin to break down the parts to understand module components.

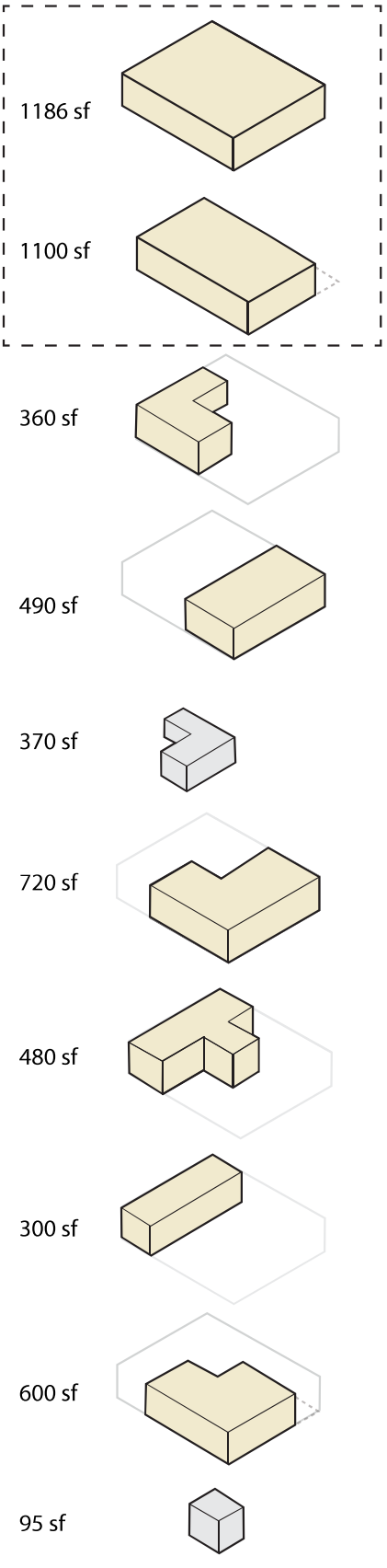
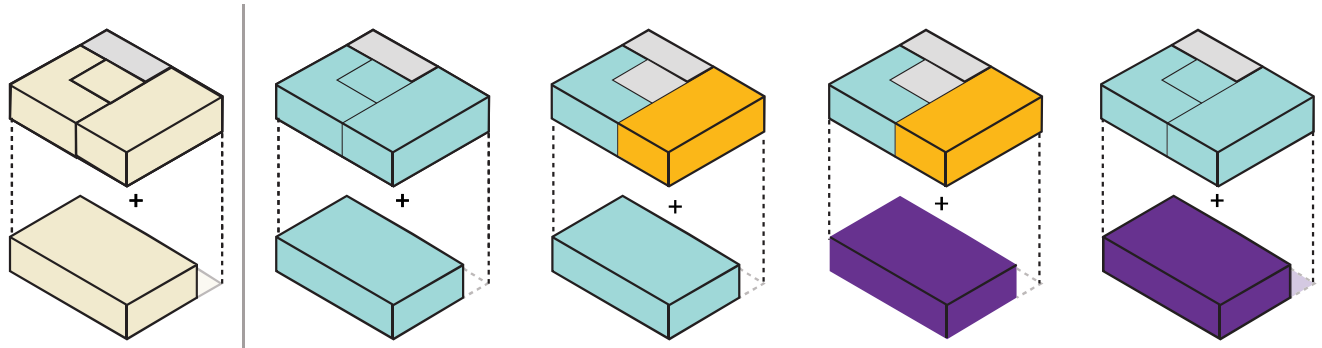
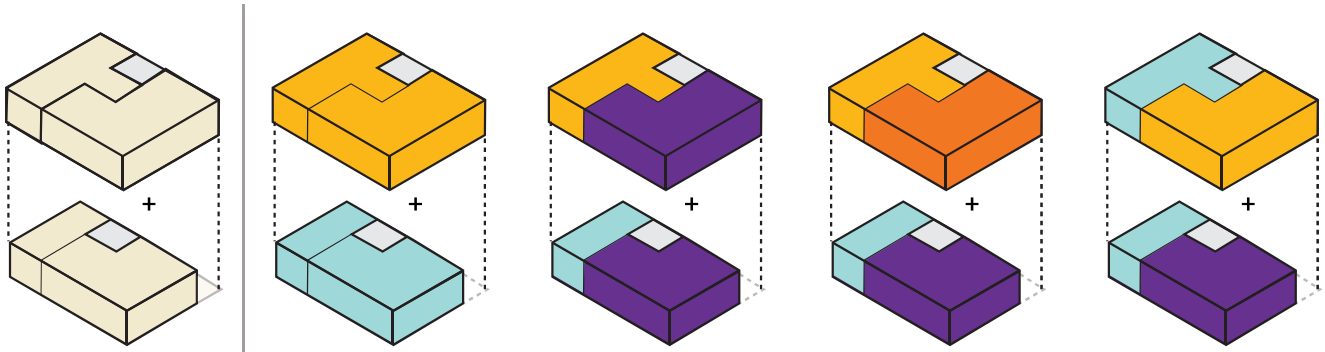


Fig 135- Module Components



3 Bay Unit - #1



3 Bay Unit - #2

Original Module
Family 1
Family 2
Family 3
Family 4
Unit community space and circulation core

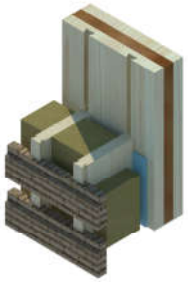
Fig 136 - Unit component diagrams for modules

M

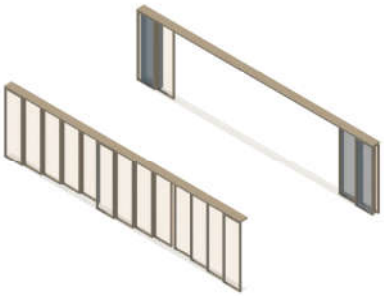
The Protective Layer

WOODEN RAIN SCREEN ENVELOPE SYSTEM
EXTERIOR FLEXIBLE OPENINGS SYSTEM
WINDOW SYSTEM

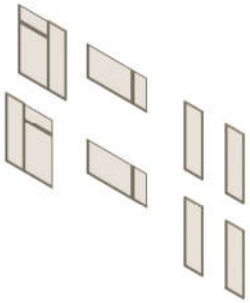
Flexibility Items



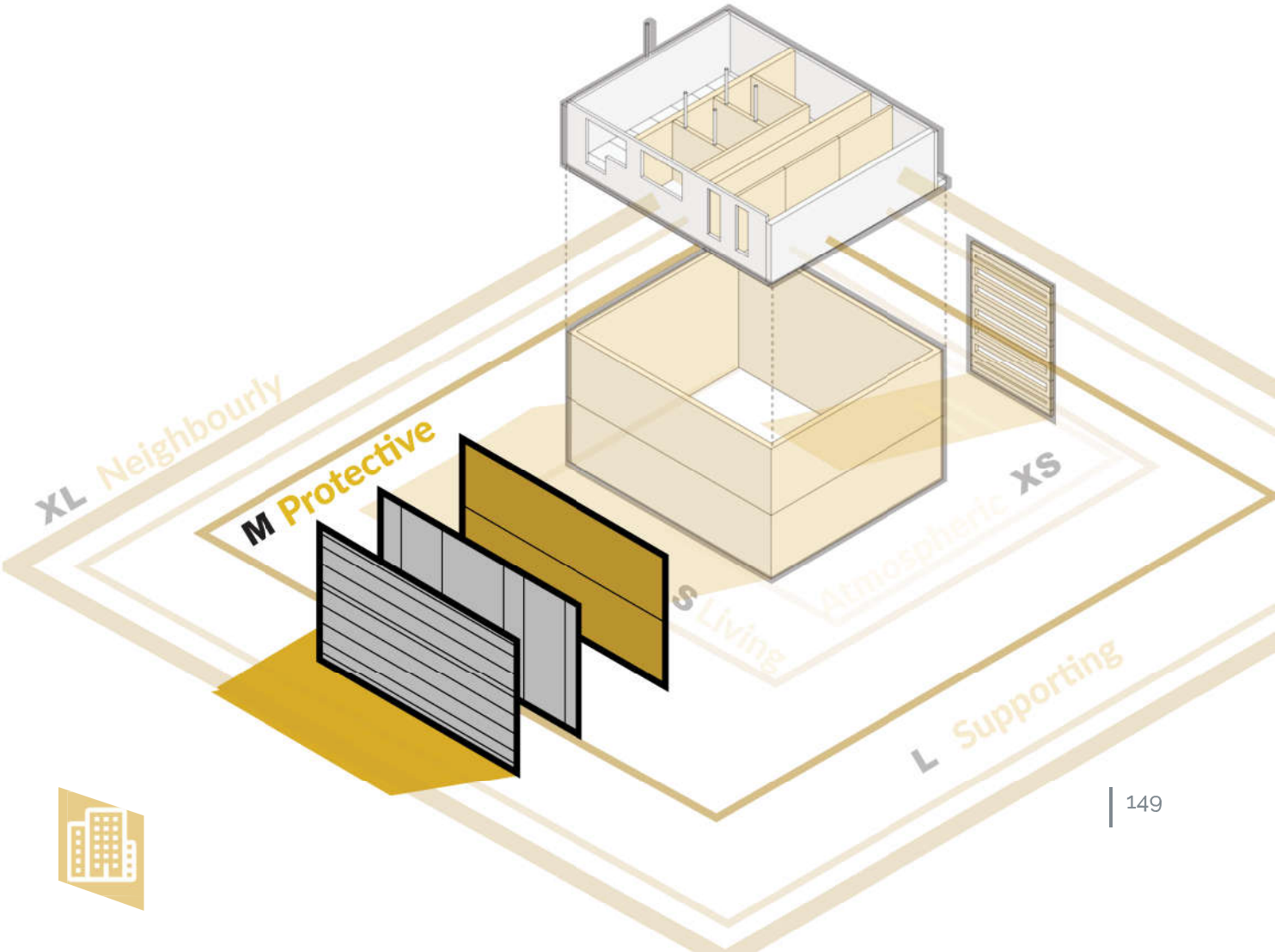
01



02



03


XL Neighbourly
M Protective
S Living
XS
Atmospheric
L Supporting

M

Protective Flexibility |

The Facade

Adaptability

Like the tree, structure composition is based on a layering system. It consists of the elements that shield the interior from the exterior. The first layer is the exterior layer of bark that is connected to the structure. It is the outer shell of the building that uses wood brick technology to conceal the CLT structure. Next is the inner raw live facade that wraps the interior and Juliet balconies that shave the wooden bricks away. Structured on a grid, three window frame dimensions are extrapolated from the contextual panes on the Victorian homes on Gerrard St. This interpretation allows for variation as they can be arranged in combination or used alone to glaze the building. This is the secondary level of protection followed by the unit layer which exposes the interior facade to the communal courtyards which are to be understood as different from the outer protective layer. Next are the units that represent the sapwood. Sapwood is between the protective bark layer and the heartwood that contains the functioning vascular tissue. This layer represents the units that house the people who are the nutrients that keep this housing project alive, active and well. The last layer is the heartwood which is the heart and centre core of the project. The heart is what ties everything together to keep the system moving and flowing and that is in support of the communal space. This communal space is the heart of every project of this type.

