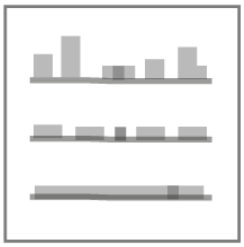
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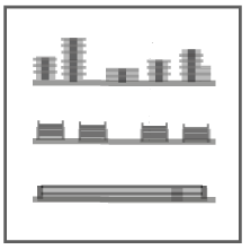
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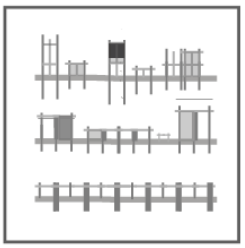
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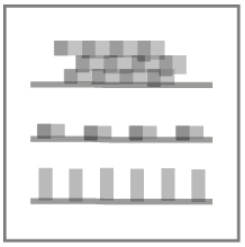
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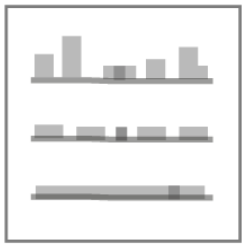
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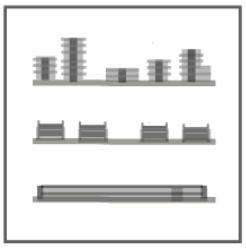
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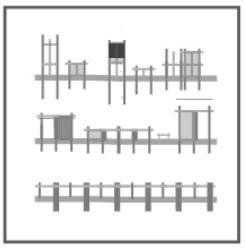
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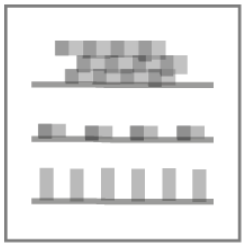
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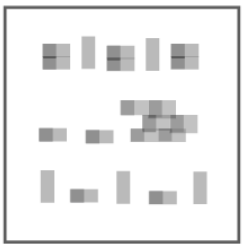
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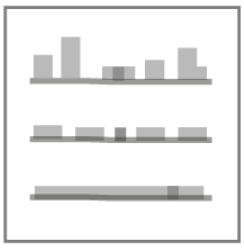
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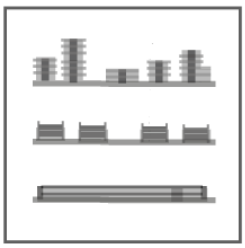
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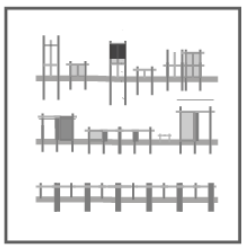
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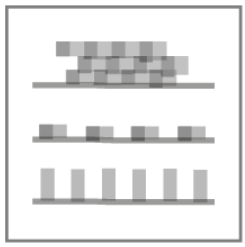
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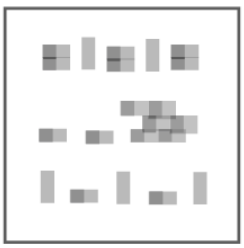
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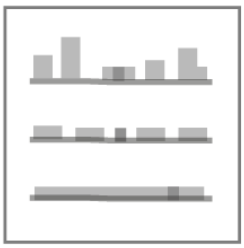
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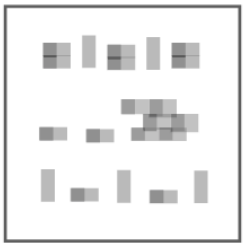
SMALL CHANGE

Incremental pattern of inhabitation in Midden-Delfland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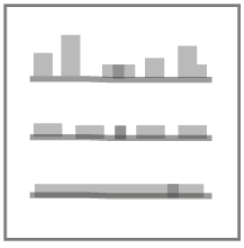
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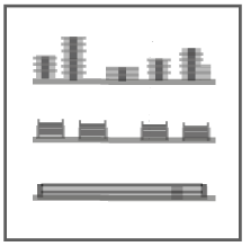
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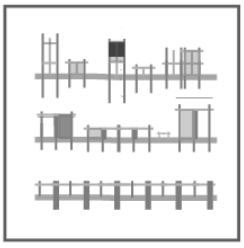
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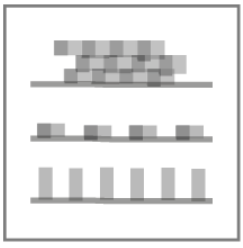
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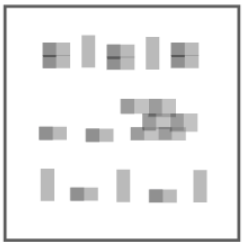
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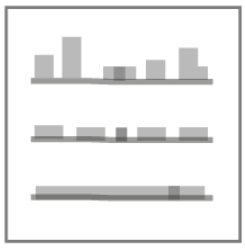
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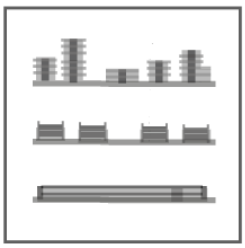
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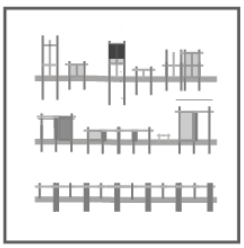
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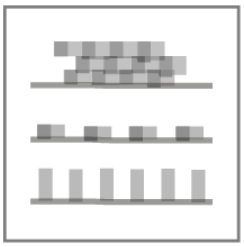
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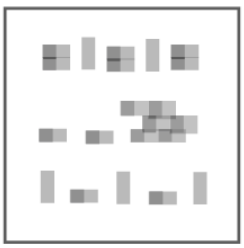
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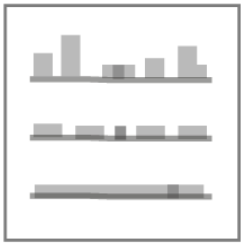
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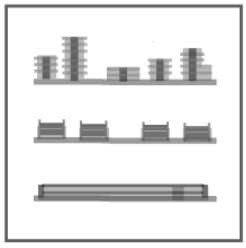
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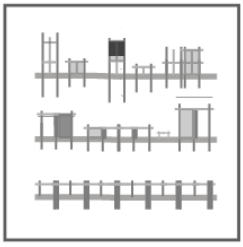
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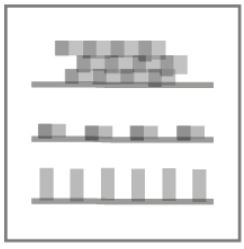
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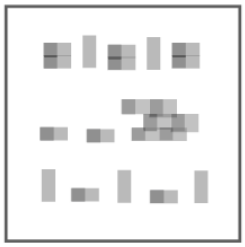

Typology Mix

CONTENTS

ABSTRACT

The report for Master Thesis in Graduation Studio Advanced Housing Design 2023/24 builds on research that was conducted in Honours Programme Master 2022/23 under guidance of Nelson Mota. I intend to include the gained knowledge as a part of theoretical framework, the integration of Honours Programme Master Research is explained in chapter “Theoretical Framework” as well as “Research Design”.

This research delves into the emergence of participatory design processes in Midden-Delfland, Netherlands. The design hypothesis posits that ZUS plan creates a great opportunity for affordable housing to emerge as an alternative to existing developments that cater to well-off members of the society. The complex socio-economic and historical context of Midden-Delfland, rapid urban growth, coupled with the array development plans, underscores the necessity to provide affordable housing. This research explores the concept of a community land trust cooperative capable of addressing the evolving needs of the inhabitants. Drawing inspiration from the successful participatory projects, this study employs a structured framework based on five fundamental tools: aggregation, variability, clustering, self-development, and support-infill. The aim is to propose a participation enabling process while addressing the need for inclusive and affordable housing in areas such as Midden-Delfland.

Keywords: Participation, self-help, affordable housing, incremental development

BACKGROUND

Housing Crisis and Environmental Impact of Urbanization

In many parts of the world, urbanization is occurring at an unprecedented rate.[1] This process often puts pressure on local governments and infrastructure to keep pace with the growing population. Nabeel Hamdi, Professor of Housing and Urban Development at Oxford Brookes University, known for his work in the field of participatory urban development and planning, claims that development is a chance for a positive change and yet it is inevitable. As a result, housing development does not keep up with the rate of population growth, exacerbating the housing crisis.[1] Environmental impact of urbanization, such as increased pollution and reduced green spaces, affects the livability of urban areas which results in limited housing choices and availability. Dutch cities not only have to deal with social pressure to deliver more housing, but also hard environmental conditions such as location below the sea level, flood risk, and land subsidence. Any built intervention must take these factors into consideration to provide future-proof, long-term solutions that can be obtained through means of proper collaboration, leading to a proper change. Hamdi underlines in his book, that big as well as small change is rooted in connections of agents that are dependent on each other.[2]

"We have learnt that development is ongoing, a process in which occasionally and from outside, some form of intervention is useful to open up opportunities, to facilitate access to resources, to act as a catalyst for change."[2]

To emphasize the importance of this thought, he refers to a photo by Peter Liversidge. (1)

Ever since 1960 and "First Memorandum for the Spatial Development of the Netherlands", Delfland is known for its intricate system of water management, including dikes, canals, and polders. Its history is closely tied to the Dutch struggle against water and the development of innovative techniques to reclaim land from the sea and rivers. However, it also is located in between expanding cities, Rotterdam, Den Haag and Delft which places it in the danger of urbanization. To address it, the policy memorandums of the past ten years build on the ambitions of the *National Buffer Zone and the Reconstruction*[3] and propose updating and supplementing parts. They comment on water management in connection with agriculture and nature however, little do they connect the need for developing housing with the sustainable plans, which has left Delfland in a paradox position for the past 60 years.

Figure 1 Photo by Peter Liversidge, 2012, Yorkshire Sculpture Park.

MIDDEN-DELFLAND AS A SPECIAL PROVINCINAL LANDSCAPE

Site introduction

CONSTRUCTING THE CONTEXT

Midden-Delfland as a Special Provincial Landscape

Midden-Delfland, situated in the Westland region within the province of South Holland (2) in the Netherlands, boasts a population of 19,414 as of 2021, spanning an area of 49.38 km2. Established in 2004 on the 1st of January, it resulted from the amalgamation of two former municipalities: Maasland, encompassing 24.42 km2, with 0.6 km2 being water and Schipluiden, covering an area of 30.00 km2, including 0.39 km2 of water.[4]

Midden-Delfland has great emotional and therefore economic value. Over the past fifty years, a lot of planning attention has been paid to the area to protect it, and a lot has been invested in the design of the landscape to make it more usable and accessible and to reduce the pain of major interventions, such as the construction of the A4. The landscape of Midden-Delfland is also unique due to its location. It is the most enclosed landscape in the Netherlands. In the middle of the cities, industry and greenhouse horticulture areas, a polder landscape has been spared that still has sufficient scale to be experienced as 'outside'. In order to preserve this original landscape, Midden-Delfland was designated as Special Provincial Landscape. This is a clear signal against future large-scale interventions in the area and it offers an opportunity to establish Midden-Delfland as a distinctive 'strong brand' and thus strengthen the economy of the area.[5]

Midden-Delfland has experienced a unique urbanization process characterized by a balance between urban development and the preservation of its rural and agricultural landscapes.[6] Concurrently, the municipality embarked on a trajectory of development plans spanning from the National Buffer Zone Plan in 1960 to the culmination of the Landscape as a location factor in the Rotterdam - The Hague Metropolitan Region Plan in 2016. Noteworthy among these is the ZUS Plan, distinguished by its innovative proposition of a new boezem system as a remedy to the issue of overflowing polders in Midden-Delfland. Despite the diverse programmatic elements woven into each proposal, a common thread of aspiration runs through them all – the seamless integration of urban fabrics and natural elements into the intricate tapestry of urban design. While one may engage in discourse regarding the extent to which the urban fabric is authentically contemplated within these plans, an indisputable hallmark is preserving the rural landscape.[6]

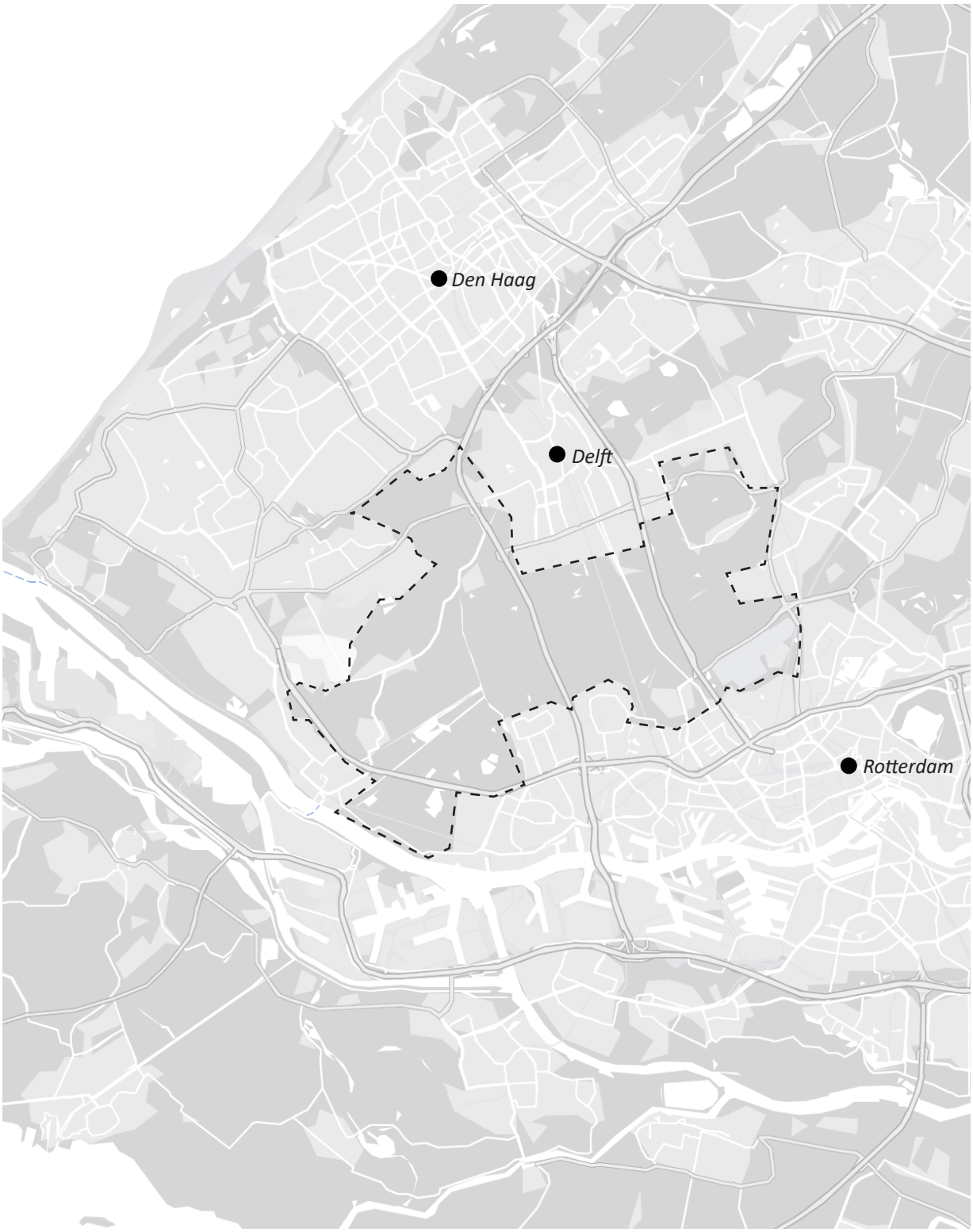


Figure 2 The location of Midden-Delfland.

National Buffer Zone, 1960

Together with Spaarnwoude, Midden-Delfland was the first area to be designated as a national buffer zone in the 'First Memorandum for the Spatial Development of the Netherlands' in 1960. (3) The purpose of this designation was to ensure that in the increasing urbanization of the Randstad, these green areas would retain a utility function for recreation, nature and agriculture. The government wanted to preserve the clear contrasts between city and rural landscape in these areas. Looking back, we can say that the status of the National Buffer Zone - which also extended east of the A13 - has saved the polder landscape of Midden-Delfland from large-scale housing construction and extensive expansion of greenhouse horticulture. In 2011, when the Structural Vision for Infrastructure and Spatial Planning was adopted, the government's plans for protection of all ten designated national buffer zones was abolished. The designation as a National Buffer Zone and the implementation of the landscape design of the Reconstruction Act have ensured that the landscape of Midden-Delfland has become what it is today. The objective of the National Buffer Zone to create a clear contrast between city and country has been achieved. The Reconstruction plan was carried out with great consistency and perseverance for thirty years. It has established land use zoning and a network of recreational facilities: forest and recreational areas and cycle paths.[7]

Landscape as a location factor in the Rotterdam-The Hague, 2016

With the Hollandse Banen plan, the Metropolitan Region aims to improve the recreational coherence between city and landscape by constructing a continuous system of regional cycle paths, which has a high degree of logic and recognisability in terms of tracing and profile. This makes it inviting for city residents to enter the landscape and connects different metropolitan landscapes.[8]

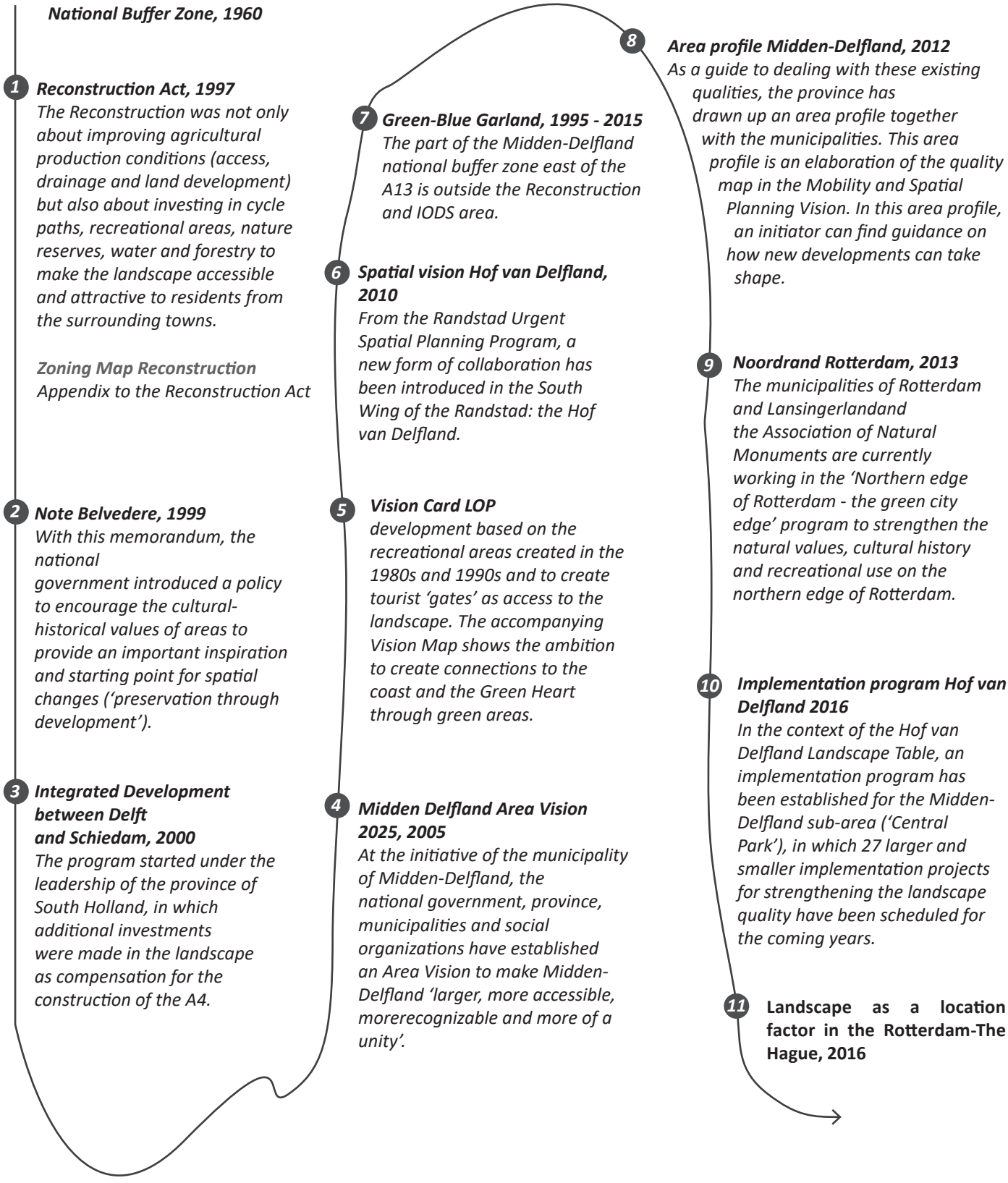


Figure 3 Plan of the National Buffer Zone.

THE CASE FOR THE PROTOTYPE VILLAGE: DE ZWETH

The meaning of De Zweth in Midden-Delfland

De Zweth

In the past, De Zweth boasted a state of relative prosperity, its community thriving. However, post 1940s it witnessed a decline in the local catering industry, prompting a mass exodus of residents to the city.[9]

In 1995, a pivotal moment in the village's evolution unfolded with the construction of the Kandelaar Bridge on the Schie river. Despite its beautiful polder landscape, contemporary De Zweth has a modest and exclusive program.[9]

However, the vision encapsulated in the ZUS Plan promises a transformative narrative. It envisions De Zweth as the nucleus of two distinct zones [10], coupled with an intersection for the main boezem canals. This plan not only suggests a chance for economic improvement but also sees the village as a place to try out a new way of working with the environment, especially the Schie river.
Thus, the forthcoming chapters in De Zweth's narrative hold the promise of revitalization, steering its trajectory toward a harmonious blend of new ecology and, wherein the Schie river becomes an integral facet of the community's renewed identity and sustainable development. The river that goes across the village is so important because beyond its aesthetic appeal, the Schie serves as a practical component of Midden-Delfland's that could become a mean of transportation. It may contribute to flourishment of new work sectors such as tourism or water farming, playing a role in revitalization of De Zweth maintaining the polder landscape.[11]

The prototype village

There is a lot of scattered developments in Midden-Delfland (5), De Zweth being one of them. They are predominantly characterized by low-rise, single-family housing mixed with amenities. These dwellings are often isolated from the surrounding cities, Rotterdam, Den Haag and Delft therefore, the inhabitants of a prototype village are either retired or owe a car in order to travel to the city where they are hired and have access to numerous amenities. Due to the elderly age of the residents there is also little to no opportunity for developing new work sectors to be able to invite the younger generation and start economical revitalization of the area. On the top of it, the dwelling is privately owned market housing and doesn't leave any avenue for affordable housing. As follows, this contributes to the exclusive nature of these settlements that only embraces the gap between people and accessible housing.

On the other hand, such settlements (4) have great potential to become reservoir areas that merge the sustainable polder landscape with urban fabric in a non-invasive way. As the research will show, they should be seen as a nucleus for processes that allow growth of prototype villages into sustainable and equal ecologies that do not only prosper in Midden-Delfland but also in the entire Netherlands.

