An Exploration of Incremental Architecture
as an Affordable Development Typology

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AN EXPLORATION OF INCREMENTAL ARCHITECTURE AS AN AFFORDABLE HOUSING DEVELOPMENT TYPOLOGY

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ABSTRACT

Incremental approaches to housing construction have long been a typology used around the world. In the context of my work, I define incremental housing as a construction methodology that provides dwellers with the essential elements of a house, allowing the resident to rearrange the fundamental parts to fit their needs, desires, and lifestyles. Through my research, I found that this approach is often a response to the scarcity of resources, be it material, monetary, labor or otherwise. In this thesis, I argue that given the current affordable housing crisis in the US, government officials and developer should explore the use of incremental architecture as a housing development typology.

This research uses a case study methodology to examine incremental housing developments in Berlin, Germany; Tel Aviv, Israel; and Hamilton, Canada as precedents for affordable and alternative approaches to residential development. Based on best practices culled from the case studies, I propose an incremental, affordable housing development in Somerville, Massachusetts including architectural diagrams, financial model, and a flexible unit scheme that facilitates the gradual expansion of a given unit. The financial analysis further suggests that incremental housing is a viable and worthwhile typology that developers and cities alike should consider as a new approach to affordable housing development.

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An exploration of incremental architecture as a development typology

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Introduction

We have always built incrementally. We are a species that identifies essential elements and continuously rearranges fundamental parts to take different forms creating everything around us. One of the most notable arrangements of features is the house. Originally we constructed our homes for the fulfillment of shelter, its initial value in its use. With the emergence of capitalism, the process of producing the build environment, including housing production for use-value fundamentally changed. The tendency became that of transforming any product into commodity production for exchange in the market. The effect of this economic shift resulted in the house occupying two roles – that of use value and that of exchange value. The wake of this transformation has resulted in the loss of self-expression and affordability in housing, particularly in the most desirable urban contexts in America.

This thesis explores the possibility of incremental architecture as a development typology and culminates in a development proposal in Somerville. Further, this thesis argues that through an incremental approach to housing, self-expression, flexibility, adaptability and affordability can be reintegrated into housing in urban America. The term, incremental housing has a myriad of synonyms: self-build housing, self-made housing, and flexible housing; each of these terms derived from different housing contexts, design principles, and eras. In the context of this thesis, incremental housing is a type of construction that provides dwellers with the essential elements of a house, allowing the dweller to rearrange these fundamental parts to fit their needs, desires, and lifestyle as a way to fulfill self-expression and an avenue towards affordability. It's important to note that incremental architecture can be applied as a development strategy to other uses beyond housing, though this research focuses specifically on the benefits and outcomes of incrementalism applied to housing.

This exploration of incremental architecture sits within the context of the necessity for flexible urban planning as a means for resiliency. Urban planning is not composed of ideas and projects cast in concrete; instead, it is a field closely connected to local conditions and city life. This project suggests we should consider embedding housing with the same flexibility – equipped with systems that allow for constant adaptability, transformation, and the ability to grow and shrink with present needs. The idea that housing architecture and planning are an open framework that provides for incrementalism is not a new notion – it has roots all over the world with simultaneous histories that converge and diverge throughout time.

Throughout the various histories of incremental architecture, the notion of scarcity acts as a connecting thread. The emergence of incremental housing is born from scarcity - be it money, land, flexibility, space or housing - incremental efforts are a response to the societal, political and economic conditions which produced a limited pool of shared resources. Within our current economic system, scarcity and the pursuit of abundance are fundamental to the perpetuation of the market. As a society, we accept that oscillating moments of scarcity and abundance affect the social and political climates and we provide people the flexibility

to adjust their actions and decisions given the climatic circumstance. Thus given the flexibility and variability of the economy, urban planning and architecture should be resilient in their abilities to react to given climate and allow for the freedom of adjustment. In South America, incrementalism emerged as a response to the scarcity of affordable land and a lack of available capital; incrementalism in Europe grew from a shortage of housing and available land. Through this thesis, I argue that the scarcity of affordable housing and architecture that allows for flexibility and self-expression produces a climate ripe for the development of contemporary incrementalism in the US.

In the reconsideration of housing as a flexible and adaptable use, we have to reconsider the appropriate part of speech. John Turner wrote in his 1972 book, *Freedom to Build*[2], that housing is not a noun, housing is a verb. The notion suggests that we should reimagine housing, not as a commodity, but rather as an activity. The resultant of defining housing as a noun is the overvaluing of objectives instead of understanding housing as a series of procedures and projects that support people's lives. [3] There is considerable variability in the housing needs of populations creating a difficult circumstance for any government. Still, governments and developers produce rigid, often

poorly organized houses that meet the standard of housing as a noun. Incremental housing is a typology that encourages the idea that housing is a verb, it is an assemblage of programs and procedures that support the creation and adaption of shelters within an open framework. [4]

As mentioned previously, incremental architecture is a typology that has been implemented all over the world motivated by circumstances of scarcity. This thesis highlights the simultaneous histories of incremental architecture in South America and Northern Europe. These selected histories highlight two areas of interest pertinent to this thesis. In the case of South America, the approach to incrementalism is considered in an urban planning context and speaks to wide-scale proliferation of this typology. The history of incrementalism in Northern Europe speaks to the evolution of the specific architectural technologies of incremental housing that inform the later portions of this thesis.

SOUTH AMERICA

Incremental architecture as it relates to this study begins with informal settlements in urban South America in the 1950s. Informal settlements in developing countries are the by-product of rapid urbanization driven by economic and political forces associated with industrialization and globalization. The migratory trends related to economic changes result in informal settlements in and around urban centers leaving governments with the financial and administrative inability to provide adequate land, infrastructure, services, and housing to the poorest of the population. The results were organically formed neighborhoods that emerge incrementally as chain migration brought people and resources to the city. The irregular, organic forms of informal settlements are in stark contrast to the regular, linear patterns of the formal urban centers. The wealthy and educated classes of the developing countries often identified with the civic values established by early colonial rulers or foreign models adapted in the 20th century. [5]

Since the 1950s migration to cities has continued to gain momentum, the financial and administrative shortcomings of governments resulted in many governments turning to the prevailing industrial models to create low-income housing; however, practically all instances of

Informal settlements in South America have emerged from rapid urbanization and inadequate urban resources.
Source: Citizen.co

Families in sites and services programs are given a plot of land to construct their own homes around the infrastructure provided.
Source: Urbanization Primer

the industrial model failed. A select few governments, including Peru, Mexico and Chile, recognized that influx of populations were irreversible and developed strategies to accommodate the rural migrants at a low cost: they legalized informal settlements and applied standards to the settlements that the poor could afford. It was these first programs that gave rise to the conceptual foundations for policies and programs that gave the poor a role in the housing processes. After researching the examples of these programs in Peru in 1972, John Turner and Robert Fichter, both planners, further iterated that industrial models and application for modern city plans to informal settlements were unsuccessful. They advocated that the city government's develop standards for informal settlements that work within the existing neighborhood frameworks. This suggestion by Turner and Fichter proved to be successful. One crucial policy feature of the early model is that governments began officially annexing or incorporated existing informal or extralegal settlements and low-income housing settlements into the city. [6]

The success of these first programs devised by Turner and Ficher created the foundation for the emergence of sites and services programs in the 1980s. Sites and services programs provided plots of land that included the essential infrastructure needed for habitation, built with the intention that homeowners would build and

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expand structures incrementally. The foundational concept of the sites and services program rested on the idea that low-income individuals have both the interest and capacity to build and improve their homes. The program enabled low-income households to overcome the significant constraints of home ownership. Government agencies would supply plots of land, either sold or leased, equipped with essential utilities (clean water, sanitation, flood protection, and security lighting), municipal services (trash collection, neighborhood schools) and importantly, financing. The construction of the home was left to the beneficiaries to use their resources such as informal finance or family labor to build a home – many of the homes built in this context were constructed incrementally depending on the availability of financing and other resources. [7]

Sites and services schemes activated neighborhoods in several ways. Each variation attempted to balance minimum acceptable housing conditions and affordability to the user. Sites and services schemes provided a plot of land and essential infrastructure, though the degree of participation from the user and the agency varied greatly. Due to these variations, sites and services took many forms ranging from an empty plot with some services (water, electricity and sanitation connections) to the provision of a core house

(equipped with a toilet and kitchen) on a plot of land with attached services. Descriptions of the different schemes are below:

- Utility Wall: A utility wall was built on the plot and included connections to water, drainable, sewer and electricity. The users then organized their homes around the wall, or in some projects, the bathroom or kitchen core contained the utility wall.

- Bathroom Core: Due to waste disposal issues observed in informal settlements, many programs included a basic bathroom.

- Roof frame/shell house: The roof is the costliest component of the house and often required skilled workers to construct. Some programs provided the roof structure on posts, and the users would then build walls according to their requirements.

Other variations included the construction of a plinth, which users would build their homes on top of, or a shell house that contained a roof and two walls leaving the rest of the house to be constructed by the user.[8]

Since the conception of the sites and services scheme, there have been several shortcomings and subsequent critiques rendering the program unsuccessful. Location was a challenge that went unaddressed in the initial conception of the program. Sites and

services neighborhoods were built on the fringes of cities, where the land was inexpensive. Fringe locations caused two main problems; the first was the expansive distance between existing delivery networks and the program site, and the distance users had to travel to employment sites.

Bureaucracy was another challenge for sites and services implementation. Families operating in informal sectors had difficulty navigating through the agencies checklists and were often not eligible for support because of their informal and irregular incomes. Sites and services was intended to formalize the informal neighborhood organization that had developed organically. Though the guidelines devised by the governing agencies often required more resources than available to the families coming from informal settings. Finally, cost recovery was a major setback to the program. Users had to bear the cost of the plot along with the construction of the house shortly after moving into the sites and services neighborhood. They faced these costs at the same time as lost income due to the reallocation of their time on the construction of their new homes.[9]

Despite the program's failings, it deserves acknowledgment and study as it is a program that recognized the ability of people to construct homes within the con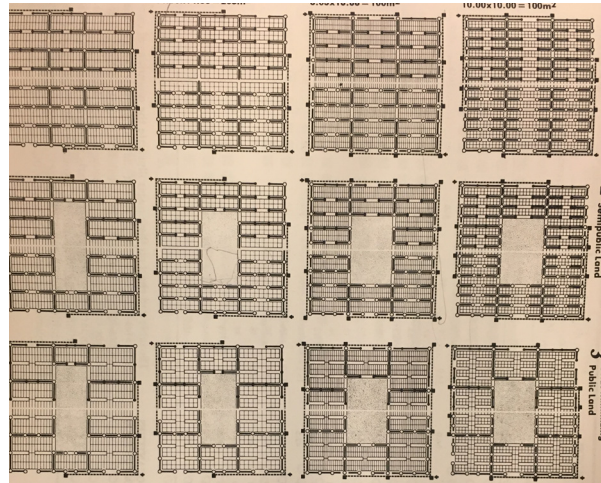text of necessary infrastructure with little backing from the government. It frames architecture and planning as an open framework that allowed residents to construct and change their environment to fit their unique conditions. It also provided a situation where government transitioned from the role of provider to that of an enabler. This program recognized that by providing a framework for construction, homes were both affordable and customized to meet the user's needs.

 Since the sites and services program, there have been numerous iterations of the idea all centering on the notion that residents can construct their own built environment that is reflective of their needs and desires.

In addition to Turner, there have been numerous academics and designers who have written extensively about sites and services programs. MIT professors Horacio Caminos and Reinhart Goethart contributed with the text, *Urbanization Primer* (1978) that addressed questions of urbanization, land subdivision and the provision of services for the neediest sectors of the population.[10] The *Urbanization Primer* was developed as a resource for organizations engaging with sites and services efforts. In their text, the authors provide a number of infrastructure templates to be implemented out to support a sustainable urban growth pattern. Additionally, Joseph Luis Sert, the founder of the Urban Design Program

at Harvard's Graduate School of Design contributed to the field through his projects in Venezuela in the 1970s. In Venezuela, Sert proposed providing residential plots organized around communal spaces that would serve initially as space for food production, recreation, and other services. He imaged that urban clusters anchored around public spaces would help the transition of the rural worker to an urban setting. [II]

Among the most recent iterations of the sites and services program is the Elemental Program, advanced under the leadership of Alejandro Aravena beginning in the 2000s. The initiative was originally conceived for the re-housing of a shanty town community in the northern Chilean town of Iquique. The government was willing to contribute money to the rebuilding of Iquique, though their contribution was not enough to cover the cost of land, construction, and infrastructure. Elemental suggested "half a house." With this scheme, residents would get a two-story, two-bedroom home with a roof, kitchen, and bathroom plus an equivalent space next to it. The first half a home was 32 square meters-- once expanded, residents would have 70 square meters. Residents would have a place to live and a space to complete once resources became available. They were free to build additional bedrooms, living spaces or transform the second half of the house into commercial use for revenue generation - an option that

Various electricity and street lighting schemes presented in Urbanization primer.
Source: Urbanization Primer

Detailed electricity and street lighting network layout.
Source: Urbanization Primer

had not been allowed in the original sites and services scheme. In total, 93 homes were built for the price of just 30.

A core principle of Elemental's approach to incremental architecture was the framework where the house becomes a generator of wealth rather than a deteriorating commodity. Users were able to purchase their homes for $700 USD and customize the remaining half of the house with $2000-3000 USD. Aravena noted that equivalently sized homes sell for upwards of $100,000 USD.[12] Ingrained in this project is the ability for the user to build equity. In order to achieve this, urban design and planning were crucial considerations. Aravena went beyond the sites and services program to consider architectural forms, street walls and public spaces within the outline of the neighborhood. The resulting architectural form composed of half houses and voids created a grid, a framework that binds the community together and ensures visual variable throughout the project. Aravena has recently published the plans for the units online in hopes that others build similar projects in other communities.[13]

Michael Kimmelman wrote an exposé on Aravena and the Elemental projects in 2016. In the piece, he interviews two inhabitants of Villa Verda, an Elemental project that was built to replace housing that had been decimated by an earthquake. The interviewees, both mothers, initially struggled with the idea of owning half a house. Subsequently, both of their families have saved enough money to renovate the other half, the families are grateful for space - something they

Villa Verde, completed in 2016, is one of Elemental's most recent iterations of the "half a house" concept. Source: El Contrista

would never have been able to afford otherwise. One of the inhabitants, Ximena Troncoso, notes "We have enough room so that all the kids get their own bedroom. We have independence." [14]

Aravena has received both praise and criticism for his Elemental work. In 2016, he won the Hyatt Foundation's annual architecture prize, the Pritzker, which is typically an award reserved for long-established professions. The head of the foundation, Thomas Pritzker noted: "his built work gives economic opportunity to the less privileged, mitigates the effects of natural disasters, reduces energy consumption and provides welcoming public space…. he shoes how architecture at its best can improve people's lives." [15] Aravena's critics point out that firstly, the idea he takes credit for is not a new concept but a contemporary version of the sites and services program. Secondly, the resulting communities have not only increased gentrification but result in communities that look no better than the shanty towns they replaced. Moreover, subsequent projects have all been co-financed by AntarChile, the country's largest conglomerate and Elemental's conventional architecture projects primarily benefit the Catholic University of Chile, a private university very closely tied to the regime of General Pinochet.

Regardless of the praise and criticism,

Elemental has brought joy and equity to many families and renewed focus to the sites and services concept that should be improved on and considered in other contexts.

The histories of informal settlements, and sites and services are an essential chapter in the story of incremental housing; particularly in that it highlights the role of planning in the creation of neighborhoods built by the users. Both sites and services and Elemental's projects understood the importance of urban design and planning as a methodology to build equity amongst users. They provided mechanisms for urban dwellers unable to buy into the market an alternative option that transformed sweat equity into a currency. The examples in South American history speaks to the potential of incremental neighborhoods born out of a planning practice that asks the agency- be it government or developer - to enable rather than provide. This transition to the role of enabling, provides an opportunity for communities to use their resources to build a home and lifestyle that accommodates their needs rather than being given a house that stifles their ability to flourish.

While the history of sites and services in South America speaks to incrementalism on the urban scale, technological and thought

development formed a foundation for a simultaneous history of incrementalism to emerge in Europe. Europe's densely populated cities, along with its vast history of formalized urban design and architectural practices gave way to incrementalism on the scale of the building. The following section describes some of the key thinkers and their work around incrementalism and flexible building typologies that emerged in the 20th century.

NORTHERN EUROPE

In 1914, World War I began, and by November of the year, nearly one-fourth of the Belgian population was homeless. A young Le Corbusier, in a context of housing scarcity, had a painfully simple idea; a standardized two-story home made up of concrete slabs supported on columns and a single staircase. There were no walls or rooms included in the plan, just a skeleton. He called the project Dom-Ino, because the houses would be joined end to end like dominos, additionally the name combined "Domus" and "innovation." Le Corbusier intended to patent the idea and take it to assembly line production, but without backers, Le Corbusier was forced to abandon the innovation.[16]

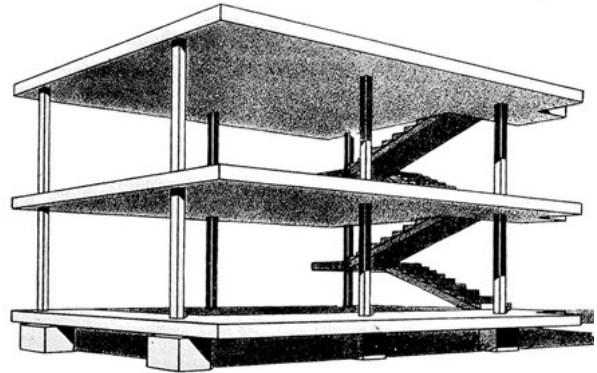Despite the lack of realized plans, the Dom-Ino house went on to inspire the construction of millions of homes around the world, in both developing countries where informal settlements are designed and built without architects and in high design environments. In cities around the world, one can see apartment buildings built with slab and concrete construction with each floor allocated to a different family free to arrange the walls however they see fit. The Dom-Ino house offered the idea of the house as an open system enabling the user to develop the interior incrementally. The columns and floor plate are the only immovable aspects of the house, allowing all aspects of the interior to be flexible, at least upon initial conception. This open system allows for the circumstances of lifestyle to be a consideration in the design of the home, even in low socio-economic situations.