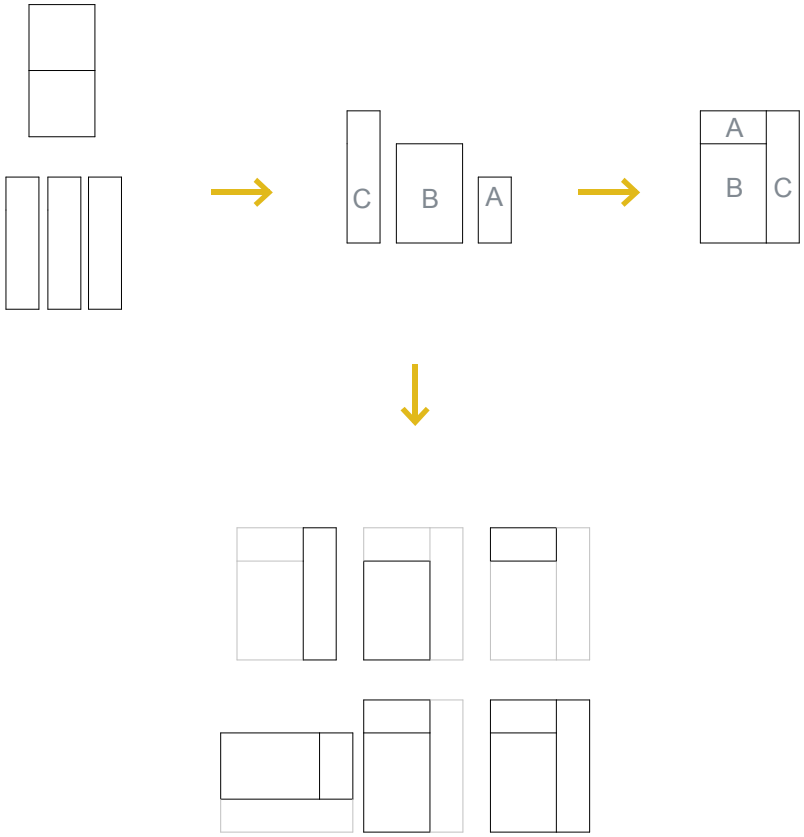


Fig 137 - Window configuration development

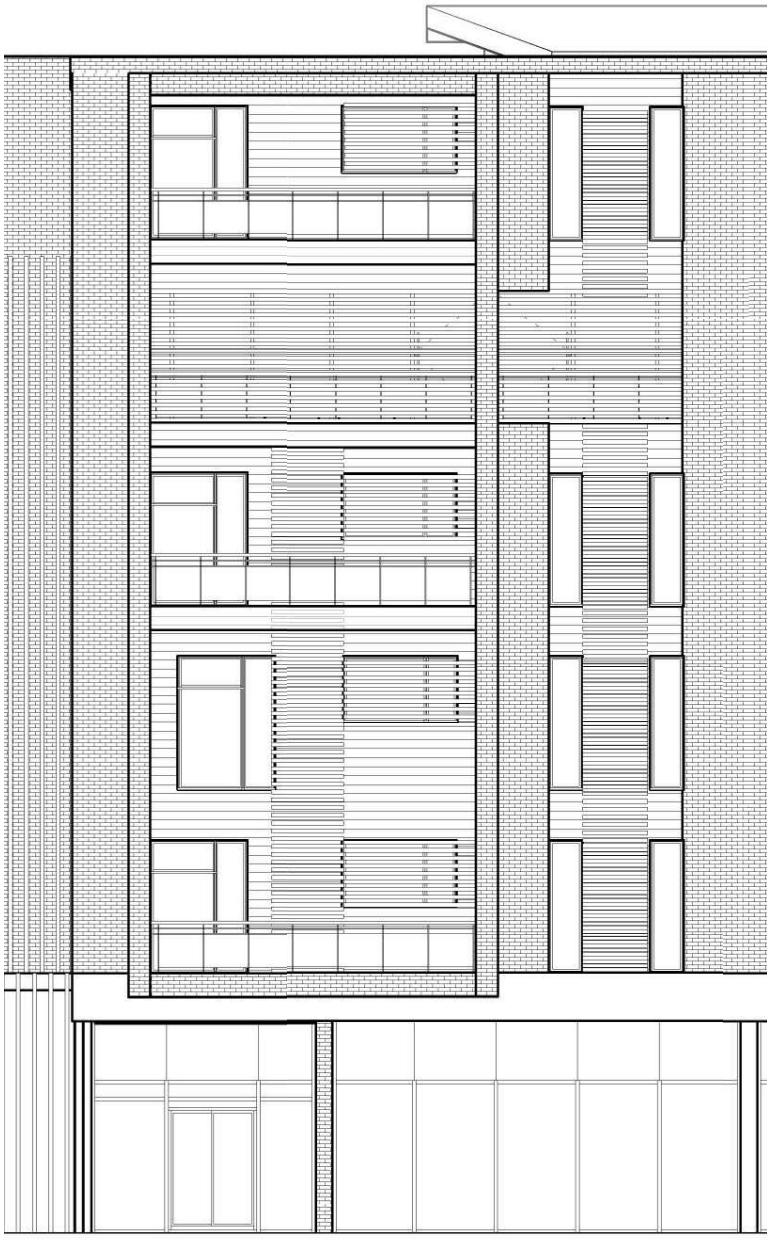


Fig 138 - Window configuration

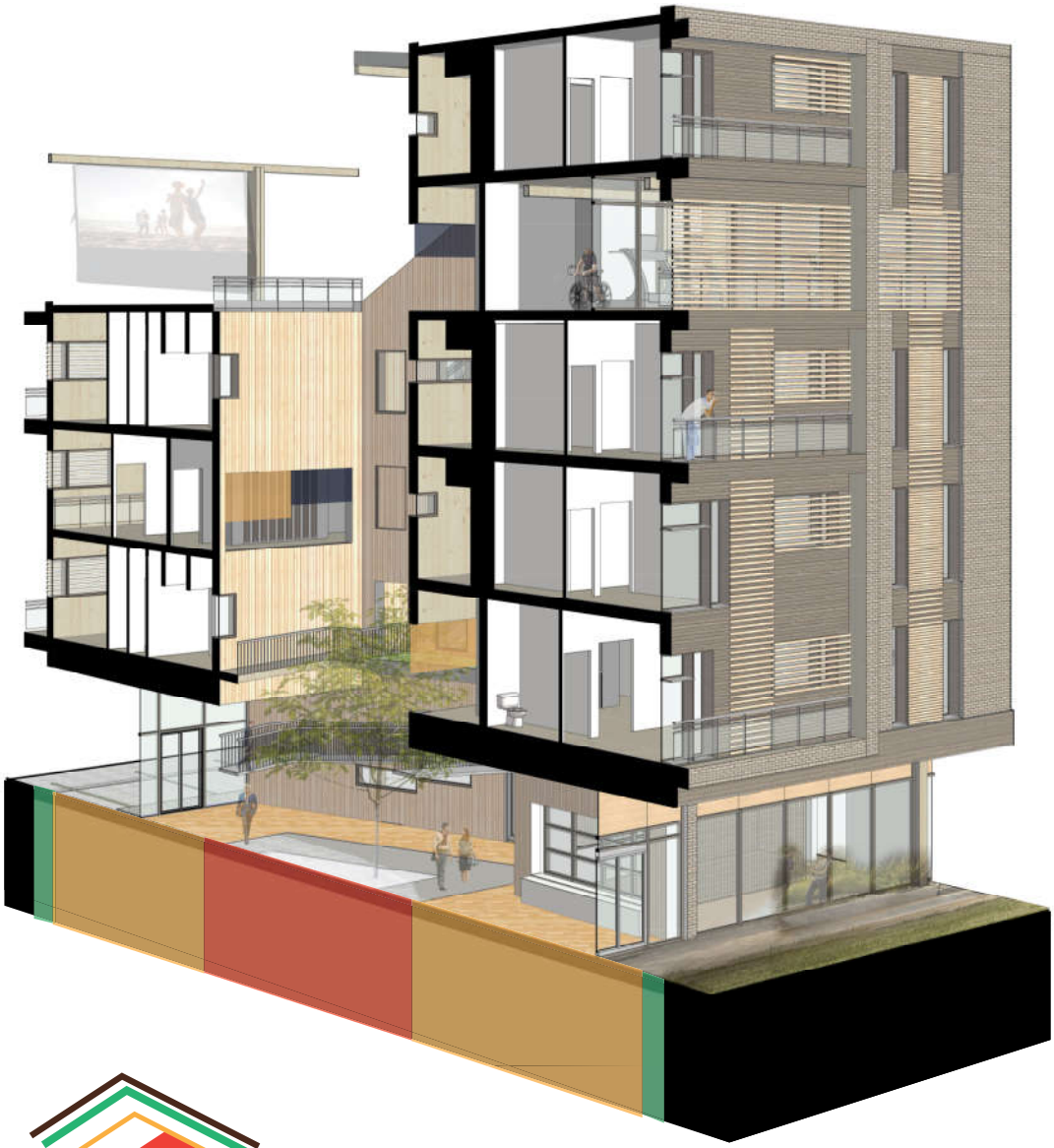


Fig 139 - Section Layering

S

The Living Layer

BOX (SEATING/ STORAGE)
PULLOUT ISLAND COUNTER W/ COUNTERTOP
FOLDING TABLE BOOKSHELF DETAIL
MURPHY UNIT DETAIL(STORAGE, BED, OFFICE) W/ FOLDING BOOKSHELF PARTITION
BATHROOM SEATING /LEDGE/STORAGE
DAYCARE KITCHEN SLIDING PANELS W/ PULL OUT
DAYCARE BED AND SCREENS
DAYCARE EQUIPMENT STORAGE
SEATING / SHELF

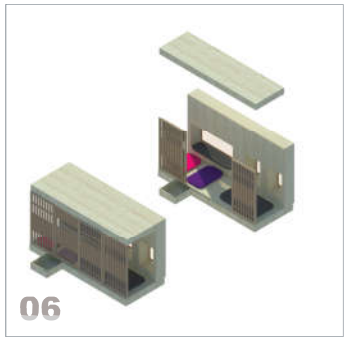

01

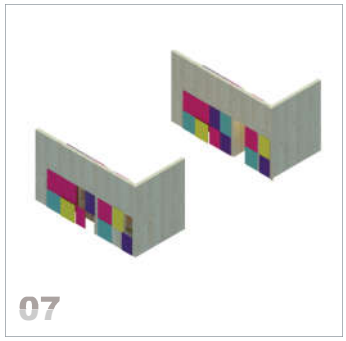

02

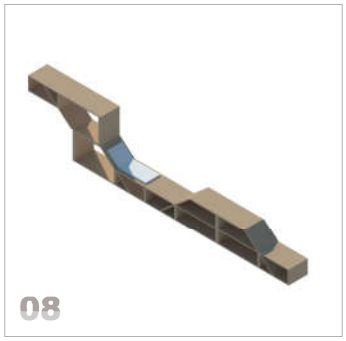

03

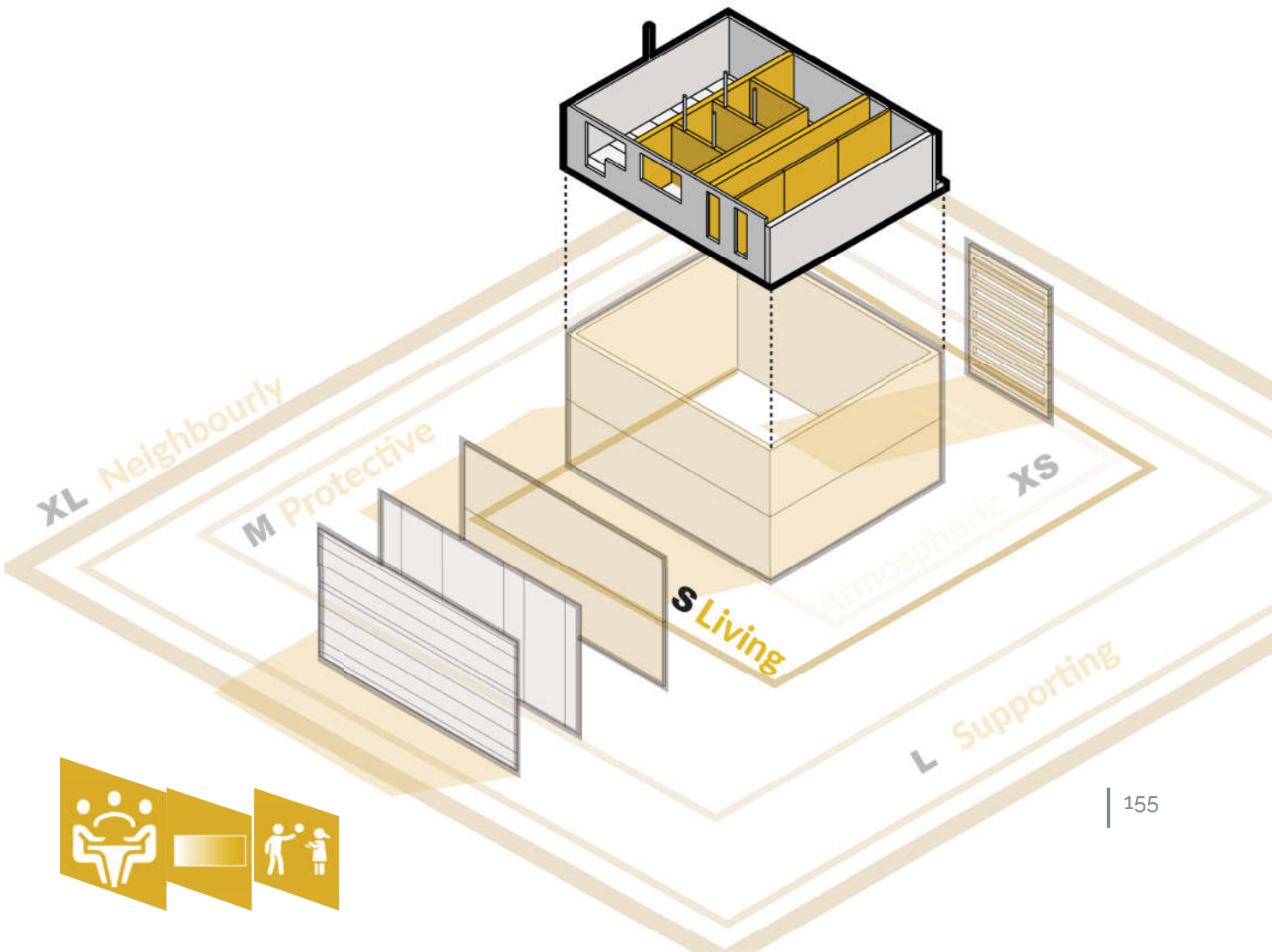

04


05


06


07


08


XL Neighbourly
M Protective
S Living
XS Atmospheric
L Supporting

s
Interiors

The Small scale represents the living layer. This is where spaces through materiality and design are altered to suit the resident's needs within the larger structure. This layer considers the use of fast flexibility for easy transitions. Fast flex consists of mobile wood furniture that opens and closes to allow for easy spatial transitions such as screens, folding shelves, and sliding walls. The interiors focused adaptability transforms spatial preferences over time and include items that require no time at all to alter.