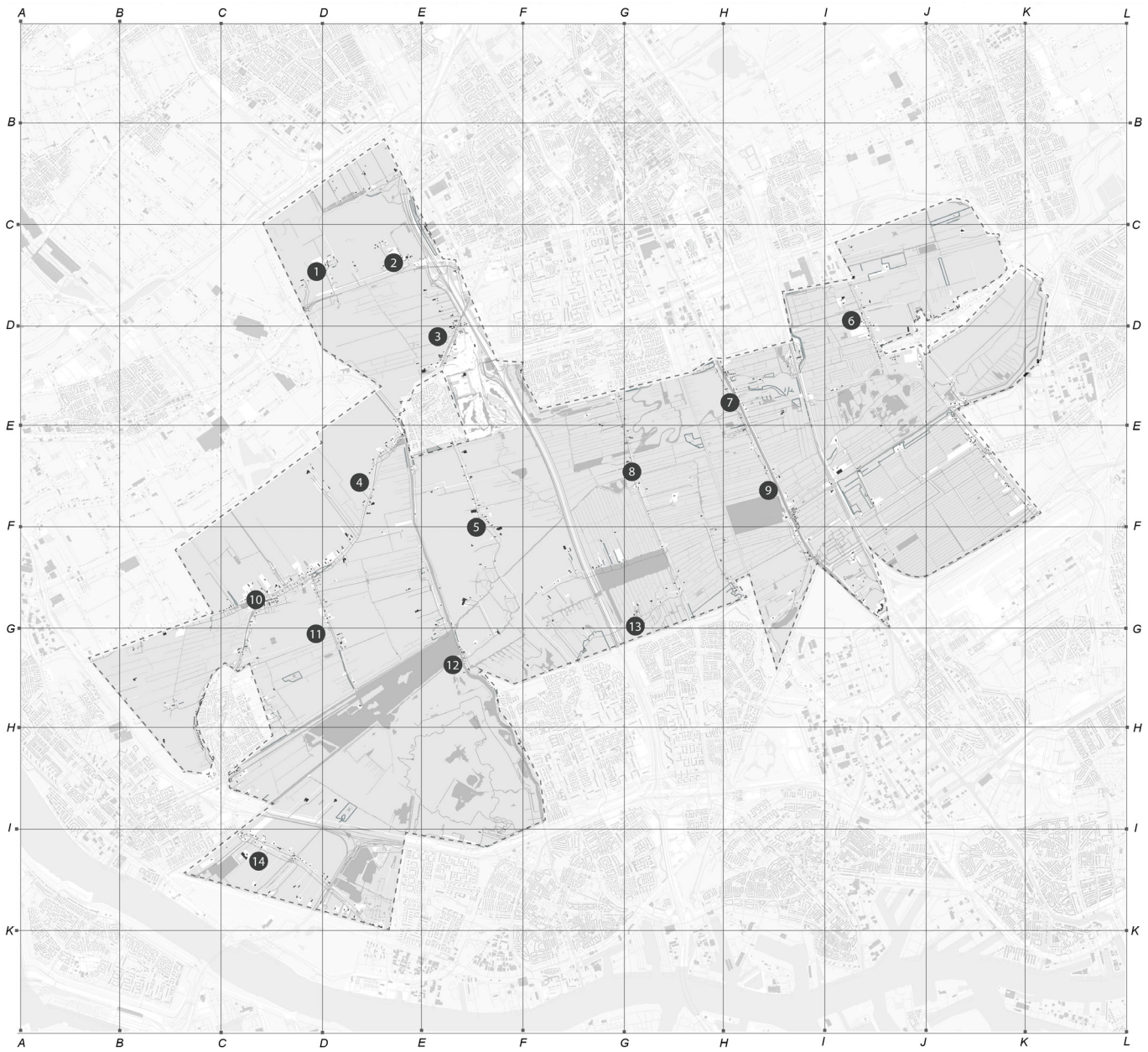


Figure 4 Midden-Delfland map.

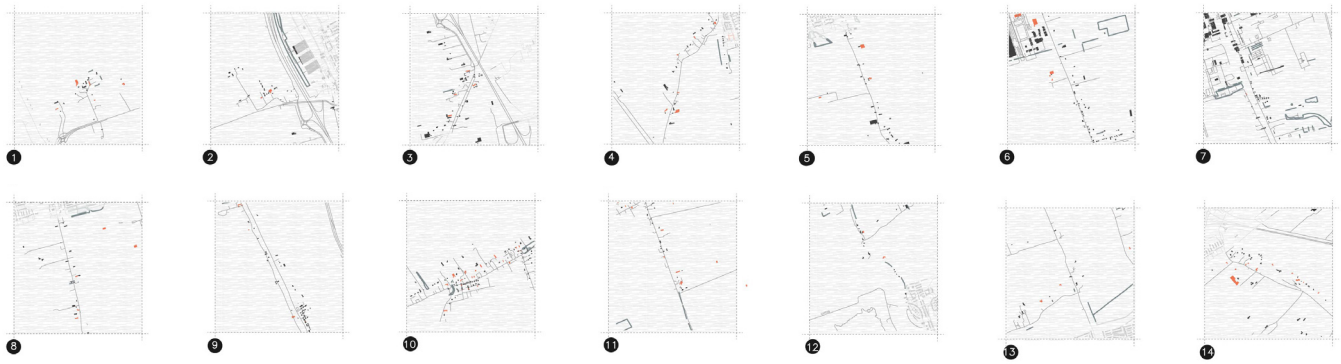
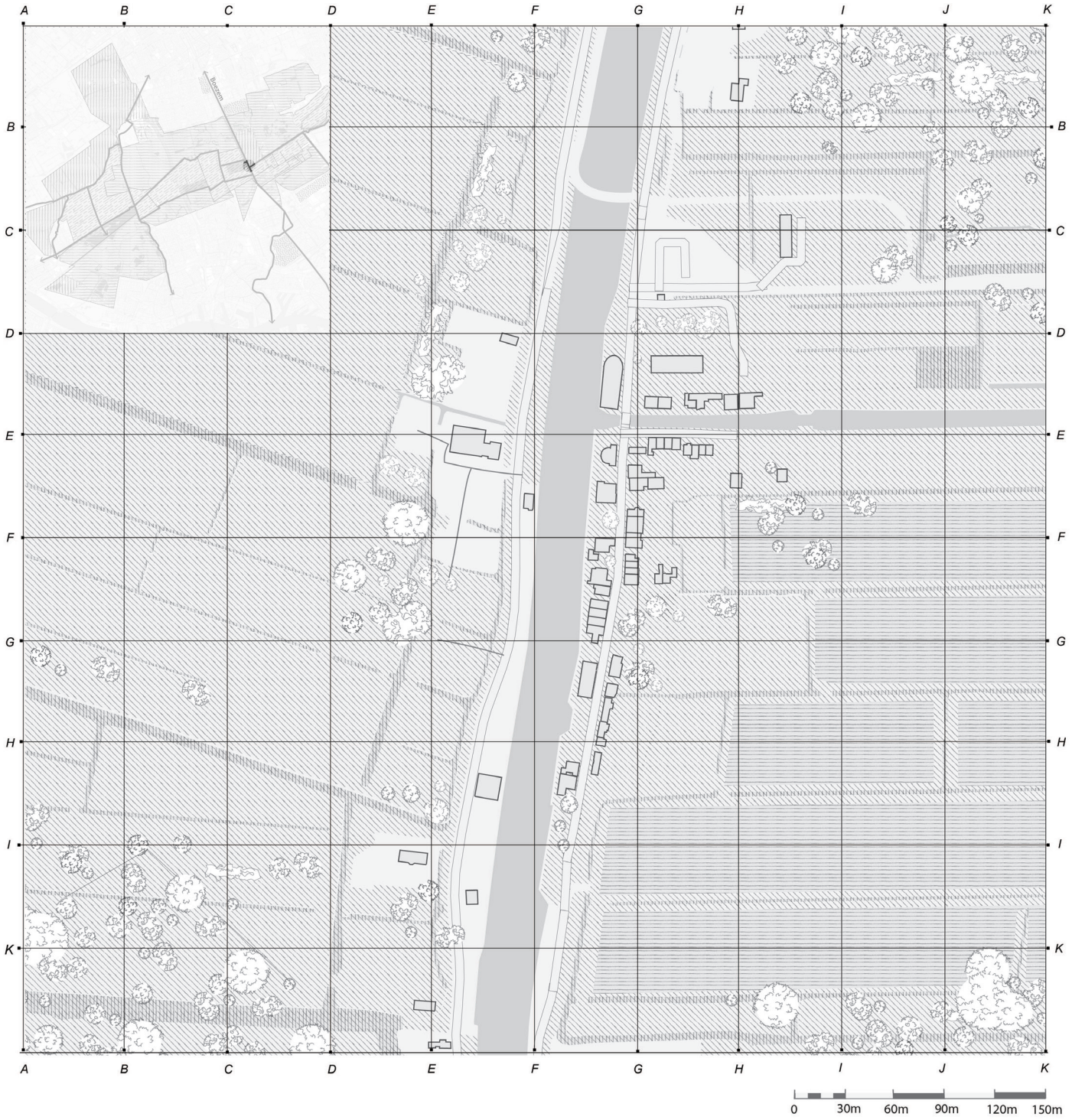


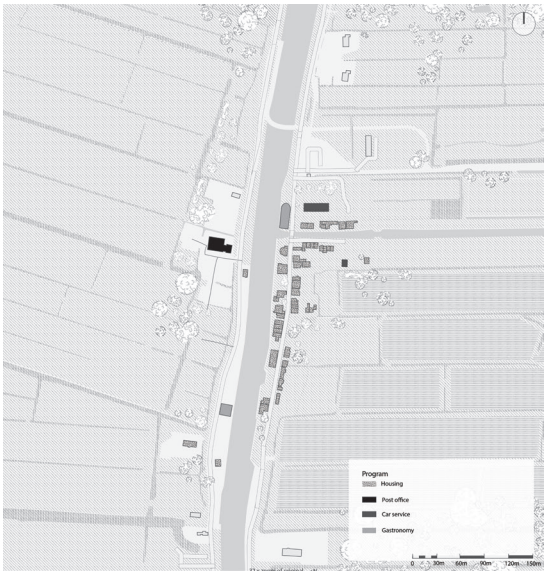
Figure 5 Prototype villages in Midden-Delfland.



As of January 2024, the current state of the occupation is based on Google Earth Pro satellite imagery. However, accurately mapping the state of housing is possible due municipality information found online.

buildable area	**2500 m²**	households with more than 2 members	**70%**
number of inhabitants	**150**	current density	**21 units/km**
number of households	**52**	average unit size	**100m²**
average age of an inhabitant	**40 years old**	current floor space index FSI	**0.75**
average income	**2100 - 4300**	current ground space index GSI	**0.24**

Current state, in 2023.



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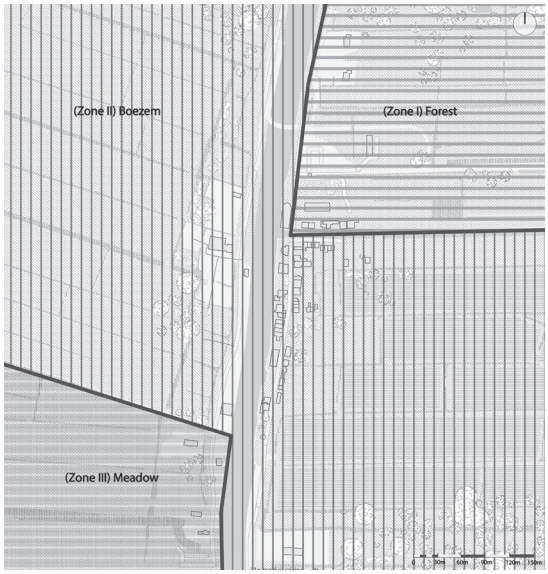
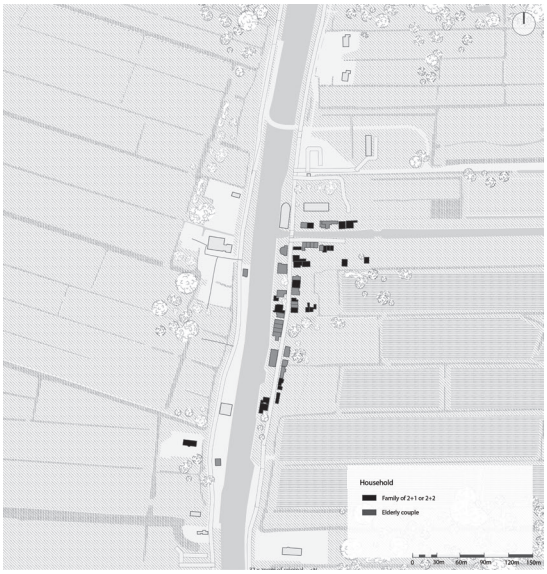
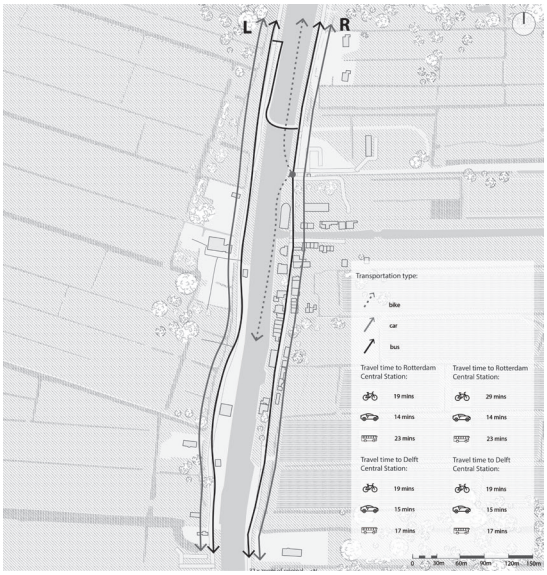


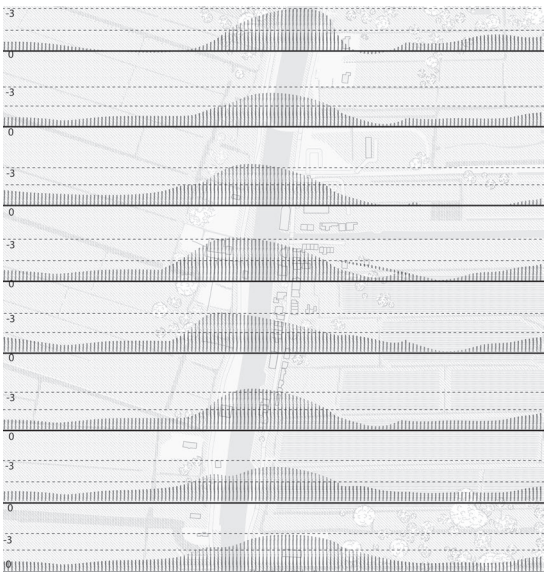
ZUS Plan zones



Household types



Accessiblity



Heights

THE CASE FOR ZUS PLAN

Reimagination of the future of Midden-Delfland

Essentially, the ZUS Plan is a zoning plan that serves as an underlay for the new “National Productive Park Delfland” will service the surrounding urban areas in various ways. (6) Based on the soil morphology, several zones for different type of production and innovative land use are assigned. The various morphologies and typologies in the landscape form the basis for the land use and will result in a waterbuffer and filter, new forms of agriculture and nature preservation, while the area is maintaining its recreative use. [12]

The project envisions a casco, based on the existing boezem-system to relieve the boezem-system from water during peaks, and inverse its traditional purpose so that it can feed the buffered water back to the city during droughts. All low polders adjacent to the Boezem Canal will be designed in such a way that they can collect the water in times of heavy rainfall. (7) At specific locations along the canal, the dike will be lowered so that water can flow to the surrounding low-lying polders. The landscape casco and landuse is determined by the topography and morphology to create floodable areas around the boezems. Next to the floodable areas are the ‘movement’ zones. Within these zones there can be different functions, based on the morphology of the site, that demand innovative living to anticipate and mitigate predicted problems. Thus, creating a casco within a casco. Instead of making the landscape suitable for the land use, we start from the soil and adapt the land use accordingly. This could be a wetland in the peat area, a production forest on the clay and new forms of natural agriculture on both soil types. [13]

The aim is to create an attractive landscape park in which various functions are integrated. There are recreational routes that connect city and park. Important cultural-historical elements are preserved in the park like old villages, churches etc. The park plays an important role in purifying household wastewater, retaining rainwater and by 2100 providing clean drinking water, food production, and a forest for the storage of CO2 and the production of circular building materials. During peak rainfall the park keeps surrounding urban ar-eas dry and provides water for a livable city in drier times, by adjusting the boezem-system. The housing assignment is an integral part of the development of the National Productive Park Delfland. Mixed use developments will be located on the edges of the park and form an attractive façade towards the park. Rotterdam and Delft both can expand in this way with a metropolitan frontier facing the National Productive Park Delfland. The National Productive Park Delfland build upon traditional landscape methods that the Netherlands has known for ages, adapting them to the needs of the future, acknowledging the logic of the existing soil layers. [14]

Figure 6 ZUS Plan.

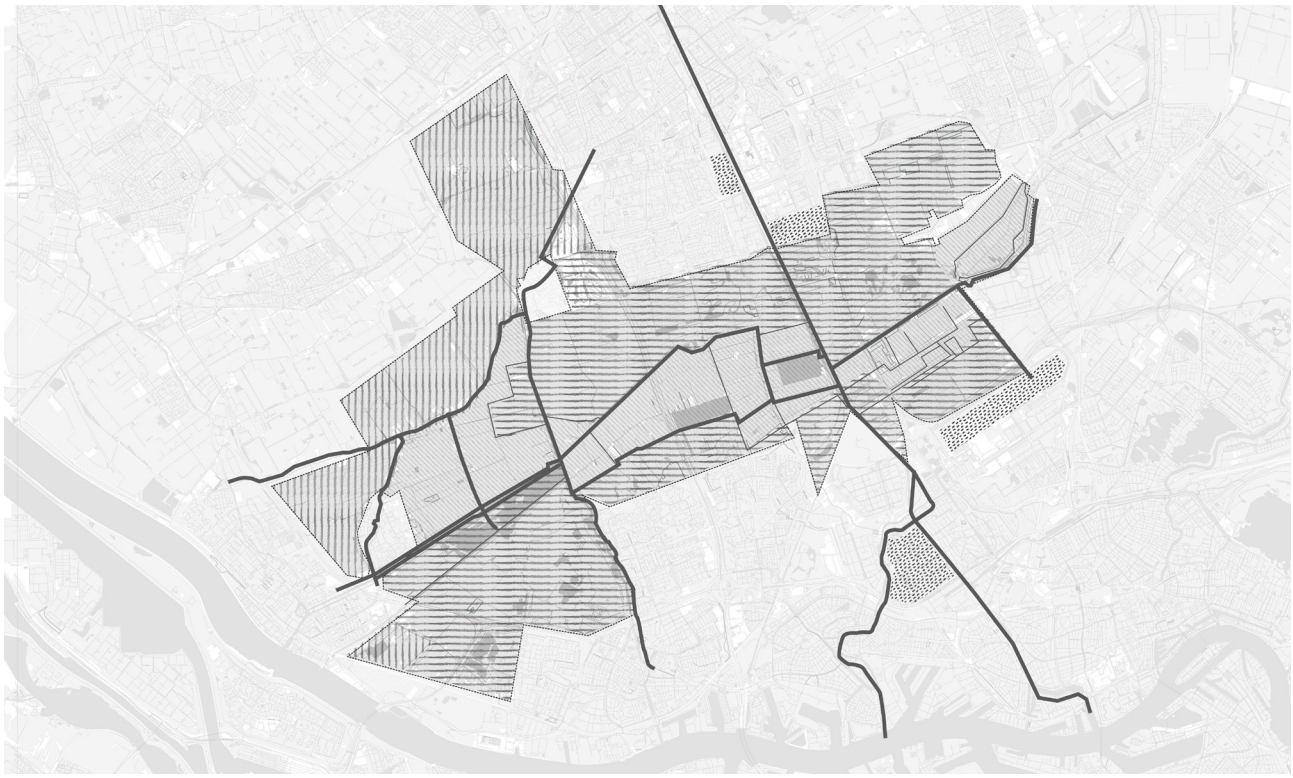


Figure 7 ZUS Plan analysis.

GLOBAL PROBLEM

Affordable Housing and Social Housing

Following a surge in house prices during the pandemic, Dutch real estate prices have experienced a decline in 2023, marking the first such occurrence in several years. However, the situation in June 2023 presents a nuanced narrative. As reported by CBS, house prices increased by 0.2 percent compared to May and raised by 1.5 percent compared to April. When contrasted with the market's lowest point in June 2013, prices in the last month were significantly elevated, surpassing 87%. This clearly indicates a growing challenge to afford or rent housing. Meanwhile, there are about three million rented homes provided by the social housing sector and the private or non-subsidized sector in the Netherlands. About 75% of them are owned by housing associations, and about 3.3 million of them are in Rotterdam. [15]

"Affordable housing" encompasses various housing systems designed for individuals with limited financial resources, "social housing" (8) being one of these systems. However, does being "affordable" truly equate to being "social"? If the idea of social housing was created to prioritizes the welfare of the people, then the existing social housing may warrant a different label as it frequently falls short of meeting residents' needs.

In theory, housing associations are responsible for the quality of life in social housing. They prevent crime, help organize street parties and other activities and provide money for play areas and sports facilities. The quality of life in a neighborhood is also strengthened by the construction of schools and community centers. [16]

In practice, people living in the poorest neighborhoods are three times as likely to face difficulties with their neighbors as the average person. One in five worry they will be robbed or hassled. That is to show that, the concentration of people who need help and support is even greater than expected. The number of vulnerable groups is increasing sharply. More and more people with different social problems live together in the same neighborhood, which requires an integrated approach. "Individual interventions no longer have any effect. [17] The band-aid phase is over". As better-off households leave problem areas, they are replaced by people on very low incomes, further exacerbating the problems. [17] The policy of care in the community has also increased the number of people with psychological issues living in social housing. As follows, local authorities should ensure that their housing policies create mixed neighborhoods. [18]

So here come the questions of how, when and who do we include?

There are two ways to approach it, first is to improve the current top-down system or second, create an alternative to it. I take the stand that even if the current system improves it still won't be future-proof due to growing housing prices and environmental impact of urbanization.

Figure 8 Social housing, Rotterdam.

SPECIFIC PROBLEM

Ownership

Ownership analysis shows (9) that 90% of housing in the area of Delfland is rented and target audience does not include people of low income.[19] These people are offered social housing instead; a model where predefined design is delivered to people who are most in need for accommodation. As follows, there is a big overlap between what is assumed that the user needs and what is actually needed. In the book *Production of Houses* Christopher Alexander, a pioneer of self-help housing, explains that these needs differ per household in the greatest detail and therefore, cannot be assembled systematically by site workers, but rather emerge through a process. Following the trilogy of the author, completed in 1977 and The First Participatory Design Conference in 1990, many theorists acknowledged that collaboration with users can improve the quality of housing opposing the ignorant processes that wouldn't include user intake such as the early sites and services proposals that were so criticized by Charles Correa and Balkrishna Vithaldas Doshi.[21] Many concluded that the collaboration of users, architects, and authorities leads to a timeless way of design that is "a public policy concern, since it can provide significant benefits for low-income families and the community as a whole, such as improvements in the safety and health of the beneficiary households" (Greene & Rojas, 2008, p. 94).

"Standard components, attached by standard connections are assembled by workers and crane operators, who know nothing about the houses, have no feeling about what is going to happen in them, and cannot possibly adapt the details of construction to fit the needs of the inhabitants."[20]

The connection between the inhabitant and architect must enable remote collaboration with essential advice that guides each step of the incremental process long after the architect is gone from the building site. Henry Sanoff continues this thought, by pointing out that radical planning methods such as master or development plans take too long to cultivate, demand substantial resources to implement, and are of no benefit to the poor majority of urban populations. Therefore, the author highlights the need for smaller-scale participation and advocates for various participatory methods by saying "Good practice hinges on effective communication. A large part of that involves listening, and, importantly, being understood as one who wants to listen" (Sanoff H., 2018, p.8.).

Parallel to that debate appears the question: How can participatory design contribute to the future-proof development of Delfland?

After all, participatory projects are more likely erected in the Global South where people are far way more economically disadvantaged. Building a house with their own hands is a necessity, not a possibility, and climate conditions are more challenging. All that considered, participatory design may collapse rather quickly in the area of Delfland where the needs of inhabitants are rather different from what is needed in the Global South.