The most fundamental aspect of the Dom-Ino is that it marks the abandonment of the idea that the architect is the total designer. The Dom-Ino structure provides only the beginning of the house, leaving the residents to assume the role of the designer and complete the building. In this context, the architect forgoes the role of the visionary and becomes the facilitator of a housing system. Although Le Corbusier had standardization in mind, he produced an architectural icon in the century that would become obsessed with customization and participation. The Domino House provides a system,

rather than a product that becomes fundamental to the development of modern and contemporary architecture in the 20th century.

Similarly interested in systems, John Habraken, a Dutch architect, contributed significantly to the literature on incremental approaches to design. Habraken's first book, De Dragers En De Mensen, Het Einde Van De Massawoningbouw (Supports: An Alternative to Mass Housing), a 130-page manifesto published in 1961, speaks to the idea of the open building. Habraken argues that housing should consider the actions of two different entities – that of the community and that of the individual inhabitant. When the inhabitant is excluded from the design process, the resulting building is uniform and rigid. When only the individual takes action, the resulting building is chaotic and conflicting. The formula for a balance of the two has far-reaching implication for all agents in the building process. Habraken believed that mass housing created by professionals without any influence from the inhabitants creates sterile and inhumane urban environments. He notes that even the word "participation" is a paternalistic term, as it implies that the professional is still in charge and grants the inhabitant an occasion for influence. Habraken's building methodology ensured the inhabitant, and the professional cooperated. In the open design system, the task of the architect is to create a structural system, designed with

Le Corbusier's Dom-Ino House marks the abandonment of the architect as the total designer.
Source: Dezeen

Next21, a building in Osaka, Japan, was inspired by Habraken's Open Building Concept.
Source: vitruvius.com

prefabricated building components, leaving the individual floor plans to be generated in collaboration with the residents. The inhabitant could then design their fit out – including that of the façade, the floor plans, and materials. All alterations would be possible without touching the main structure. The metaphor that Habraken used to describe this idea was jazz; all musicians the central theme which is the urban plan and the mission of the community, individual players then play their solos based on the agreed-upon theme. [17]

Central to Habraken's idea was the creation of the support structure. He notes, "A support is a building containing dwelling that can be built, altered and taken down, independently of each other." The support structure, envisioned as an autonomous, durable structure constructed as building land in the air, each floor containing connections for electricity, water, and other general utilities. This notion of simple plots equipped with only essential connections is remanence of the sites and services configurations.

At the core of Habraken's idea is the redistribution of power. The open building system is a response to mass housing development that creates a society that is represented by uniformity, whereas a city composed of support structures can transform a place into an accurate representation of society. He envisioned not only the customization of housing but the opportunity to spur social revolution by empowering people to have control over their environments. Habraken imagined that support structures would create conditions in which occupants would look with renewed interest at their built environment, equipped with the experience to alter and influence it.

TODAY

We are in the midst of two scarcity crises in the built environment; the first of which is affordability. In major urban centers across the country, there is an extreme shortage of housing for low income and workforce individuals and families. The next major crisis is the monotony of contemporary housing architecture and the inflexibility of the product. In urban environments, multifamily residential buildings tend towards blocky, colorful modernism with predictable rigid floor plans. These crises provide the impetus for research into alternative housing models that address affordability and provide communities with architecture that acts as an open framework and system for empowerment.

The need for affordable housing is a conversation in nearly every city hall in urban America. There are an abundance of reasons and events that have led to the affordable housing

crisis, which should be explored in other writings, but one major contributing factor is that wages have fallen far behind housing costs. For instance, in New York, one needs at least an hourly wage of $27.28 to rent a one-bedroom comfortably, but the median hourly rate is just over $20.[18] Many Americans are now forced to spend nearly half their income on rent which exceeds the 30% deemed reasonable. Cities need to build more affordable housing – that includes genuinely affordable housing and workforce housing. Families within the workforce bracket are often unable to qualify for affordable housing and yet unable to afford to buy homes in the city, forcing them to rent or move further from the urban center.

A solution to the housing crisis is the construction of more housing. Both affordable and market rate developers are constructing housing, though the resulting buildings all have similar aesthetic qualities. The buildings I refer to range from three to seven stories tall and can stretch for blocks, their facades laded in bright modern colors and the exterior, blocky. These buildings are sometimes referred to as "stumpies" on the internet or five-over-one which refers to five stories of residential over a ground floor "podium" of parking or retail. The proliferation of these structures has been one of the most drastic changes to America's built environment in decades. One developer points out that the explosion of this

Five-over-one construction is cost effective but typically has bland and rigid aesthetic qualities. Source: nishkian.com

typology is the result of two key things: a chronic shortage of skilled labor and the universal use of wood. [19]

As a result of the unskilled labor and the use of wood these buildings are cheap to construct. The number of floors and the presence of the podium varies between development, but all have identical parts – two-by-fours or "stick" construction. This type of construction can cost 20-40% less than building with concrete, steel or masonry. Not only are the materials cheap, two-by-fours are convenient building material. When a construction team runs out of supplies, they can go to the nearest big box store and get what they need. This building typology has enabled developers to build density for affordable prices, something desperately needed in urban centers. A five-over one building can get 50 to 60 units onto a single acre of land which is not far from the target Jane Jacobs advocated to achieve vital street life.

There are several downsides to these buildings. One of the major issues is that sticks burn. Stick and podium buildings are notorious for burning before construction is complete which has resulted in the banning of the typology in New York City. [20] Additional issues include; the cost of framing lumber is increasing; moisture and termite issues, a lack of thermal seal; excessive waste due to shaping and resizing of lumber;

variable swelling and shrinking of the wood frame; additionally, it is challenging and expensive to build wood frame buildings that are disaster resistant, this is a particular concern in the context of climate change. Another major issue is the sheer monotony and proliferation of the predictable and boring building type.

American cities each have a distinct identity, created by the communities that founded and developed the environment. Skylines, block size, grid patterns, and specific aesthetics derived from the history of the place are all variables that define the urban design of a city. The proliferation of a single typology across the entire country dilutes the essence of individual American city life. Of course, affordable housing and opportunity for masses are more important than ensuring the purity of urban uniqueness, but it may be possible to do both.

Thinkers previously referenced, including Turner, Fichter, Habraken, Sert and Aravena encourage the development of urban place in collaboration with the residents to ensure spaces respond and reflect the needs of the community. Habraken believed that mass housing created by professionals without any influence from the inhabitants creates sterile and inhumane urban environments. We can see this in the proliferation of mid-rise wood

construction. The monotony of this mass housing provides no opportunity for residents to influence the built environment, transforming a place in a space designed and determined by proformas. Turner argued that people without housing choices are unable to use housing as a vehicle for existential ends. In Turner's research, residents without options tended to minimize their housing action by doing and paying as little as possible. Turner concludes by suggesting that governments and developers should stop imposing their own will onto populations and support those fighting to regain control of their built environment by allowing for flexibility, adaptable and the incremental constructions of homes.[21]

The remainder of this thesis includes a chapter of case studies and a development proposal for an incremental development in Somerville, Massachusetts. The case studies featured describe three different housing projects, each achieving affordability and flexibility while empowering the resident to influence and manipulate the space to fit their own needs. The criteria used to select the case studies included a location in a developed urban center, multifamily residential typology and either built or conceived of in the last ten years. The congruency between these variables ensure the takeaways from these projects are applicable to the subsequent

Somerville development proposal. The research on the case studies was conducted through interviews and onsite observations. The final case study is a proposal for an incremental development project in Davis Square that considers the foundational work of Turner, Aravena, Habraken and others to create an incremental development that fits within the regulatory code of Somerville. The proposal includes a conceptual design for incremental development, site plan and brief financial summary that would support the construction of the building.

Methodology

Methodology

INTRODUCTION

This chapter intends to introduce the case method methodology used in this thesis that explores incremental architecture as an affordable housing typology. The case study approach allowed for the comparison of three multifamily residential projects that employed incrementalism to achieve affordability and opportunities for self-expression.

RESEARCH QUESTIONS

This thesis explores various forms, functions, processes, and possibilities of incremental housing as a development typology in the US. Specifically, I explore, given America's context of scarcity of housing, could incremental housing be an affordable housing typology? What lessons can be learned from other incremental projects? What would incrementalism look like in a local setting?

METHODOLOGY SELECTION

To conduct this study, I used the case study method. The case study methodology is a research method that involves an up-close, in-depth, and detailed examination of a subject as well as its contextual conditions. As outlined by Robert Yin in his classic text, Case Study Methods, this methodology is most appropriate when the following is true: when the researcher considers "how" questions; when the investigator has little control over the events; and when the focus is on a contemporary phenomenon situated in a real-life context. Given my inquiry into how various incremental development projects have been created and exist, my inability to influence the subject and given the urban settings of the projects, my research approach sits squarely into the parameters of the case study methods.

DESCRIPTION OF METHODS

The case study method includes the investigation of three projects located in three different cities. The locations include Tel Aviv, Israel, Berlin Germany, and Hamilton Canada. The criteria used to select the case studies included a location in a developed, urban center, multifamily residential typology, and either built or conceived of in the last ten years. Additionally, in each of these settings, the cities are dealing with housing scarcity. The congruency between these variables ensures the takeaways from these projects are applicable to the subsequent Somerville development proposal.

Additionally, I had connections to key players in these projects. I spoke with Rafi Segal in the fall of 2018 regarding my thesis interest and he introduced me to Eitan, whom I met in Tel Aviv. I was introduced to John Van Nostrand through a fellow DUSP classmate, and finally, MIT had established connections with the team behind the R50 project.

My research on each of the housing projects was conducted through a series of interviews. For each of the projects, I interviewed two people involved in the development of the project.

R50 – Berlin, Germany

- Verena von Beckerath – R50 architecture team
- Christoph Heinemann – R50 architecture team, resident of the building

Home:front - Hamilton, Canada

- John van Nostrand – Developer
- Sheida Shahi– Architect and project researcher

Chlenov42 - Tel Aviv

- Eitan Serber – Developer, property manager
- Rafi Segal – Project architect, Professor, MIT

Additional Conversations

- Hendrik Jansen – Urban Planning PHD candidate at Tormund University, planner at WBM, a public housing agency in Berlin
- Christoph Reinhart – Professor, MIT
- Jota Samper – Professor, University of Colorado Boulder
- Garnette Cardogan – MLK Fellow MIT, essayist
- Peter Roth - Lecturer, MIT, affordable housing developer

The conversations with the project constituents provided details on both qualitative and quantitative aspects of the projects. I structured the interviews congruently; we

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discussed each of their theoretical approaches to the projects, the types of issues they were addressing, local political settings, financing structures, construction methods, demographics, and the participatory processes. The interviewees provided information such as photographs and drawings that helped create the subsequent case studies. I used the interviews and the materials to build each case study, which consists of descriptive texts and analytics diagrams that explore the project and its functions. The conversations with professionals who were not directly connected to the case studies informed the theoretical framework of this project and provided guidance towards specific resources.
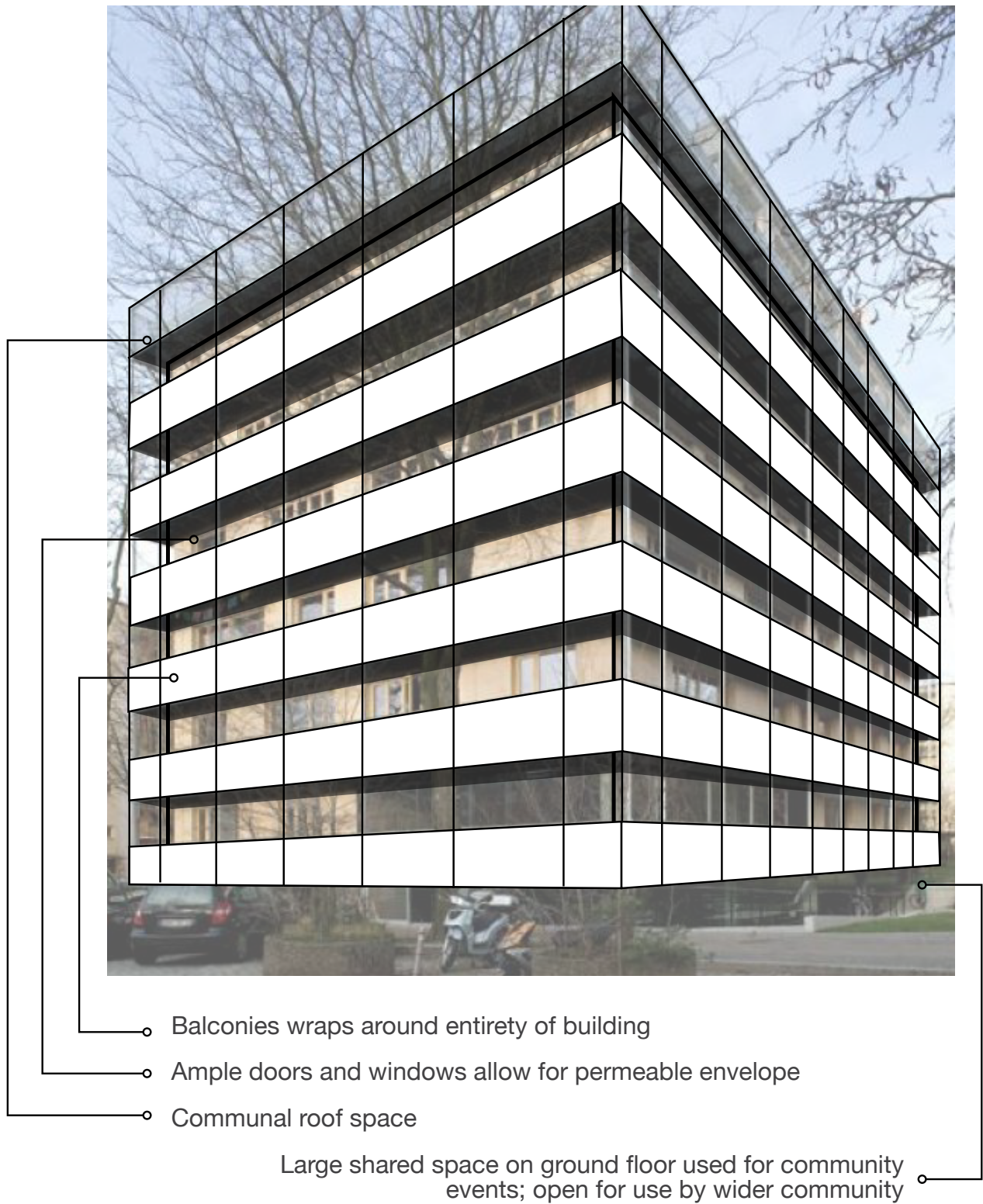
Case Studies

Source: Noshe

Berlin | R50

R50 is a cohousing project in Berlin-Kreuzberg, Germany. This project was born out of a collaboration between architects, ifau and Jesko Fezer, Heide & von Beckerath and a group of residents. During my research on R50 I spoke with Verena von Beckerath (of Heide & von Beckerath), one of the project's principal designers in addition to Christoph Heinemann (ifau) another principle designer and resident of R50.

The architects initiated the project during a concept-based competition that awarded the group with a subsidized parcel in Kreuzberg, Berlin. The resulting project was a collaboration between client and architect founded on clear urban design principles, a simple, elegant and affordable architectural design that facilitated the incremental transformation of a slab and concrete building into a project that would go on to receive international acclaim. The detached building, completed in 2013 has six, three-unit floors, and shared common space which include a roof terrace, wraparound balconies, a spacious communal room, and a garden.

The architects approached this project intending to contribute to societal change through architectural intervention. When speaking with Verena von Beckerath, she remarked that the architectural team was interested in exploring architecture as a "substantial tool for change." They explored societal change through the design process, relationship to their context, programmed amenities and a financial structure that required residents to both collaborate and compromise on the collective facilities in the building.

figure 1 | R50 Architectural Features

Balconies wraps around entirety of building

Ample doors and windows allow for permeable envelope

Communal roof space

Large shared space on ground floor used for community
events; open for use by wider community

BASIC INFORMATION	
Number of Units	19
Total Square Footage	21926
Stories	7
Year Completed	2013
Architect	ifau and Jesko Fezer, Heide & von Beckerath
Developer	ifau and Jesko Fezer, Heide & von Beckerath and Winfried Härtel - Büro für Projektentwicklung (project management specialized in cohousing projects)
Use	Residential
FINANCIAL	
Funding Sources	Berlin Land Trust (subsidized land), R50 residents, Umweltbank
Total Development Cost	250 dollars a square foot
DEVELOPMENT	
Construction Type	Slab and concrete
Materials	Cross-Laminated Timber, Concrete
Parking Spaces	0
INCREMENTALISM	
Type of Incrementalism	Each floor plate designed in collaboration with the residents. Elements are movable and features were left unfinished for residents to finalize

TYPOLOGY

R50 is a Baugruppe project; Baugruppen ("building groups") are a modern form of cohousing in Germany where households collectively finance and build a multifamily building as a mechanism to improve quality of life and foster community in dense urban environments. The structure is based on providing affordable housing rather than in politics or ethics – it is a mechanism to live in dense urban environments at an affordable cost. The structure includes private living quarters for residents in addition to shared amenities. Dissimilar to many American cohousing projects, Baugruppen are often high density and include a variety of unit types for families, individuals, couples and seniors often mixed in a way that the market would not naturally provide. The Baugruppen work directly with architects and designers, bypassing developers to build a shared dwelling that they collectively own. By removing developers from the process, the homeowners can save 25-30% of costs (in Berlin). This reduction in cost provides capital to take on more ambitious, innovative and often sustainable architecture and fosters collaboration, cooperation and community amongst members as they move through the design process.22

ARCHITECT BACKGROUND

The team of architects came together each providing different expertise ranging from participatory design processes to construction methods. ifau previously had worked in designing spaces for arts and culture in New York which

The shared communal space in R50 is used for community events, neighborhood parties and play. Source: Archdaily.com

often demanded shared space that had to be negotiated. Heide & von Beckerath had previously developed a successful cohousing space and were posed to design a baugruppen structure. Finally, Jesko Fezer operated in academic areas and had done research on participatory design and was interested in incorporating his findings into the residential design process. The team had been interested in working together on a baugruppe project and when an opportunity arose to collaborate, they eagerly agreed. One of the common threads that tied this team together was an interest in creating a precisely defined architectural structure that supported different modes of negotiated space and allowed for a multiplicity of infill patterns.