Small also considers interior space as it may be within the semi-public context. Understanding how to organize spaces and programs to allow occupants the sense of privacy they require within a communal centric design.

Fig 140 - Bedroom created using small scaled furniture, Fig 141 - (below) Bedroom opened to secondary space

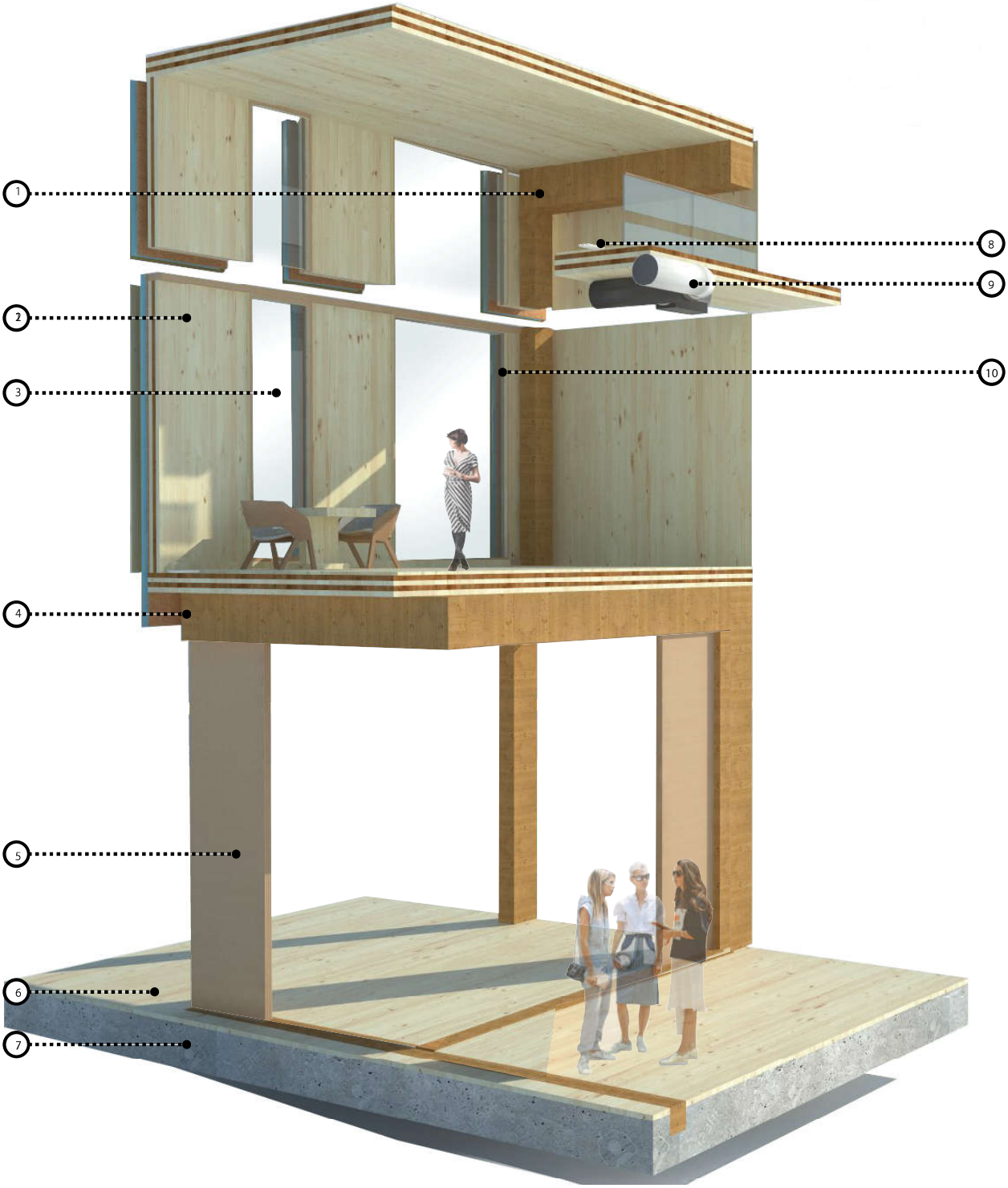


Fig 142 - Partial building axonometric - Open

1. LAMINATED WOOD COLUMN
2. RAINSREEN FACADE SYSTEM OVER INSULATED WALL
3. HIGH PERFORMANCE WINDOW SYSTEM
4. LAMINATED WOOD BEAM UNDER CLT PANEL
5. SLIDING WALL PANELS
6. FINISHED FLOOR (PINE) OVER CLT FLOOR STRUCTURE
7. CONCRETE SLAB AT GRADE
8. ELECTRICAL
9. HVAC SUPPLY AIR AND DUCT
10. PINE WINDOW MULLION

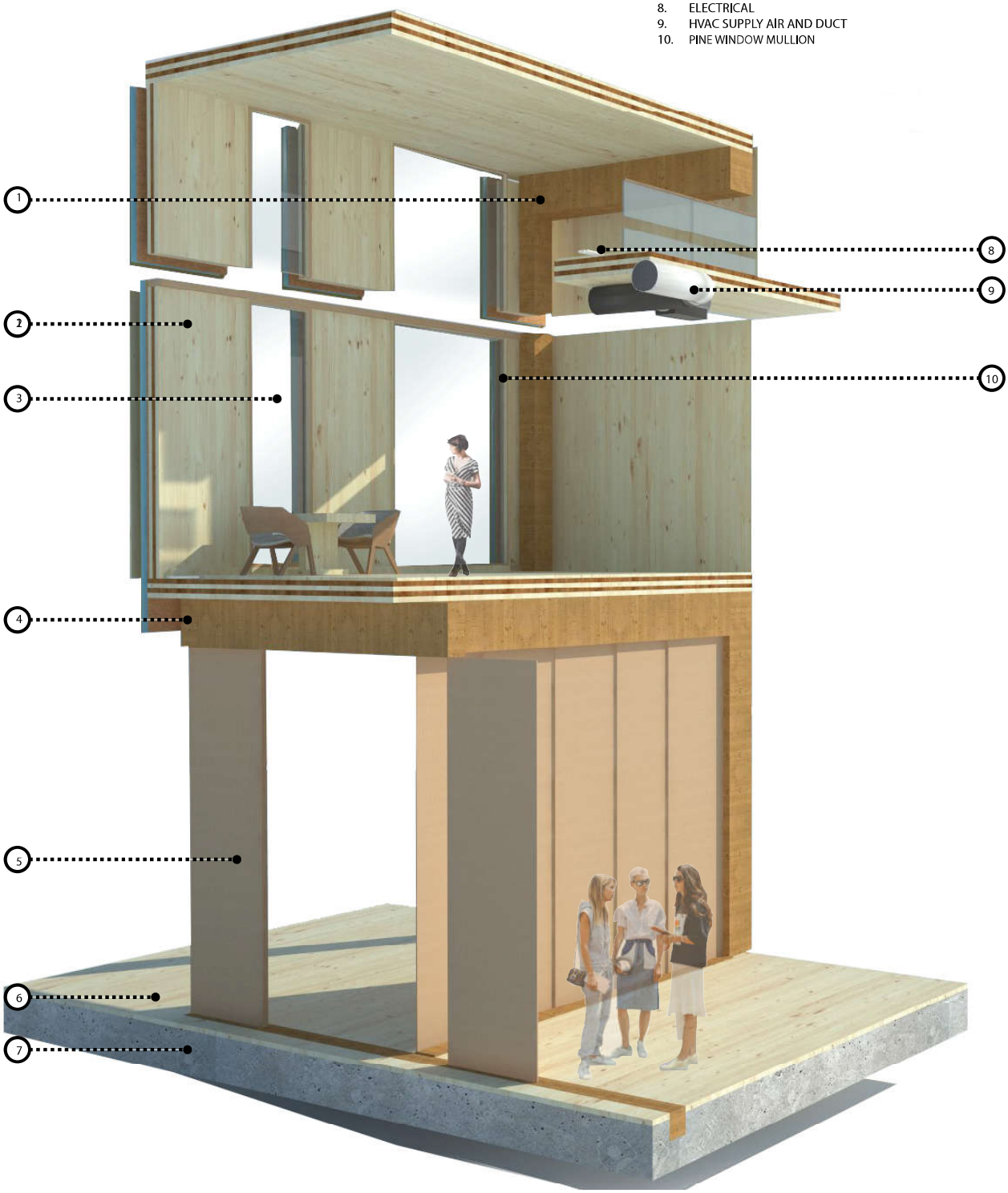


Fig 143 - Partial building axonometric - Closed

Fig 144 - One bay closed to secondary level - Open, Fig 145 - (below) One bay opened to secondary level

Fig 146 - Secondary level of Module

Fig 140 + 141 (below)

Spatial gradient

Within the communal areas there is also the opportunity for varying levels of the gradient as the larger lower level may be too busy and a quieter retreat may be desirable. In this case there is a secondary level of privacy available on the second storey of the communal space. At the end of the privacy spectrum are the units that are connected to the communal area corridor that provides access to the residential portion of the building. This gradient unlike many condominiums livens the central vertical circulation and corridors, as streets and sidewalks sometimes operate, but it does so in an central interior manner providing advantageous opportunities to residents.