Rent models

Cost rent model

Rent is based on the cost of building maintenance and land use therefor, the rent does not depend on the market prices and cannot be increased.

Rent to buy

Tenants pay rent each month and a portion of those payments can count toward down payment to buy the property. This option is for buyers who do not have good credit score and cannot afford paying the mortgage.

Intermediate rent

Future inhabitants built the houses and the complete mortgage will be split on every inhabitant to build more efficient. To avoid speculation fixed prices can be included, with only rising house prices for inflation and a set percentage of profit (for example: 5%). [22]

Ownership models

Freehold

In a freehold ownership model, individuals or entities own the land and the property on it outright. They have full control over the property and can make decisions about it without many restrictions.

Leasehold

In a leasehold ownership model, the property owner owns the land, and the homeowner (leaseholder) owns the building on it. The homeowner pays an annual lease fee to the landowner, and this arrangement can extend for a long period, often up to 99 years.

Self-help

Residents have direct involvement in the physical aspects of housing, often during construction, renovation, or maintenance. The design is prepared together with the inhabitants however, they do not have the governance power like in the case of self-development.

Social housing

The building is owned by a housing association. Tenants can rent under condition their common income is less than € 44.035 (one-person household) or € 48.625 (multi-person household). A tenant can also buy a flat or house from the housing sector. [23]

Non-profit housing

The building is owned by a non-profit organization which leases the land for plot for the municipality. Municipality still is the land owner of the plot.

Cohousing

While residents maintain private ownership of their dwelling, they share common spaces and collectively decide about community rules, maintenance, and shared resources.

Cooperative

Members of a housing cooperative collectively own the entire property through shares in the cooperative corporation. The cooperative entity owns the building(s) and land.

Self-development

Residents participate in decision-making, governance, policy development, and community well-being, beyond building with their own hands. It is an elaborated version of self-help housing. [24]

Figure 9 Rent models and collective housing models in Europe.

RESEARCH QUESTION

The research question intends to investigate how certain participatory methods in post-occupancy development could decrease building costs as well as potentially become source of income.

Can user involvement in the building process make housing more affordable?

Can a **participatory** proce
pattern of inhabitation in th

Could inhabitants of midden-delfland earn income with housing?

ess become an **affordable**
ne **Midden-Delfland**?

Can post-occupancy housing development decrease building costs?

THEORETICAL FRAMEWORK

Honours Programme Master Research

Participation in Honours Programme Master 2022/2023 allowed me to expand my knowledge on participatory methods through creation of research paper "Toolkit Models". The paper that was formulated under supervision of Nelson Mota presents 4 toolkit types (4) and 5 tools for post-occupancy development that sees housing as a process, an alternative to "cookie-cutter" approach in the current social housing. In the research paper I will introduce relevant participatory approaches: self-help, aided self-help, self-development and support and infill. These approaches involve user participation during various stages of the process, resulting in different tools. As follows decision-making power of user fluctuates therefor, it is important to understand what tasks and how much freedom a user holds in each of the 4 approaches. I will explain this matter below.

(Aided) Self-help

Self-help approach allows most agency to the user. The idea of participation emerged alongside the boom of the worldwide DIY concept in the 50s.[25] On one hand, many rebel against designing for predefined essentials.[26] Others, like Christopher Alexander, opt for automatization of the building process in self-help.[27] In 1964 UN-Nation develops Manual on Self-Help Housing, in which they describe the participatory process for self-help, including analysis of user interviews, as a crucial point in the manual. One of the most crucial aspects of that work is the questionnaires which selected families part took in. Architects try to understand people's desires by formulating user profiles or maps[27] and utilizing them to raise people's ability in rationalization and articulation of their needs properly to create a "reasonable customer"[28] [29] whose wantings shall be materialized in a form of facilities in the spirit of Scandinavian Functionalism.[30] [31] Nils Ole Lund emphasizes users' individuality by creating multiple possibilities of personalization in a handbook (4) as a part of a proposal for the residential district in Skjetten.[32] At the same time, Cedric Price advocates for family member profiles to alter the flexibility of housing units which is supported by prefabricated construction providing a catalog of possibilities for user's selection in Supplement 5.[33]

Support and infill

Contrastingly, support-infill approach takes upon pro-active role on the architect's site. Users are invited to design within predefined frame, which gives them less agency. Dutch architects, like Frans van der Werf, Gramersbacher, and Schneider manifest ideas similar to support and infill, they put focus on heterogeneous typologies that involve different scales of participation varying from drawing together with the user[34], to Open Building approach.[35] [36] John Habraken expands the concept by adding "infill", to the necessary structure that is the "support". British architects, build upon this idea and propose a support-infill that involves assembly kits. In 1967, Nick Wilkinson and Nabeel Hamdi as a part of GLC unveil PSSHAK (Primary Support System and Housing Assembly Kits), propose a manual for system of prefabricated version of support-infill approach developed by Habraken. Two schemes were built using this method, Adelaide Road, Camden, and Stamford Hill, Hackney.[37] On the other hand, in Germany, there is the focus primarily on the structural aspect of kits that emerged from the

architecture of the XIII century. May and Wagner, to name a few, undertook various experiments that manifested in a series of projects, essays, model houses, and Siedlungen. They followed two different categories of industrial logic: First, a flexible Assembly Line, and second Construction Kit[38] [39] as means for industrialization of modular elements to build fast and easily as a response to the housing shortage.

Self-Development

Self-development approach focuses on ownership laws that emancipate user's right to rent or buy property affordably. It is done on a "big", as well as, "small scale". While "small scale" solutions represent a version of support-infill approach which focuses on space diversification of a unit, "big scale" solutions resolve the issue on a community management level resulting in, for instance, cooperative cohousing projects where residents share ownership of the entire property.[40] [41] As follows, self-development approach gives the managerial power to the user mostly after the design process. One of the support-infill take on the issue is Experimental Housing Project, an idea developed by as a response to a number of problems related to "right of use" laws that Japan was facing in the 80s. The government called for a manual that describes the basic principles and methods of mobilizing human and technical resources for self-help housing. This is complementary to the "Tsukuba Method" which began in 1995 and was led by Hideki Kobayashi, who developed a manual for moveable partitioning and storage systems that allow residents to alter their living environments themselves. Both notions were inspired by the support-infill approach however, the leading thoughts were more concerned about the ownership of the flat. A "big scale" approach was taken by Spanish architects, in 2018 studio Lacol designed a cooperative cohousing focusing on passive energy solutions to reduce the overall costs of units. This and many other initiatives such as La Balma or La Diversa are the outcome of collaboration between the community, designers, and the government leading to right-to-use cooperatives.[42]

METHODOLOGY

a) Methodology

The preliminary research method is a comparative analysis of case studies (10) to find out key participatory methods in the context of affordability. A study that focuses on participation enabling tools that allow post-occupancy development, a change. Such a process allows the extraction of general tools to create a specific process for participatory design in the Delfland context. The methodology comprises two distinct phases: tool identification and assessment of its applicability. Initially, in pursuit of a more impartial approach, the selection of a tool is determined through a comparative analysis involving two case studies. This ensures that the tool possesses a level of universality rather than being a singular characteristic of a particular case study. To render a meaningful comparison between two processes, they must be contextualized within the same participatory approach, encompassing options such as support and infill, self-help, aided self-help, and self-development. Furthermore, the paired case studies should originate from analogous circumstances, including corresponding social, political, and economic backgrounds. A misalignment, such as comparing a housing project in a prosperous, developed nation with one in an impoverished, underdeveloped setting, would compromise the integrity of the entire experiment.

Research methods:

- Comparative analysis by difference
- Qualitative typology research
- Structured interviews

b) Method

After identifying the tool, a mechanism is required to check its validity. To achieve this, the tools will be implemented in the design project created in the Advanced Housing Design Graduation Studio. This will result in three different outcomes for the tool: the tool is applied successfully within the project's process, that the definition is weakened in the case that the tool needs alteration to the legal, social and economic context in the Netherlands.

Alternatively, the definition may be expanded to incorporate any nuanced insights that the specific Dutch context might offer, enriching the discourse with what was previously overlooked. The ultimate objective is to curate a set of participatory tools, potentially refined or redefined, that collectively constitute a comprehensive toolkit. This toolkit is envisioned to serve as a guiding resource for future architects in participatory design processes that effectively involve local users, particularly in situations where the architectural context may be unfamiliar to the architect. Although the process is case specific, the general concept aims to be implemented globally.

This approach was inspired by manuals for self-help housing that emerged in the 80s. While, most influential was Self-Help Manual by United Nations that taught me how to read and create participation driven toolkits, Skjettenbyen's Handbook made by Niels Ole Lund for Skjetten Town in Oslo, was great inspiration of scope of information that should be included in the toolkits for incremental process.

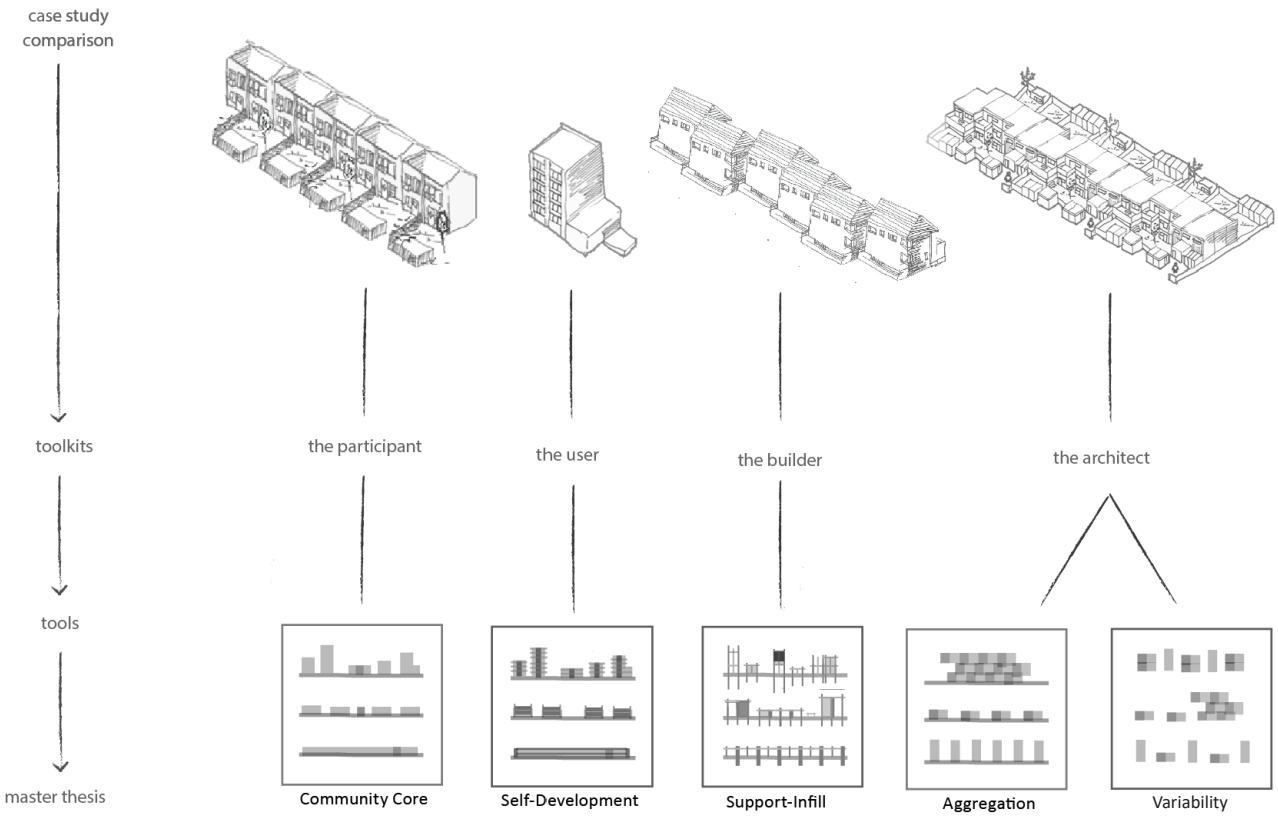
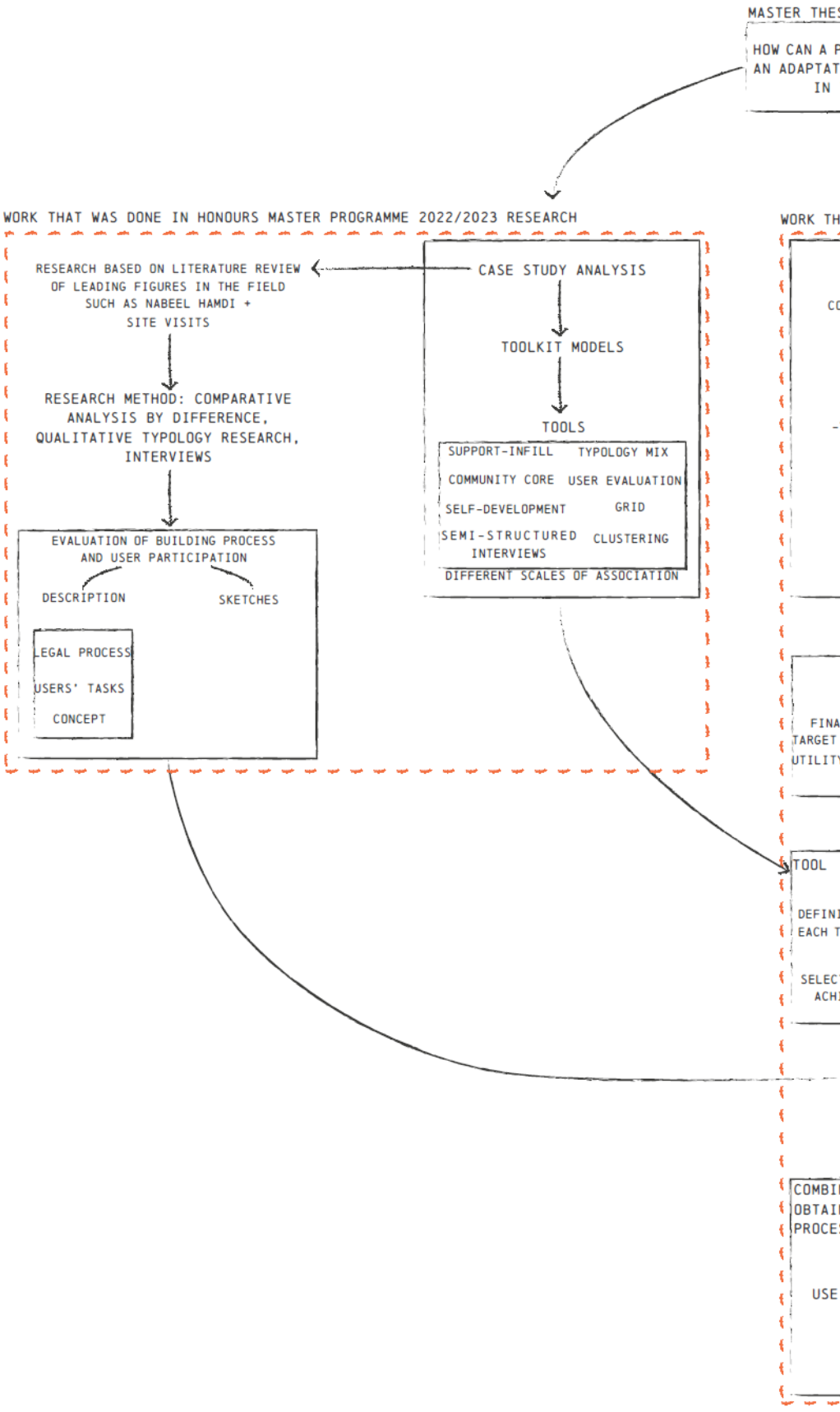
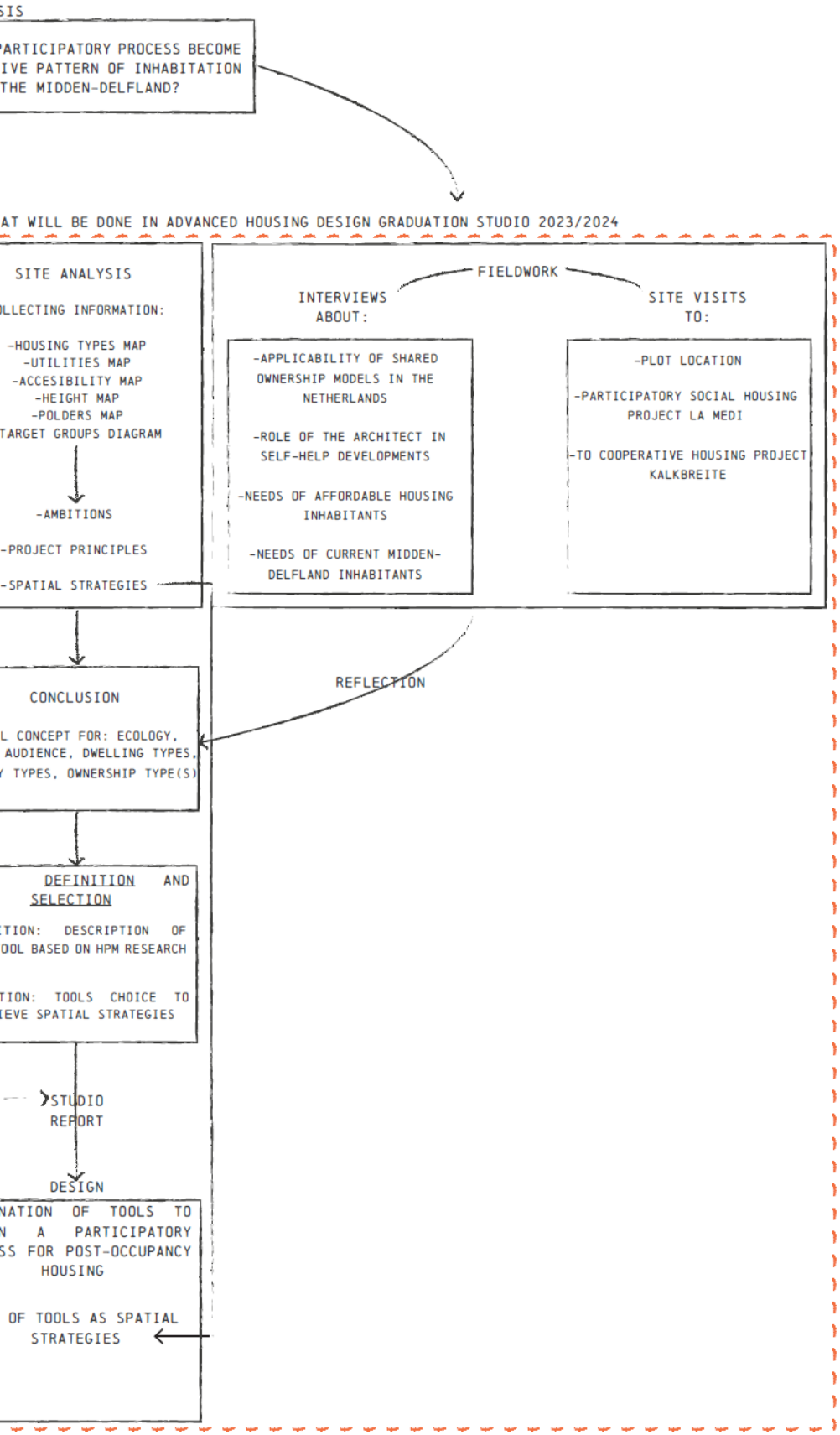


Figure 10 Toolkits and tools.

RESEARCH DESIGN




SIS
PARTICIPATORY PROCESS BECOME
IVE PATTERN OF INHABITATION
THE MIDDEN-DELFLAND?
AT WILL BE DONE IN ADVANCED HOUSING DESIGN GRADUATION STUDIO 2023/2024
SITE ANALYSIS
OLLECTING INFORMATION:
-HOUSING TYPES MAP
-UTILITIES MAP
-ACCESIBILITY MAP
-HEIGHT MAP
-POLDERS MAP
TARGET GROUPS DIAGRAM
-AMBITIONS
-PROJECT PRINCIPLES
-SPATIAL STRATEGIES
FIELDWORK
INTERVIEWS ABOUT:
-APPLICABILITY OF SHARED OWNERSHIP MODELS IN THE NETHERLANDS
-ROLE OF THE ARCHITECT IN SELF-HELP DEVELOPMENTS
-NEEDS OF AFFORDABLE HOUSING INHABITANTS
-NEEDS OF CURRENT MIDDEN-DELFLAND INHABITANTS
SITE VISITS TO:
-PLOT LOCATION
-PARTICIPATORY SOCIAL HOUSING PROJECT LA MEDI
-TO COOPERATIVE HOUSING PROJECT KALKBREITE
REFLECTION
CONCLUSION
L CONCEPT FOR: ECOLOGY,
AUDIENCE, DWELLING TYPES,
Y TYPES, OWNERSHIP TYPE(S)
DEFINITION AND SELECTION
TION: DESCRIPTION OF
OOL BASED ON HPM RESEARCH
TION: TOOLS CHOICE TO
IEVE SPATIAL STRATEGIES
STUDIO REPORT
DESIGN
NATION OF TOOLS TO
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SS FOR POST-OCCUPANCY
HOUSING
OF TOOLS AS SPATIAL
STRATEGIES

RESEARCH AIM AND RELEVANCE

Why bother with a self-help participatory toolkit?

Aim

The aim is to formulate a possible participatory process in Delfland that decreases current dwelling prices. Adaptive design, an alternative to current social housing which does not meet residents' needs. The proposal should be a part of the ecology bridging the necessity of affordable dwelling with sustainable solutions that protect and embrace the current natural habitat of Delfland on the basis of incremental growth.

Relevance

1. Legal support

In recent years, the Dutch government has shown interest in supporting self-help housing initiatives through various policies and subsidies. (11) These subsidies not only create legal foundation for self-help projects, but also show the necessity for them. As for this current moment there are 3 main laws which support self-help projects: Cooperative Housing Stimulus (Woningbouwimpuls), Stimulating Cooperative Housing Development (Stimuleringsfonds Volkshuisvesting Nederlandse Gemeenten), and Community Land Trusts (CLT). While, Woningbouwimpuls supports the development of cooperative housing initiatives by funding, SVn does not only that but also provides loans to cooperatives and other community housing initiatives. These loans are often used to facilitate the acquisition of land, construction, and development of housing projects.

The terms of the loans are designed to be flexible and supportive of cooperative initiatives. Lastly, Community Land Trusts are organizations that acquire and hold land in trust to provide affordable and sustainable housing options. They often collaborate with cooperatives to develop and manage housing projects. That is to show that self-help approach receives strong support from the government.

Active self-help organizations in the Netherlands

Cooperative Housing Stimulus (Woningbouwimpuls)

Stimulating Cooperative Housing Development (Stimuleringsfonds Volkshuisvesting Nederlandse Gemeenten)

Community Land Trusts

Binding incentives that support self-help initiatives

Wooncoöperaties

In cooperatives, the users share the ownership of the building and part-time in the decision making process.To join a cooperative in the Netherlands, one must meet certian (low) income levels, and residency requirements. The residents do not build the dwelling, they only manage and inhibit.

Collective private comissioning

The CPC group needs to establish a legal entity that represents them as a collective. This could be a housing cooperative. While the residents initiete the start of the project, they must hire professionals, such as architects, to collaborate with them and apply for building permit. the residents own units separetly, which is the biggest difference between this cpc and cooperatives.

Bouwgroepen

Bouwgroepen are the marrying of cooperatives and cpc which makes it the ultimate self-development scheme. the residents design, build as well as manage the dwelling. on the top of it, bouwgropen is a legal entity on the contrast to cpc, which needs a legal represntation.

Figure 11 Non profit housing organizations in the Netherlands.