SITE CONTEXT

The idea of the Baugruppen emerged from the social and political climate in post-Berlin Wall Germany.23 The idea took hold in Freiburg and quickly spread to other German cities. By the end of the 1990s there was no subsidized rent in Berlin, yet still a large amount of available housing stock including many undeveloped parcels which were remnants of East Berlin's urban fabric. Some of these parcels had been obtained by private owners who had constructed modernist housing projects, exploring typologies beyond the 1960's social housing known as Altbau (Gründerzeit houses), that made up most of the existing housing stock. The undeveloped parcels were assumed by the government and managed by the Liegenschaftsfonds Berlin

R50 is situated in the context of a low density 1950's development. Source: Google Earth

(Berlin Land Trust). Berlin recognized that the parcels developed with alternative housing created a value surplus. This resulted in a program supported by The Berlin Land Trust that awarded land at a fixed market rate to residential projects that were using alternative models to provide affordable housing in a city where property prices had begun to soar. The architects developed the R50 concept, and after five months of development submitted their proposal to the Berlin Land Trust winning the subsidized land in Kreuzburg.

For decades, Kreuzberg was on the periphery of West Berlin, following the fall of the Berlin Wall, Kreuzberg became a central neighborhood in the unified city. The buildings surrounding R50 are part of a 1950's development project that was intended to create a community that was 50% less dense than the predominate density in Berlin. The resulting urban design is long rectilinear buildings situated on relatively large lots leaving ample space for gardens and passive green space. The architects on the R50 team recognized the need to design buildings that would reflect the contextual structures, engage the street edge and provide ample open space on their property.
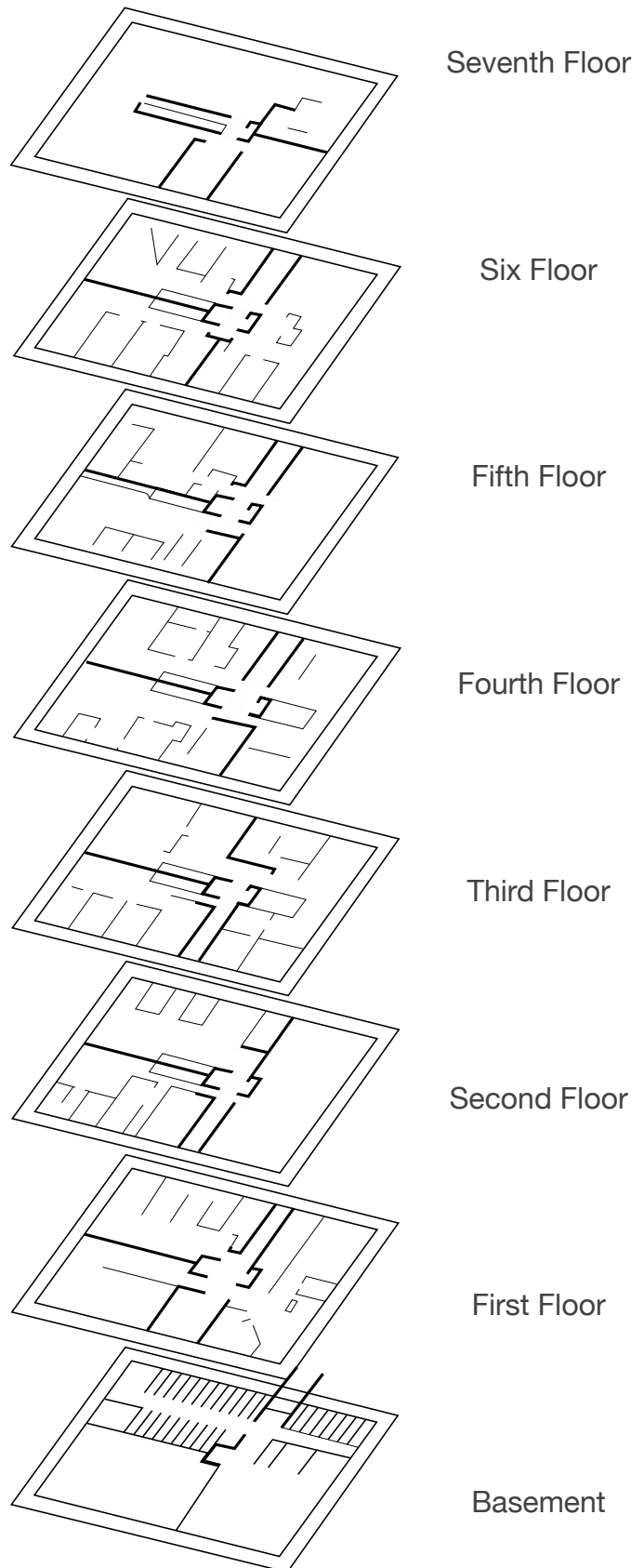
DEMOGRAPHICS

The building contains a total of 19 residences – most of which are occupied by families or couples. The group came together through a series of conversations with friends and friends of friends "in similar situations." Most of the residents are in creative professions such as architecture and design. The residents are all German and relatively the same age (currently in their early 40s). Verena noted, "it is a very homogeneous group, which from my point of view is part of the success of the building." Christoph mentioned that the homogeneity of the residents was at first frustrating, as they had imagined a more eclectic community, though he added that decision making processes were much easier because of the shared value system and backgrounds of the residents. The residents all entered R50 intending to live in the community for 10-20 years and planned to raise their children there. Since its completion in 2013, only one of the original families has moved out of the community.

The prerequisites for involvement with the R50 group were that the family would need to have up-front capital and eligibility for a loan application. The first R50 group was composed of 10 groups that together committed to moving through the design process as a unit. The group did not predetermine a resale price

figure 2 | Floor Plans

This diagram depicts the layouts co-created by residents and architects in R50. The heavy lines represent the buildings structural walls the lighter lines show the flexible components.

Seventh Floor

Six Floor

Fifth Floor

Fourth Floor

Third Floor

Second Floor

First Floor

Basement

Frei Otto's Okohaus [Eco House] was designed as green vertical cocoon where inhabitants built their own "nests."
Source: the-offbeats.com

Next 21 in Osaka was one of the first built examples of John Habracken's open building concept.
Source: habraken.com

for the units, though since the group was able to construct the project for only $250 USD a square foot, and the project has received international acclaim, the units have increased in value by over 100%. The residents collectively devised a set of standards that they refer to as a manifesto, which acts as a governing document.
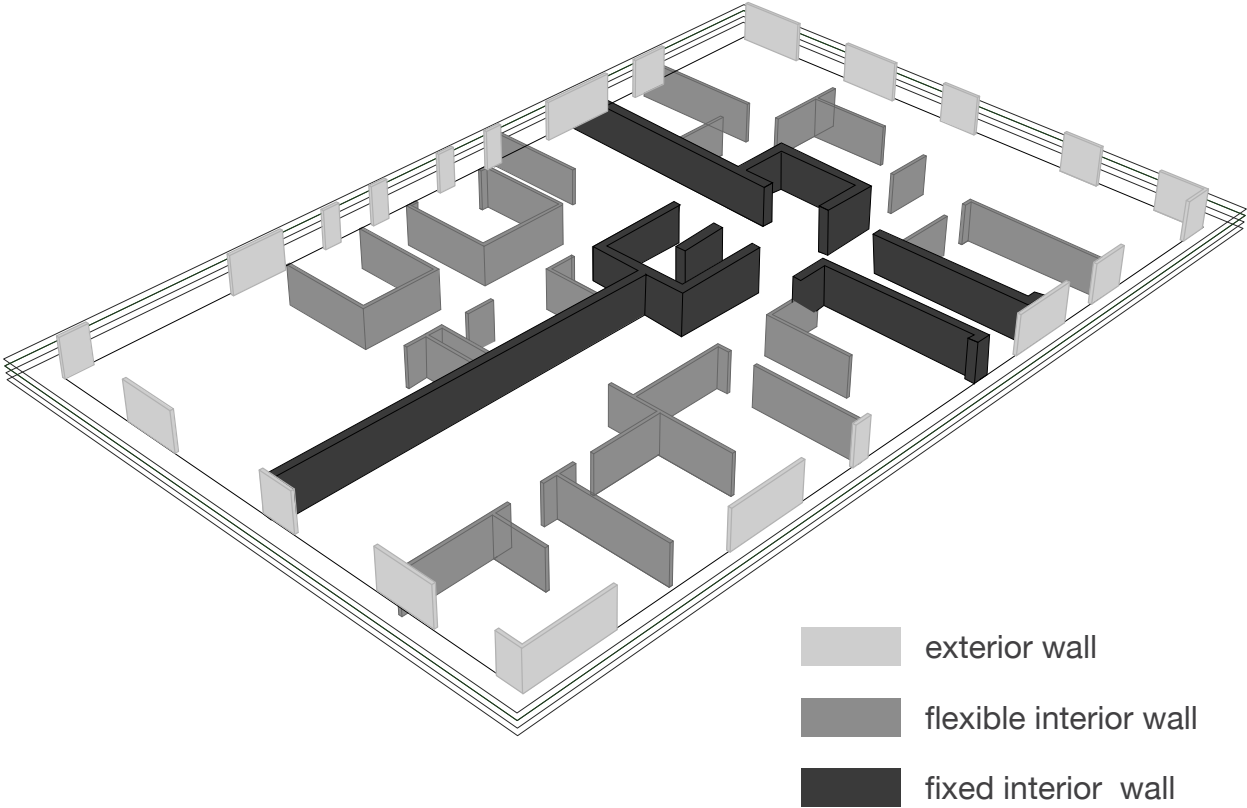
PARTICIPATORY DESIGN

The architects and clients designed simultaneously over the course of 45 meetings held every two weeks; the entire participatory process was 1.5 years. At meetings, the architects facilitated design exercises and held conversations that enabled the residents to represent their vision of R50.

The architects used a variety of techniques to garner an understanding of the potential possibilities for the building configuration. The participatory design process allowed the residents to design within the predetermined concrete structure, almost "like a playground." One of the initial design exercises asked each resident to design the floor plan of their apartment using conceptual bubble diagrams. The size of each bubble corresponded to the size of the room, and bubble proximity represented room proximity. The exercise exposed that families imagined vastly different unit configurations. This outcome resulted in a reinforced concrete structure with blank floor plates for each family to fit out themselves.

Source: Archdaily.com, Andrew Alberts

figure 3 | Wall Typologies

exterior wall

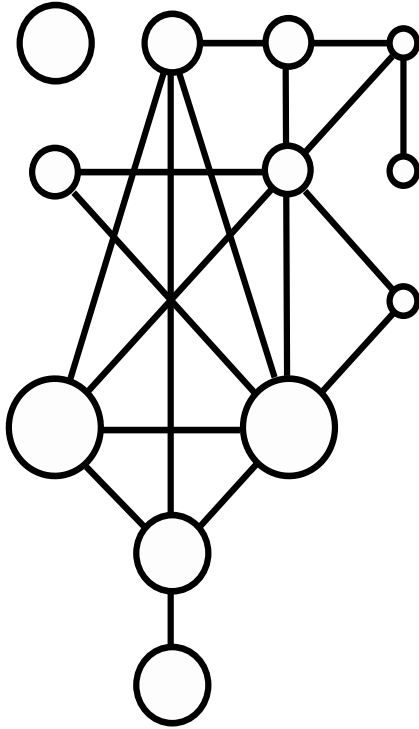flexible interior wall

fixed interior wall

DESIGN APPROACH

Creating an affordable project that allowed for a high threshold of flexibility was central to design process. In response to these goals, the architects designed a reinforced concrete structure with minimum requirements that could be constructed for a relatively low price and allowed for the high degree of unit flexibility. The design enabled customized floor plans, adaptable apartment sizes, flexible community spaces and enabled the transformation of apartments. The resulting building included partly exposed infrastructure, a modular timber façade with custom-designed fixed and flexible glass doors; the development costs for the site were only $250 per square foot. The concrete skeleton has one access and two service corridors, an independent timber facade and suspended steel construction that supports the balconies. Each of the floors allows for flexibility of apartment size that's determined by the individual's preferences and requirements.

The baugruppe used their collaborative design process to build common standards for fixtures and fittings, essentially a toolkit for customization. The toolkit included a modular bathroom that came in three colors, a palette of finishes and predetermined wall dimensions.[24] Christoph noted that there is no

contradiction between employing measures, standard materials and proportion, with adaption, diversity and the appropriation of space. The essence of the project is merely an architecturally precise support that allows for a range of infill patterns. When looking to inspiration in the work of Habraken and Otto, the team decided to provide a toolkit of parts that provided some standards across the units to ensure congruity instead of allowing residents to have full autonomy. The architects came to call this approach "situated standards." Each of the families worked with the architects to create a floorplan that would meet their needs. The dividing walls in each of the units were completed before the families moved in, though certain aspects of the building were left for residents to fit out later. For instance, the design of the ground floor common spaces anticipates the dividing of the room horizontally to create a second floor. Additional details such as paint and finishes were left for the residents to finish. Providing ample common space in R50 was paramount for the Baugruppe. The architect/client team decided to spend 25% of the budget on the construction of shared resources. Initially, the architects conceived of shared space on each floor used as a guest room, a start-up office, or an extra playroom for children. The clients disagreed. The residents felt that larger spaces that

figure 4 | Proximity Exercise Diagram

The architects and residents used circle and line diagrams to communicate possible unit configurations.

allow for multiple forms of use and constant transformation would be more appropriate. Designing a singer large space on the ground floor would make the project more accessible to the neighborhood and ensure the space could we rented to third parties if its use to the inhabitants became obsolete.

LIFE IN R50

From my interview with Christoph, I gleaned that living in R50 is similar to a typical multifamily situation where one has heightened interaction with one's neighbors, and the community acts as the property manager. When questions and challenges do arise, each unit has a single vote despite the portion of the total square footage they own. This has been a successful system for governance thus far. Christoph notes that by inserting spaces that require negotiation, those spaces are kept alive by the continuous questioning of their purpose and use - this has contributed to the success of the common spaces. The common spaces are typically used by guests, children and the entire community when a planned program takes place.

FINANCING STRUCTURE

Although Baugruppen can be an affordable housing option, it is developed for and by the middle class. Baugruppe can often be more affordable

for a family in the long run, though this typology is not accessible to low-income housing due to high upfront costs. The initial investment ranges from 20-30 percent of the purchase price which is often more than the 20% down payment typically required. Down payments are a barrier to low-income families who do not have adequate savings to invest in the baugruppe development.

Initially, Baugruppen were all self-financed as banks were unwilling to commit to this unconventional housing model. Though after two decades of successful projects, two banks in Germany are financing the Baugruppen projects, GLS Bank and Umwelt Bank. In order to secure a construction loan of the bank, the baugruppen pool their down payments.

Financing in the US would likely be the most challenging obstacle in replicating this model. Regional banks or credit unions would be the most likely financiers to help normalize the underwriting for these types of projects, where buyers would use the same mechanism as the baugruppen - pool their mortgages in order to access the funding for a construction loan.

The building has accrued significant value due to both the Berin's housing shortage and the price explosion of real estate both in Germany and globally. The building's value is a result of low construction costs coupled with the success of the architecture which has received critical acclaim. Christoph noted that R50 was constructed for $2150 USD per square meters when typically construction today is going for $5000-6000 USD per square meter. As a result, the units are worth significantly more than the initial investment made by residents.
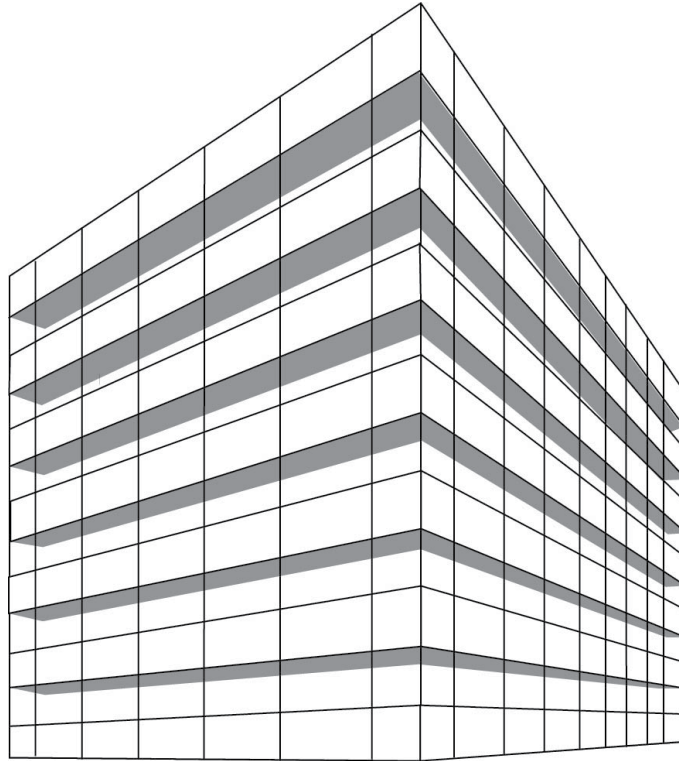
CONSTRUCTION

Baugruppen are constructed without a developer, which leaves the architect to effectively take the place of the General Contractor and hire subcontractors to deliver on particular tasks. The architect then works with the residents to identify the floor plans for each of the units, leaving the spaces flexible enough to adjust in the future, as lifestyles and circumstances change with the stages of life. Verena noted that this configuration also allows the architect to have the final say in the details rather than allowing space for the contractor to make decisions.