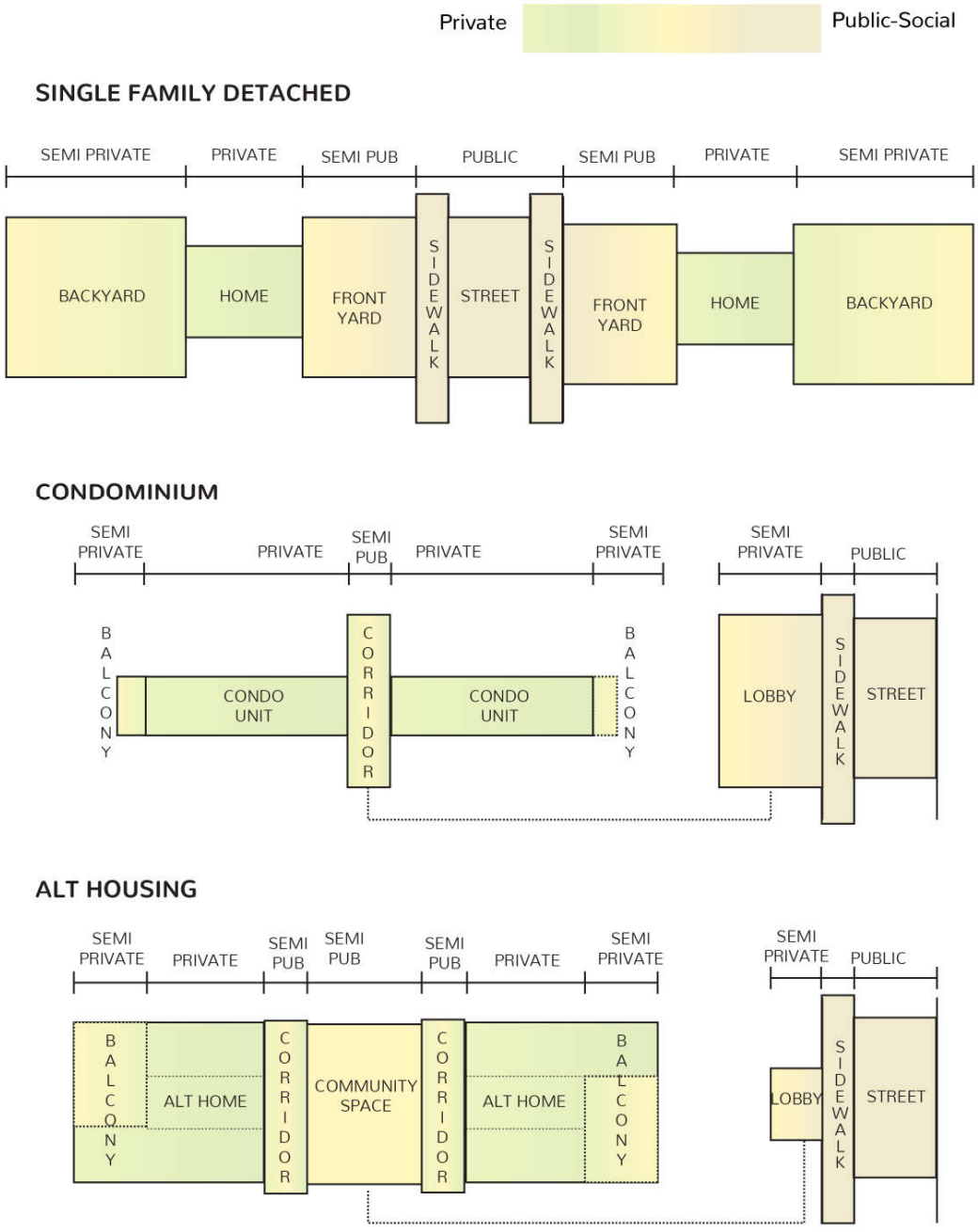


Fig 147 - Privacy gradients for different housing typologies

Circulation to central

Neighbourhood separation

Skip-stop corridors are used throughout this design. This helps to create the needed flexibility vertically by granting access to secondary levels. Residents will enter their units through the corridor and will have the opportunity for varied unit designs as the secondary units will provide more space. Every 2 floors would become a neighbourhood, with a central communal space supporting both primary and secondary floors. Single loaded corridors provide visual access to residents who are either outside or across the building in the communal spaces.

This circulation strategy provides accessibility to those in need, it finds a way to join neighbourhoods and divide them for a manageable number of neighbours.

The yellow highlight in figure 148 shows where access to *primary levels* of suites are located via corridors.

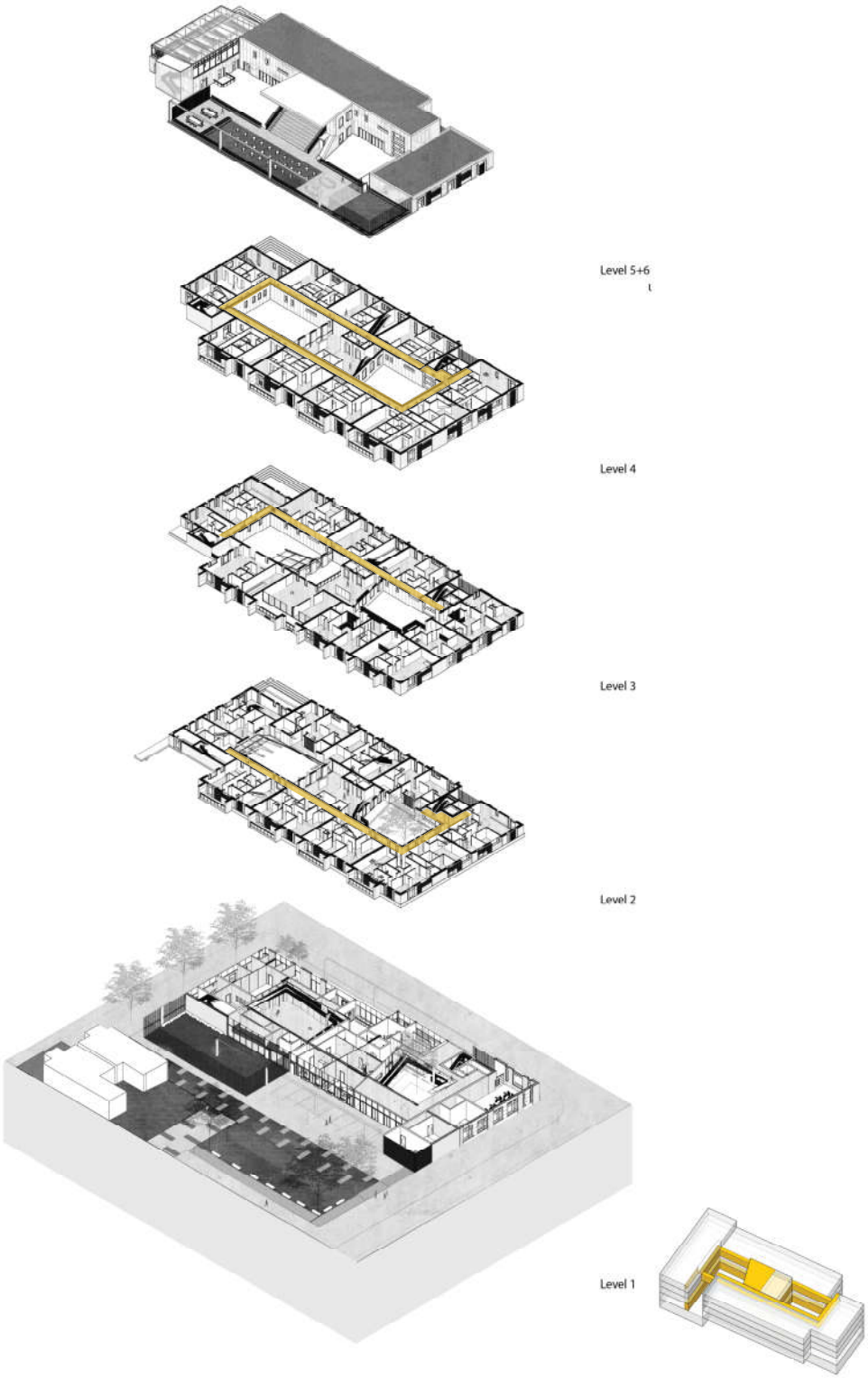


Fig 148 - Site 2 - Circulation

Indoor Communal Space

Community Space

Once passing through the exterior threshold, dwellers will enter the residential building lobby, that will grant access to the elevator core. Most dwellers in residential buildings no matter the height do not take the stairs, so the aim is to provide choice. The elevator will be the main point of circulation that will be supplemented by interior core stairs that are separated from the exit stairs. This allows for spontaneous and inclusive interaction. The dweller is taken from the elevator core through the central area where there may be a quick exchange between residents, for them to arrive at the corridor before arriving at their unit. At the unit there is another chance for a brief exchange through proximity to other unit entrances, until full privacy is obtained.