2. Community Support

Moreover, there are communities who actively participate in self-help housing. Having such communities provides support from the people and an opportunity to involve them in the building process. Wooncoöperaties (Housing Cooperatives) collectively own and manage their housing. Members often participate in decision-making processes regarding the design, maintenance, and policies of the housing complex. This model easily allows a participatory approach. It is done similarly in the case of Collective Private Commissioning (CPO), which is a form of self-development where groups of people come together to commission their own homes. This emancipates users to have a say in the design, cost, and features of their housing. It's a way for residents to be actively involved in the development of their living spaces. Next group represents aided self-help approach - Bouwgroepen are formed by individuals who collaborate to design, develop, and construct their own housing. The "aid" is typically provided by professionals who guide them through the process, while the residents have a significant say in the design and layout of the development. Upper cases represent self-help scheme which flips the question of participation, "Indeed, it is us [architects] who must participate" says John Habraken, in Towards a new Professional role, describing the essence of his envisioned new role, the architect advocates for endorsing, directing, and fostering an ongoing human settlement process that has largely evolved organically, without substantial professional intervention throughout history.

Now, considering the broad scope of participatory communities, this could serve as a base for an organized network of local organizations. This network could resemble Hassan Fathy's envisioned "national team of architects," working collaboratively to cultivate a national architectural tradition focused on housing.

This initial investigation into the established social systems within the Netherlands and the potential they offer for participatory housing begins to unravel the intricate and disorderly interconnections present for the future development of Delfland. These connections are presently overlooked by strictly top-down housing approaches. The more relationships we extract from these established systems, the higher the potential of the ensuing participatory process.

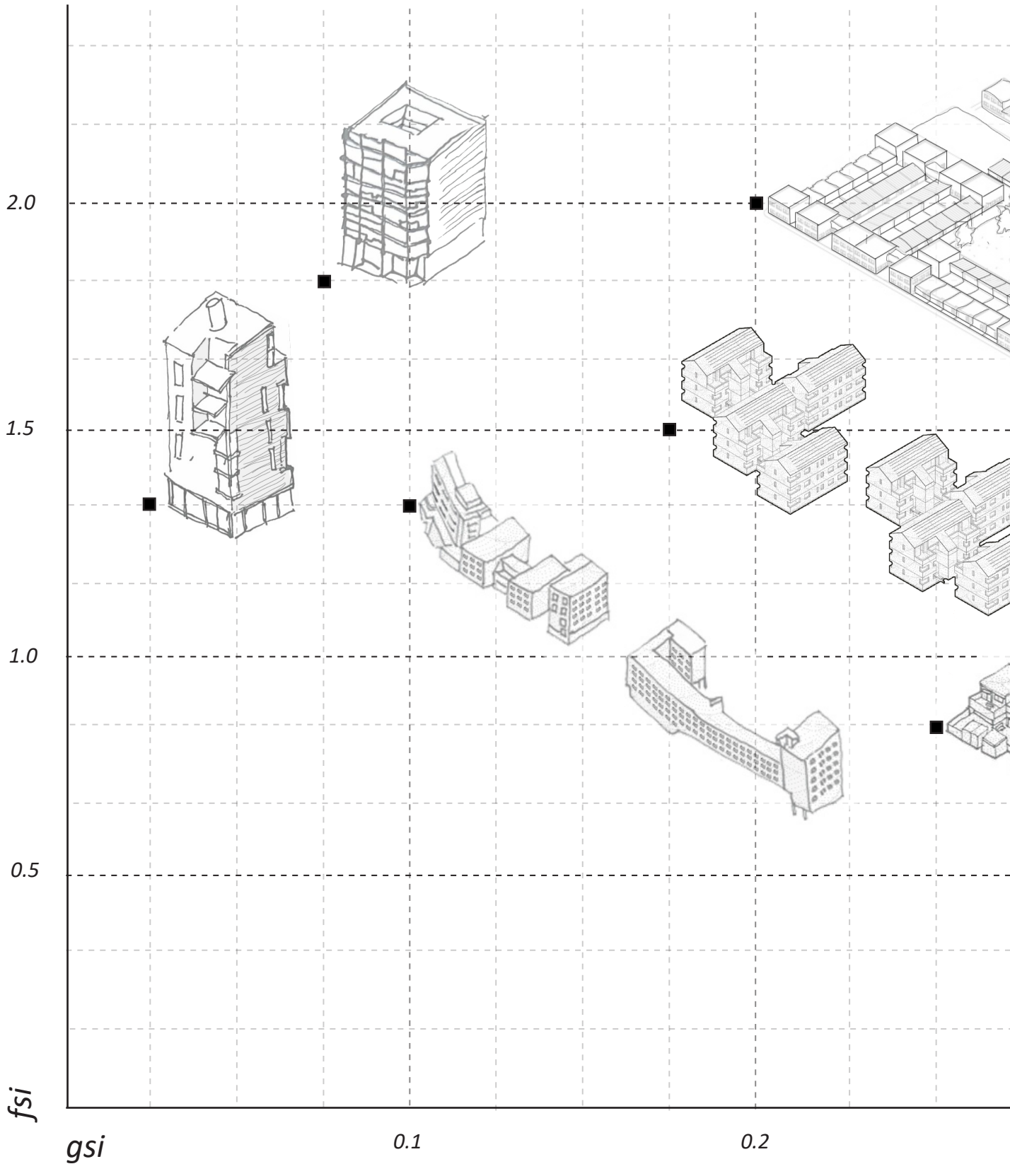
Figure 12 Protesters taking part in the 'March Against Vacancy' protest in Amsterdam.

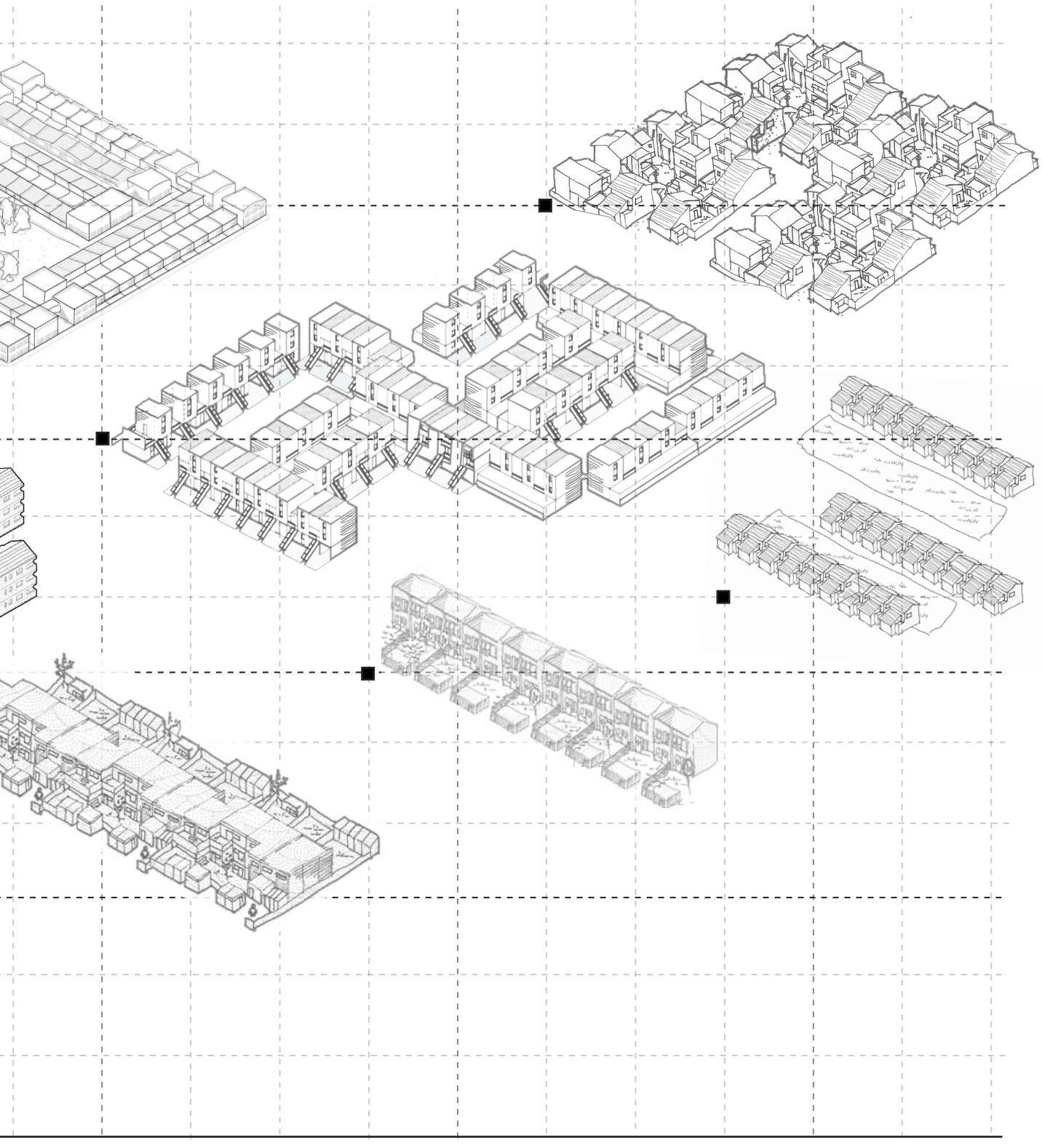
RESEARCH

Case study analysis & tool definitions

CASE STUDIES INTRODUCTION

Fsi and gsi of case study options

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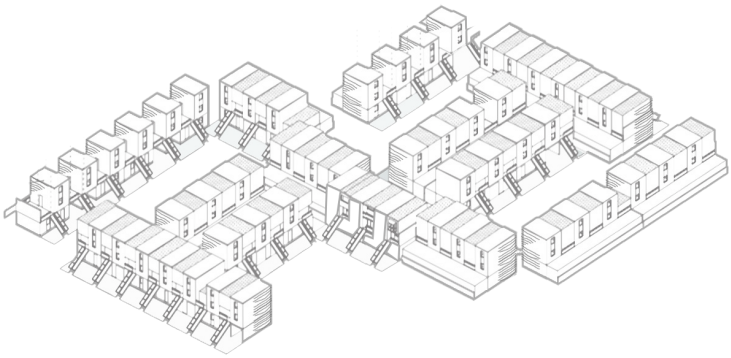
CASE STUDIES INTRODUCTION

Case study selection

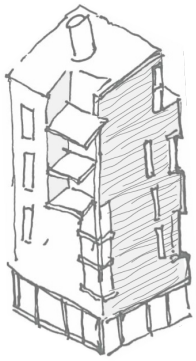
Tsurumaki Estate -3, 1989

Duration: 5 years
No. Dwellings: 30
Site area: 45m²
Density: 120dw/ha
Average dwelling size: 32m²
GSI: 0.30
FSI: 3.50
Participation: Consultation



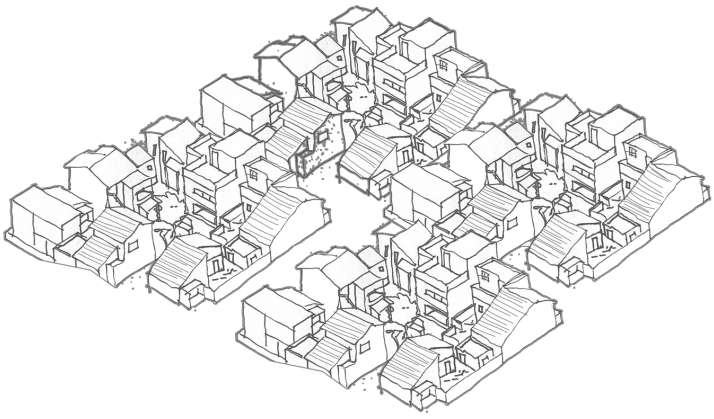
Quinta Monroy, 2003

Duration: 2 year
No. Dwellings: 93
Site area: 5000m²
Density: 35dw/ha
Average dwelling size: 90m²
GSI: 0.11
FSI: 0.33
Participation: Self-Help ● ● ● ○



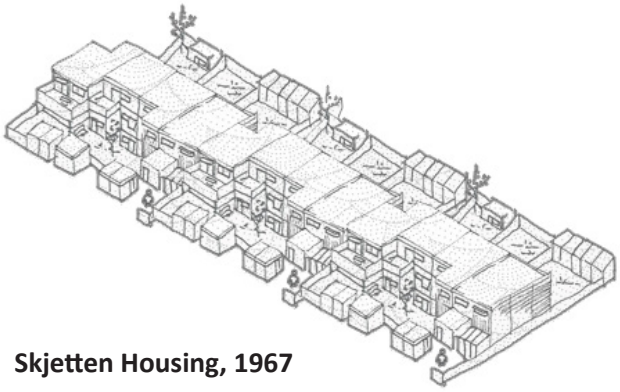
La Balma, 2021

Duration: 2 years
No. Dwellings: 20
Site area: 80m²
Density: 100dw/ha
Average dwelling size: 40m²
GSI: 0.23
FSI: 1.38
Participation: Empoverment ● ● ● ○



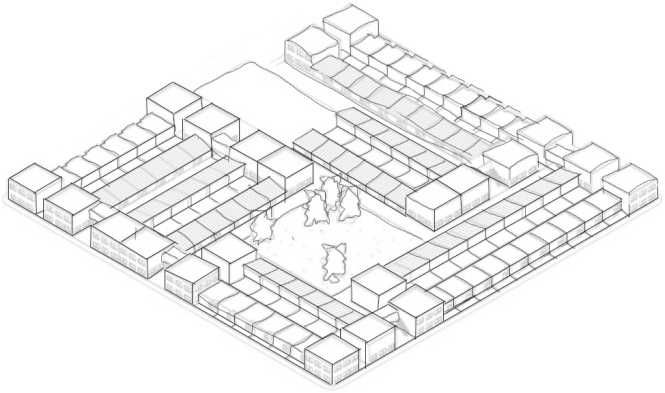
Belapur, 1983

Duration: n/a
No. Dwellings: 100
Site area: 5.4ha
Density: 44dw/ha
Average dwelling size: 55m²
GSI: 0.42
FSI: 0.84
Participation: Site and services ● ● ● ○



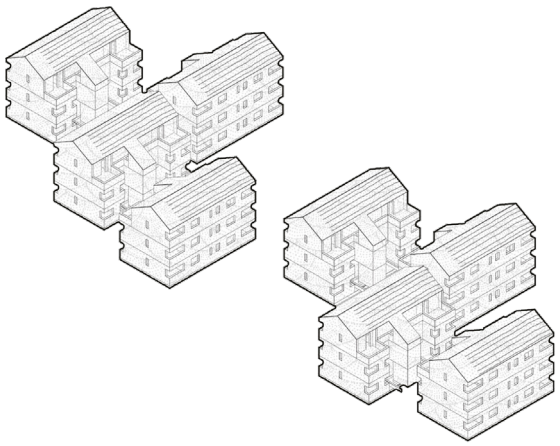
Skjetten Housing, 1967

Duration: 2 years
No. Dwellings: 330
Site area: 16.2ha
Density: 1dw/ha
Average dwelling size: 80m²
GSI: 0.09
FSI: 0.3
Participation: Self-Help ● ● ● ○



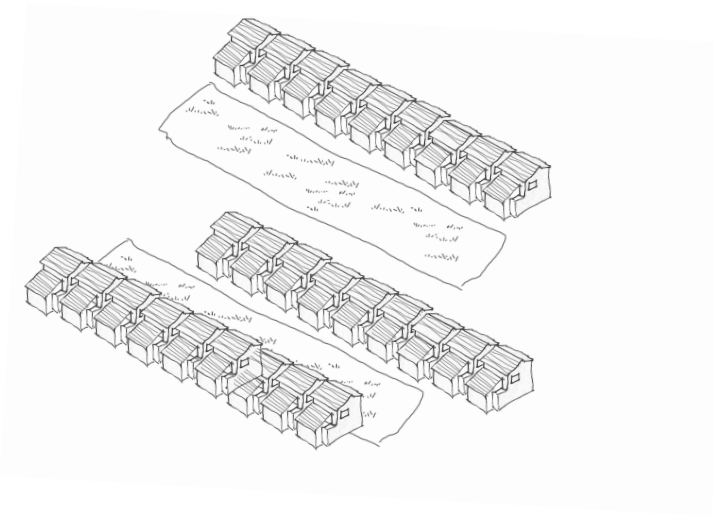
Tema, Community 4, 1960

Duration: 3 years
No. Dwellings: 60
Site area: 5ha
Density: 60dw/ha
Average dwelling size: 80m²
GSI: 0.10
FSI: 0.25
Participation: Self-Help ● ● ● ○



Adelaida Road, 1979

Duration: 1 year
No. Dwellings: 45
Site area: 5650m²
Density: 80dw/ha
Average dwelling size: 89m²
GSI: 0.23
FSI: 0.7
Participation: Consultation ● ● ○ ○



Solanda, 1989

Duration: 9 year
No. Dwellings: 6211
Site area: 150ha
Density: 23dw/ha
Average dwelling size: 80m²
GSI: 0.19
FSI: 0.5
Participation: Self-built ● ● ● ●

TOOLKIT ANALYSIS

Case study analysis and tool definition

Skjetten Housing

Niels Ole-Lund, Oslo, Norway, 1967

The aim of the planners: Flexible housing. In the post-war atmosphere, Norwegian society required fast pace change, fighting orthodox modernism and nostalgic neoconservatism. PAGON, the Norwegian chapter of CIAM, adopted a strictly structural position to adopt the underlying economic status of the society and translate it into architecture.[43] Both flexibility and affordability were to be brought through a modular grid that was spatial as well as structural. However, for this to succeed the users had to have a handbook guiding them to play with the grid. The handbook had to be prepared by a multidisciplinary team to avoid the old-fashioned paternalistic model of postwar planning.[44] Through a competition organized in 1965, a proposal by Nils Ole-Lund was chosen and built in 1974. (14) The project was a reflection of the notions of personalization and flexibility as a part of the Scandinavian Functionalism that was so popular in Europe throughout the 70s and 80s.[45] The very flexibility was achieved with a 200 pages long manual, which was essentially a self-help handbook. The project began by defining standardized plot divisions, assigned to future residents - families, concluding with 2000 housing units, and 6000 users. Each family could choose plots based on their needs, regulated by housing type, as the Skjettenbyen's handbook says.[46] The task was to set a framework, while residents were given a lot of freedom as a part of the plan to achieve diversified space. Users were able to add their extensions once the project was officially "finished".

It is important to note that, the project was never finished since it continues to develop through the years with the residents' own hands.

The grid system is spatial (13), but also structural. Each module, measuring either 3m x 3m or 2.1m x 3m, is demarcated by a 0.1m wide structural line, providing the placement for columns, beams, and structural walls. Remarkably, this plot-based framework facilitates diverse housing types, varying in built area, module placement, and flexible interior partitions thanks to the column and beam system. Initially selecting 10-15 "best" plans, architects found that residents continued to propose alternatives beyond the predefined models.[47]

The primary structural components are constructed from wood, with laminated wood columns serving as anchor points for partition walls. Laminated beams traverse the central space where columns stand freely, ensuring structural cohesion. Stair-limiting walls act as key stiffening elements. Concrete foundations employ a ring method, creating a base plate with edge drainage and insulation. Residents are permitted a maximum of two stories, with the ground floor potentially occupying the entire plot. However, regulations ensure that the first floor is limited to no more than one module adjacent to the core, guaranteeing sunlight and preventing obstruction by neighbors.[48]

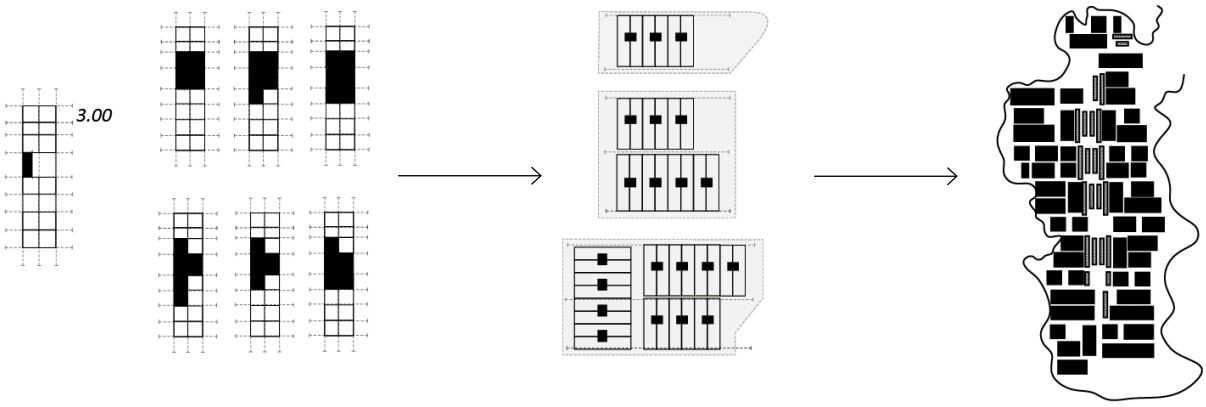


Figure 13 Principles of design. House, cluster and materplan.

Figure 14 Bird's eye view, 2017.

Housing types (15) differ in bedroom and living room organization, suitability for renting rooms, presence of balconies, inclusion of double-height spaces, and the existence of features like greenhouses. The four chosen housing types range from 77m2 to over 100m2 (16) (17), each possessing unique aspects. Despite distinct house plans, circulation spaces remain consistent, typically located adjacent to the service core. Studying four specific houses revealed extensions such as fences, sheds, terraces, additional rooms on different floors, and non-adjacent structures serving various purposes.

In the Skjetten project, no plot stands alone, as each must be attached to another, forming a minimum block of four plots to ensure proper neighbors and community organization. Plots with north and south access feature roads on both sides, while those with only one access are strategically arranged. East-west plots are introduced for diversity and aggregated with north-south plots. The application of these rules to the urban scale is detailed in the subsequent chapter. The consistent width of each plot, aligned with the N-S axis in small aggregations, facilitated the placement of a rational grid on the terrain. Pedestrian roads align with horizontal grids, connected by a central vehicle road with parking lots. Some plots are omitted to create communal spaces and playgrounds. Larger communal spaces, including a playground and school in the northwest corner, and cultural centers along the east side, contribute to the rational yet community-centric urban plan.