POLITICAL SETTING

Planning and development are centralized efforts in Germany, nearly half of the housing stock in Berlin is publicly owned. [25] This fact speaks to the scale at which the government has influenced the housing market. Germany's extreme regulation and involvement in the housing market is part of the reason why the

baugruppen have been so successful. Berlin as a dedicated government staff working on Baugruppen, as well as an agency designed to assist people interested in cohousing projects. In Hamburg and Munich, there is a quota for initiated cohousing projects per year.

In many cases Baugruppen form organically, when bands of friends embark on a project. Alternatively, Baugruppen form with the assistance of state-sponsored organizations like STATTBAU, a consulting group that connects residents with architects to realize projects. STATTBAU also provides groups with financial advice and conducts tours and workshops on Baugruppen and other cohousing opportunities. The organization has assisted over 250 groups, providing technical assistance and standard contracts that other advice on how to create a Baugruppen project. R50 used a consultant to help navigate the many processes that went into the realization of the project. This idea of a group that would navigate and standardize the planning, design, land acquisition, construction and management would be an essential element in the adoption of such programs in the United States.

INCREMENTAL INNOVATION:

- Flexible floor plates allowed residents and architects to design floor plans together

- Dividing walls constructed so that they can later be reconfigured

- Financing structure reduces development costs and frees up capital to be invested in common spaces and apartment improvements

- Shared common space open to the public

- Intensive participatory process enabled residents to build community before moving into R50

- Range of materials and finished provided by architects enable self expression while ensuring quality.

CRITIQUES:

- Large windows (and minimum curtain use by residents) have resulting in adjacent apartments installing more curtains for privacy.
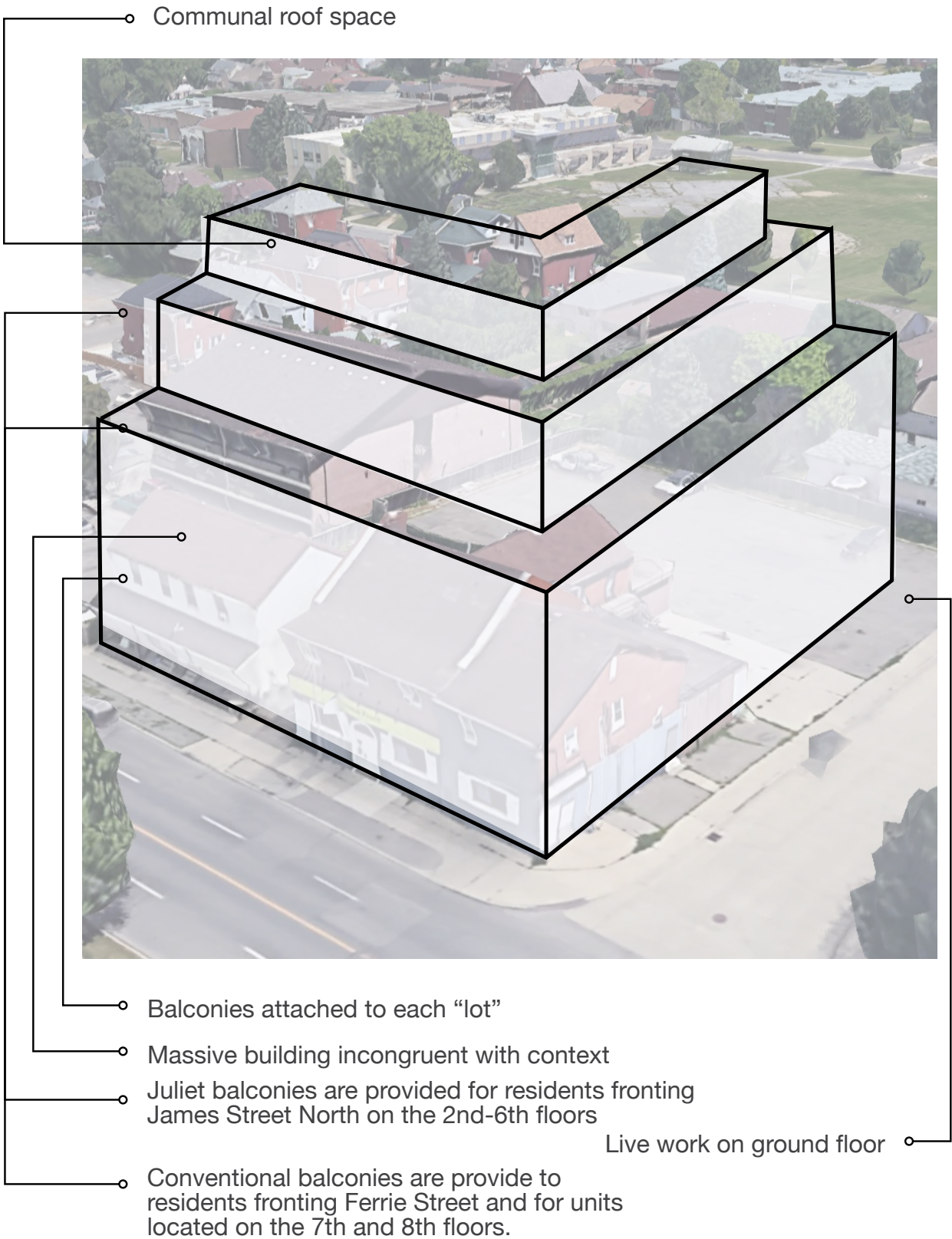
Source: Parcel

Hamilton | Home:Front

Home:Front is a mixed-use condominium development project in Hamilton, Ontario that pairs incremental architecture with an innovative financing structure to provide low-cost ownership opportunities in the City's North End neighborhood. Home:Front, slated for construction commencement in Spring 2019 will be an eight-story residential building in an industrial-waterfront-turned-residential neighborhood. In addition to condominiums, the project development contains retail and community space on the ground level on James Street and live-work facilities on Ferrie Street. The project includes 41 parking spaces in a rear courtyard and one level of underground parking consisting of 29 residential spaces, two carshare spaces, and nine visitor spaces.

- This project's innovation lies in the construction, floor plan system, and financing elements of the project.

- Choice of unit size and layout – Owners have the opportunity to buy however many lots they can afford and design the layout as they see fit.

- Opportunity to purchase a unit as an individual, with friends and family or as a co-housing group.

- A portion of street-fronting units are zoned as live-work space enabling small businesses to operate out of homes.

- Parcel allows owners to buy partially finished units for a lower price enabling the owner to complete the unit when they can afford it.

- Rental Opportunity – Owners can buy a unit, divide it, live in one part and rent out the other to supplement income or accommodate family members.

- The building has a rigid exterior and flexible interiors that enabled residents to renovate and manipulate their units easily.

- Lots are individually tilted, owners can buy and sell individual lots over time.

figure 5 | Home:Front Architectural Features

Communal roof space

Balconies attached to each "lot"

Massive building incongruent with context

Juliet balconies are provided for residents fronting James Street North on the 2nd-6th floors

Live work on ground floor

Conventional balconies are provide to residents fronting Ferrie Street and for units located on the 7th and 8th floors.

BASIC INFORMATION	
Number of Units	Maximum of 91
Total Square Footage	80,576
Stories	permitted = 4, planned = 8
Year Completed	2020
Architect	SnV + Planners, OfficeARCHITECTURE
Developer	JvN/d
Use	Residential, Live-work
FINANCIAL	
Funding Sources	Parcel (14%), a Single High Net Worth Investor (18%) and Investors (banks. Lenders, ~ 68%)
Total Development Cost	$304 USD psf
DEVELOPMENT	
Construction Type	Slab and concrete
Materials	Cross-Laminated Timber, Concrete
Parking Spaces	44
Bike Parking (long and short term)	18
INCREMENTALISM	
Type of Incrementalism	Each floor is divided into lots, residents are able to build as many plots as they would like configuring their own apartments.

DEVELOPER BACKGROUND

Parcel is a Toronto-based for-profit developer that constructs low-, mid- and high rise mixed use condominium buildings. The organization is mission-based and aims to lessen the social and economic gap by reducing the cost of homeownership as a tool for households to grow their wealth. The company aims to reduce the minimum annual income required to own a home from 100,000 down to 25,000 Canadian dollars, opening the door for more Canadians. [26]

For this case study, I had the opportunity to speak with John van Nostrand, the CEO of Parcel who has a background in both planning and architecture. His early career was devoted to housing in the Global South; many of the principles he implemented in early projects have

Source: Google Earth

informed the Hamilton project. In addition to John, I spoke with Sheila Shan, a Ph.D. student working with John to develop strategies for flexible units.
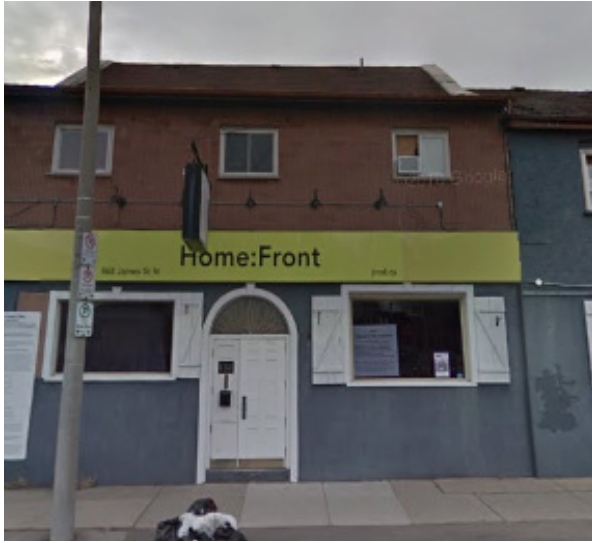
SITE CONTEXT

The site is located in the North End neighborhood in Hamilton, about 2 miles from Downtown. Historically, the North End was home to Irish, Scottish, Italian, Portuguese and later Eastern European immigrants that worked at nearby factories or as longshoremen on the shipping docks. Today, the neighborhood ranks amongst the top 10 areas in Hamilton to invest in with an average house price of $329,778 CAD in 2017. [27] The housing stock is predominantly early 20th-century brick single family homes (likely with additional entrances to accommodate aforementioned rental units). In 2017, Parcel bought two adjacent parcels containing single story buildings for 1.6 Million CAD.

The proposed development is directly adjacent to two bus routes that connect from the waterfronts to the hospital, the downtown commercial district, connections to Toronto and the Hamilton International Airport. In addition to the proximity to transit, the North End Neighborhood has designated bike facilities, a multi-use trail along the waterfront and multiple open space destinations. In addition to the bicycle facilities, the proposed development is within the coverage of the Hamilton bicycle share system (SoBi), a third generation dockless bike sharing system, where users terminate bike trips at designated docks. The City has plans to transition one of the existing bus routes into BRT further enhancing the transit conditions in the neighborhood.

figure 6 | James Street Elevation

Home:Front

Home:Front needs to acquire a variance to allow for an 8 story building in an area zoned for 2-3 stories.

Community meetings take place in the existing building on the parcel were Home:Front will soon stand. Source: Google Earth

Neighborhood corner store located on the same block as Home:Front. Source: Google Earth

THEORETICAL FRAMEWORK

The impetus for the 468 James is grounded in the recognition that developers need to consider more innovative possibilities that lead to homeownership. Parcel conducted a study that explored the building patterns in the town of Hamilton. The research revealed that between 1915-1946, 40-60% of all homes in Hamilton were built by their owners. By 2006, less than 1% of all homes in Hamilton were constructed by their owners. In addition to the changing patterns in construction, over 80% of homes built between 1915-1946 included at least one rental or boarding room, a revenue stream that has since disappeared from typical housing typologies.

From Parcel's perspective, the changes in construction patterns were not necessarily reflective of the resident's needs, but rather a difference in the products offered. Home builders in Hamilton offered turnkey products, though homeowners were often renovating their new construction homes to accommodate aesthetics, family size, and lifestyle.

DEMOGRAPHICS

In my conversation with Sheida, she explained that the Home:Front units are marketed to millennials in the Toronto area making between 60-120k a year. This doesn't necessarily fit with the brand that Parcel wants to lower home ownership from a $100,000 income threshold to $25,000, though it is

likely that younger people would be more willing to participate in a new condominium typology where sweat equity is a prominent currency. Thus far, they have had immense interest from individuals and groups alike. Parcel has sold 70 of the 92 available units.

COMMUNITY ENGAGEMENT

The community engagement process began in March 2017; the following April Parcel acquired the James Street property. Emily Powers, the community engagement lead on the project knocked on 1,500 doors to ask how people felt about the changes in the neighborhood. In addition to outreach, Parcel conducted education sessions as much of their target market was unaware that they could be eligible for home ownership. Parcel's roots in urban planning make the firm particularly sensitive to urban issues such as gentrification. Powers stated, "We really see this project as a chance to intervene in that process of gentrification and displacement" in a January 2018 interview with the Hamilton Spectator.[28] While there were concerns from the community about gentrification there was also initial concern from in-income locals that the promotion of affordable housing would tarnish the existing land values in the neighborhood. Since the acquisition of the site, Parcel has held nine public meetings and two learning sessions about the project.
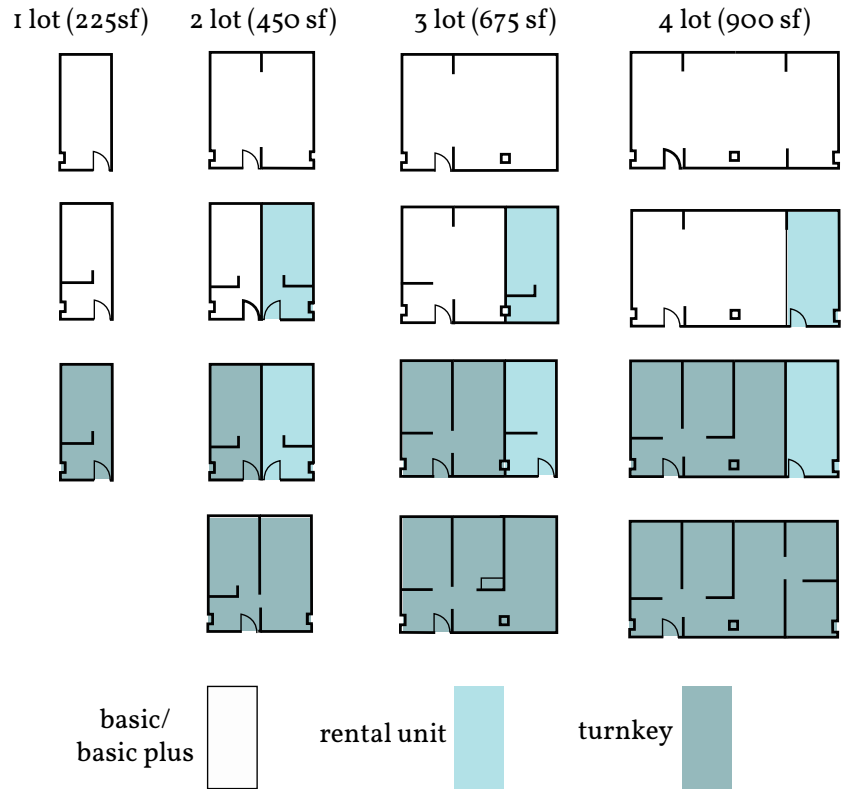
DESIGN APPROACH

Through an innovative, participatory approach to financing, design, and development Parcel devised a concept where the developer and resident co-develop the property. Unlike conventional condominium developments that have a fixed number of units, this development as a maximum number of units, yet to be determined. While the unit number is the proposed maximum at any time, due to the ability of owners to purchase multiple lots and customize the unit configuration, the size and number of units will fluctuate over time.

Each floor is divided into a series of 225 square foot "lots," each owner can purchase as many lots as they would like. Parcel provides the structural, mechanical and electrical frame for each lot; the owner then has the opportunity to decide which level of completeness is right for their budget and lifestyle (Basic, basic plus, turnkey).

This system provides owners the opportunity to customize their homes without paying the upfront costs for predefined layout and details. Additionally, residents have the chance to buy adjacent plots to be used in the short term as revenue-generating rental units that can be later integrated into the owner's apartment when their family expands.

figure 7 | Lot Typologies

Each floor plate is divided into a series of lots. The resident has the choice of purchasing as many lots as they would like in addition to choosing the level of "completeness." Below is a possible configuration of a floor.

1 lot (225sf)   2 lot (450 sf)   3 lot (675 sf)   4 lot (900 sf)

basic/ basic plus   rental unit   turnkey

figure 8 | Possible Floor Plan Configuration

Parcel should consider leaving one lot between owners to allow for growth (buffer lots shown in hatch). The shared lots could be used as shared space prior to purchase.

52

Parcel can achieve structural flexibility by using column and slab construction rather than shearwall. This construction method allows for maximum flexibility as the walls are not weight bearing. The design group is exploring the use of cross-laminated timber (CLT) and steel as opposed to concrete which is the prevailing material used for residential in the area.
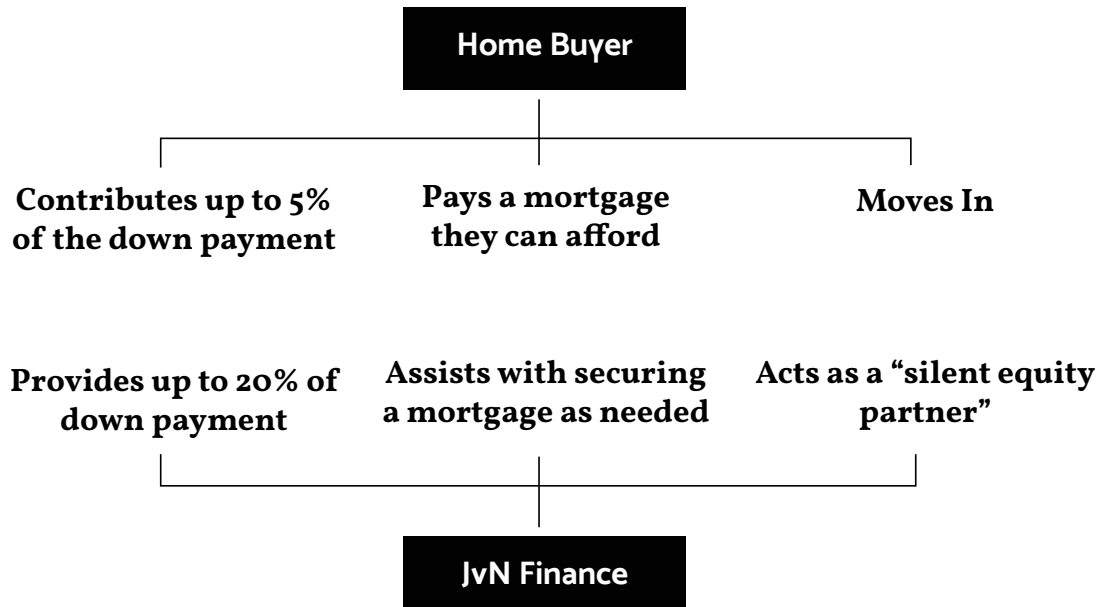
Central to the design concept is ensuring the design of the units facilitates easy adjustment by the owner. Using drywall instead of concrete allows for homeowners to make adjustments to their units themselves instead of hiring a contractor.