Fig 149 - Kitchen

Fig 150 - Dining + Laundry

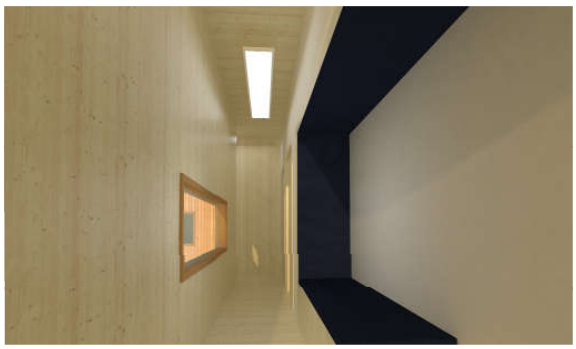


Fig 151 - Indoor communal spaces

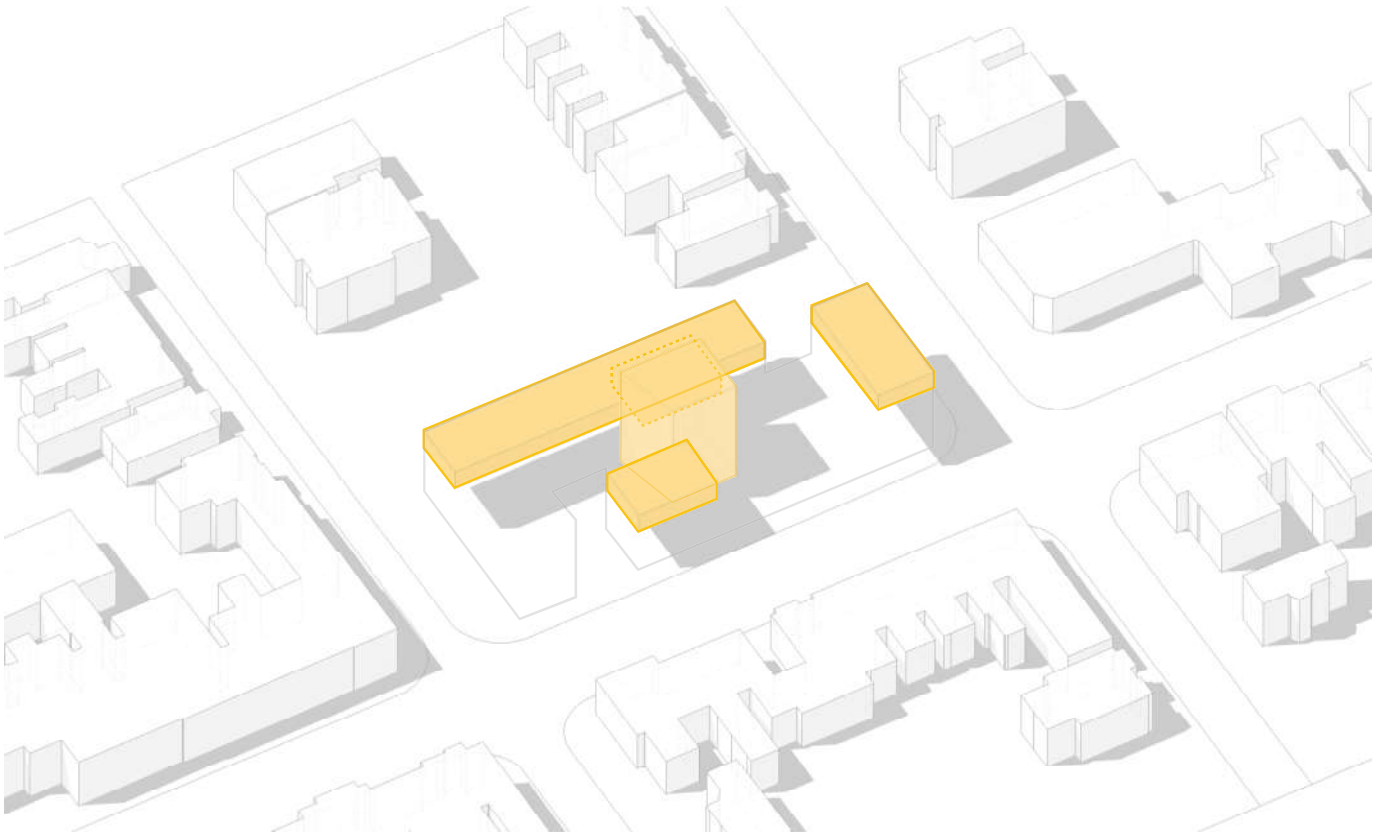
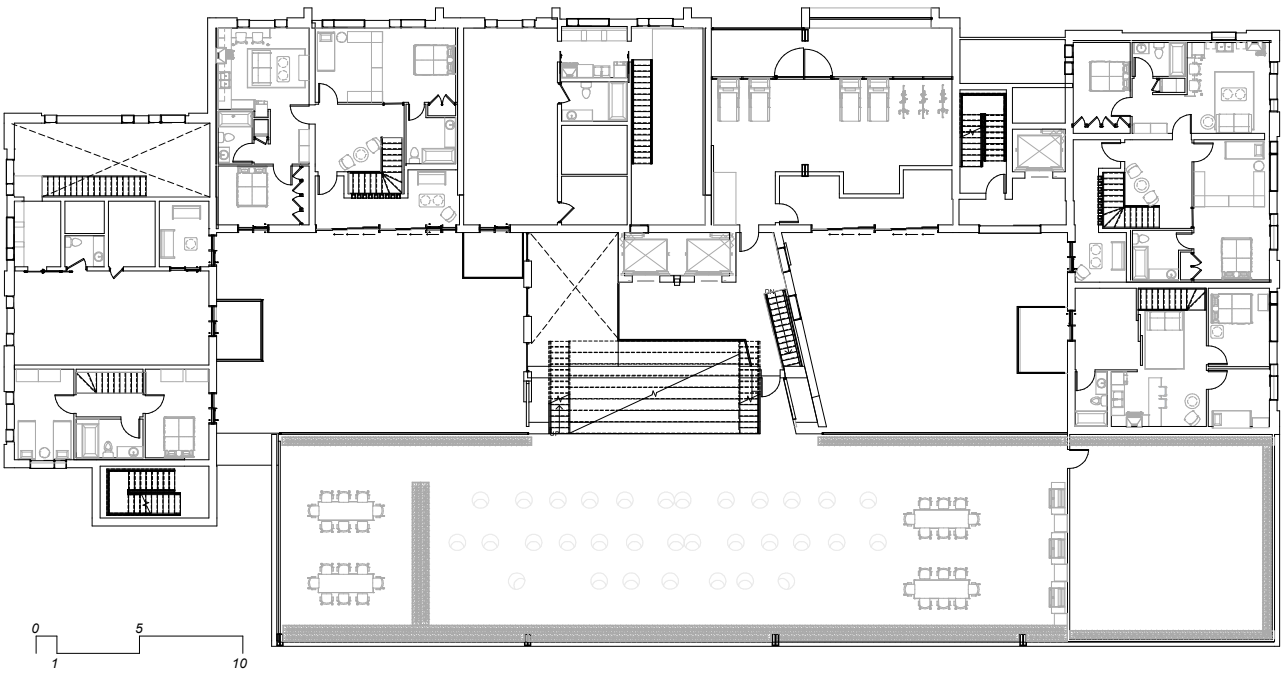
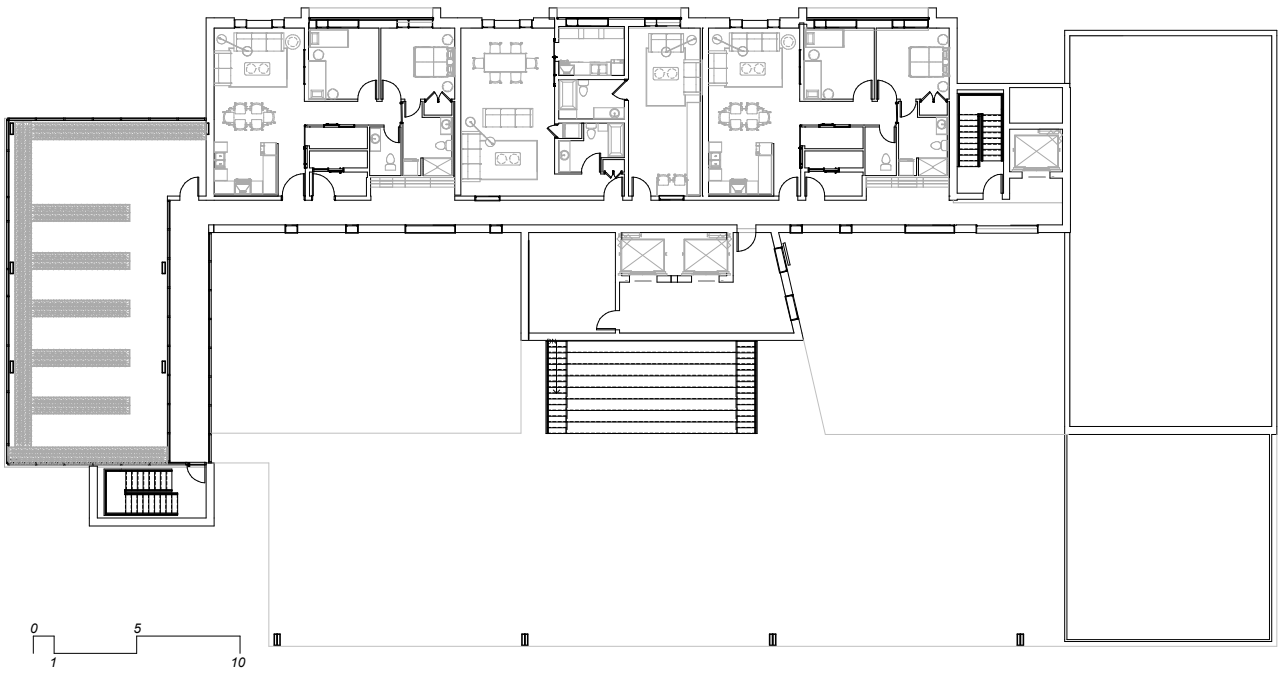


Fig 152 - Diagram of communal spaces



Level 5

Fig 153



Level 6

Fig 154

Fig 155 - Daycare quiet space

Child Space

Daycare spaces

The need to support parents with local places for their children while they are at work is needed but child space is not needed in every building. In the two developed schemes, there is a daycare in one building. What this design aims to do, is explain that buildings do not work in isolation. Every block should have its own daycare that supports the children within it and ultimately supporting the parents.

Fig 156 - Connection between child space and indoor communal area

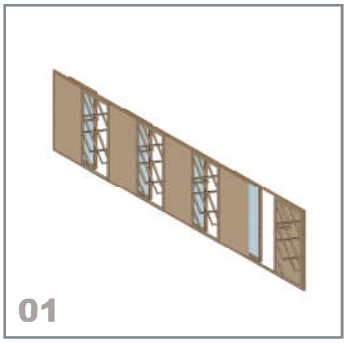
Fig 157- Daycare

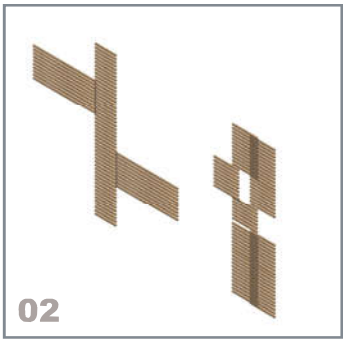
XS

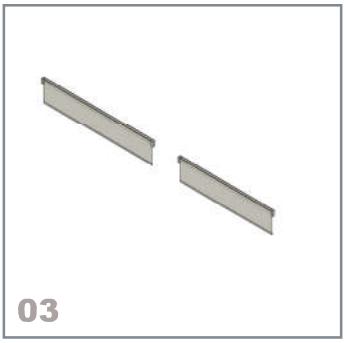
The Atmospheric Layer

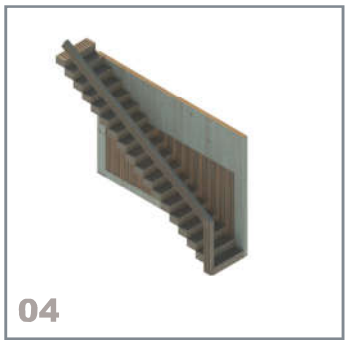
FACADE SHADING/VISIBILITY SYSTEM X2
FABRIC SHADES
DOUBLE STOREY STAIRS (CLT SLATS)
CEILING (DLT)
W/C FLOOR SLATS (MAT)
BALCONY IDENTITY SHADING

Flexibility Items

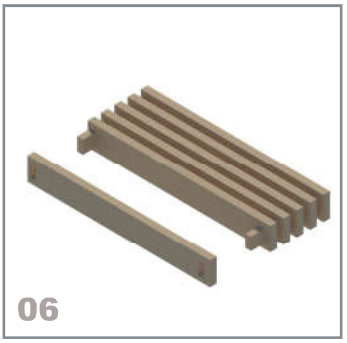

01

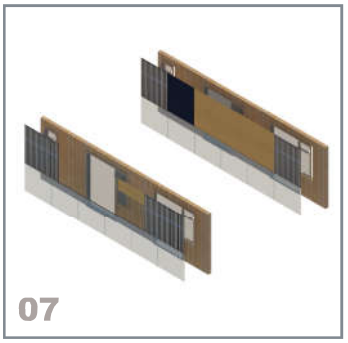

02

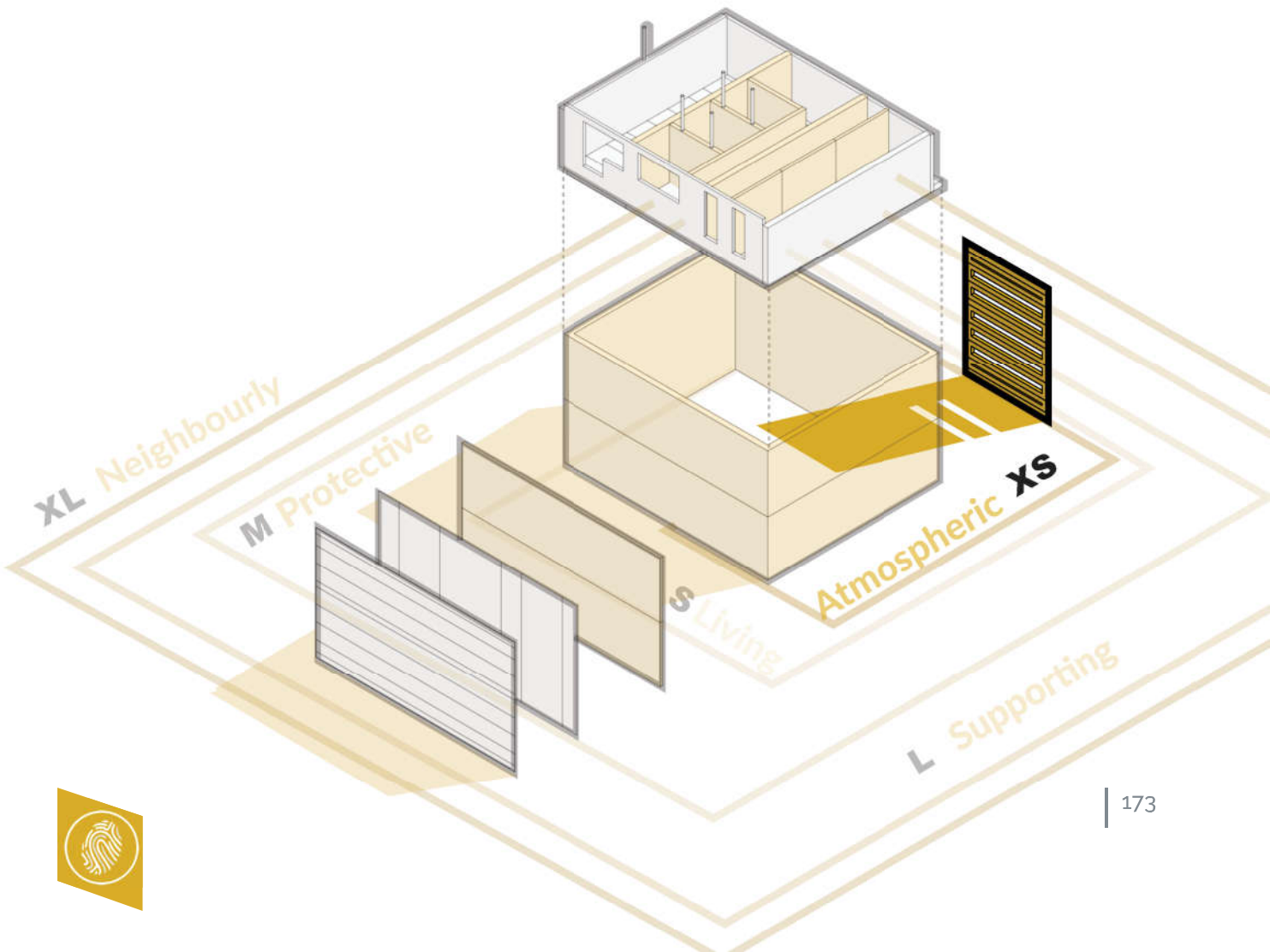

03


04


05


06


07


XL Neighbourly
M Protective
S Living
Atmospheric XS
L Supporting

XS

Atmospheric Flexibility |

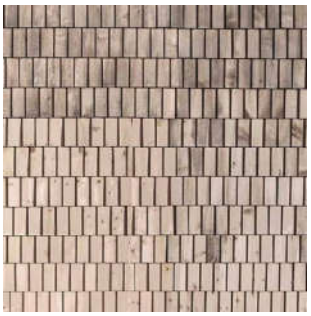
The Facade

Adaptability, Material and Community Identity

At all scales wood has played a part in being exposed through design to seek a residential feel. The extra small works in hand with the small and medium scale to provide texture, acoustics, and visual screening techniques as seen in the images throughout this study to highlight this exceptional material.