While the aim was to achieve user-defined flexibility, it has to be mentioned that the experiment didn't go entirely as the architects had planned due to conflicts with local planners that led the team to lose parts of the original plans. In various journals from the 80s and 90s, we can read about Skjetten's failure in motivating users' participation: "it is surprising to see how little the resident's initiatives have actually shaped Skjetten. The variation and local richness that we hoped for has not emerged."[49] The carefully crafted rules left a feeling of rigid system. However, if we analyze the extensions made by inhabitants, we can spot a lot of initiatives, it is just that they were not planned out in the concept or the handbook, like the greenhouses that emerged in the backyards, garages in the front of the plot or completely new typology types.66 It hinges to think that the manual was the catalyst for the participatory initiative of the resident, after all it encouraged action despite the fact it wasn't actions planned by the designers.[50]

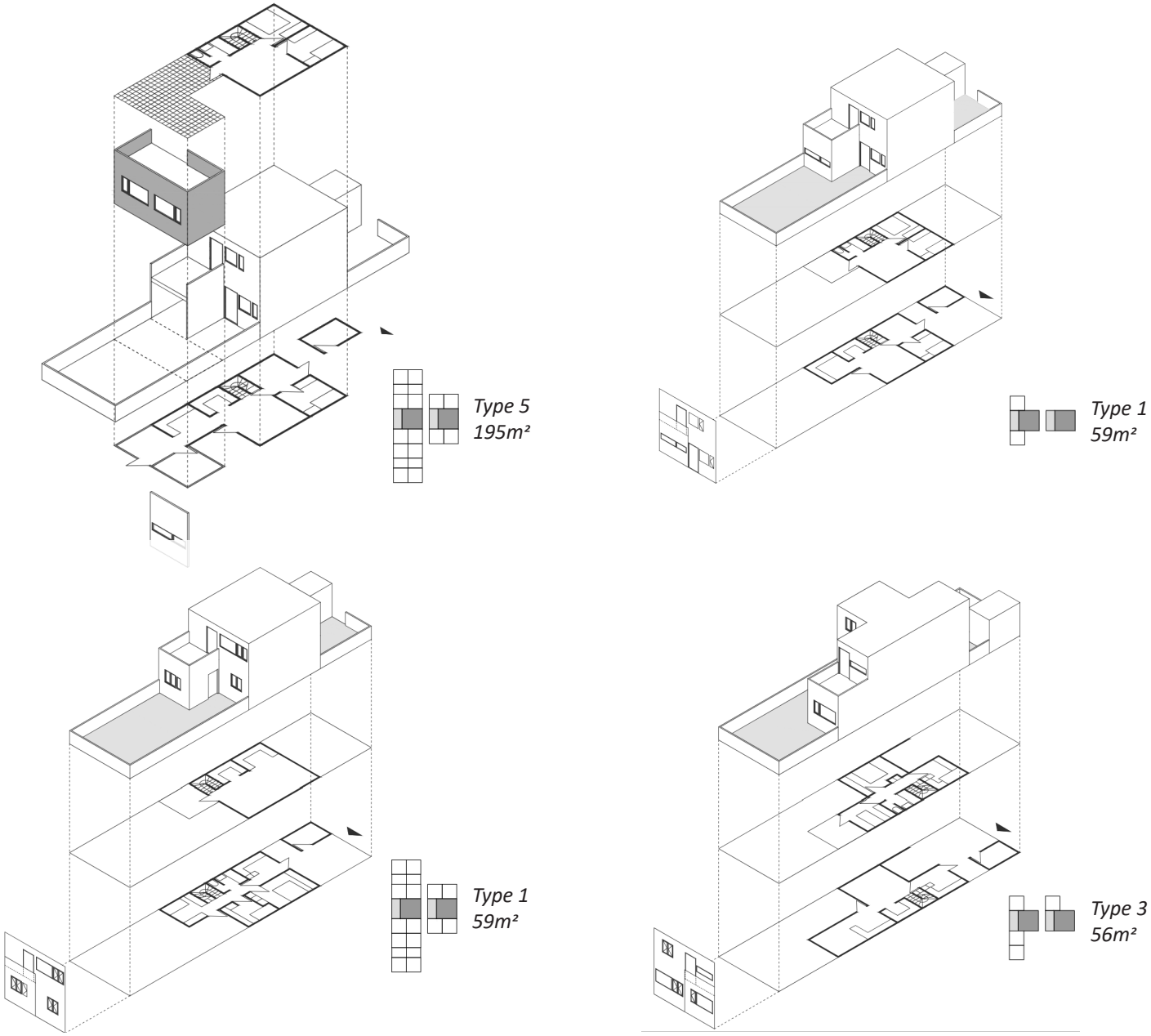


Figure 15 Dwelling types in Skjetten.

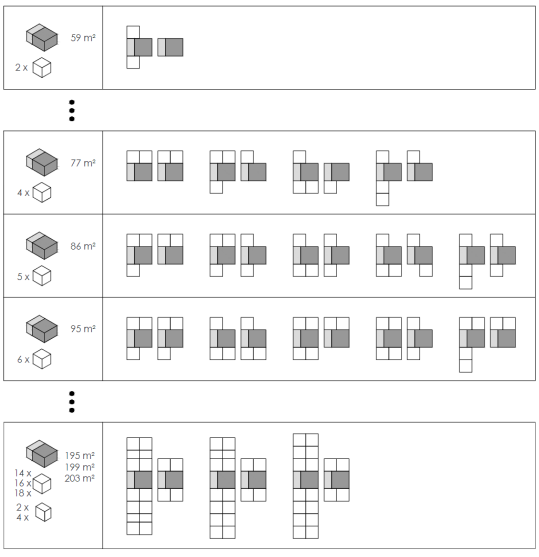


Figure 16 Increments options.

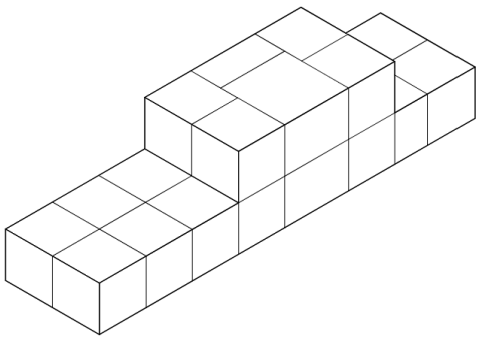


Figure 17 Maximum build up area.

Tema, Community 4

Constantinos Doxiadis, Tema, Accra Ghana, 1960

In 1957, Prime Minister Kwame Nkrumah proclaimed Ghana's independence, marking a pivotal moment in the country's history. While Ghana was still under British colonial rule, the decision to construct Tema Harbour was made as part of the broader Volta River Project. The initiative evolved beyond a harbor to encompass the establishment of an entirely new city in the region.[51]

In the 1950s, an English planning team initiated the design process however, this did not align with Nkrumah's vision of a fast-paced and rational urban image. In 1960, Nkrumah enlisted the services of Greek planner and father of Ekistics Constantinos Doxiadis to expedite and scale up the project while rationalizing the urban plan.[52]

Doxiadis introduced a mathematical system that was rigidly hierarchical, categorizing roads into eight classes, from footpaths (Road I) to highways (Road VIII). Similarly, residential areas were classified from small clusters of houses (Community Class I) to the entire city (CC V) and the larger metropolitan region (CC VI). Doxiadis streamlined and eliminated irregularities in the existing urban plan, incorporating the first two Communities of Tema into an orthogonal grid of main roads.[53]

The urban grid (18), slightly diagonal to harness prevailing winds, aimed to facilitate social cohesion within Communities. Doxiadis prioritized the design of public buildings and spaces, standardizing schools, marketplaces, government institutions, roads, paths, and squares.[54]

The development of housing types (20) showcased Doxiadis's departure from the compound house. Experimental houses in Community 4 ranged from bungalows to terraced houses, catering to the modern nuclear family. Unlike some contemporaries, Doxiadis dismissed the extended family as unsuitable for a modern industrialized society.[55]

The current state of Tema (19) (21) (22) diverges from the envisioned English Garden City, with modernist terraced houses obscured by self-built structures. Nevertheless, the city capitalizes on the initially planned open space, and the institutions, including schools and hospitals, continue to function well. Despite its evolution, Tema is regarded in Ghana as a desirable place to live, particularly for the middle class, prompting plans to redevelop the initial public housing areas with commercial housing.

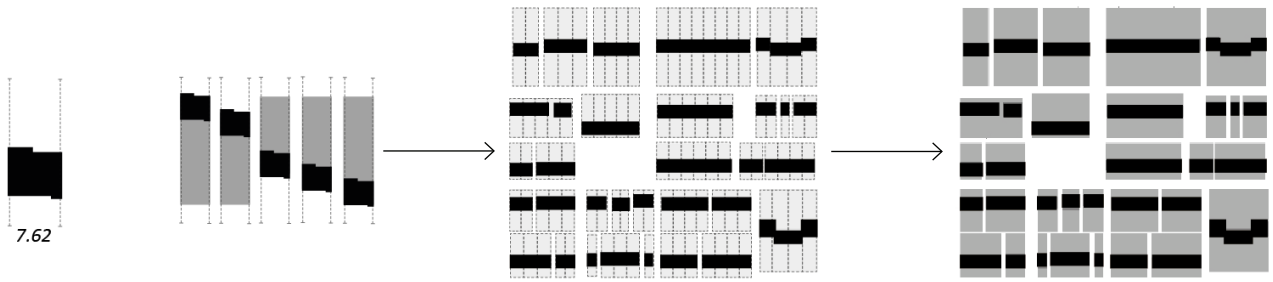


Figure 18 Principles of design. House, cluster and materplan.

Figure 19 S-N unit. Date of the photo: 2016.

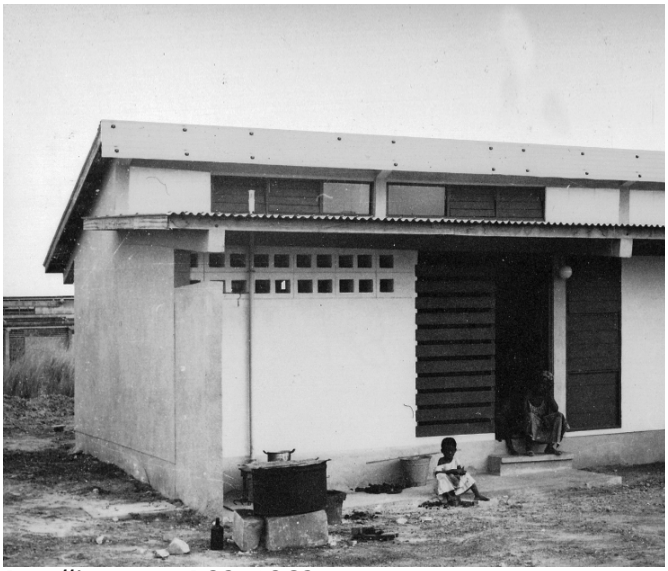
One of Doxiadis's primary objectives was to foster social cohesion within the Communities, a critical aim given the prevailing disparities and conflicts among tribes in the country, as well as the absence of established social structures for newcomers in the city. As a result, a lot of focus was put on designing public buildings and communal areas. Everything was carefully standardized, including schools, markets, government offices, roads, pathways, and squares. Even the landscaping was meticulously planned with thoughtfully chosen plants.

Although the city was intended to accommodate a diverse range of income levels, socioeconomic mixing within each community was minimal. Lower-income residents were clustered near the industrial zone and along the highway, while those with higher incomes resided in proximity to green spaces and lagoons. Doxiadis also allocated areas where migrants could construct their own dwellings, reflecting the "sites & services" approach popularized by John Turner in the 1970s. However, this approach, while providing some autonomy, fell short of empowering residents to fully organize and tailor their housing solutions.

Doxiadis's approach to housing design moved away from the traditional compound house. For Community 4, he created a variety of experimental designs, including bungalows, terraced houses, and apartment buildings, to meet the needs of the modern nuclear family. Unlike Maxwell Fry and Jane Drew, who favored local housing traditions, Doxiadis - guided by Prime Minister Nkrumah - believed the extended family model was not suitable for a modern industrialized society. The new city featured suburban terraced houses inspired by English designs, accommodating immigrants from various tribes working in industrial jobs. This resulted in a dynamic yet somewhat uneasy blend of industrial activity and pastoral beauty, vividly illustrated in Doxiadis's sketches.[56]

Figure 20 Selected dwelling types.

Figure 21 Dwelling type B02, 2007.



Dwelling type B02, 1963.

Variability

The first tool is variability, it is expressed by a variety of housing types which ultimately allows the variability of inhabitants. (22) Whenever a housing project emerges, ''marrying'' of different social groups is inevitable. Both, Lund as well as Dioxiadis recognize it as a positive phenomenon. Therefor, it is important to them to realize rules based on which the inhabitants mix. For both, the rules are assigned within a grid system - seemingly rigid solution which ultimately allows for a variety of housing types that respond to individual needs of the users. Due to the fact that a grid system simplifies the building structure, it becomes an easy to understand system. Such structure makes it is possible for the inhabitants to add whatever increments they wish for. This way, not only the increments can respond to the users' desires better than any predefined design, but also it allows a somewhat controlled development which still respects resident agency while maintaining a reasonable social and economical diversity. To be able to construct and maintain the individuality, the design team of Skjetten conducted interviews to ensure that design possibilities truly respond to the desires of future inhabitants. While Lund's dedication to individuality is remarkable, Dioxadis focuses on a mix of incomes.

''At Skjetten, one did not try to find a general housing type, but sought rather a system that could make each house as distinct as possible. In the same way that each family is different from every other family, so is their need different when it comes to dwelling. An open system also allows the planners to leave more decisions to the residents, instead of acting as tailors to people's domestic habits.''.[57]

The economic groups were arranged in a way that low incomes were concentrated near the industrial zone, while the highest incomes were situated along green areas and lagoons. He also allocated areas for migrants to build their own houses, reflecting an early form of "sites & services." That may seem quite pragmatic at first sight however, Dioxadis explains:

"We do not learn only from great minds; we learn from everyone, if only we observe and inquire. In order to create a better architecture- that is, a better habitat- we have to assist in the creation of a better way of living." [58]

Both approaches directly oppose the classification of user as a monotonous whole and allows specific needs to be addressed such as different family compositions, economic status as well as personal quirks and preferences. On the top of it, such a self-help process places users in the position of both, an architect and a builder. User becomes an architect the decision-making power is passed onto while choosing where the increments shall be added. Then it is the time to erect the increment and at this point inhabitants claim the role of a builder. That is why, it is important that architect assists in this step as builders may not have enough means to conduct the building process in a safe and fruitful manner. To provide such assistance Skjetten design team came up with User's Manual that is essentially a 200 pages toolkit on how to erect increments, the manual goes as far into detail as proposing arrangements of flower pots in the terrace.[59] As one of the current residents says:

"The Manual motivated our family to develop 2 rooms, for my children. It was a good catalyst for action however, now the knowledge is a bit outdated." [60]

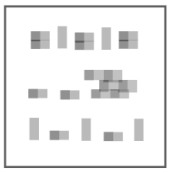


Figure 22 Diagram depicting tool "Variabilty".

Adelaide Road

Nabeel Hamdi & Nick Wilkinson, London, England, 1971

PSSHAK - Primary Supports Structure Housing Action Kit, emerged in the atmosphere of housing crisis in England. Hamdi, amongst many, attended to build in a cheap and fast way. PSSHAK, the toolkit consisting of written instructions and models, not only allowed future residents to be involved in the design of their homes in an informed manner but also enabled the possibility to change unit layouts.[61] The very flexibility is yet again the aim of the designers as the mean for social oriented housing that does not have to be a margin topic. With that mindset, PSSHAK is a tool meant to help people understand the details of their homes better, giving them a deeper understanding of the architecture that shapes their living spaces. The manual was a great source of knowledge on structural and interior design, in its contents we could see drawings of exploding apartment views showing the fixed outside walls with spaces for windows, and the flexible panels inside that could be used for both walls and cupboards. There was also shown a kitchen, bathroom, and other storage units designed as an integral part of the system (25). It all was to guide the residents on what kind of decoration would be used, and what kind of light fittings, shelving, and other accessories are advised in conjunction as the infill part.[63]

"Suddenly, when the housing scheme is well advanced on the drawing board, the brief is changed: the director of housing...wants many smaller units on the site plus two eight-person houses. One of the many flexibilities in the PSSHAK process means that a change such as this simply causes Nabs Hamdi (the architect)... to smile."[62]

Inspired by Habraken's support-infill theory, the load-bearing walls are separated from the detachable, interior walls allowing for larger units, including two- and three-story houses and maisonettes. The manual explained how to work with the panel structure of the infill to modify one's home. Furthermore, one can find a planning chart that was used to help prospective tenants design their flats. The panels of kitchen and bathroom walls would contain ducts for wiring, the panels also have an integral vertical channel with bin spacing for internal wiring, fixing shelves, suspending cupboards, or hanging pictures. Once in place, the panels could then be painted or papered; where a detachable steel duct enables services to be placed away from the vertical columns if desired, and cantilevered working surfaces can be placed above washing machines or cookers.[64] With the help of the models, details of unit layouts and the partitioning system were shown.[65] These were used to explain the system to possible tenants. Because of the fixed nature of the bathroom and kitchen walls, architects had to reach out to the users for advice. Tenants were called in at the building stage to analyze their requirements and plan their accommodation, it was to establish a research program to see what changes they make to their interiors over a period of, say, five years.[66]

"One of the critiques of the project was whether the assembly kit (infill) was a desirable way of doing things. Due to the long time scale of the changes made to the infill, it would be possibly more economically viable to be constructed traditionally." Habraken referring to Hamdi, Define and Let Go, 2010, p.20.

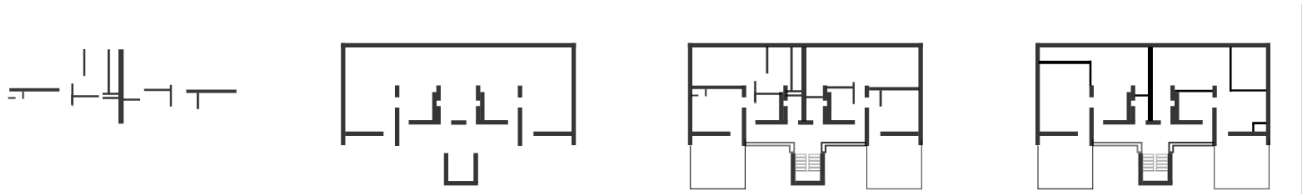


Figure 23 Principles of design. Infill, support, and support-inifll typology.

Figure 24 One of Adelaide Road units, 2015.

Users' feedback suggested that the experience was empowering but the system has since been criticized for lacking real flexibility. Other models, such as one by Dutch architect John Habraken, allowed residents to express individuality through the exterior of their homes, support. That is to say, not only the infill is the participation-driven freedom of aesthetics and design, but also support belongs to this realm, with the difference that it is communal, while infill is private. In Adelaide Road, the support contains the collective spaces, the entrances, the corridors, and the stair-wells.[68] This course of thinking is a response to issues that John Turner would often point out about the support-infill approach. In his radical opinion, the system is exclusively about the structural approach that does not support important mechanisms of participation like community making as the erection of infill walls is done individually.[69]

''You must do what is good for the community - that is our domain. By this, I'm not saying that an architect provides solely the structure, which has to be filled out by others, or that he should not be allowed to concern himself with the aesthetic outcome. Quite the contrary."[67]

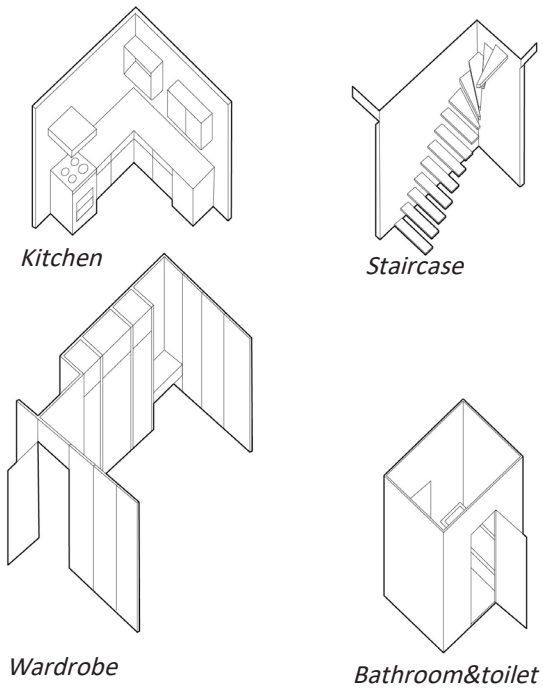


Figure 25 Fixtures infill types.

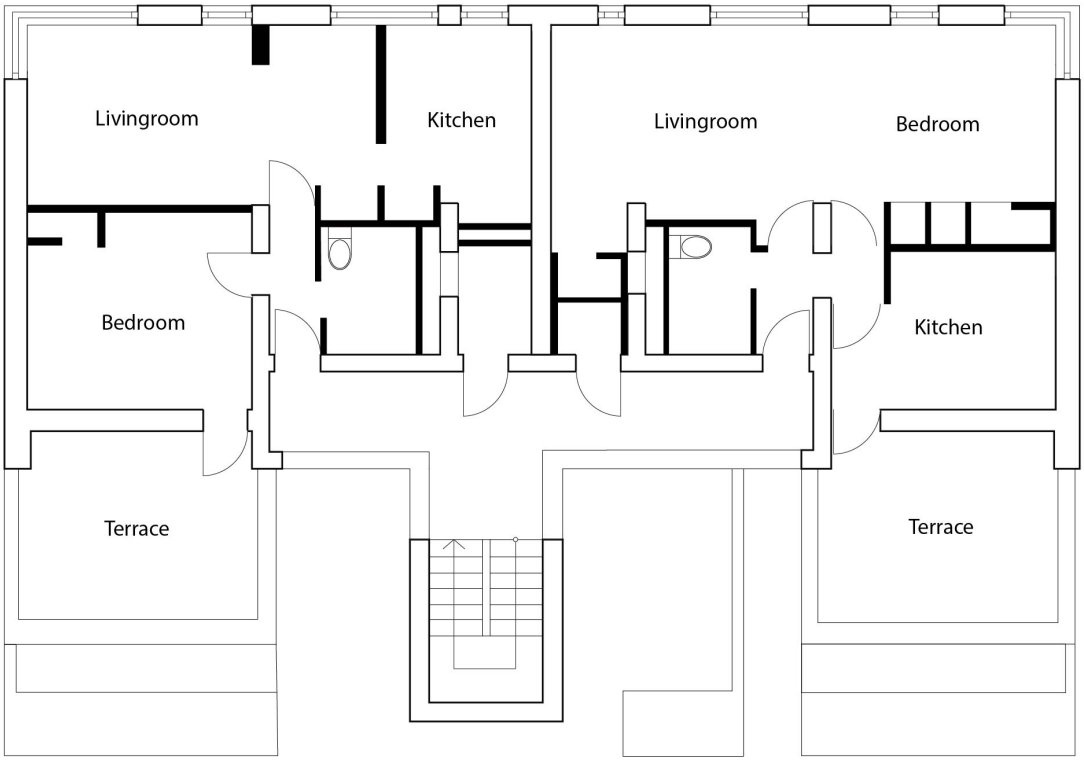


Figure 26 One of Adelaide Road units, groundfloor.

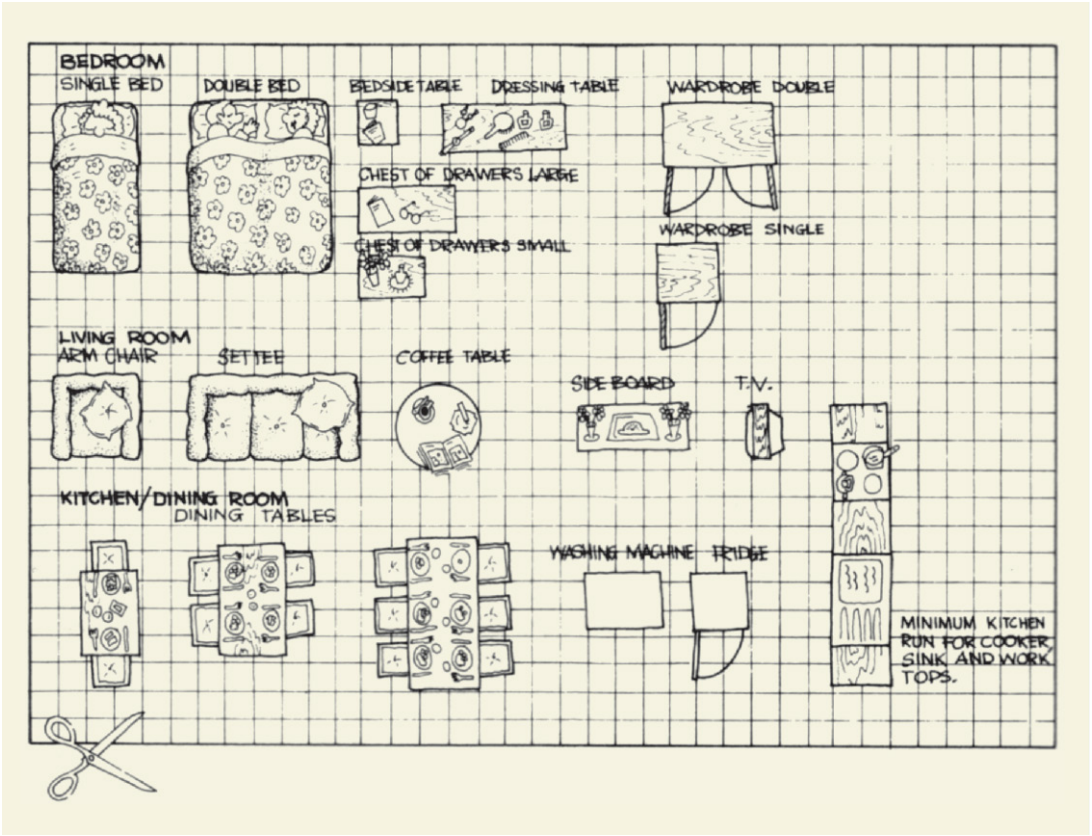


Figure 27 Study of inhabitants' infills.