The units are rectilinear; each includes basic kitchen amenities, a bathroom and in some cases, a balcony. Sheida's research explores balconies as an agent of apartment expansion. When calculating FAR, unheated spaces do not count towards overall FAR – thus balconies, constructed as an exterior space can be incorporated into the design with the anticipation of enclosing later on for year-round use without increasing FAR.

FINANCING STRUCTURE

As housing prices rise out of pace with wages, homeownership has become out of reach for many Canadians. Typically the down payment deters renters from transitioning to homeowners, which has been the impetus for the launch of the financing arm of the company that enables people to own homes at lower personal cost. The research revealed that in Hamilton, the median rent is $1200 CAD. This rent can carry a $223,000 mortgage which includes a 20% down payment. People without access to the 20% down payment become stuck in a renting cycle. The finance arm, called JvN/f helps owners understand what they can afford towards a down payment and co-invests the remaining amount. This ensures the potential owners has a 20% down payment when applying to a bank or credit union. As co-investors, the owner and JvN/f share in the growth of the value of the home over time. JvN/f assumes that after five years the homeowners will be in a position to refinance their mortgage enabling the owners to buy out JvN/f's equity position sand capture 100% of home value growth.
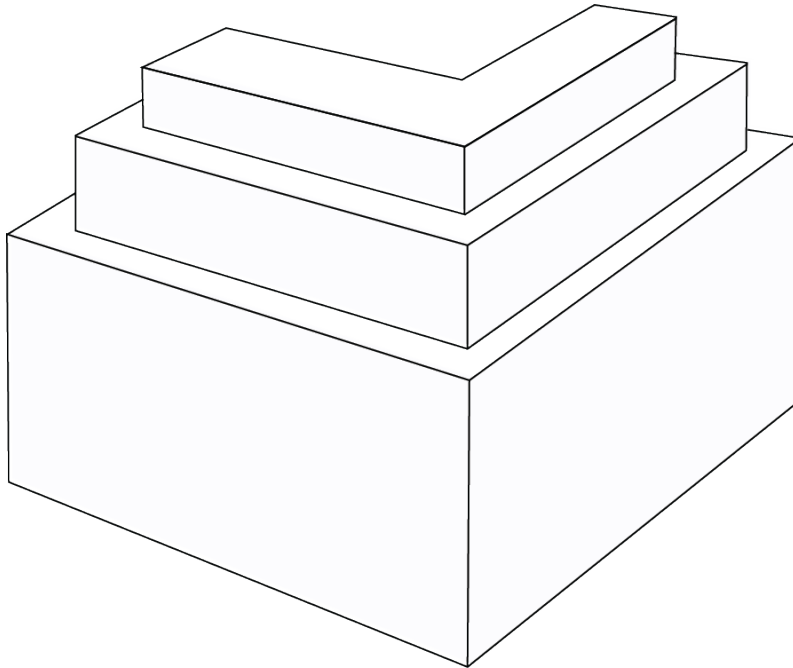
figure 8 | Financial Assistance Structure

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                        ┌──────────────┐
                        │  Home Buyer  │
                        └──────────────┘
                               │
         ┌─────────────────────┼─────────────────────┐
Contributes up to 5%    Pays a mortgage            Moves In
of the down payment     they can afford


Provides up to 20% of   Assists with securing    Acts as a "silent equity
down payment            a mortgage as needed           partner"
         └─────────────────────┼─────────────────────┘
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                        ┌──────────────┐
                        │  JvN Finance │
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POLITICAL SETTING

The neighborhood zoned for low-density, multifamily dwellings with max heights ranging from 11 ft to 26 ft. The current zoning defines the site as community shopping and commercial. The City is in the process of rezoning the North End as a Transit Oriented Corridor Zone reducing the parking requirement from 1.25 down to 1 per unit. Additionally, JnV/d worked with IBI Group, a transportation consulting firm, to analyze the parking requirements for the proposed site. The report concluded with recommendations to reduce the parking requirement further to .55 due to the anticipated transit enhancements of BRT in the neighborhood.

Home:Front is a challenging project for city planners who typically process projects with a set number of units. Strategizing around the permitting process has been a challenge for the Home:Front Team though they plan to get their project passed in Spring 2019.

INCREMENTAL INNOVATION

- The lot system enables residents to have a flexible approach to unit size and reconfiguration

- Financing structure allows renters to easily transition from renters to homeowners

- Balconies allow for expansion of the units

- Option for different "levels of completeness" provides appeal for a range of consumers

CRITIQUES

- As of now, Parcel has not planned to maintain a construction schedule. This may be disruptive to have adhoc construction happening throughout the year.

- Each lot comes with a bathroom - in a three lot condo, there would be three bathrooms.

- Juliet balconies are not functional.

- The building massing is not contextually sensitive.

Tel Aviv | Chlenov 42

Chlenov 42 is a temporary cohousing project in Tel Aviv, Israel. It is the first project created by Communit, an Israel startup creating and managing living spaces for young urbanites. Communit, founded by two urban planners Eitan Serber and Shay Am-Shalem, aim to address multiple urban issues including the mismatch between available housing stock and market demands, lack of affordable options and a lack of opportunity for self-expression in housing. Chlenov 42 is a renovated two-story structure converted from commercial use to residential. Today, it houses ten people and is composed of small private spaces, extensive shared amenities, a public gallery, artist studios and open space that continues to be modified by the inhabitants.

Integral to the project is temporality. The building is currently owned by a developer who has a planned condominium project that will break ground in 2021. Eitan and Shay contacted the developer in 2017 with the desire to use the existing two-story building as a site for an experimental housing project. Once they secured the site for their temporary use, they worked with architect Rafi Segal, an architect and MIT professor of urbanism, to renovate the building to house the first iteration of Communit. The ephemeral nature of the project provides a unique circumstance allowing for the experimental and incremental growth of this project.

While researching Chlenov 42, I had the opportunity to speak with Eitan Serber in Tel Aviv in addition to speaking with Rafi Segal.

figure 2.9 | Chlenov 42 Architectural Features

Garage space has been converted to a gallery

Rigid concrete form restricts exterior manipulation

Overhang provides shade above living room windows

Outdoor space has been converted to a garden

BASIC INFORMATION	
Number of Units	10
Total Square Footage	~5000
Stories	2
Year Completed	2018
Architect	Rafi Segal
Developer	Communit
Use	Residential, Live-work
FINANCIAL	
Funding Sources	Developer
Total Development Costs	100,000 Renovation
DEVELOPMENT	
Construction Type	Renovation
Materials	Concrete, plywood, sheetrock
Parking Spaces	0
Bike Parking (long and short term)	0
INCREMENTALISM	
Type of Incrementalism	Residents alter individual units, additionally, residents have incrementally build a rooftop area and garden.

DEVELOPER BACKGROUND

Eitan and Shays consider themselves entrepreneurs, planners, developers and property managers that plan to implement Communit buildings around the world. Their model is similar to that of WeWork and Common, though Communit has development goals derived from a planning perspective. The team envisions creating buildings oriented toward the street, connected to the neighborhood, infused with placemaking elements and that offer alternative housing options that enhance the vibrancy and character of the neighborhood.

Chlenov 42 is the first Communit structure and is essentially a to-scale model of permanent projects in the pipeline. The temporality of the project allows the team to experiment with variables including the community development process, public outreach, construction technologies, design systems, and management services. Since Communit opened in 2018, the team has faced several challenges that will inform the next Communit building, a permanent 100 unit rental property in Haifa, Israel.

CONTEXT

Communit is in Florentine, a neighborhood in the southern part of Tel Aviv, Israel. The neighborhood - named for David Florentine, a Greek Jew who purchased the land in the 1920s, - developed rapidly due to the proximity to the Jaffa-Jerusalem railway. Historically, Jewish immigrants from North Africa, Bulgaria, Turkey, Greece the Buhkara populated the neighborhood. The

Florentine has a gritty aesthetic popular amongst artists and young creatives.
Source: Airbnb.com

urban fabric is composed mainly of two and three story mixed-use buildings and includes a combination of land uses such as industrial, garment, marketplace and assembly points for day workers.

In the late 20th century, the area began to struggle with urban decay and rampant poverty. A revitalization process initiated in the 1990s has spurred Florentine's transformation into a vibrant, grungy, creative class haven. The changes in the neighborhood have been exacerbated more recently as rental prices have soared resulting in hoards of young urbanites and artists moving the neighborhood. This influx of the creative class has resulted in the opening of dozens of workshops, cafes, restaurants, markets and graffiti tours.

I spoke with Eitan regarding Communit and gentrification; he noted that he does not feel Communit has "contributed significantly to the gentrification process" in Florentine as the rental prices in the building are less than the median rental prices in the area. He suggests that Communit has opened in a "post-gentrification stage" as the government has already identified several urban renewal sites on the Chlenov Street. Additionally, before Communit, Chlevnov 42 housed a motorbike accessory store, and its transformation into a residential use has not displaced

anyone directly. Eitan also noted that both management and the residents do an immense amount of work in their events for the neighborhood. Despite Communit's efforts to positively influence the neighborhood, it is necessary to add that Communit has undoubtedly contributed to the re-imagining of a place that is become more exclusive, expensive and curated for a white, more affluent population.

DEMOGRAPHICS

Eiten and Shay chose the ten tenants to inhabit Chlenov 42. From the founder's perspective, finding the right people for Communit was essential for the success of the project. In order to curate the right community, Eitan and Shay looked to their existing communities to find tenants. They were looking for people willing to take an active role in the community. In an interview with Eitan, he said they were looking for "community animals" people who thrive with social interaction, high situational awareness and a respectful disposition that would contribute to space.

After posting an advertisement for Chlenov 42 on Facebook, over 200 people responded with interest in addition to dozens of requests from friends and friends of friends offline. The main criteria for renting was a commitment for two years – this enabled the team to experiment and

make adjusts to their systems without being stifled by the accommodation of new residents. After interviewing dozens of people, Eitan and Shay offered to house to 10 individuals.

Chlenov 42 is composed of a mostly homogenous population. The residents are all Israel, average 32 years of age and work as creative professionals and artists. One of the tenants, an architect noted that he was interested in Communit because he had reached an age where he was not able to tolerate roommates but enjoyed company -- Communit provided an option where he had dedicated private space, communal areas and the opportunity to influence the future of the structure.
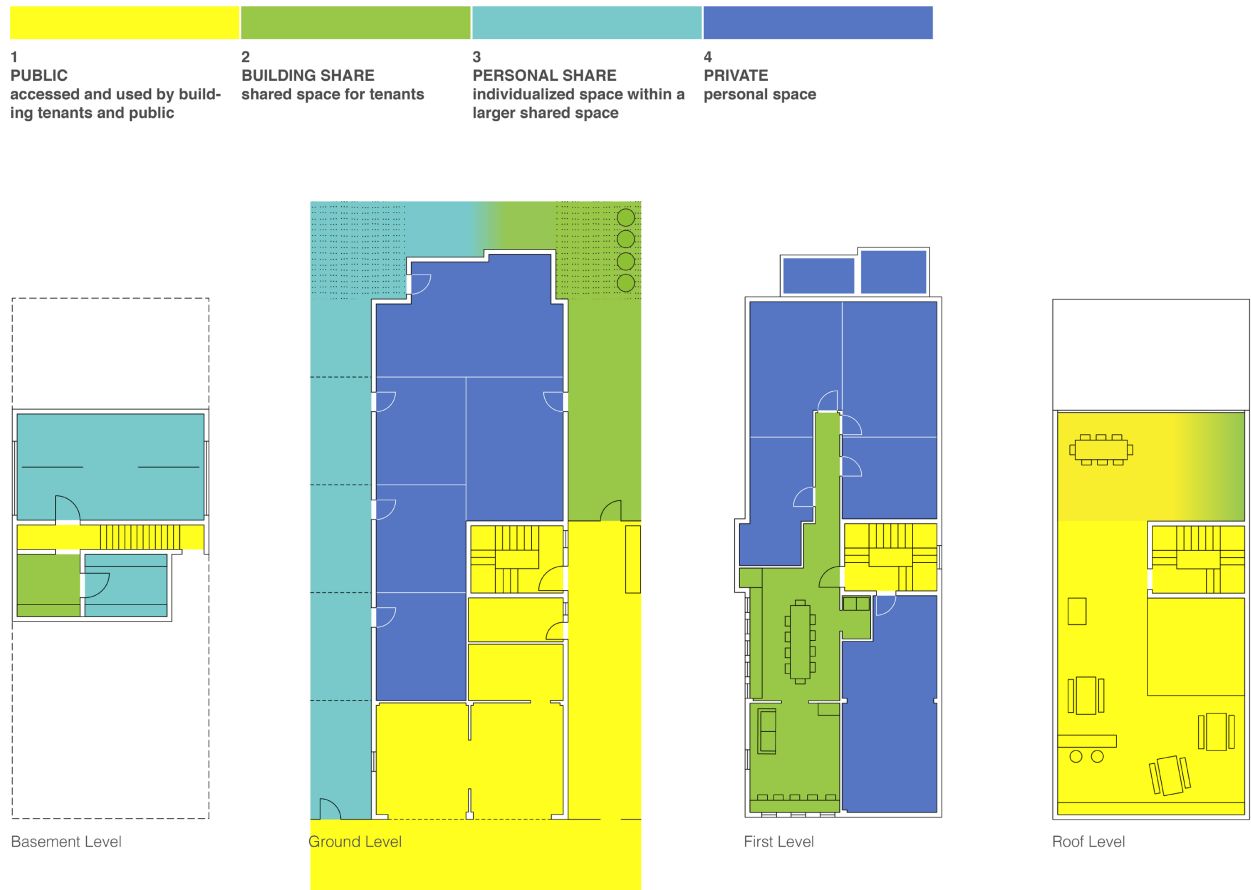
PARTICIPATORY DESIGN

Participation is a key and necessary feature of cohousing. Communit established and normalized an active dialogue with residents that began before the project was constructed and continues today. Eitan met with each of the residents to understand their spatial needs. The team had imagined creating small residential units with ample shared space, but the ratio of private to public space was to be informed by the inhabitants. The inhabitants were adamant that they wanted half of the second floor to be shared public space. Upon the competition of the initial renovations, Eitan gave a tour of the building to six of the new residents. Following the tour, they sat together and discussed possible next steps with the design. Eitan describes the community

Eitan (left) meeting with residents to discuss the Chlenov Project
Source: Communit LTD

figure 10 | Public and Private Spaces

1 **PUBLIC** accessed and used by build- ing tenants and public	**2** **BUILDING SHARE** shared space for tenants	**3** **PERSONAL SHARE** individualized space within a larger shared space	**4** **PRIVATE** personal space

Basement Level

Ground Level

First Level

Roof Level

CO-LIVING: CHLENOV 42, TEL AVIV (2018)

Source: Communit LTD

In an interview with Eitan, he mentioned that the shared kitchen is the "heart of the home."
Source: Communit LTD

Six of the ten units are equipped with their own kitchen. Communit does not plan to include this feature in the next Communit building.
Source: Communit LTD

participation with the building as "more spontaneous than method." Two months after residents moved into Chlenov 42, Eitan and Rafi hosted a workshop about how to program the shared space.

Following the completion of the initial construction, the residents were invited to continue to morph and adjust both the private and public aspects of Communit. One of the residents who work as a chef transformed his private space into a large kitchen enabling him to cook without engaging in the shared kitchen. Another tenant created the second level in this private space through the use of hammocks.

To facilitate continued building the Chlenov 42 community, the residents divided themselves into three groups: one group responsible for the garden, another for neighborhood programming and another for events. The garden team is in the process of building a community garden around the first floor of the building in addition to a rooftop garden space. The neighborhood team focuses on building connections with the neighborhood, for example holding a bicycle repair pop up on the sidewalk outside the building. They are currently in the process of partnering with a nonprofit to finance this project. The events team plans community dinners and parties for the residents.

The projects and Chlenov have largely been initiated by the residents, though facilitated by Eitan's encouraging approach. The Communit team has

Exterior changes to the property are lead by a group of Chlenov residents.
Source: Communit LTD

empowered the community to morph their environment to be representative of their interests and needs and finally, the temporarily of the housing project provided freedom, as it's understood that the results from altering and experimentation are ephemeral.