XS represents the atmospheric flexibility layer that is used to take fast flex a step further. It allows the occupant to move past the physical adaptations of space and allows for the manipulation of one's sense at a given time. Often large scaled residential buildings lack material qualities and are often bland and stark. This layer gives agency to users as they manipulate their atmospheric surroundings in a way that is also used in this project to speak to individuality within the community.

Individuality is achieved through groupings. The base module is dimensionally grouped into two floors of 3 bays. This should be visible on the exterior; a proud indication as to what is happening on the interior because there is something to boast about as onlookers see this building and the life it hosts.



Front Facade

Community Facade

Fig 158- Atmospheric additions to facades.

In conclusion, Christian Schittich mentions in his book *High-Density Housing* that in order to retain the affluent and educated individuals in the city there is a need to provide space that would currently only be found in penthouses and single family homes, to all places we call home (Schittich, 2004). Home should have the best quality of living that everyone agrees upon, which is why this project aims to provide a baseline design that gives the homeowner the necessities to high quality living, in a way that allows for change over time. Flexibility for managed complexity for user diversity provides the single most desired element to residents, choice.

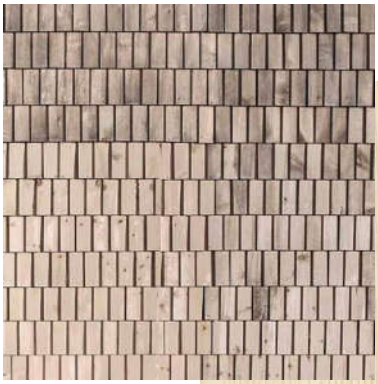
By designing XL, L, M, S, and XS layers, flexibility can be achieved in hopes of producing built forms that harness difference for people who do not live the same way yet understand that home is not to be designed for isolation but in connection with the 8 design parameters and considerations for a more satisfied built form for living.

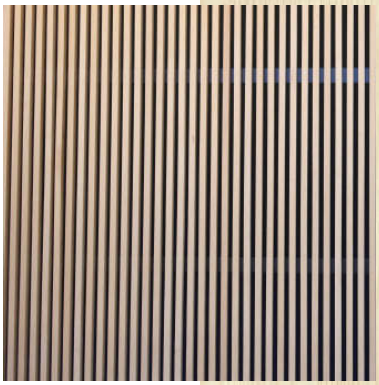
Neighbourhoods, living spaces, envelopes, atmospheric qualities and structural layers should all address and serve this goal. Neighbourhoods are directly integrated into the structural fabric of this module, ensuring that the basic functionality of a variety of layouts support change and interaction. These scales also achieve the creation of a social framework for children to thrive on site and for adults to support each other while enjoying their own desires and preferred level of interaction. They achieve a level of social support accomplished through this thesis in a way that encapsulated the XL outdoor spaces and suggest a need for spaces that represent its users through identification, an element of design implemented through user participation that instills a quality of pride and comfort.

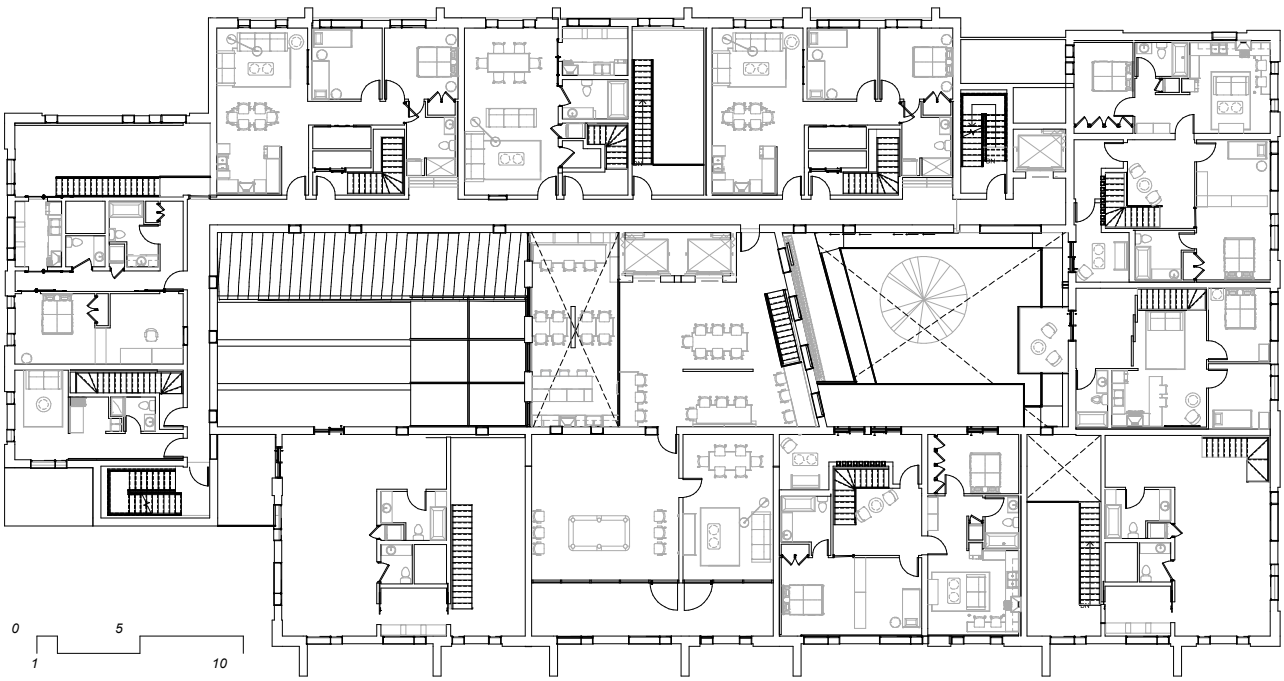
These parameters and the use of scale achieve the level of aspired flexibility at a community and diversity level, a physical level and on a material level which is something that should be sought after in residential design to best fulfill *design outcomes* for all.

Fig 159 - Rooftop Communal space

Appendix |

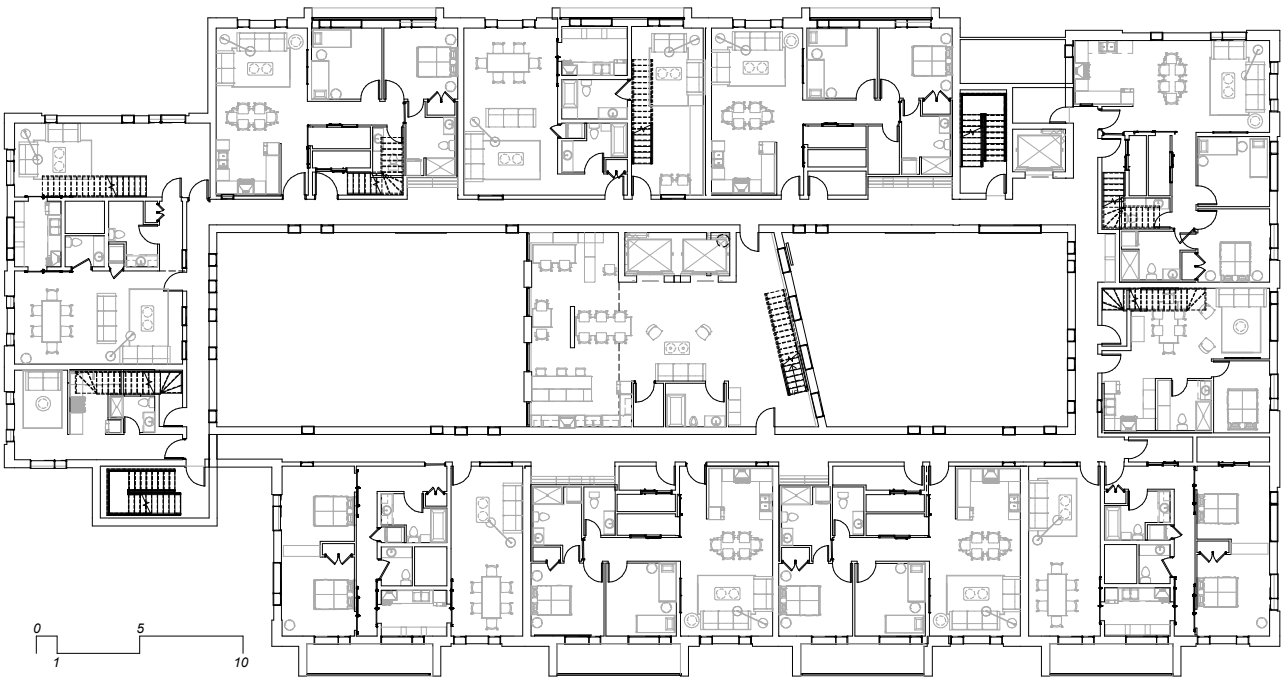






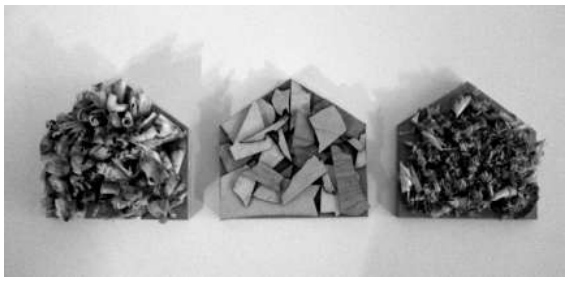
Level 3

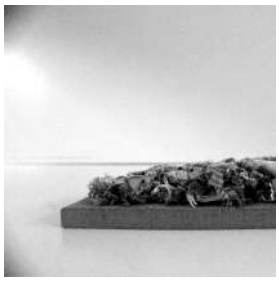
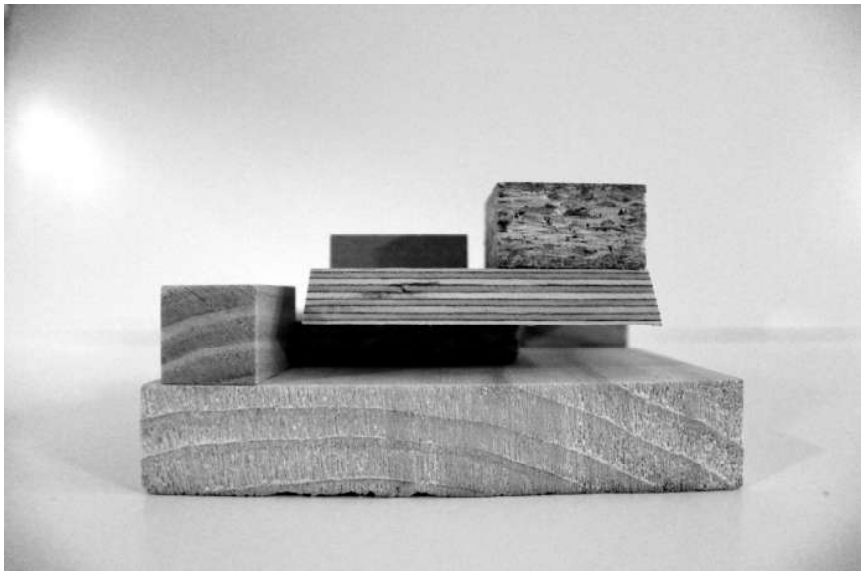
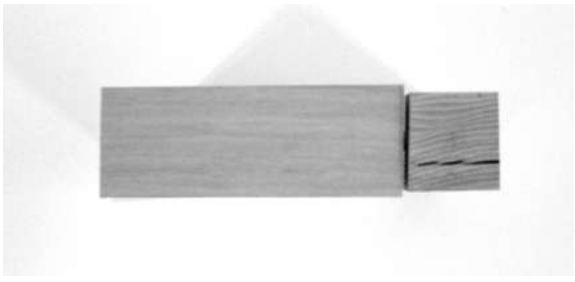
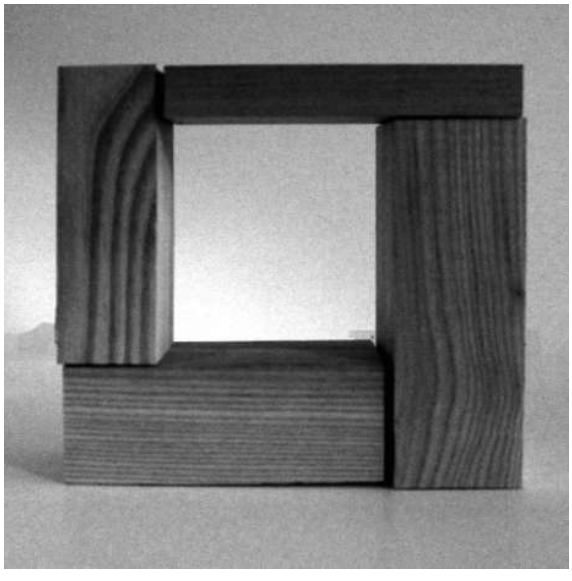
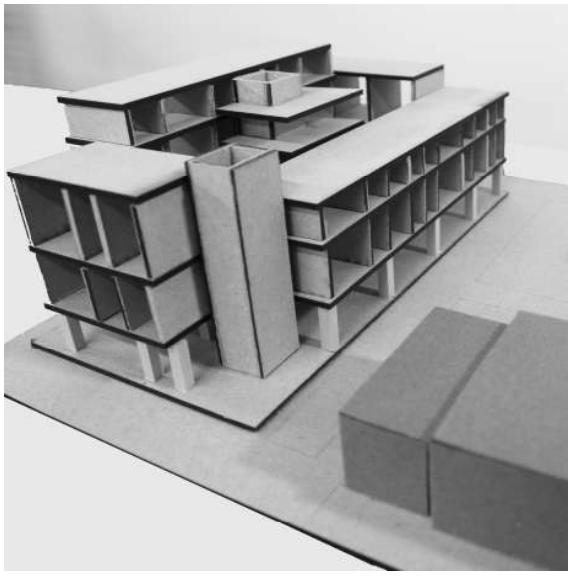
Fig 160