Quinta Monroy
Elemental, Iquique, Chile, 2002

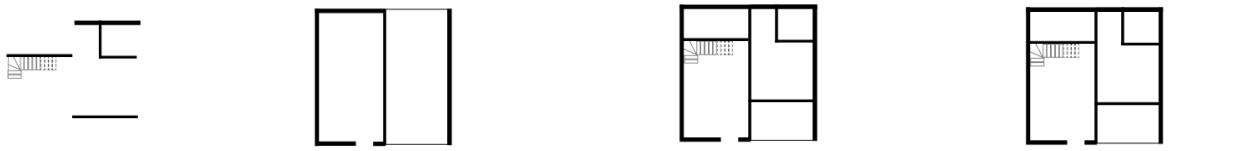
While Quinta Monroy also addresses the problem of affordability, it tackles it not from the perspective of time. More specifically the time in which incremental process occurs. On the contrast to Hamdi, Alejandro Aravena focuses on the maximum expansion as a result of the process, rather than maximum flexibility however, both are within the reasonable frame of the support. The importance of time is well explained by Aravena:

> ***"We think that social housing should be seen as an investment and not as an expense. So we had to make that the initial subsidy can add value over time. All of us, when buying a house expect it to increase its value. But social housing, in an unacceptable proportion, is more similar to buy a car than to buy a house; every day, its value decreases."***[70]

The architect points out 3 dilemmas that appeared in the project; however these could also be applied to the most of social housing developments. Firstly, the cost of land is often far way too high for social housing. In the project, retaining the site was crucial for bolstering family economies and appreciating property values. Secondly, providing physical space for the "extended family" was pivotal for the economic upliftment of impoverished families. Introducing a collective space for around 20 families between private and public domains became integral, serving as an intermediate level of association in fragile social conditions. Thirdly, anticipating that 50% of each unit's volume would be self-constructed, the design required a porous structure, enabling individual units to expand within their limits. The initial building aimed to be a supportive framework, avoiding negative impacts of self-construction on the urban environment and facilitating future expansion.

The task was to address the settlement of 100 immigrant families in Quinta Monroy, situated on a 5,000 sqm site they have unlawfully occupied for the past 30 years, centrally located in Iquique, a city in the Chilean desert. Operating within the parameters of the existing Housing Policy, they were required to utilize a USD 7,500 subsidy to cover the costs of the land, infrastructure, and architecture. Given prevailing values in the Chilean building industry, the allotted USD 7,500 equated to approximately 30 sqm of constructed space. Instead of designing a small house, where everything is inherently compact within the confines of 30m², the team focused on creating a middle-income dwelling.[71]

The approach involved delivering only a fraction of the entire structure at the present moment. This necessitated a shift in the design standard, requiring the planning of kitchens, bathrooms, stairs, partition walls, and other intricate elements to accommodate the ultimate vision of a 72m^2 house. 93 apartments within the settlement were organized into 13 blocks surrounding four courtyards. Among these, two blocks, comprising 27 apartments, directly faced the street (29), while the remaining 66 apartments were oriented towards the interior courtyards. Elemental adapted their Parallel Building concept to create low-rise, replicable apartment structures characterized by a "porous" design, allowing for versatile development of each unit (Aravena and Iacobelli, 2016, p. 37).



Infill *Support* *Support and infill 1st floor* *Support and infill 2nd floor*

Figure 28 Principles of design. Infill, support, and support-inifll typology.

Figure 29 Quinta Monroy, 2021.

This approach provided a systematic framework for the "half a house" strategy. Recognizing the challenge of doubling the size of ground floor apartments to 72m^2, Elemental proposed an extension covering two-thirds of the rear yard. (32) Site plans indicated a smaller room in the yard to preserve adequate light and ventilation for the apartment, hinting that a more practical limit might be 63m^2. Upper-level apartments, having two levels available for expansion, could be doubled from 36 m^2 to 72m^2. However, this modification posed a more intricate task, requiring a new floor, roof, and four new walls across two levels.[72]

While the extension scheme in Quinta Monroy is impressive, it is important to mention that **lack of information about structural elements and details lead inhabitants to make uninformed choices which eventually contributed to safety-hazardous, low quality infill. Inhabitants would choose material and building techniques that didn't match structural design of the initial projects. The structural connections were often weak resulting in infill walls to fall apart. There also was a lot of speculations to which point one can extend their unit, according to Elemental's idea the design was supposed to grow on the first and second floor, while users also decided to expand on the ground floor in the backyard area. (31) (32)** That is to show that architect should design the primary housing unit in a way that allows unpredictable extension to grow in a safe manner within the resident's plot. The highest density possible was attained using the available construction materials, much of which were re-purposed from packaging left at the nearby port. This organic evolution persisted as the population grew, resulting in properties being divided to create narrow passages between tightly packed rooms, often lacking in natural light and ventilation. Initially, Elemental's leaders described the settlement as visually unattractive, unsanitary, and excessively populated, while neighboring residents voiced concerns about safety hazards such as crime and fire risks.

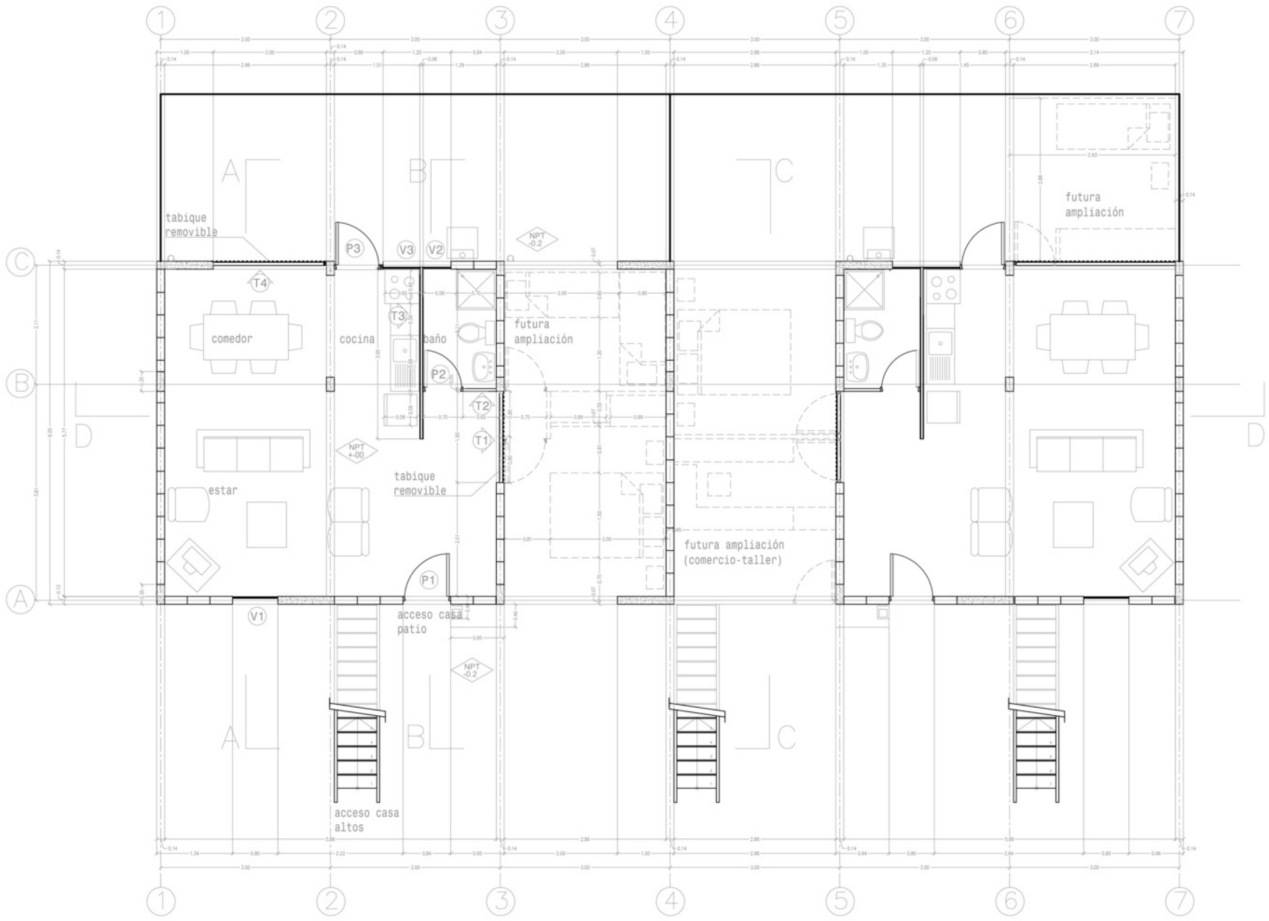


Figure 30 1st floor of Nancy's groundfloor.

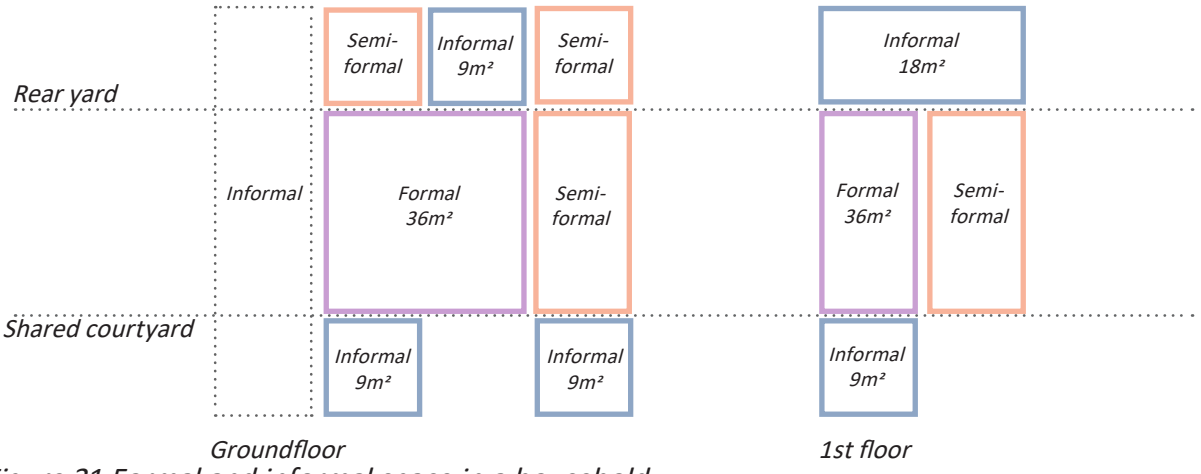


Figure 31 Formal and informal space in a household.

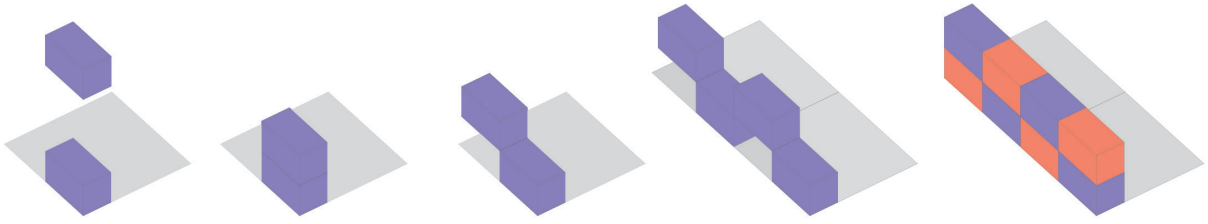


Figure 32 Incremetal growth.

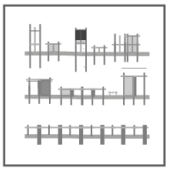
Support-Infill

In both examined cases, the support encompasses architecture shared among all residents, while the infill represents features specific to individual families or individuals. This division of support and infill corresponds to a separation between communal and individual elements, essentially delineating ownership. The Quinta Monroy project is characterized by a porous form that opens into internal courtyards, creating semi-public spaces. Conversely, the "solid"[73] part of the building provide distinct framing for the infill. The courtyard design aimed for an optimal size, neither too small to encourage neighborly interaction nor too large to hinder visibility across the space. In Quinta Monroy, the common and semi-public areas served a dual purpose, acting as support in the support-infill sense and functioning as spaces facilitating circulation for individual units. In the case of Adelaide Road, the literal separation of ownership is evident as the council maintains complete control over the public realm and its visible facades. In an interview with the architect, Nabeel Hamdi expressed his original vision. The separation of support and infill not only establishes a division of ownership between users concerning public and private spaces but also grants control to various entities such as housing organizations, local councils, or government bodies within a housing scheme. The relationship between support and infill can imply a hierarchical structure, known as the law of dominance, where one element has direct influence over another as Habraken describes.[74] This hierarchical structure is evident in vertical relationships, analogous to the support of a beam by a column or the necessary connection between infrastructure and buildings.

This hierarchical division theoretically enhances the efficiency of construction and management, providing clear responsibilities and offering flexibility with different life spans for elements at each level. However, the economic and social benefits of such a division of responsibility remain a subject of debate. Critics question the desirability of an assembly kit (infill) and whether traditional construction methods might be more economically viable due to the prolonged time scale of changes made to the infill.

"One of the critiques of the project was whether an assembly kit (infill) was really a desirable way of doing things. Due to the long time scale of the changes made to the infill, it would possibly be more economically viable for it be constructed traditionally."[75]

Despite this debate, the separation of housing production into support and infill introduces a new perspective on housing, fostering user participation in design, establishing a hierarchy of scales, and redefining the role of the architect.[76]



Support-Infill

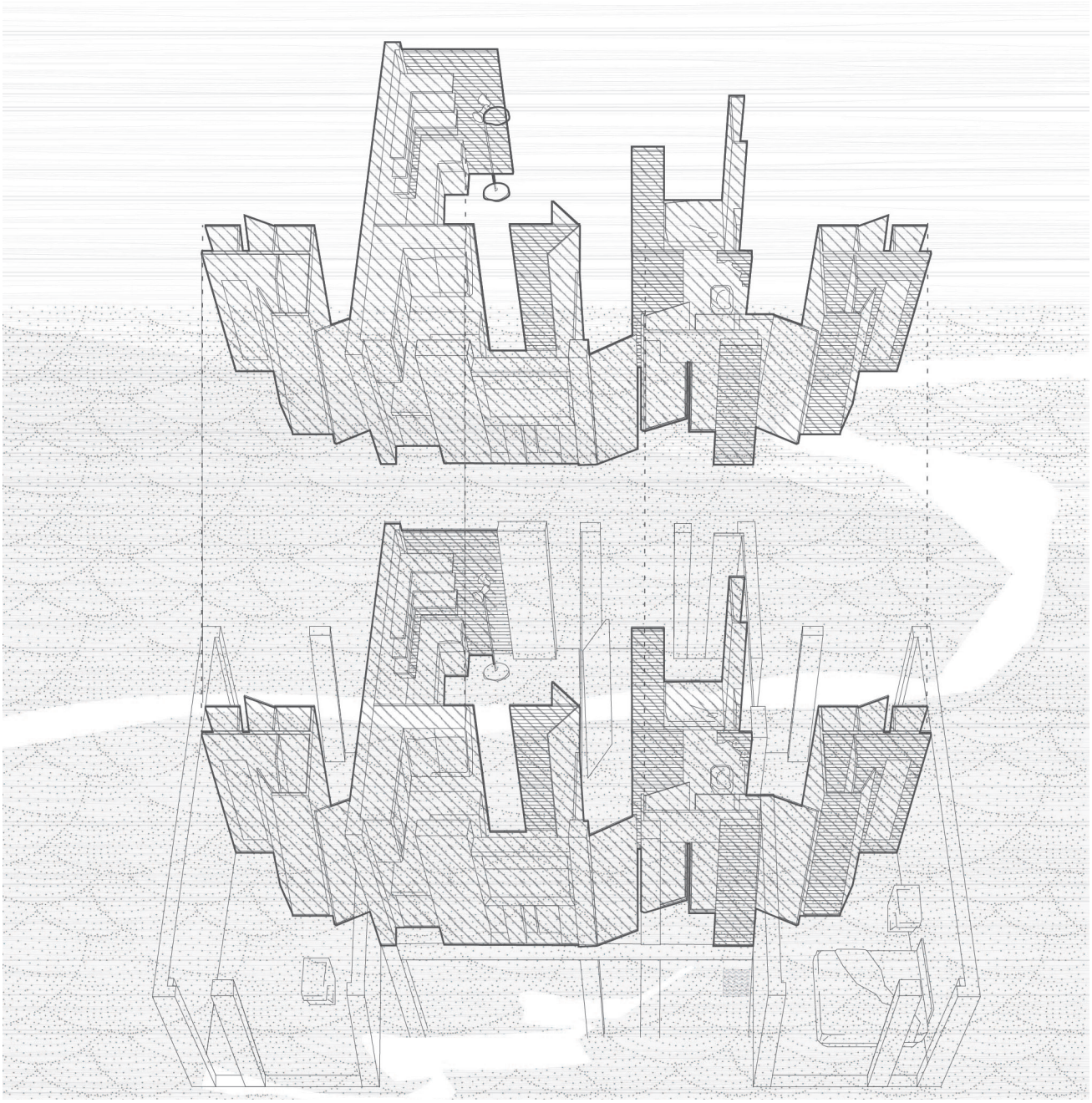


Figure 33 Diagram depicting tool "Support-Infill".

Tsurumaki Estate -3
Hideki Kobayashi, Tokyo, Japan, 1985

In the 1970s, the total number of dwelling units in Japan began to exceed the number of households, forcing the government to turn the existing housing into a more flexible model to meet diverse residential needs. At the time, many dwellings did not fully satisfy users' daily life needs that emerged due to changes in the family structure and lifestyle. The durability of interior finishing and equipment was shorter than the durability of the base buildings, and the failure to perform appropriate maintenance became a social problem. To overcome these challenges, the Ministry of Construction started the Century Housing System as a certification system in 1986 following the research and development of the KEP - KSI Experimental Housing Project. (37) While "K" in the name "KSI" stands for KODAN which means "public corporation" in Japanese, SI represents Skeleton and Infill. (38) Additionally to the mentioned issue, it was believed that there will be a shortage of construction workers in the future therefore, the citizen labor had to be educated to build. The manual for KEP has been developing since 1982[77] as a response to the ongoing issues of land ownership law in the country. There were several stages of participation in the project. First, architects would meet with the future residents and draw plans together, this meant that participants had a direct role in the conceptual part of the design. Second, there was a series of questionnaires in 1982, 1995, 2005, and 2014, where interviewees were asked about changes that have been done. The questionnaires were placed in the residents' mailboxes. They were distributed to 228 of 234 homes, and responses were received from 58 homes.

The results of the survey showed two things. For one, residents have become more willing to live in their units as long as possible as they aged. As they have aged, their interest in permanent occupancy has increased to the point where 67% of the residents in 2014 wished to live in their units permanently. Second, both the KEP movable partitioning system (Fig. 9) and a conventional remodeling system were used to make changes in the room arrangement, which ultimately proved that the manuals developed for the system were useful.[78]

In the Tsurumaki -3 estate (35), there are 192 units in four-story flats and 29 units in two-story terrace houses, many of which were modified by 2005, because the children of those households had already moved out The KEP system allowed a living room or a private room to be enlarged by moving the partitioning wall and partitioning storage walls separating two rooms, this is at the essence the well adapted system to the changing needs of residents. As children grew, and when they left home, many families used the partitioning system to adjust the room arrangements to fit the changes in their lifestyles. Those lifestyles were strongly motivated by the renovation works that were done. The first type of lifestyle change was when a family moved to a used dwelling unit, and the reason for the renovation was matching the flat to their individual taste. The second kind was strongly motivated by a turning point in the family's life that concluded in the renovation of bathrooms, toilets, kitchens, etc., (36) and other wet areas, mainly because of deterioration over time.[79]

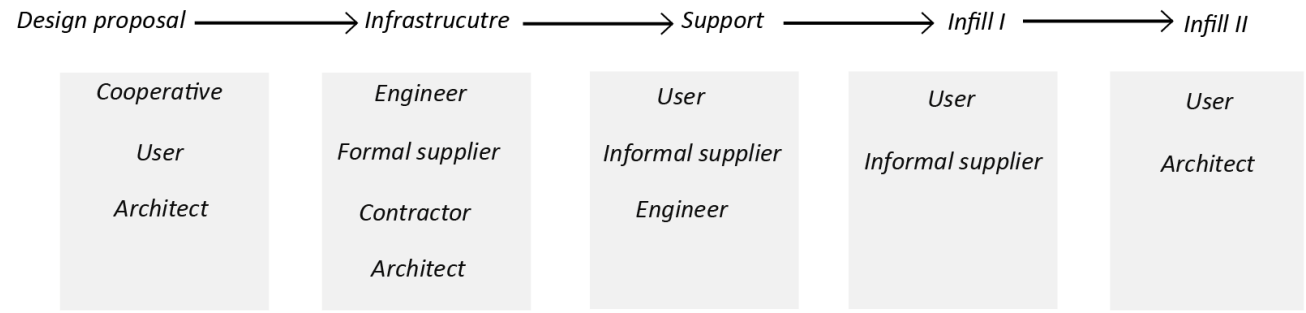


Figure 34 Principles of design. Managirial strategy.

Figure 35 Tsurumaki Estate -3, 20217.

Figure 36 Plan types in Tsurumaki 3, for a four-story apartment. The top of the drawing indicates north. Blue: Relocatable storage unit; Green: Movable partition wall.

Figure 37 Concept of KSI.

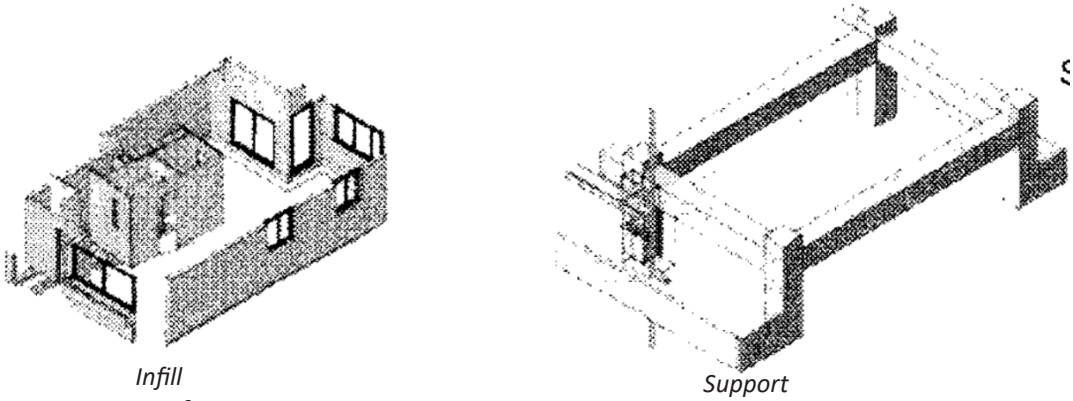


Figure 38 Concept of KSI.