DESIGN APPROACH

The initial renovation of the building, conceived of by Rafi Segal, an architect, and professor of architecture and urbanism at MIT, contains three distinct types of space – private space, public space, and space that exists in between. This spectrum of public/private space is a core design principle references numerous times both in my conversation with Eitan and Rafi. The design team was interested in how one builds a private residence that welcomes the public, engages the neighborhood and actively programs space for the public to use while maintaining discrete private spaces. The plans on the different page speak to the organization of public and private realms within site.
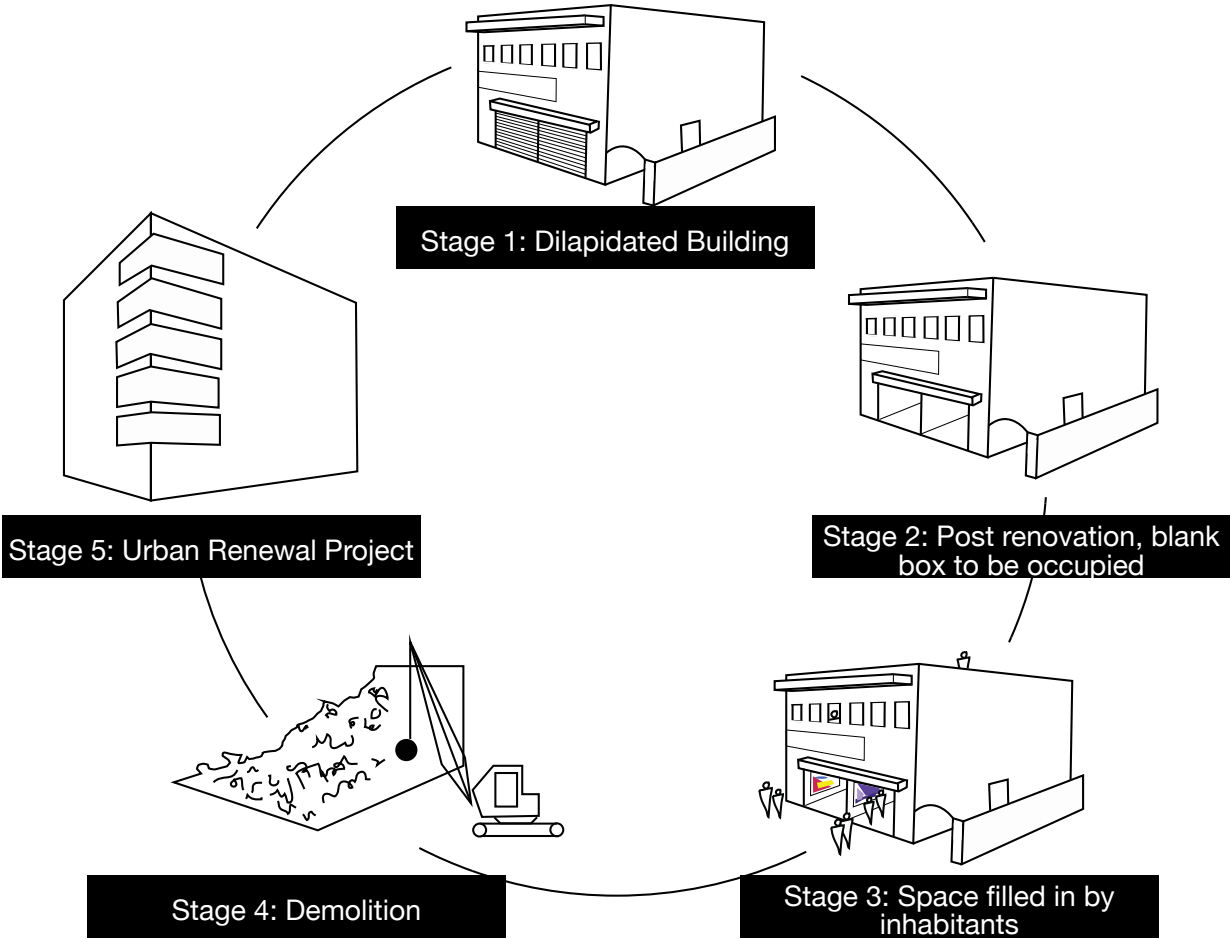
Once initial ideas around public and private space were conceived, Eitan worked with the ten residences to understand their thoughts, concerns, and expectations on the spaces they would occupy. Together they designed the floor plan with each unit ranging from 18 to 32 square meters. Each of the units, priced per square meter and ranging from $900-1300 USD, have a

toilet and shower; six of the units have a small kitchen while the remaining four rely on the communal kitchen. Eitan and Shay provided residents with a single blank space which they were encouraged to renovate themselves. The temporality of the space empowered the management and residents alike to consider creative alternatives for the floor plans.

Some of the design features communicate that this is a project born from planners. The communal living room has a set of windows that look out over the street. The design team built a desk underneath the windows allowing for eyes to be on the street – Eitan noted that this Jacobsian idea was the inspiration for the living room configuration. Additionally, Eitan and the Shay made the deliberate decision to use keypads rather than traditional keys. They felt that when a resident has to carry keys around to move between spaces, it does not feel like home. Moreover, the team incorporated a gallery space and numerous art studios into the basement to ensure a mix of uses.

Eitan and Shay are designing a housing service that goes beyond a traditional cohousing model. As property managers, they provide community goods such as wifi and cleaning services. A unique aspect of their management service is that when residents are away, Eitan rents the room on Airbnb generating income for the resident and exposing more people

figure 11 | Life Cycle of Chlenov 42

Stage 1: Dilapidated Building

Stage 2: Post renovation, blank box to be occupied

Stage 3: Space filled in by inhabitants

Stage 4: Demolition

Stage 5: Urban Renewal Project

to the collaborative style of living. This scheme is both financially savy and provides free, if not profitable, marketing for their startup.
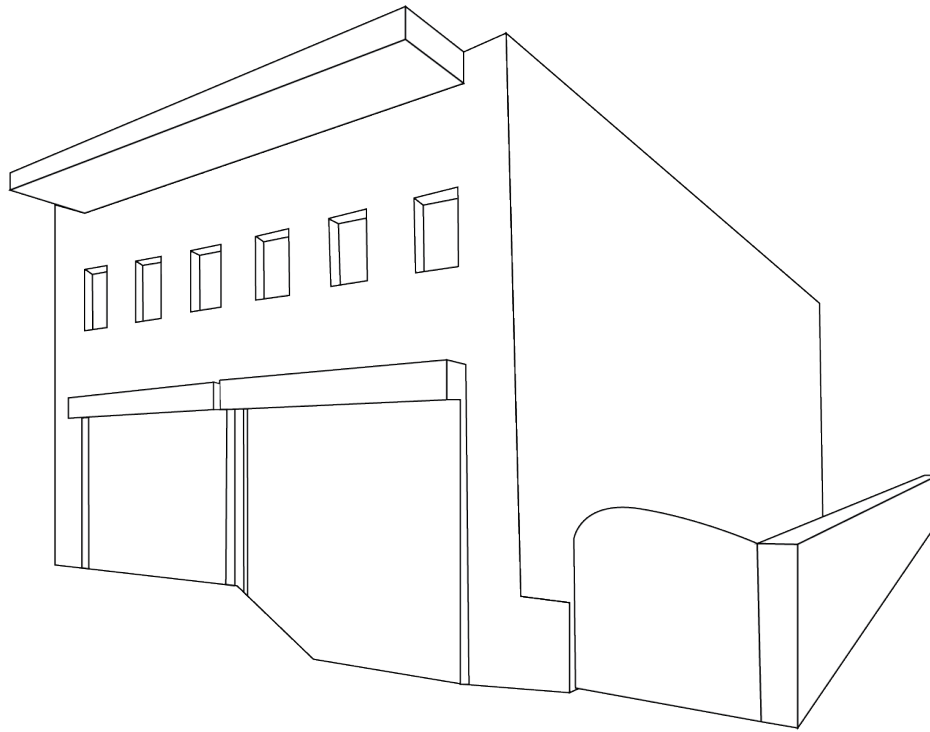
POLITICAL SETTING

It is essential to remark upon the context and tradition of cohousing in Israel. The kibbutz is a cooperative settlement typology based in equality, sharing and mutual aid that emerged in the early 20th century as part of the Zionist efforts to create utopian communities around agriculture in Israel. To build self-sufficient communities, the members collectively owned property, managed the work division and cast votes on all major decisions. Though following a century of substantial societal, political, technological and economic shifts that have transformed the world, the kibbutz too has changed. The typology has responded by shifting to a model that combines individual and shared ownership. Instead of the community owning everything, families have a single private home set within an agrarian landscape nested within the infrastructure of the kibbutz. This new typology attempts to marry the social idealism of the early kibbutz with the lifestyle that comes with privatized detached homes.[29]

It's important to mention the history of communal living in case study as it's an idea to fundamental to the Israel tradition. Many Israelis either grew up in kibbutz or know someone who has and the idea seem familiar and relatable. This compares to the idea of communal living in America which feels novel and representative of politics mainstream Americas have long rejected. It seems natural that the startup nation has produces a startup innovating on the Israel tradition of coliving.

FINANCING STRUCTURE

The developer owns the building and financed the renovations enabling Eitan and Shay to manage the building under the Communit brand. Despite the developer's ownership, Communit is completely responsible for the upkeep of the building. For example, if a leak occurs, it is entirely on Communit to pay for the repair. The developer rents the building to Communit at a reduced price which is one of the mechanisms that allows for rent to stay so low within the building. The rent that Communit receives from the tenants pays for rent to the owners and upkeep of the property. Communit has yet to be a profitable business, though their financial models indicate that after three years the building would become profitable. Unfortunately, Chlenov won't survive its third birthday, but the lessons learned from this housing experiment will be passed on to subsequent Communit projects.
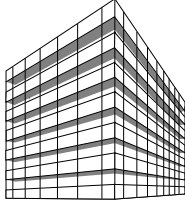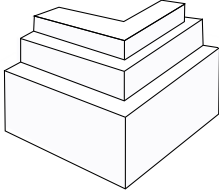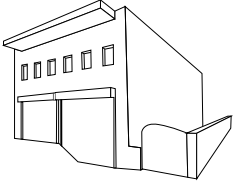
INNOVATION:

- Provides residents with freedom to make design changes

- Allows renters to make significant changes to the property

- Institutes a management team that provides support for improvements, programming, utilities and amenities.

- Provides alternative types of spaces on premise including the gallery and artist studios.

- Temporality of the project enables the team to be more experimental.

- Supporting residents to form action groups and engage the neighborhood.

CRITIQUES:

- Building floor plan is too inflexible to make significant changes.

- Diversity was not addressed, instead the group filtered for a homogeneous group.

	R50	HOME:FRONT	CHELNOV 42
FINANCIAL STRUCTURE		+	
PARTICIPATORY DESIGN APPROACH		+	+
BUILDING SYSTEM AND MATERIALS	+		+
MARKETING AND BUILDING OF COMMUNITY		+	
TYPE OF INCREMENTALISM	+	+	+

FINANCIAL STRUCTURE

These explorations have further confirmed that the financial structure of 55 Day street should mirror current local practices. In Berlin, for example, the 20-year history of Baugruppen has given rise to alternative banking practices that support alternative development methods, additionally, the German government does not bar down payments used for a construction loan - a practice not allowed in the US. In the case of Tel Aviv, the project was financed mainly by the owner which would not be possible at the Somerville project scale. Home:Front, backed by private equity, has created an entire financial arm to assist homebuyers with down payments. The 55 Day Street project is most likely to be realized under the management of an affordable housing development firm with access to tax credit experts and experience overseeing new construction.

PARTICIPATORY DESIGN APPROACH

This project will be constructed as an affordable housing project; thus, the community will participate in the initial visioning of the building. The resident community will only form after the building's completion, such as in the case of Home:Front. I imagine that there will be an architect retained on staff to assist with the visioning of the units. Additionally, the project team will help participants form groups to coordinate with contractors both for the intention of costs savings on services and to organize a schedule to avoid continuous construction.

STRUCTURAL FRAMEWORK AND MATERIALS

The structural framework and material composition of 55-day street most clearly reflects the practices used in both R50 and Home:Front. Similar to R50, 55 Day Street will utilize the concrete and slab methodology to minimize construction costs, and maximize the flexibility of each unit. Dissimilar to R50, the unit divisions are predetermined like in the Home:Front development. This predetermination of unit divisions is necessary to ensure the project conforms to the parameters determined by the affordable housing tax credits. The 55 Day Street team should also consider using CLT, for its benefits of high strength and structural simplicity, which further the projects ability to be built affordably.
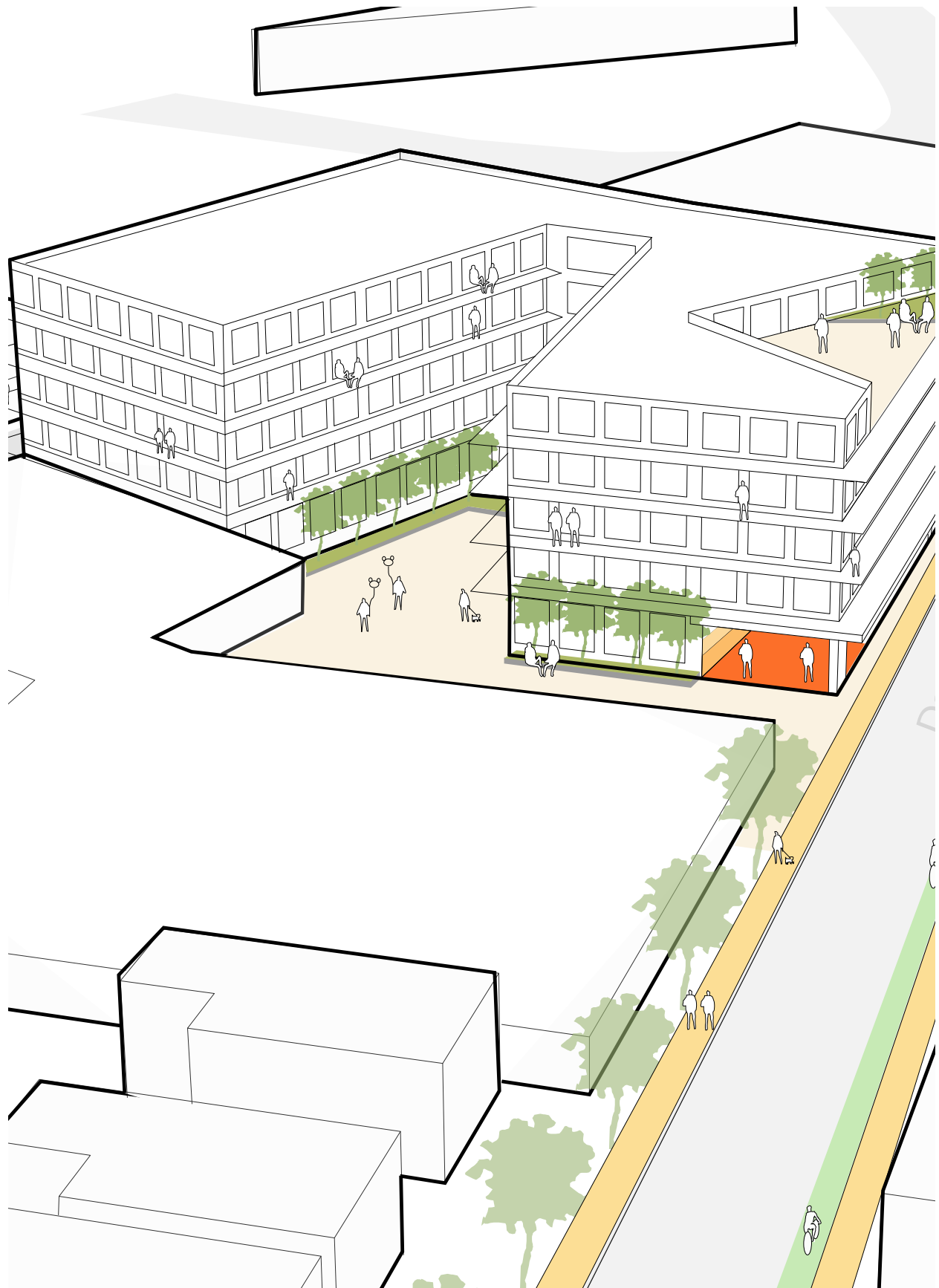
TYPE OF INCREMENTALISM

The incrementalism in 55 Day is inspired by all three of the case studies explored. Each of the units at 55 Day Street is inherently flexible, allowing for the residents to design and construct the layout themselves and provide an opportunity for adaptation when the resident's circumstance inevitable changes. Drawing inspiration from the Home:Front project, 55 Day Street encourages the notion of using the home as a revenue generator and accommodates splitting a unit to transform one half into a rental. Finally, the 55 day street project encourages incremental changes to the exterior of the building including the rooftop space and in the plaza similar to Chlenov 42.