Level 4

Fig 161



Models



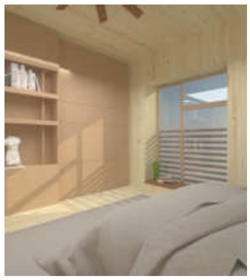


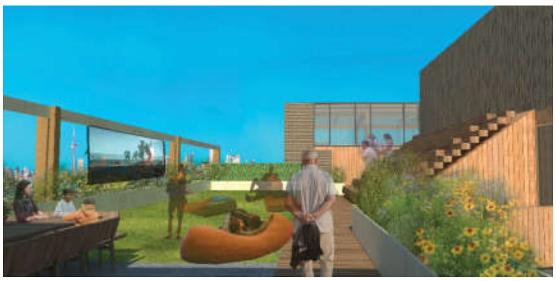













Works Cited

Architecture Guide. (2011). URBAN REDEVELOPMENT HAARLEMMER HOUTTUINEN (HERTZBERGER). Retrieved from http://www.architectureguide.nl/project/list_projects_of_typeofbuilding/typ_id/8/prj_id/332

Architecture Norway. (2005, October 5). Svartlamoen housing, Trondheim. Retrieved from Arkitektur N magazine website: http://www.architecturenorway.no/projects/dwelling/svartlamoen-2005/

Adams, S. (2013). *How to fail at almost everything and still win big: kind of the story of my life*. New York: Portfolio/Penguin.

Andersen, E. (2012, May 12). Going it alone: Single moms share their stories. *Lincoln Journal Star*. Retrieved from https://journalstar.com/lifestyles/family/going-it-alone-single-moms-share-their-stories/article_d705611c-0879-5b55-a402-fb7efb7d26c4.html

Andrew Steptoe, Aparna Shankar, Panayotes Demakakos, and Jane Wardle. (2013, February 15). Social isolation,loneliness, and all-cause mortality in older men and women. Récupéré sur PNAS: http://www.pnas.org/content/110/15/5797.full

Baum, A., & Valins, S. (1977). *Architecture and social behavior: psychological studies of social density*. Hillsdale, N.J.: New York: L. Erlbaum Associates; distributed by the Halsted Press Division of Wiley.

Bébout, R. (2001, December). Master builders meet citizen activists. Retrieved from http://www.rbebout.com/queen/mtc/2ptref.htm

Blumer Lehmann. (2019). *Building with Wood*. Gossau, Switzerland. Retrieved from http://www.blumer-lehmann.ch/fileadmin/documents/20_Holzbau/28_Admin_Flyer/Blumer-Lehmann_AG_-_Building_with_wood.pdf

Bozikovic, A. (2018, January 31). Ontario home rethinks suburban norms with a highly unusual floor plan. Retrieved from https://www.theglobeandmail.com/life/home-and-garden/architecture/ontario-home-rethinks-suburban-norms-with-a-highly-unusual-floorplan/article37789848/

BSLC, Forestry Innovation Investment, & Think Wood. (2014). *Summary Report: Survey of International Tall wood buildings (with appendices)* (p. 153). Think Wood. Retrieved from https://www.thinkwood.com/wp-content/uploads/2017/12/Survey_Tall_Wood_REPORT_WITHOUT_APPENDICES_web.pdf

Bumgardner, W. (2019). *Should You Walk 10,000 Steps per Day for Weight Loss?* Verywellfit. Retrieved from https://www.verywellfit.com/10000-steps-per-day-fitness-weight-loss-3435744

Calthorpe, P. (1995). *The next American metropolis: ecology, community, and the American Dream* (4. print). New York, NY: Princeton Architectural Press.

Cameron, J., Wood, D., & Thorogood, J. (2012, April). Profiles of a Movement: Co-Operative Housing Around the World. CECODHAS Housing Europe and ICA Housing. Retrieved from http://www.housingeurope.eu/file/40/download

Canadian Co-operative Association. (2015). Cited Benefits of Housing Co-operatives in Canada. Canadian Co-operative Association. Retrieved from http://www.cooperativedifference.coop/wp-content/uploads/2015/02/Cited-Benefits-of-Housing-Co-ops.pdf

Carozzi, F., London School of Economics, Hilber, C., & Cheshire, P. (2017, July). 14th Annual Demographia International Housing Affordability Survey: 2018 Rating Middle-Income Housing Affordability. Retrieved from http://www.demographia.com/dhi2018.pdf

City of Toronto. (2010). *Section 3 Performance Standards for Mid-Rise Buildings* (p. 44). Retrieved from https://www.toronto.ca/wp-content/uploads/2017/08/960c-Performance-Standards-for-Mid-Rise-Buildings.pdf

City of Toronto. (2017). Accessibility Design Guidelines. Toronto. Retrieved from https://www.toronto.ca/wp-content/uploads/2017/08/8fcf-accessibility_design_guidelines.pd

Chirametli, K. (2011, January 17). The Girls' Home, 229 Gerrard Street East. Retrieved from https://torontopubliclibrary.typepad.com/trl/2011/01/toronto-orphanages-and-day-nurseries.html

Cole, L. (2008). *Under construction: a history of co-operative housing in Canada*. Ottawa: Borealis Press.

CompetitionLine. (2015, December 2). Energieefizienter Wohnungsbau - Modellvorhaben e%. Retrieved from https://www.competitionline.com/de/projekte/57551/per/post/125328

DiGiulio, S. (2018, January 9). In good company: Why we need other people to be happy. Retrieved from https://www.nbcnews.com/better/health/good-company-why-we-need-other-people-be-happy-ncna836106

Deplazes, A., Krötsch, S., & Huss, W. (2016). Revolution and Continuity in Wood Construction. *Detail, Timber Construction*(1), 23.

Deppishch, M. (2016). Modellvorhaben Energieeffizienter Wohnungsbau Ansbach. Retrieved from https://www.bak.de/berufspolitik/energie-und-ressourceneffizientes-bauen-1/initiative-besser-mit-architekten/160419-best-practice-3-deppisch.pdf

Dirksen, K. (2015). *Switch flat Tokyo: mobile walls transform home into office*. Retrieved from https://www.youtube.com/watch?v=tWd-umQ0tlE

Dudek, M. (2016). *Children's spaces*. Place of publication not identified: Routledge.

Elemental, Aravena, A., & Iacobelli, A. (Eds.). (2012). *Elemental: manual de vivienda incremental y diseño participativo ; incremental housing and participatory design manual*. Ostfildern: Hatje Cantz.

EUMiesaward. (2019). Haarlemmer Houttuinen Housing. Retrieved from https://eumiesaward.com/work/1507

Fahkry, T. (2017, December 3). How To Live A Purposeful Life From Where You Are Now. Retrieved from https://medium.com/the-mission/how-to-live-a-purposeful-life-from-where-you-are-now-d6dc345194ef

Fieldhouse, P. (2016). (Still) Eating Together: The Culture of the Family Meal. *The Vanier Institute of the Family: Transition Magazine*, 45(1). Retrieved from https://vanierinstitute.ca/eating-culture-family-meal/

Fishel, A., Prof. Psychology. (2015, January 9). Science says: eat with your kids. Retrieved from http://theconversation.com/science-says-eat-with-your-kids-34573

Florida Family Law Clinic, LLC. (2015, August). The Different Types of Non-Traditional Families in Florida. Retrieved from https://www.floridafamilylawclinic.com/the-different-types-of-non-traditional-families-in-florida/

French, H. (2008). *Key urban housing of the twentieth century: plans, sections, and elevations* (1st American ed). New York: W.W. Norton.

Friedman, A. (2001). *The grow home*. Montréal: McGill-Queen's University Press.

Friedman, A. (2005). *Homes within reach: a guide to the planning, design, and construction of affordable homes and communities*. Hoboken, N.J: J. Wiley.

http://www.solutionsforwood.com/_docs/reports/Wood_Human_Health_final-single.pdf

George, A. (2017). Influencing Factors on Age-Friendly Interiors. *Forensic Science & Addiction Research*, *1*(4). https://doi.org/10.31031/FSAR.2017.01.000517

Glynn, Ruairi. Fun Palace – Cedric Price, Design for Performance and Interaction. 2005. http://www.interactivearchitecture.org/fun-palace-cedric-price.html

Goodfellow, M., & Goodfellow, P. (2010). *A guidebook to contemporary architecture in Toronto*. Vancouver [B.C.: Douglas & McIntyre. Retrieved from http://www.deslibris.ca/ID/443049

Granneman, J. (2017, June 20). Why We Need to Have Deeper Conversations. *Psychology Today*. Retrieved from

https://www.psychologytoday.com/us/blog/the-secret-lives-introverts/201706/why-we-need-have-deeper-conversations

Groneman, C. H. (1976). *General woodworking* (5th ed). New York: McGraw-Hill.

Guiton, J. (2000). The Ideas of Le Corbusier on Architecture and Urban Planning . New York: George Braziller.

Habraken, N. J., & Teicher, J. (2011). *Supports: an alternative to mass housing*.

Habraken , N. John. (2018). Open Building; brief introduction. http://www.habraken.com/html/introduction.htm

Hansen, M. M., Jones, R., & Tocchini, K. (2017). Shinrin-Yoku (Forest Bathing) and Nature Therapy: A State-of-the-Art Review. *International Journal of Environmental Research and Public Health*, *14*(8), 851. https://doi.org/10.3390/ijerph14080851

Hartany, J., & Le, A. (n.d.). NextGen Housing Chapter Study: On flexible spaces and modularity. NG Housing.

Hayden, D. (1986). *Redesigning the American dream: the future of housing, work, and family life*. New York: W.W. Norton.

Hearne, R. (2017). A home or a wealth generator? Inequality, financialization and the Irish housing crisis. Presented at the Cherishing All Equally 2017 Economic Inequality in Ireland, Economic Inequality in Ireland. Retrieved from https://www.tasc.ie/download/pdf/a_home_or_a_wealth_generator_inequality_financialisation_and_the_irish_housing_crisis.pdf

Heckmann, O., & Schneider, F. (Eds.). (2018). *Floor Plan Manual Housing - Grundrissatlas Wohnungsbau* (Fünfte, überarbeitete und erweiterte Auflage =). Basel ; Boston: Birkhäuser.

Heerwagen, J. (2017). Psychosocial Value of Space. *WBDG:Whole Building Design Guide*. Retrieved from https://www.wbdg.org/resources/psychosocial-value-space

HOK. (2019). *Workplace Strategies that Enhance Performance, Health and Wellness*. Retrieved from

https://www.hok.com/thought-leadership/workplace-strategies-that-enhance-human-performance-health-and-wellness/

Hughes, Jonathan and Sadler,Simon eds., "Open Ends: The Social Visions of 1960s Non-Planning," from "Non-Plan: Essays on Freedom, Participation and Change in Modern Architecture and Urbanism,", 2000.