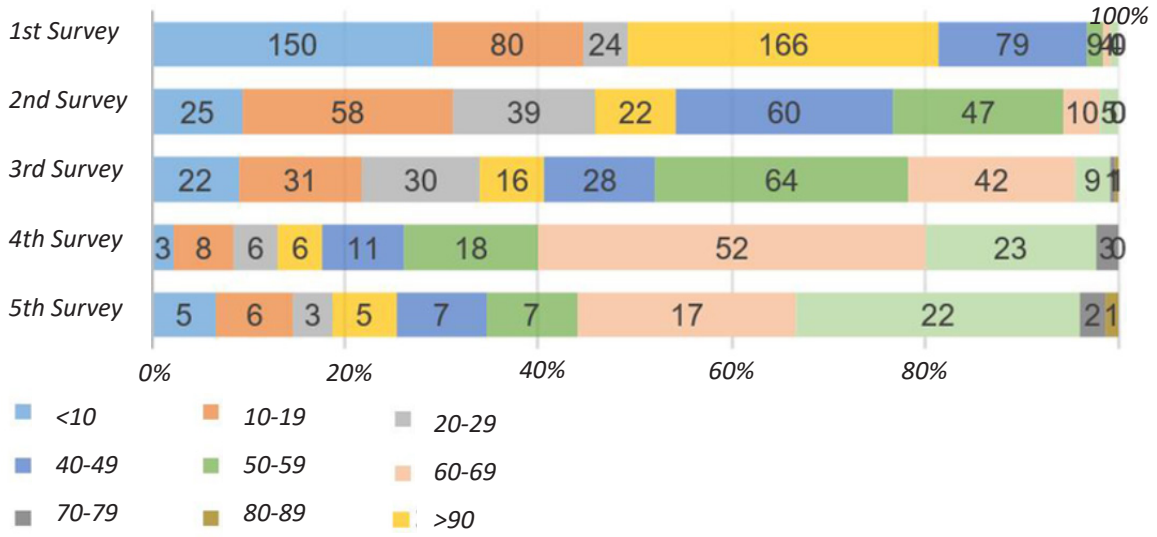


Figure 39 Ages of family members in each surveyed year. (The numbers indicate the number of responding units)

La Balma

LaBoqueria, Lacol, Barcelona, Spain, 2021

Just like in Tsurumaki Estate -3 citizen consultation was chosen as the main participatory tool for the sketch design however, it was done at a more global scale.[80] During the competition phase, a socio-economic diagnosis of the group and a participatory process were made to work on and reach a consensus proposal, in which the user and the community play a leading role; the outcome is a building understood as an infrastructure that accompanies them and allows them to evolve freely from three social spheres: the neighborhood, the community, the unit of conviviality. That is to show that on the contrast to Tsurumaki Estate -3, La Balma emerged in a more collective process where not only the architect and inhabitant collaborated, but also the entire community. That is also reflected in the space - the building has 20 apartments, of which one will be used as a bridge for families in the process of social reintegration. The typologies are flexible and designed from a grid of 16m² open pieces, these pieces allow very diverse divisions and distributions, allowing the user to decide on their spaces. Each unit starts from a fully equipped 50m² base, corresponding to the small typologies (S). This basic unit is extended with one or two pieces, becoming types Medium or Large. The changes are managed by the cooperative to adapt to the needs through time.[81]

The program of community spaces (41) arises from the participatory process as well. These are distributed in height on all floors. Circulations always accompany community spaces. They are open, ventilated and sunny spaces, to enhance human relationships, spontaneous encounters, and cooperative activities throughout the building. On the ground floor we find the communal kitchen-dining room, space for bicycles and workshop open to the neighborhood, the lobby and two commercial spaces. In the other floors the program is distributed in smaller rooms (multipurpose room, reading space, guest rooms, care space and laundry). Finally, the roof, fully accessible, is understood as the outer space of the cooperative. A terrace of more than 300m2 that will be equipped with productive orchards, space of shade and recreation.[82]

Barcelona has only 3% of affordable housing. The last increases in rental prices leaves an average price of € 17.4 / m². The objective of the cooperatives is to facilitate and guarantee access to decent and affordable housing for their members, with a maximum quota set according to the legislation at € 7.82 / m². To try to achieve this price, the architects focused on minimizing costs of construction and heating:

- Maximum solar capture is sought on floors 1, 2 and 3 where the walkway is on the Espronceda facade acting as an acoustic cushion for the street. In floor 4 and 5 the walkway on the interior facade acts as sun protection.

- Heating and domestic hot water will be generated by a geothermal system that will achieve comfort at the minimum energy cost and environmental impact.

- Heating and cooling terminals are radiant clay panels in the walls. The maximum performance is obtained with this system that works at low temperature.

- Centralization of systems to facilitate maintenance, improve efficiency and minimize costs.[83]

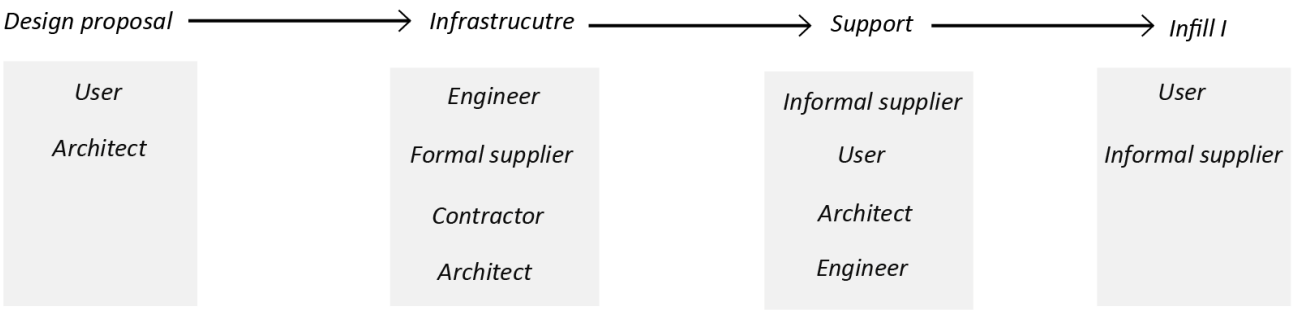


Figure 40 Principles of design. Managirial strategy.

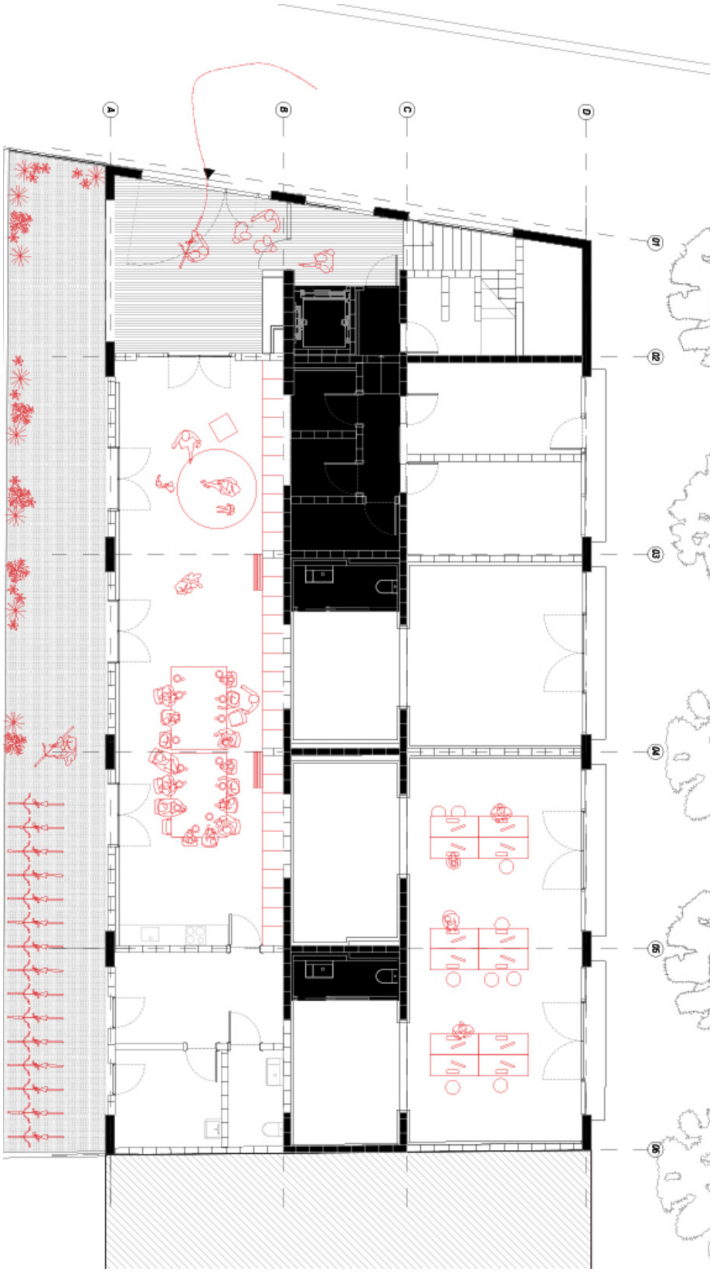
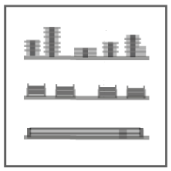


Figure 41 Layout of groundfloor consisting of collective spaces (red) completly.

Self-Development

While self-help is an approach where participation revolves around the physical work that is connected with building process as it exemplified by Quinta Monroy, the self-development approach goes a step further and allows inhabitants to take upon managerial and decision making initiative. These initiatives are often carried out through participatory tools such as interviews, semi-structured interviews, 1:1 scale model etc..[84] The scopes of user involvement also varies for each tool. For instance, specific interview methods give more agency to the user, this was well exemplified in Tsurumaki Estate -3 where re-occurring interview methods was chosen allowing the residents to impact unit management over the span of 3 generations. Not only the participatory tool decides upon the agency of a user, but also ownership type. As shown in the diagram there are 5 types of collective self-provision, each of these types vary in level of agency given to the community. Since Tsurumaki Estate -3 is a self-help project and La Balma is a cooperative they deal with the user agency on different scopes. The Japanese proposal focuses on communication between the resident and architect, while the cooperative does not involve the architect in the process, instead the community designs on their own account. The reason why both participatory approaches were successful was because they were curated to the needs of inhabitants at that time. To be able to maintain participation it is important that the chosen tool enable long term control after the architect is gone from the site.

Both of the projects managed to achieve this goal however, in different manners. While La Balma achievied it through managerial aspect of self-development approach, Tsurumaki E-3 state achieved it with long-term interview process that allowed participants to maintain decision-making role.



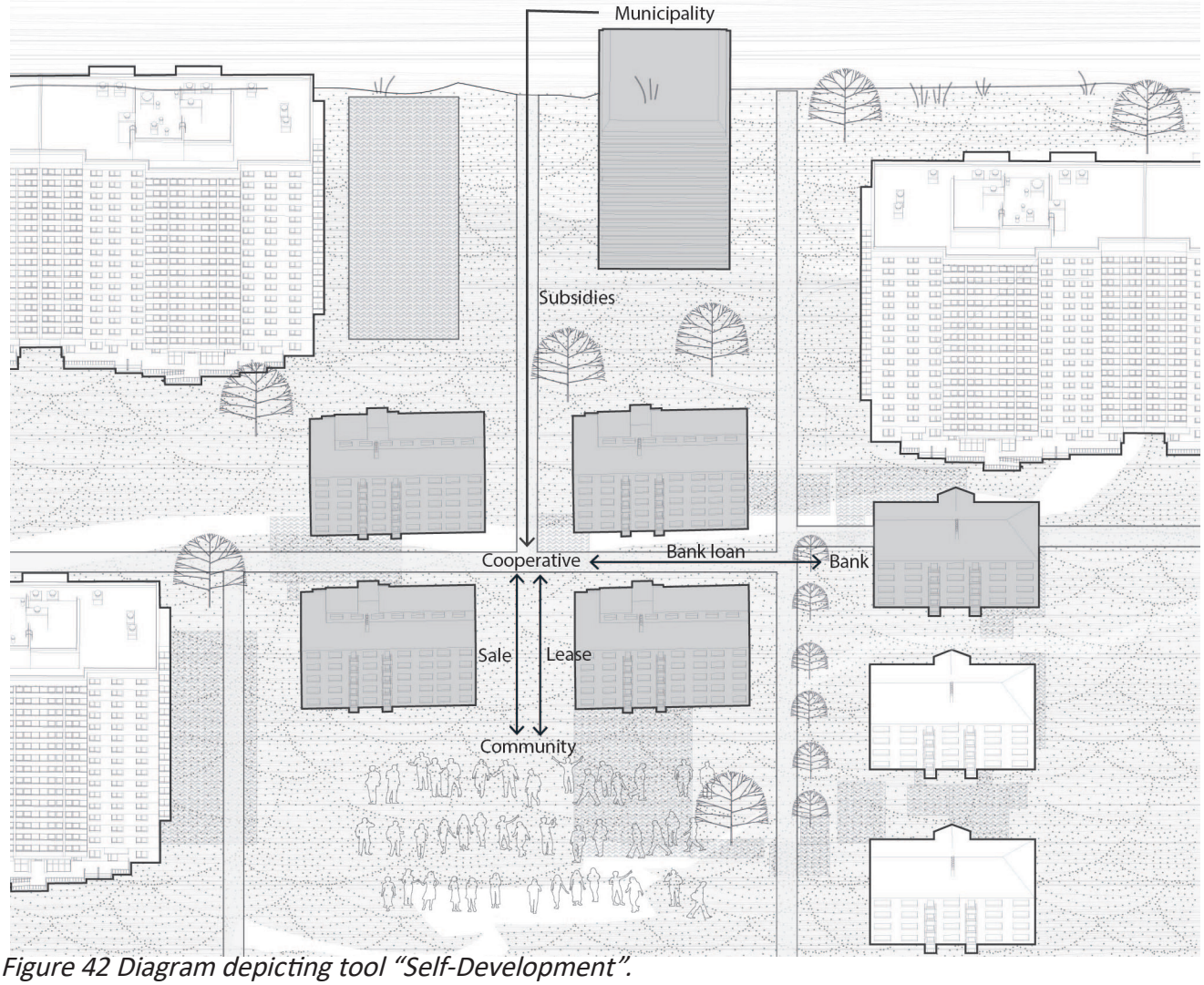


Figure 42 Diagram depicting tool "Self-Development".

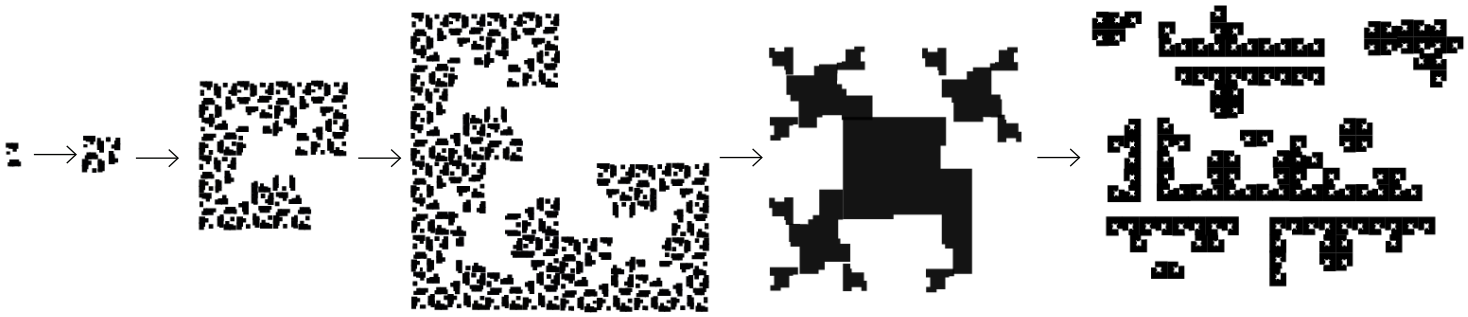
Belapur

Charles Correa, Navi Mumbai, India, 1983

Charles Correa's architectural principles are deeply intertwined with socio-economic ideals.[85] He opposes the notion of prefabricated system building, arguing that it stifles individual participation in home construction and redirects resources away from the abundant pool of artisanal craftsmanship found in local markets. Consequently, the structures in Belapur are modest, one or two stories high, constructed using traditional methods. They serve as foundational frameworks onto which families can imprint their unique lifestyles through personalized dwelling designs. [86] According to Correa, the privacy of families within their living spaces holds paramount importance. [87] He asserts that in the Indian context, the presence of "open-to-the-sky space" (44) is indispensable for fostering a sense of familial intimacy. Thus, each dwelling is accompanied by a private yard that incorporates a lavatory block. These lavatories are strategically paired to minimize service distances, while groups of three or four houses are clustered around courtyards. These courtyards, in turn, connect to larger public spaces where, given the entrepreneurial spirit of India, various shops and enterprises are likely to flourish rapidly. [89] The project has a single principle at its roots: an individual plot for each dwelling to allow for future expansion as and when necessary.[90] The housing scheme was intended to accommodate a diverse range of income groups, including lower, middle, and upper classes. Despite the considerable variation in income levels, with a ratio of 1:5, the sizes of plots exhibit less disparity, ranging from 45 m^2 to 75 m^2. Initially, Correa envisioned identical plot sizes for all residents; however, adjustments were necessary due to considerations of affordability and lending agency regulations.

Each dwelling has its own private yard, (43) serving as the smallest open space. Seven homes are arranged around a cozy courtyard measuring approximately 8m x 8m. This design offers dual benefits: fostering a sense of individuality within a densely populated community and allowing for potential expansion as desired by homeowners. This characteristic has been lauded as exemplary contemporary planning. The development maintains a low-rise, high-density configuration, consistent with many of Correa's other low-cost housing endeavors. Five types of dwellings have been delineated based on plot size, ranging from modest single-room units with attached toilets to more elaborate two-story tenements. While the houses maintain independence from shared walls, the toilets of adjacent dwellings are connected for streamlined plumbing services. [91]

"Making housing is like a bird building its nest," [92] says Correa. "You start with a basic house, but you have to let people change it to their own needs."[93] In Belapur, this philosophy has been embraced wholeheartedly. The neighborhood has undergone a transformation, with many of Correa's original buildings being replaced by larger concrete houses built by the aspiring middle class. Even with all these changes, the community's heart and soul – its courtyards and communal spaces – are still there. In this setting, Charles Correa once again showcases his distinctive use of hierarchical open spaces to a feeling of belonging and community. These clusters of homes converge around progressively larger communal spaces, with three clusters forming a gathering area of around 12m x 12m, and three of these larger areas coming together to create the largest community space spanning 21m x 21m. [94]



Unit Neighbours Primary cluster Secondary cluster Courtyards District

Figure 43 Aggregation steps.

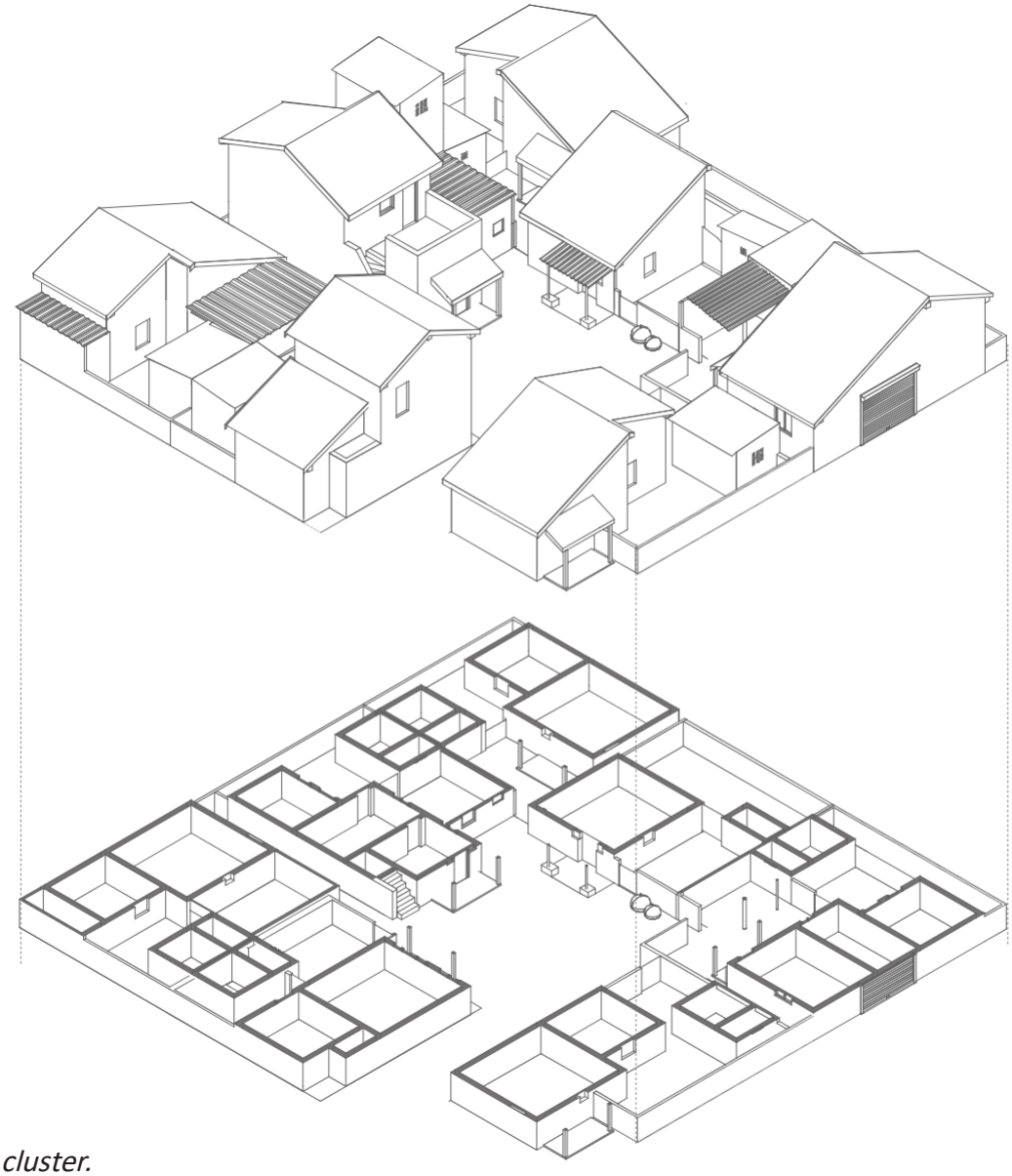


Figure 44 Primary cluster.

Solanda
Quito, Equador, 1989

The Solanda Housing Project was Ecuador's first attempt to build affordable homes while making sure the costs were covered. It included 4500 homes initially, but eventually grew to 6211 along with community facilities and job programs. The project was on a large plot of land that used to belong to a wealthy family, spanning 1581,33 m². The homes were meant to be affordable for families earning less than $233 per month, but were too expensive for those below the 35th percentile. [95]

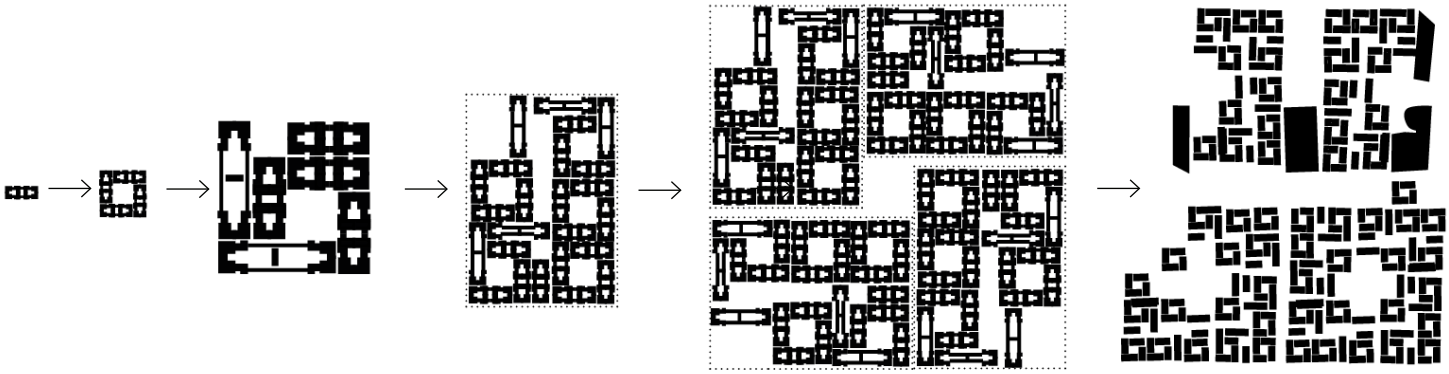
There were six different types of dwelling (46) to choose from, tailored to the needs of the families. Solanda gives us insights into Ecuador's efforts to provide affordable housing, looking beyond just the physical changes to understand the broader social and economic factors at play. Although architectural designs for the Solanda housing units were established as early as 1980, adjustments were made due to increases in construction materials and labor costs resulting from monetary inflation. Consequently, six distinct housing models, each offering varying degrees of flexibility for incremental expansion, were constructed on lot sizes ranging from 60m² to 123m²:

- Sanitary Unit: This is the most basic housing model, featuring a 10m² construction consisting of a bathroom and kitchen on a 60m² lot.