Development Proposal
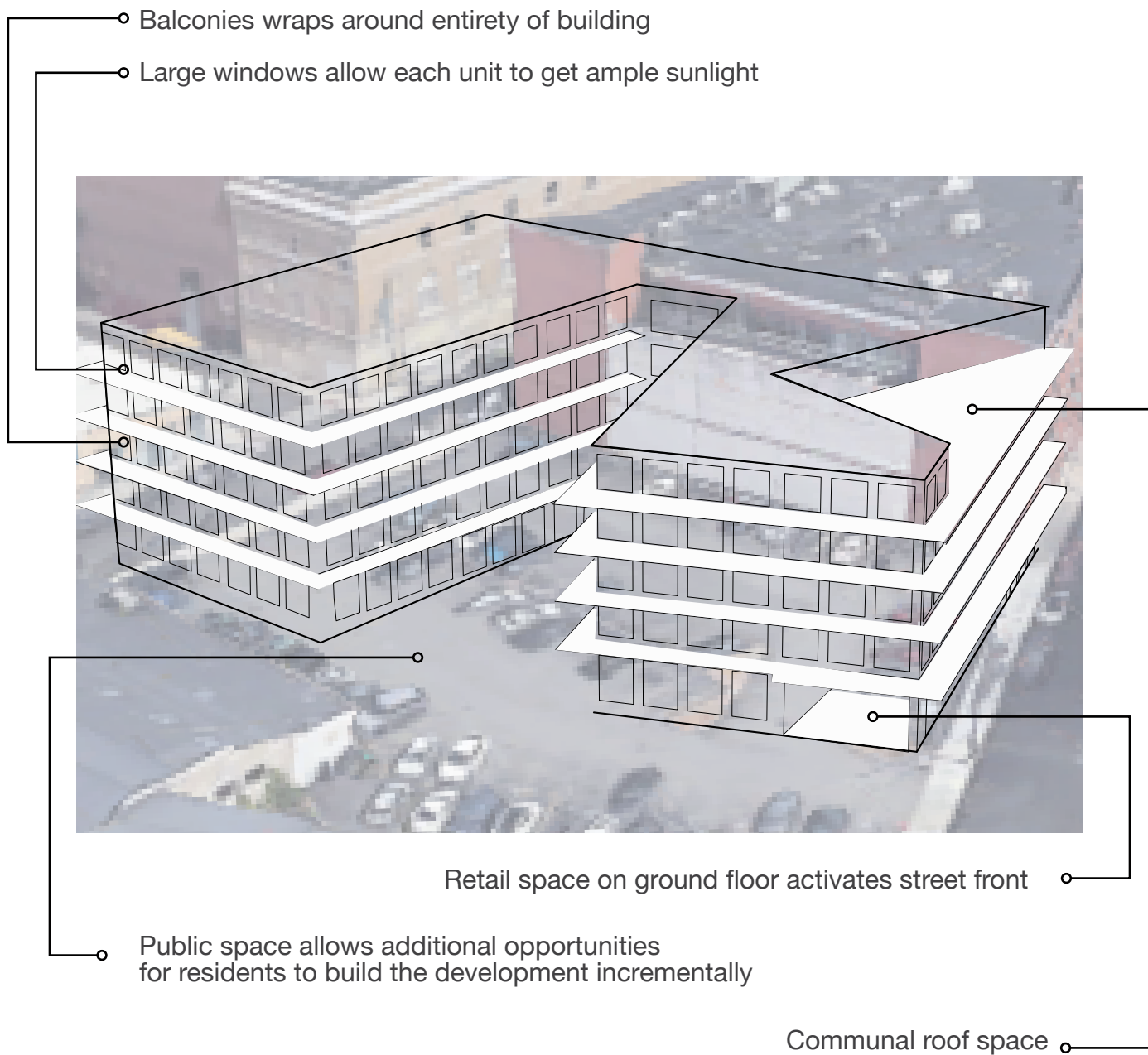
Somerville | 55 Day

The 55-Day Street Project is an incremental development project in the heart of Davis Square in Somerville, Massachusetts. The project is born out an academic interest in the evolution of incremental designs that emerge from climates of scarcity. 55-Day provides an exploration of incremental housing as a development typology that responds to an American environment of scarcity; an affordable housing crisis and the limited ability to purchase contemporary housing products that are reflective of their inhabitants.

In-depth explorations of projects in Berlin, Germany, Tel Aviv, Israel and Hamilton, Ontario provide specific insights to the successes, failures and the potential of incremental housing as a development typology that offers affordable and unique homeownership possibilities. Based on the research; flexibility, community participation, ability for design to anticipate change and contextual sensitivity are fundamental to the success of incremental projects.

Somerville is an ideal setting for the conceptual development case study for multiple reasons. First, it's local, proposing a development on a site easily accessible enabled a greater understanding of environmental and political contexts and enabled conversations regarding the project to be more relatable. Second, Somerville, along with the greater Boston area is in the midst of a housing crisis in dire needs of not only more housing but alternative typologies that ensure opportunities for the diverse population of the city. Finally, Somerville is home to a creative and young community willing to consider sweat equity as a potential currency.

The following conceptual case study is the synthesis of research on incremental housing and an exploration of flexible building design, fit within the context of a dynamic, growing and urban American setting. The case study is in the style of the previous case studies; a description of the design approach, context, participatory process, social organization, finances, and political setting.

figure 2.12 | 55 Day Street Architectural Features

Balconies wraps around entirety of building
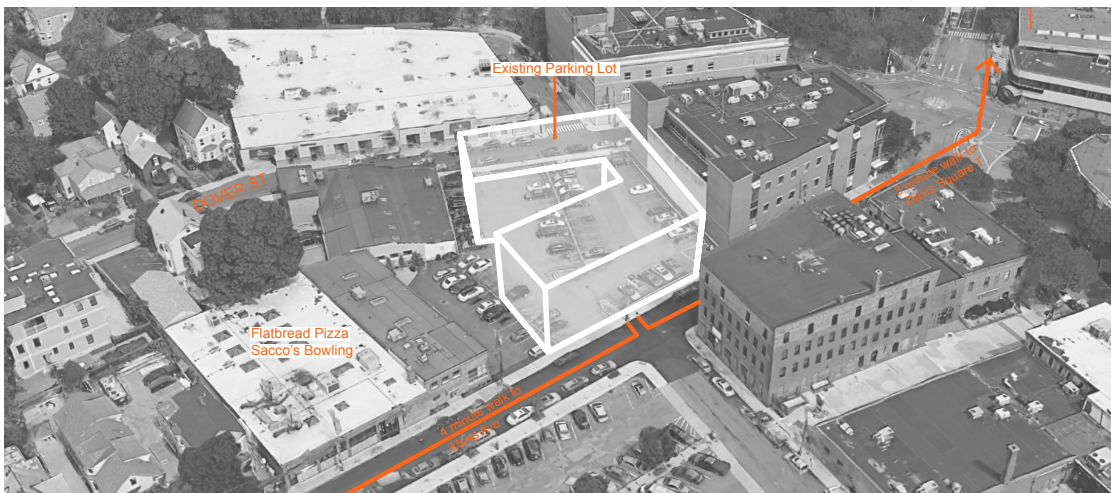
Large windows allow each unit to get ample sunlight

Retail space on ground floor activates street front

Public space allows additional opportunities
for residents to build the development incrementally

Communal roof space

BASIC INFORMATION	
Number of Units	>50
Total Square Footage	75,314
Stories	5
Year Completed	2020 - Ongoing
Architect	TBD
Developer	TBD
Use	Residential
FINANCIAL	
Funding Sources	Affordable Housing Trust Funds, Workforce Housing Subsidies
Hard Costs:	19,038,500
Total Development Cost:	26,942,909
DEVELOPMENT	
Construction Type	Slab and concrete
Materials	Cross-Laminated Timber, Concrete
Parking Spaces	23
INCREMENTALISM	
Type of Incrementalism	Each unit is equipped with basic infrastructure - kitchen, bathroom and bathroom hook up. The rest of the unit is flexible and intended for the resident to design and build out themselves.

DESIGN APPROACH

John Turner's notion of the house as a verb is a core tenant to the building system. The design of the structure enables the user to consider the unit as a framework that supports multiple iterations. This framework allows the user to move into a home that can accommodate the inevitable changing circumstances of life at an affordable cost. By providing a unit embedded with an opportunity to participate deeply in the design and construction, the residents housing becomes the result of their own decisions and circumstances transitioning housing into an active process rather than passive consumption.

55-Day Street is an incremental condominium development that prioritizes affordability and flexible customization. Drawing inspiration from R50, the building is composed of a rigid exterior, a complete, c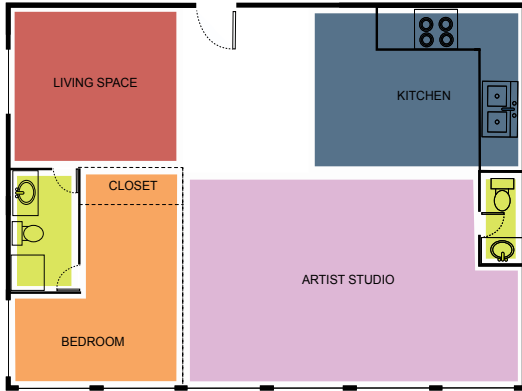ontinuous building envelope with an internal design that is flexible and customizable based on the user's needs. A unit contains only the essential infrastructure; the simplicity of the product allows residents to purchase the units at a low price, opening the door for home ownership in a highly desirable location. Each of the units, ranging from 875-1500 square feet, comes equipped with structural walls, a kitchen, one bathroom and one bathroom hookup. All immovable utilities are concentrated on the structural walls allowing for maximum flexibility of the unit plan. This configuration enables the user to design and build the unit to fit the circumstance of the residents. Similar to the Home:Front project, the individual unit divisions are fixed, though in 55 Say Street, units are large to avoid some of the issues the Home:Front project will likely foresee such as redundant bathrooms and strip kitchens. Given the more congruent political settings

55 Day Street is located in the heart of Davis Square.
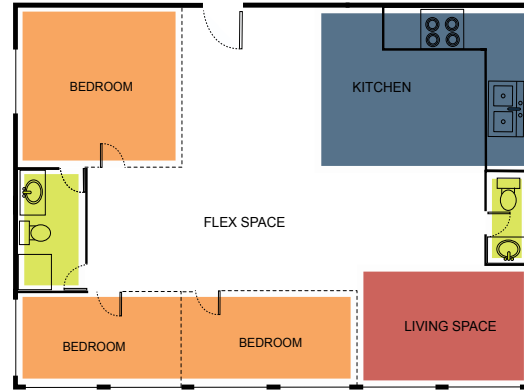*Source: Communit LTD*

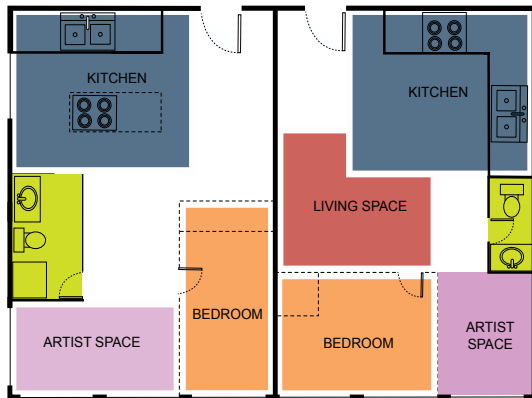## figure 2.13 | Possible Unit Configurations

Artist Studio

LIVING SPACE
KITCHEN
CLOSET
ARTIST STUDIO
BEDROOM

$ 2000 | two temporary walls

Apartment + Rental Unit

KITCHEN
KITCHEN
LIVING SPACE
BEDROOM
ARTIST SPACE
BEDROOM
ARTIST SPACE

$ 14000 | four temp walls, bathroom and dividing wall

Nuclear Family apartment

BEDROOM
KITCHEN
FLEX SPACE
BEDROOM
BEDROOM
LIVING SPACE

$ 6000 | six walls

New Family Apartment

ARTIST STUDIO
KITCHEN
CLOSET
BEDROOM
LIVING SPACE
BEDROOM

$ 4000 | four walls

This diagram depicts possible layouts configured by the resident. Each layout is accompanies by the cost of achieving the layout. One approach to building an incremental and flexible space is through the use of temporary walls, which cost 1000 dollars each.

Costs:

Temporary Wall - $1,000

Additional Bathroom - $10,000

Apartment Dividing Wall - $2,000

Legend:

- *Living Space*
- *Artist Space*
- *Bathroom/Bathroom Hook Up*
- *Kitchen*
- *Bedroom*

Davis Square is a center of art and culture. Source: somerville.wickedlocal.com

The Rosebud restaurant is a landmark destination in Davis Square. Source: Bu.edu

of Hamilton and Somerville, the predetermined units are more palatable to planning permit processes.

The size and configuration allow the user to express the floor plan in a myriad of ways. This is largely inspired by the success of the flexible floor plans designed in R50 that allow both for flexibility and adaptability. Some residents may configure a unit as a one bedroom with ample space for their creative business, reconfiguring the space into a three bedroom when the resident begins to grow a family. Others may equip the unit with three bedrooms to accommodate children with the anticipation that the bedroom walls will be dissolved to achieve an open concept once children go to college. Inherent in the size of the units is the ability to divide the unit in half. The resident could divide the unit to prepare one side as a rental unit - this transforms a house into a revenue-generating asset.

PARTICIPATORY PROCESS

This development will contribute to the community's vision for Davis Square's future by providing public amenities, improved streetscapes and aesthetics representative of the community's tastes. In all the case studies researched, public participation was central to design process. Each of the projects invited the community into the design process to ensure their voices were heard and integrated into the built environment. In conjunction with the design process,
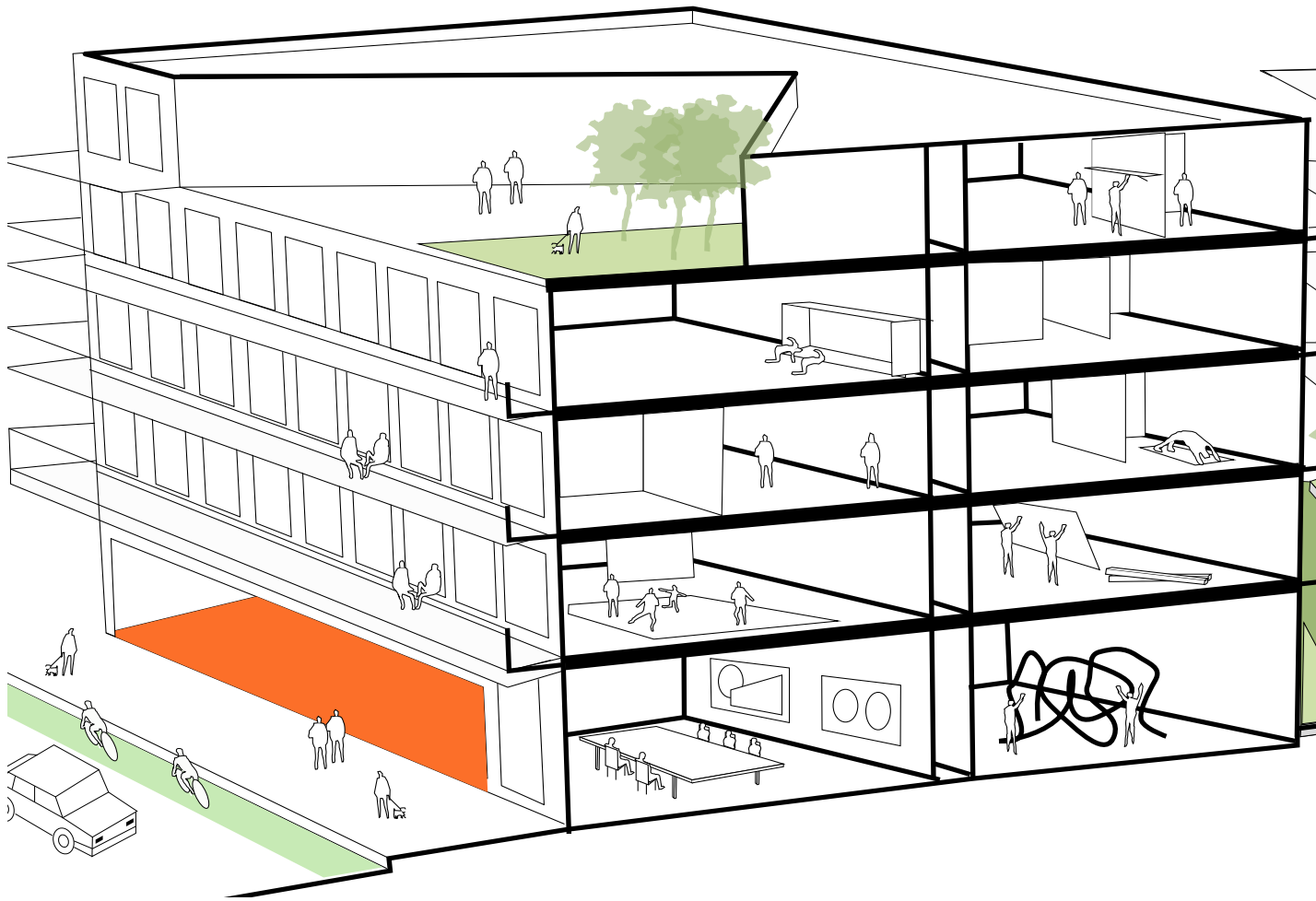
figure 2.14 | Floor Plan

The floor plan contains a range of unit configurations showing the possible diversity of infill patterns achievable in 55 Day Street.
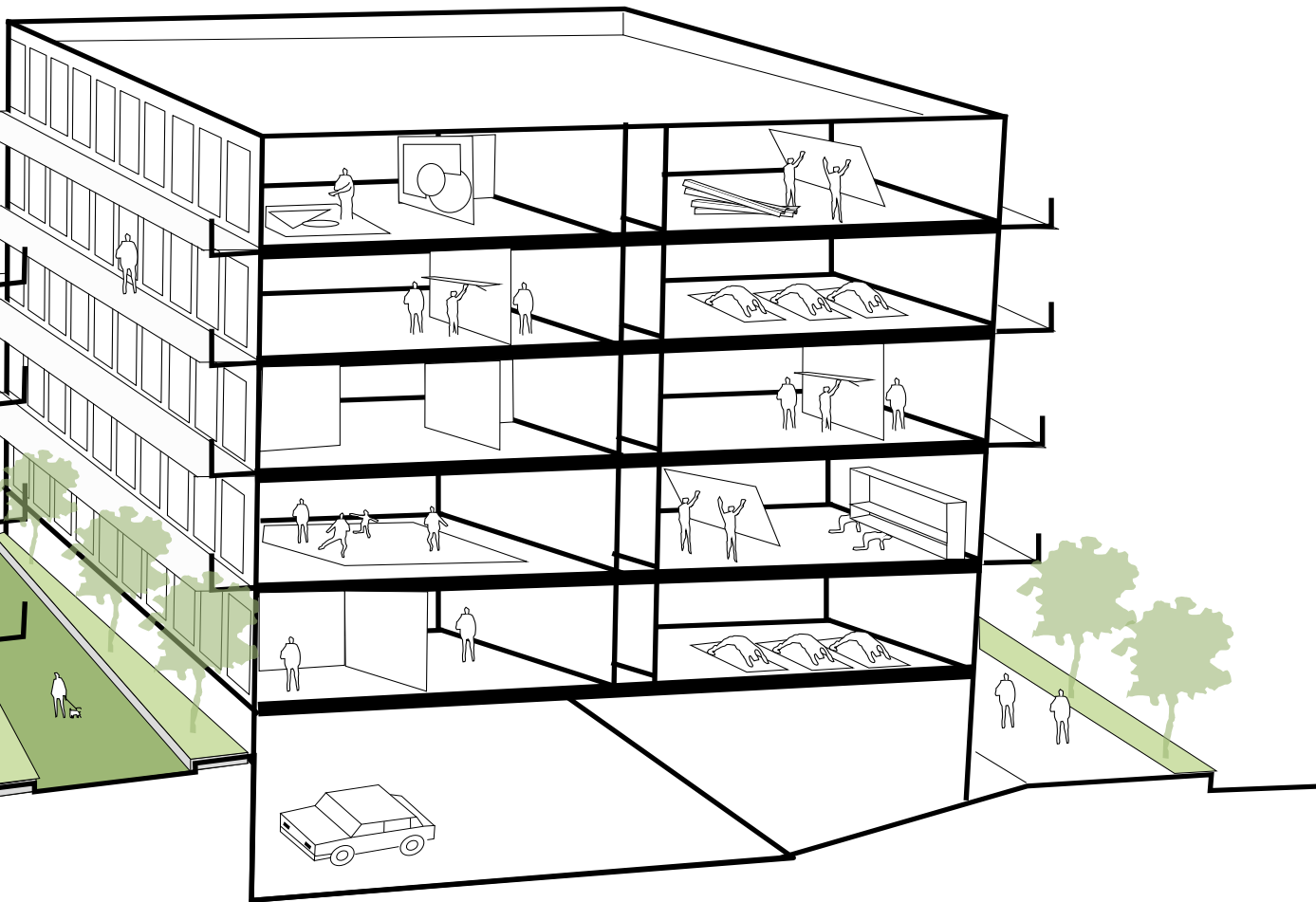

DOVER STREET

ARTIST STUDIO

BEDROOM

KITCHEN

CLOSET

LIVING SPACE

KITCHEN

KITCHEN

ARTIST SPACE

LIVING SPACE

KITCHEN

DAY STREET

figure 2.15 | 55 Day Street Section

the development group will hold a series of community engagement pop-up workshops on the site of 55-Day Street to gather the community's input on exterior aesthetics and public amenities. The workshops will include a series of interactive activities and questions that aim to incorporate the neighborhood's perspective into the realized product.