Jacobs, J. (1961). The Death and Life of Great American Cities. New York: Random House.

Jansen, T. R. (2015, October 2). The Nursing Home That's Also a Dorm. Récupéré sur CityLab: https://www.citylab.com/equity/2015/10/the-nursing-home-thats-also-a-dorm/408424/

Kalinowski, T. (2019, February 26). New-build house prices in GTA slide while condominium prices climb. Retrieved from https://www.thestar.com/business/real_estate/2019/02/26/new-construction-house-prices-slide-as-condo-prices-climb.html

Kaufmann, H. (2018). *Manual of Multistorey Timber Construction*. Munich: Detail Business Information GmbH.

Kenneth Koo, P. (2013, May). A study on Historical Tall-Wood Buildings in Toronto and Vancouver. FP Innovations. Retrieved from https://fpinnovations.ca/Documents/a-study-on-historical-tall-wood-buildings-in-toronto-and-vancouver.pdf

Kim, G. (2017). *How cohousing can make us happier (and live longer)*. Vancouver B.C. Retrieved from https://www.ted.com/talks/grace_kim_how_cohousing_can_make_us_happier_and_live_longer/transcript?language=en#t-600383

Knoll, inc. (2014). Knoll Workplace Research: Benefits of Wood: Wood Resonates with all Generations. Knoll. Retrieved from https://www.knoll.com/document/1353003671877/Benefits-of-Wood-Knoll_wp.pdf

Kronenburg, Robert . (2011). Kronenburg's Lecture on Flexible Architecture. [Online Video]. 5 March. Accessed from: http://vimeo.com/21803296. [Accessed on 10 May 2014].

Kundig, O. (2017). Bigwood Residence. Retrieved from https://www.olsonkundig.com/projects/bigwood-residence/

Lawton, M. P. (1977). *Design and evaluation of an institutional environment for the mentally impaired aged*. Minneapolis. Retrieved from https://journals-scholarsportal-info.ezproxy.lib.ryerson.ca/pdf/00187208/v23i0001/39_rdftaetb.xml

Le Corbusier, Baudouï, R., & Dercelles, A. (2013). *Correspondance. T. 2: Lettres à la famille 1926 - 1946*. Gollion: Infolio.

ate/toronto/article-celebrating-10-years-of-raw-design-architecture-with-good-manners/

Lewis, S. (2005). *Front to back: a design agenda for urban housing*. Oxford: Architectural Press.

Lifetime Homes. (2008). *Lifetime Homes Principles*. Retrieved from PRP website: http://www.lifetimehomes.org.uk/pages/lifetime-homes-principles.html

Maslow, A. H. (1943). A theory of human motivation. *Psychological Review*, 50(4), 370–396. https://doi.org/10.1037/h0054346

Max-Neef, M. A. (1991). *Human scale development: conception, application and further reflections*. New York: Apex Press.

McCamant, K., & Durrett, C. (2011). *Creating cohousing: building sustainable communities*. Gabriola Island, B.C: New Society Publishers.

McLeod, S. (2018). Maslow's Hierarchy of Needs. Retrieved from https://www.simplypsychology.org/maslow.html

Mezzadr, H. (2008). Mies at Weissenhof. *ARQTEXTO*, (13). Retrieved from https://www.ufrgs.br/propar/publicacoes/ARQtextos/PDFs_revista_13/02_humberto%20mezzadri.pdf

Moe, K., & Smith, R. E. (2012). *Building systems: design, technology, and society*. Abingdon, Oxon [England] ; New York, NY: Routledge.

Morris, P. (1978). *Embattled shadows: a history of Canadian cinema, 1895-1939*. Montreal: McGill-Queen's University Press.

Murrell, K. (2018). *Time for Action: Investigating the role of the Architect, Community and governance through Participatory Design and phases of implementation* (Seminar Research Paper No. 1) (pp. 1–21). Dr. Leila Marie Farah: Ryerson University.

Murrell, K. (2018). *Troping Architecture - Portico, Port, Porch* (Written). Toronto: Ryerson University.

Nascimento, Denise Morado. Open House International; Gateshead Vol. 37, Iss. 4, (Dec 2012): 5-13.

Nasr, A.-M., Oppedisano, A., Zonena, A., Floro, E., & Bogdanowicz, J. (2017, May). Planning for children in new vertical communities. City of Toronto. Retrieved from https://www.toronto.ca/legdocs/mmis/2017/pg/bgrd/backgroundfile-103920.pdf

Neff, C. (2011). The Role of the Toronto Girls' Home, 1863—1910. *Journal of Family History*, *36*(3), 286–315. https://doi.org/10.1177/0363199011407030

Newman, O. (2008). *Creating defensible space*. Darby, Pa.: Diane.

Nielsen. (2014). *Millennials prefer cities to suburbs, subways to driveways* (Demographics). Retrieved from https://www.nielsen.com/us/en/insights/news/2014/millennials-prefer-cities-to-suburbs-subways-to-driveways.html

O'Byrne, D. P. (2006). *Reversing the Trend: Strategies to Make Center City Seattle Livable and Attractive to Families with Children* (Master of Urban Planning). University of Washington. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.173.9013&rep=rep1&type=pdf

Peper, E., & Harvey, R. (2018). *Digital Addiction: Increased Loneliness, Anxiety,and Depression* (NeuroRegulation No. Vol 5. No 1) (pp. 1–6). San Francisco, California, USA: San Francisco State University. Retrieved from http://www.neuroregulation.org/article/view/18189/11842

Perkins, K., & Zizys, T. (2005, December 16). St James Town Neighbourhood Toronto. Retrieved from http://www.stjamestown.org/wp-2014/wp-content/uploads/2015/05/Final-report-to-WVC.pdf

Planning, S. o., & Hulchanski, J. D. (1990). Planning New Urban Neighbourhoods: Lessons from Toronto's St. Lawrence Neighbourhood

Planning, Q. U. (2001). Directions for New Urban Neighbourhoods: Learning from St. Lawrence. CEDRO.

Powell, N. (2018, June 7). Millennial housing crisis? Turns out, it's real and worse than you thought. Retrieved from https://business.financialpost.com/real-estate/millennial-housing-crisis-turns-out-its-real-and-worse-than-you-thought

Reed, C., & Lister, N.-M. (2014). Ecology and Design: Parallel Genealogies. *Places Journal*, (2014). https://doi.org/10.22269/140414Sargisson, L. (2007). Second-Wave Cohousing: A Modern Utopia. *Penn State University Press*, *18*(3), 393-424.

Schittich, C. (Ed.). (2004). *High-density housing: concepts, planning, construction*. München : Basel ; Boston, Mass: Edition Detail ; Birkhäuser.

Schmidt, R., & Austin, S. A. (2016). *Adaptable architecture: theory and practice*. London ; New York: Routledge, Taylor & Francis Group.

Schneider, T., & Till, J. (2005). Flexible housing: opportunities and limits. *Architectural Research Quarterly*, 9(2), 157–166.

Schoenauer, N. (2000). *6,000 years of housing* (Rev. and expanded ed). New York: W.W. Norton.

SHAPE Architecture. (2017). Union Street EcoHeritage - SHAPE Architecture. Retrieved 15 December 2017, from https://shapearchitecture.ca/projects/union-street-ecoheritage/

Seno, S. (March 03). The People Make The Place. Retrieved from http://individual.utoronto.ca/shireen/project2.pdf

Smith, R. E. (2010). *Prefab architecture: a guide to modular design and construction*. Hoboken, N.J: John Wiley & Sons.

Spatial Agency. (2017). Fourierist Communities. Récupéré sur Spatial Agency: http://www.spatialagency.net/database/how/empowerment/fourierist.community

Statistics Canada. (2011). Homeownership in Canada, 1971 to 2016. Retrieved from https://www150.statcan.gc.ca/n1/daily-quotidien/171025/cg-c001-eng.htm

Statistics Canada. (2016, October 7). An aging population. Retrieved from https://www150.statcan.gc.ca/n1/pub/11-402-x/2010000/chap/pop/pop02-eng.htm

Statistics Canada. (2017, August 2). Families, households and marital status: Key results from the 2016 Census. Retrieved from https://www150.statcan.gc.ca/n1/daily-quotidien/170802/dq170802a-eng.htm

Statistics Canada. (2017). *2016 Census: Families, households and marital status; Language.* Retrieved from https://www.toronto.ca/wp-content/uploads/2017/10/8f49-2016-Census-Backgrounder-Family-Households-Languages.docx

Statistics Canada. (2018, May 17). Fertility: Fewer children, older moms. Retrieved from https://www150.statcan.gc.ca/n1/pub/11-630-x/11-630-x2014002-eng.htm

Statistics Canada. (2018). Living arrangements of seniors. Retrieved from https://www12.statcan.gc.ca/census-recensement/2011/as-sa/98-312-x/98-312-x2011003_4-eng.cfm

Statistics Canada. (2019). *Census Profile, 2016 Census, Toronto, City*. Retrieved from https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/Page.cfm?Lang=E&Geo1=CSD&Code1=3520005&Geo2=PR&Data=Count&B1=All

Summers, J. K., & Smith, L. M. (2014). The Role of Social and Intergenerational Equity in Making Changes in Human Well-Being Sustainable. *AMBIO*, *43*(6), 718–728. https://doi.org/10.1007/s13280-013-0483-6

The City of Toronto. (1906). *Fiftieth Annual report of the Girls' Home 229 Gerrard St. East.* Retrieved from https://archive.org/details/annualreportofgi1906girl/page/n5

Think Wood. (2018). *100 PROJECTS UK CLT*. Retrieved from https://www.thinkwood.com/wp-content/uploads/2018/10/CLT-100-UK-Projects_Think-Wood-Web.pdf

Toronto Realty. (2018, March 14). How Big Are Toronto's New 3-Bedroom Condos? Retrieved from https://torontorealtyblog.com/blog/big-torontos-new-3-bedroom-condos/

Tory-Henderson, N. (2016, February 22). Quinta Monroy [Arcspace]. Retrieved from https://arcspace.com/feature/quinta-monroy/

Towers, Graham. Building Democracy: Community Architecture in the Inner Cities. UCL Press, 1995
Unicef. (2012). Children in an increasingly urban world. Unicef. Retrieved from https://www.unicef.org/sowc2012/pdfs/SOWC-2012-Chapter-1-Children-in-an-increasingly-urban-world.pdf

United Nations. (2018, May 16). 68% of the world population projected to live in urban areas by 2050, says UN. United Nations. Retrieved from https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html

UoC, S. C. R. C. (2011, May 9). Firmness Commodity and Delight - Firmness, Commodity, and Delight - The University of Chicago Library. Retrieved November 30, 2018, from https://www.lib.uchicago.edu/collex/exhibits/firmness-commodity-and-delight/

Walk Score. (2019). How Walk Score Works. Retrieved from https://www.walkscore.com/how-it-works/

Webb, M. (2017). *Building community*. New York, NY: Thames & Hudson.

Williamson Chong Architects. (2016, March 9). Grange Triple Double. Retrieved from https://issuu.com/ontarioassociationofarchitects/docs/grange_triple_double

Wisconsin Center for Cooperatives. (2018). Economic Impacts of Cooperatives › Social and Public Services Housing. Retrieved from http://reic.uwcc.wisc.edu/house/

Wood, H. (2017, December 28). Co-living 2030: Are you ready for the sharing economy? Retrieved from

https://archinect.com/features/article/150042590/co-living-2030-are-you-ready-for-the-sharing-economy

Wood Works. (n.d.). Building Types. Retrieved from http://www.woodworks.org/design-and-tools/building-types/

WUP_Wimmerundpartner. (1998). Housing Donaufelderstraße. Retrieved from http://www.wimmerundpartner.com/index.php?seite=projekte&projekt=donaufelder&id=1&lang=en

Young, J. (2018, April 3). Toronto has a history of rebuilding after two great fires [Toronto.com]. Retrieved from https://www.toronto.com/opinion-story/8367002-toronto-has-a-history-of-rebuilding-after-two-great-fires/

Zatarain, K. (2017, May 8). BIG Changes on the Horizon for Bjarke Ingels and His Firm. Retrieved from https://www.archdaily.com/870621/big-time-big-changes-on-the-horizon-for-bjarke-ingels-and-his-firm