The intent of the workshops is to understand the following perspectives:

- What public amenities would most interest and benefit the Davis Square neighborhood?

- What aesthetics would be most appropriate for the exterior of the building?

- Would the community prefer the development to use vernacular materials such as brick, or would the community like a bold and contemporary aesthetic statement?

DEMOGRAPHICS

Somerville is committed to retaining people with a range of incomes, cultures and experiences. Diversity has enabled Somerville to be a thriving, eclectic and vibrant community for many years. In an era of increasing housing demands, the market and available housing stock have had significant influence on who can and who is willing to continue living in Somerville. Since the building will be funded through affordable tax credits, the residents will go through an application process instead of a self selecting group in the cases of R50 and Chlenov 42, which will hopefully result in a more diverse community.

One of the trends reported in the Sustainable Neighborhoods Working Group, is that Somerville has the second lowest percentage of children under 15 for communities with a population over 20,000 in the Commonwealth; though the City's 25-34-year-old population is more than twice the state average.

Millennials are transitioning to a life stage that includes children, without housing options that accommodate families; new families often leave the City for the suburbs with more spacious accommodations. Another pressure point families face is the limited number of units large enough for families; Somerville is actively trying to address this problem by encouraging developers to create larger units. [30]

The units in 55 Day Street are designed to accommodate the price range of millennials (60-100% AMI) with the spatial flexibility to transform the space into a home that can support a family. Since the units are relatively basic upon delivery, 55 Day Street will likely appeal to a wide range of creatives interested in designing the interiors of their homes. The typology has been imagined with an "age in place" mentality that allows users to buy into the property when they are relatively young and rearrange their units as circumstances change enabling the resident to stay in the same home for 10-15+ years. Similarly, R50 used a model that encouraged larger units to ensure that the spaces were adapted about accommodate different phases of life.

SOCIAL ORGANIZATION

The building design is a condominium structure which enables people to buy the units as opposed to renting. Given

the research, providing opportunities to buy gives the residents a greater freedom to alter the space they're occupying. There is no formal organization of people; instead the project is developed for residents to purchase individual units. The only anticipated collective social organization is the Home Owners Association (HOA). The HOA will be responsible for making decisions regarding the buildings communal spaces and upkeep. Onsite property management will be responsible for the day-to-day upkeep and will require the HOAs input when decisions are needed. This structure does not eliminate the opportunity for co-housing groups to co-opt the provided space and transform several units into shared spaces.

POLITICAL SETTINGS

Somerville officials are currently considering the most sweeping zoning changes in the past 30 years. The postponed changes facilitate more development around Somerville's squares and main corridors to provide more housing to current and future residents. Somerville is part of a collection of cities in the Boston region that have recognized that the housing crisis is a regional issue. Somerville Mayor Curatone is one of 15 area mayors who announced in October 2018 that they could collectively advocate for the

construction of 185,000 new housing units. [31]

Davis Square has primarily been zoned to facilitate densification of residential parcels. The City rezoned the 55 Day Street site and adjacent parcels from CBD to MR5. The zoning code for MR5 encourages multi-family residential with commercial ground floors to activate the street frontage. The designation along includes a maximum lot coverage of 90% and a height of 55 ft. The high lot coverage and generous maximum height enable the building to be relatively dense in comparison to the surrounding neighborhood. Given the minimum setbacks, buildings are encouraged by the zoning parameters to engage the streetscape directly, supporting the continuous street wall typically found in the contextual urban environment.

Given the local interest in developing affordable units, the Somerville government would likely be willing to consider 55 Day Street as it enabled affordable housing opportunities for a demographic that is often not consider in the housing discourse. The political challenge that seems to be the greatest obstacle would be the regulations of specific affordable tax credits, this is expanded upon in the finance section.

FINANCIAL STRUCTURE

This project will be financed as a typical development project with affordable housing subsidies. Unlike South American and Germany, in the US, developers cannot use deposits from individuals to leverage a construction loan. Instead of the developer collecting deposits from future residents, the developer needs to provide equity in other forms. Fortunately, the affordable housing subsidies act as a form of equity. In addition to personal equity and affordable housing subsidies, the developer needs to secure a guarantor or a pool of guarantors motivated by their commitment to the mission to secure a construction loan. Using personal equity and affordable housing subsidies, one would obtain a construction loan for the development of the property.

Somerville has an inclusionary zoning policy that requires all developments with over six units to maintain 20% of those units as affordable. In compliance with this policy, the entirety of the 55 Day Street development will be available to those making between 60—110% AMI. The maximum sales price for an inclusionary unit can be no more than 28% of household income for housing costs. The 55-Day Street development is committed to providing affordable workforce housing and as a result, qualifies for several subsidies.

The properties at 55 Day Street would be considered affordable. The average unit would sell for $282,926, which requires a salary of $53,500. This

figure 2.16 | Applicable Affordable Housing Subsidies

Applicable Affordable Housing Subsidies			
Program	Target Population	Source	Developer Eligibility
Workforce Housing	Targets individuals and families with incomes of 61% to 120% of Area Median Income (AMI),	Total of $100 million from the Opportunity Fund (MassHousing's mission-oriented fund) available on a rolling basis. Must show local support, market need, and proof that it meets affordability. Cannot be used to fulfill the workforce housing requirement of inclusionary zoning policies.	Both for-profit and non-profit borrowers are eligible, but the strong preference is for production rather than rehab or acquisition
Affordable Housing Trust Fund	At or below 110% of AMI	State Bonds; reduces 9% LIHTC basis	Governmental subdivisions, community development corporations, local housing authorities, non-profit organizations, for-profit organizations
Commercial Area Transit Nose Housing Program	51% units - 80% AMI	State Bonds	Profit or Non-Profit

Max Funding Per Unit	Per funding Project	Terms
$100,000/unit	$5,000,000/ project	O percent or up to applicable federal rate (AFR) for the loan, which can mature up to 40 years. At least 20% of units must be affordable to those earning up to 80% AMI, but if using the HUD HFA Risk Share Program as another financier, the stipulations are more stringent (20% of units affordable to 50% AMI or 40% units affordable to 60% AMI). Rents need to be above LIHTC and below market rents
$50,000 per unit	$1,000,000 ($2,000,000 if funded with discretionary finds)	Varies, but 30 year affordability term required
$50,000 / unit	750000	30-year deferred payment loan at 0% interest <25 units: neighborhood commercial area; >25 units: TOD less than 1/4 mile from transit node

figure 2.16 | Finacial Summary

Condo Units and Timing	
Total Units	50
Number Pre-sold	25
Number of units sold per month	7
Date for closing of Presales/ Sales Start	6/2019
Month	6
Year	2019
Months until sell out	4
Number of units sold in last month	4
Sell out Date	9/2019

Program - Units	
Total Units	42
X beds	42
2 beds	0
3 beds	0
Penthouse	0
Average SSF Per Unit	754
Average $/PSF Sale Price	375
Average Unit Sale Price	282,926

Square Footage - Building Stacking Plan	
Floor	GSF
	89,085
Roof	
5	16,317
4	16,317
3	16,317
2	16,317
1	16,317
B1	7,500

Pre-Sale Expenses Op Ex	
HOA Dues PSF - Per Month	$0.60 psf
HOA Dues Per Unit - Pere Month	$453
RE Taxes PSF - Per Year	$7.10 psf
RE Taxes Per Unit - Per Year	$5,355
RE Tax Workbox	
Taxes Due	224,896
Millage Rate	7.235
Assessed Value	31,084,405
HOA Expense Workbox	
Monthly Total PSF	$0.60 psf
Item	$/SSF - Monthly
Landscaping	$0.20 psf
Community Room	$0.10 psf
Utilities	$0.15 psf
Snow Removal	$0.15 psf
Admin	
Sales Expenses	
Percent of Gross Income	3.00%

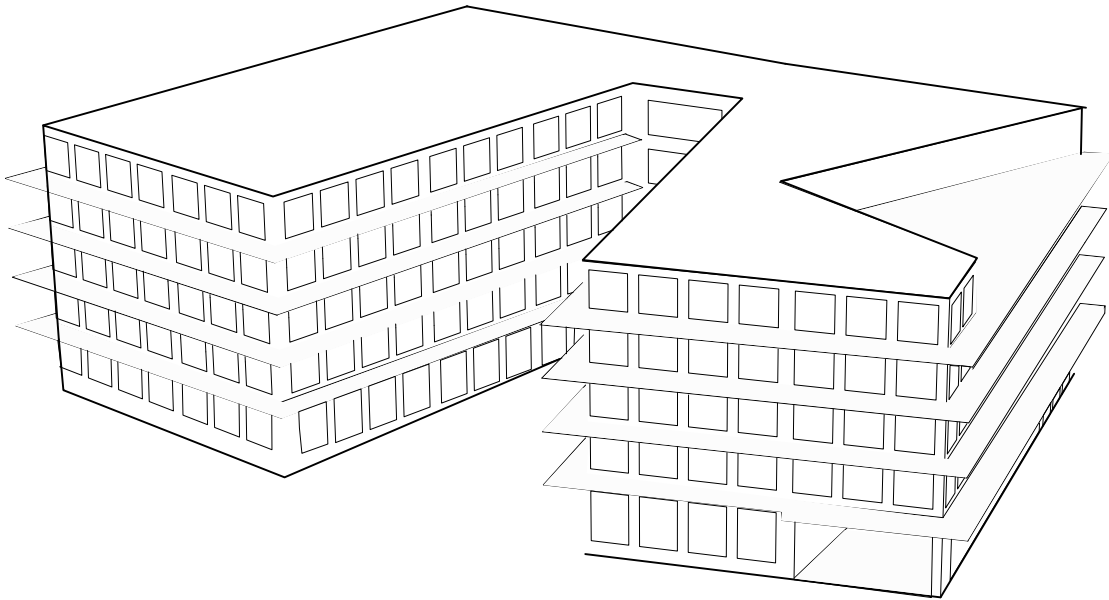| SSF	Parking SSF	Amenity SF	MEP
31,688	7,500	10,000	0
		3,000	3,000
6,338			
6,338			
6,338		3,000	
6,338			
6,338		7,000	
	7,500		

price satisfies the City's definition of housing at 60% Area Median Income (AMI). Currently, the median home in Somerville is valued at $553,300 and sells for a median price of $660,000. Providing homes at 60% AMI aligns with the City's need for more affordable units and the policies that are in place to guide Somerville to a sustainable and inclusive future. [32]

Despite the relevant feasibility of this project, it's important to note the challenges of the financial structure of this project. Tax credits were considered an integral part of the model because this would enable the development to be partially funded through affordable tax credits and ensure perpetual affordability and provide housing to those who are in need. Unfortunately, there are inevitable frustrations that come with a project whose potential realization is dependent on bureaucracy. Providing raw units for workforce housing likely would not be accepted by the city or the state given the competitiveness the affordable tax credits. The city and state are in the business of providing affordable housing, not affordable construction projects. Given that the partition walls and finishes are the least expensive of the development process, the savings likely aren't large enough to warrant the awarding of these credits. Although funding through affordable tax credits may not be a realistic outcome for this project, the

project could be feasible for a private developer.

REFLECTIONS ON THE DESIGN PROCESS:

Throughout this process, as feasibility loomed large – I was primarily focused on creating a development proposal that could be built within the given zoning of Somerville. Though this commitment to working within given planning structures led the eventual product to be less radical, less incremental that I had originally imagined. By the end of the project, I had created a project of lofts - a typology that has been normalized in the US for a long time. It's frustrating to go through a long journey only to find your end project as a repackaged version of a product that already exists. Although the frustration lingers, I think lofts are an underutilized typology in new construction and providing an affordable typology should be explored by developers. Another way to have approach this project would have been to think about incrementalism as it relates to larger scales and policies that would support progressive development.

INCREMENTAL INNOVATION:

- Efficient floor plan with all infrastructure clustered along walls.

- Located in proximity to existing transit

- Ample community space in courtyard and roof to express other forms of incrementalism

- Use of affordable housing subsidies to offset cost and maintain affordability

- Intensive participatory process with contextual community

CRITIQUES:

- Smaller units have few possible configurations

- Offers parking despite TOD location

Conclusion

Conclusion

This thesis rests on a fundamental belief that cities should be affordable places that are representative of their inhabitants. The challenge of affordable housing and the sustainable creation of urban space are just two items on an extensive list of urban problems. As planners, these challenges are a call to action - a call to reconsider prevailing practices and devise innovative alternatives that enable a livable, equitable and sustainable futures for cities. With the right idealistic mindset, we can consider these challenges as opportunities to be reflective of past practices, critical of prevailing norms and imaginative about the possibilities of the future.

Many of the challenges cities face are rooted in scarcity despite a time of relative abundance. Over many centuries, cities have transformed from chaotic mangles of cow paths to streamlined industrial machines. The systems that uphold these urban spaces have produced climates of scarcity, taking the form of inequity, injustice, a lack of clean water, limited food access, ineffective transportation, inadequate wages, and insufficient housing all created by inequitable distributions of power.

As explored in the first chapter of this thesis, incremental housing has long been an architectural reaction to scarcity. Although incrementalism has typically been in informal typology, incrementalism was implemented in more formal ways in South America and Northern Europe in the 20th century. The scarcity communities faced motivated their need for shelter through the innovation of piecemeal and flexible construction. Scarcity provides a situation where not all requirements can be satisfied -- in this environment, inhabitants prioritized specific elements of the home resulting in a piecemeal approach to the construction process.

My research has suggested that in Europe, a complete building envelope was a priority given the colder climates and variable weather conditions. When the building envelope becomes the priority in a piecemeal construction process, incrementalism morphs into flexibility. Instead of continuously adding to the exterior of the building, the incremental changes are confined within the building. The structural system of the building is static, and the components that define and articulate the space are flexible. The role of climate, though always an influential role in the development of vernacular architecture, creates a decisive fissure in incrementalism - warmer climates allow for incremental construction on the exterior structure whereas colder climates require the additional changes to unfold within a building envelope.

This role of climate is further exemplified by the case studies explore in Part 2 of the thesis. Tel Aviv's warm, Mediterranean climate provides a situation where the changes at Chlenov 42 occur both within the building and around the exterior of the structure. This is in contrast to R50, located in a cold, German climate that requires a continuous building envelope uninterrupted by the incremental alterations. As a result of the importance of the continued building envelope, the changes and modifications occur on the interior.

Zoning, local policies and institutional systems play a pivotal role in any building project. The case studies for this project were explicitly chosen for their developed world contexts enabling the transfer of critiques and lessons to be more applicable to the development case in Somerville. Cities like Berlin, Tel Aviv and Hamilton all have complete design standards and active planning departments that ensure projects are delivered to the public in a complete and habitable form. Though further investigation on the requirements of the certificate of occupancy is relevant for continued investigation on the subject, the essentials include a completed exterior, kitchen, bathroom, electricity, plumbing and safety features. The reality of these requirements inform the conclusion that flexible building is more appropriate than incrementalism in cities with cold climates and strict regulatory environments.

Integral to the framing of this project was the culmination of research in a development typology as a response to the scarcity of housing and self-expression. In an age of scarcity, a strategy to combat prevailing practices of sprawling development is to create concentrations of resources - creating zones of abundance around transit nodes. Integral to the creation of these abundant urban zones is the densification of housing. Multifamily housing is the most practical avenue

to addressing a lack of affordable housing. Additionally, much of incrementalism's history, including Habracken's Open Design, required structural support systems for incrementalism to occur within.

Inherit to a system that empowers people to create their own environments is the redistribution of power. In all of the instances explored and created in this thesis is rests on the notion that people should have the freedom to build. By enabling people with an opportunity to construct their own homes, you encourage people to consider their priorities be it privacy, or kitchen size or closet space. This freedom allows the user to build an environment that best supports their circumstances enabled the personal or family unit to thrive in their home.

Flexibility and the inherit redistribution of power should also be considered on the neighborhood scale. Planning impacts environments by creating a framework that the built environment occurs within. The case studies I explored operate similarly by providing a structural system that enables users to develop and grow within. To enable an incremental environment on a larger scale the existing situation would need to be planned and built in a more flexible and malleable way. For instance, streets could be curbless allowing for opportunities to transform into festival sites; parks could have

moveable features that allow for the creation of alternative play spaces; commercial district could provide retail spaces allocated for pop up shops that enable local artists to garner traction with a following. In all of these examples, it requires the city to relinquish some control, a redistribution of power to the neighborhood and the people.

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