- Piso-Techo Unit (Floor-Roof): Built on lots ranging from 60m² to 80m², this unit includes a bathroom, kitchen, and multi-purpose space without exterior walls but covered by a cement roof.

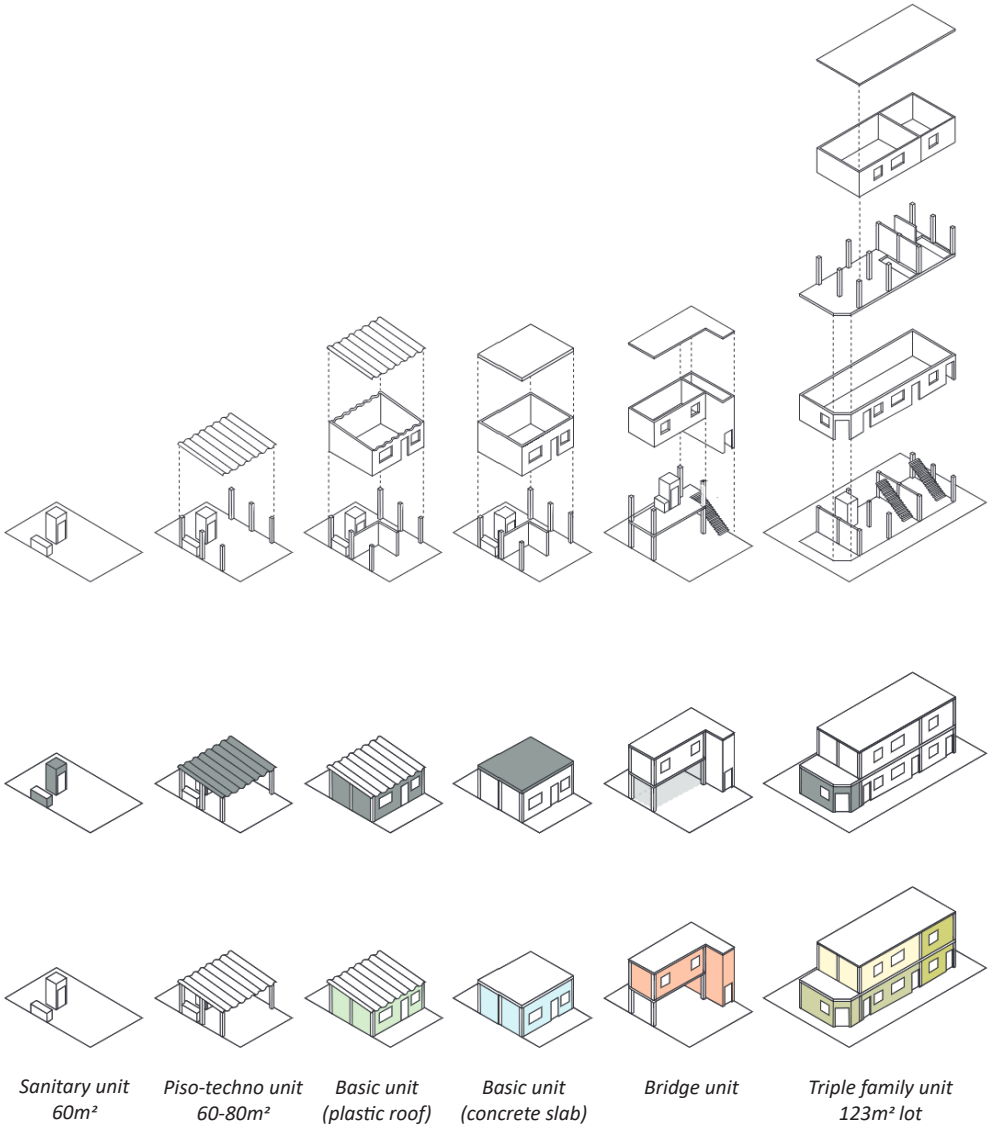
- 3 & 4. Basic Unit: This unit incorporates the components of the Sanitary Unit, with the addition of exterior walls made from bricks. Two roof variations are available: a concrete slab or a corrugated plastic roof.

- Tri-family Unit: Consisting of three apartments, this model features one apartment on the first floor with potential for a commercial store, a second-floor apartment, and a contiguous two-floor apartment. These units are situated on the corners of squares to encourage commercial activity.[96]



Unit *Neighbours* *Primary cluster* *Secondary cluster* *Courtyards* *District*

Figure 45 Aggregation steps.



Sanitary unit 60m² *Piso-techno unit 60-80m²* *Basic unit (plastic roof)* *Basic unit (concrete slab)* *Bridge unit* *Triple family unit 123m² lot*

Figure 46 Primary cluster.

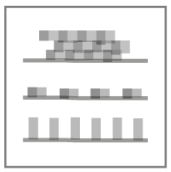
Aggregation

In contrast to the idealized “tower in a park” modernist housing concept, projects that address the social aspect of architecture, particularly participatory designs, often manifest in more modest forms, typically through low-rise, high-density solutions. Aggregation plays a crucial role in fostering social networks at various levels, as evidenced by both case studies to different degrees.

In the Belapur project, Charles Correa intertwines the concept of “open-to-the-sky space”[97] with pattern theory, drawing from Christopher Alexander’s “A Pattern Language,” Correa incorporates the idea of “Courtyards which Live,” [98] which outlines guidelines for designing socially successful communal courtyards. He further interprets this pattern by considering the courtyard’s size and its impact on social interactions, highlighting the social justification behind their use in Belapur.

The aggregation of families sharing the same staircase to access communal courtyards fosters a sense of closeness among them. Moreover, the repetition of courtyard clusters within the Belapur project imbues each cluster with a unique identity, contributing to the overall distinctiveness of the development and enhancing social interactions.

While the courtyard typology is effective in creating clusters at various scales, it is not the sole method employed. The Solanda project also achieves a gradient of social relationships through strategic placement of housing blocks and the subdivision of units within these blocks. By offering a variety of housing types, the Solanda project promotes a diverse and heterogeneous community. The clustering pattern observed in these projects is not exclusive to participatory housing initiatives but is relevant nonetheless. Creating a sense of community cohesion at different social levels is crucial for collaboration, self-help, and ultimately, self-determination, regardless of the project’s participatory nature. In Solanda, aggregation proposes similar qualities of neighborhood-bonding with the addition of tenure mix so that users of different income background can interact with one another preventing from creation of social classes and further economical and physical division of the estate.



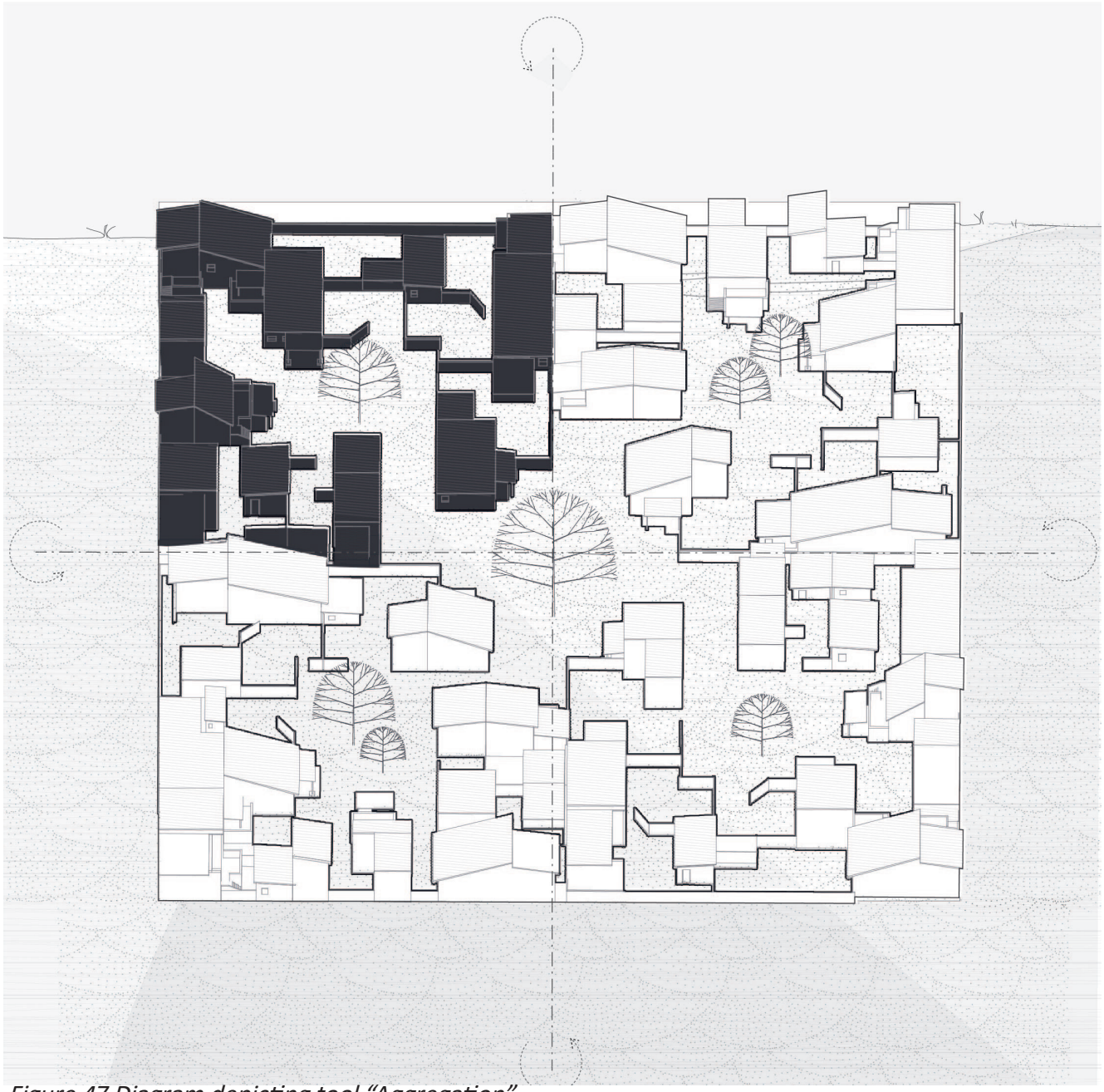


Figure 47 Diagram depicting tool "Aggregation".

Mexicali

Christopher Alexander, Mexicali, Mexico, 1976

Christopher Alexander, renowned as the founder of the Pattern Language, has been advocating for a more intimate connection between architectural design and its users. In his seminal work, "The Timeless Way of Building," he argues for a return to principles reminiscent of traditional societies, asserting that order in the human environment can only flourish under similar circumstances. His subsequent volume, "A Pattern Language," not only serves as a systematic exploration of built environments but also empowers users to interpret and engage with their surroundings actively. This emphasis on user participation forms the foundation of Alexander's philosophy. The Mexicali project, an experimental design sponsored by the state of Baja California[99], reflects Alexander's dedication to strengthening the connection between architecture and people. Wanting to move away from standard mass housing, Alexander saw the need for a new production system, which he aimed to introduce in Mexicali. By decentralizing control and educating stakeholders about the Pattern Language, he hoped to create a more natural and responsive design process. Drawing from twenty-one entries of the Pattern Language, Alexander decentralized control by entrusting his Berkeley students and educating Mexican families on the principles. Central to Alexander's approach is the concept of a nucleus - a practical, social, educational, and spiritual center - that serves as the genesis of subsequent developments. [100]

"the human environment can only come to order under circumstances similar to those which have existed in most traditional societies". [98]

In Mexicali, this nucleus materialized as the Builder's Yard, evolving through a continuous series of construction experiments. These interventions serve not merely as architectural statements but as catalysts for community engagement, laying the groundwork for the evolution of architecture in response to user needs. Furthermore, the source of development, exemplified by the Builder's Yard (48) (49), serves as both a blueprint for unbuilt structures and a repository of knowledge for users. This role underscores Alexander's belief in architecture as a dynamic and participatory process, rooted in the social fabric it continues to enhance. Another function of the source of development is to act as an architectural model for the remaining unbuilt buildings and a source of knowledge that the users can refer to. Such attitude of building from the grass roots is also well explained by Hassan Fathy, noted Egyptian architect who pioneered appropriate technology for building in Egypt, especially by working to reestablish the use of traditional construction, in his book Architecture for the Poor, he explains the importance of feasibility of developing a construction method that could be easily understood and implemented by individuals with no prior knowledge of building. [102]

"For the place that became our builder's yard was, and was built, as a result of a continuous, ongoing series of experiments in construction; it was both the site of our experiments and their outcome, both the construction yard for the construction of the family's houses and the laboratory where we worked out the methods of construction we would use". [101]

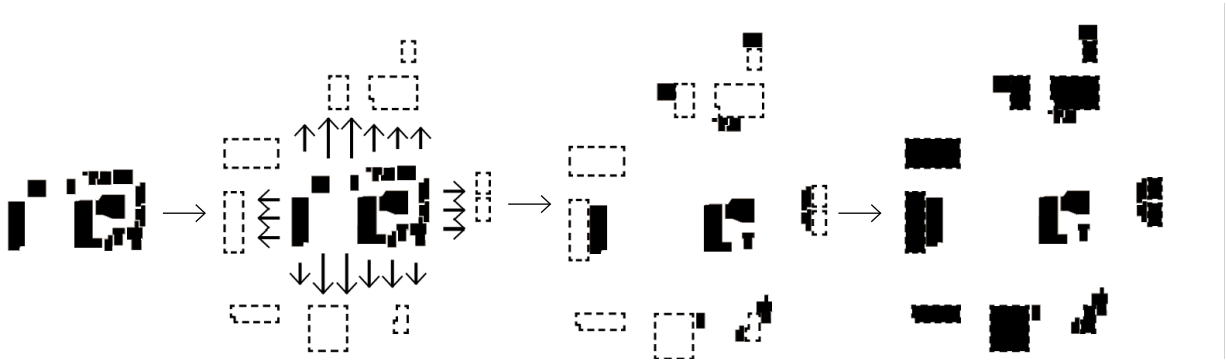


Figure 48 Incremental growth from Builder's Yard to inhabitated units.

Figure 49 Courtyard in the Mexicali's Yard.

Fathy tells us that a vigorous and self-perpetuating tradition of building [89] can only exist if an understandable, cheap method of construction is adequately demonstrated to the users. The builder's yard in Mexicali achieves this on two levels. Architecturally, the builder's yard provides an exemplary model of the building method and details of construction that are a result of an affordable building process. This architectural didactics can be experienced by the user every time they visit the Builder's Yard for social functions. Intellectually, the Builder's Yard provides the site for material experiments and an archive documenting the knowledge gained. There was even a small library (50) which contained a copy of A Pattern Language where users could study and discuss its contents. The setup redefined on-site fabrication; the workshop was fitted out with molds, pallets and fabrication tools and was accompanied with its own drying and curing yards. The didactic role of the source contributes to the decentralization of knowledge, complementing the decentralization of building production. My last point refers to how this source object should be implemented on a project. For this, I refer back to Hassan Fathy's quote about a national team of architects.

" We should have a team of architects working at the very highest level of their art, working as a team, continuously advising, criticizing, and revitalising one another's work..." [103]

We learn that central to this source of development should be a community of architects supporting the users around them. This is characterized by the inner courtyard of the builder's yard which houses the architect-builders. During non-working hours, Alexander writes how they play poker in the garden and discuss about difficult details during dinner. This 'investment', as described by both architects, is above all a political choice. Public authorities must see the importance of these sources of development and provide adequate funding for them.[105]

"The possibility of creating a system of construction which people who knew nothing about building could follow, could use successfully in their houses, depended essentially on this daily connection which we had to the design and to the building." [104]

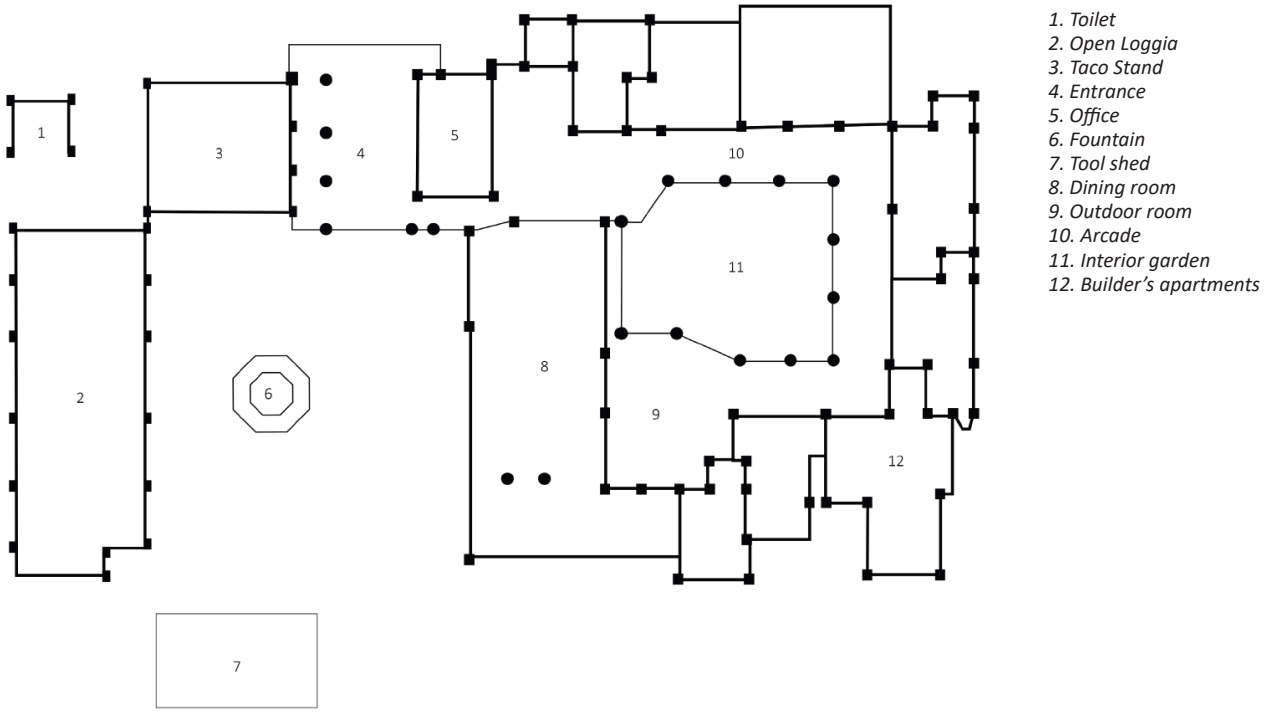


Figure 50 Builder's Yard groundfloor.

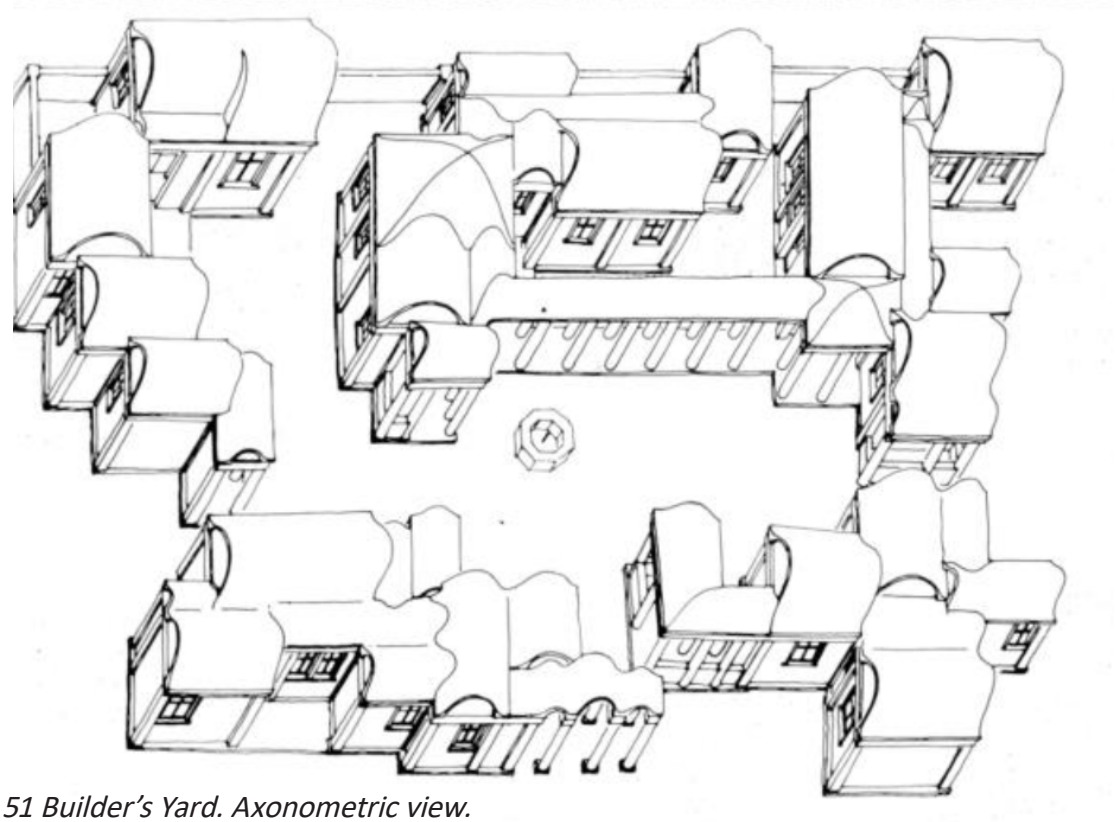


Figure 51 Builder's Yard. Axonometric view.

Community Core

The genesis of the builder's yard stemmed from both practical and symbolic needs. Initially, there was a necessity for a workspace where architects could collaborate, innovate with materials, and safely store them. Simultaneously, there existed a deeper, spiritual need to imbue the first erected building on the site so that users feel bounded to the space. Its architectural design serves as a repository of construction techniques and intricate details, acting as a blueprint for future developments within the scheme. Additionally, it functions as a communal gathering space, facilitating interactions among users and builders, complete with essential public amenities like a water fountain and taco stand.

Community Core appears on the site before any demolition occurs, an information center will be established. This center serves as a means of providing transparency and information to current residents who may harbor skepticism towards major government projects. Renamed as the Community Core, the builder's yard acts as a pivotal link between the overarching authorities and the grassroots community. The emerged tool is Community Core, it is a nucleus which is supposed to encourage user's initiative. It's function is to be a support place for the inhabitants where they can expand their knowledge and learn about prefabrication process as well as build increments for their extensions. As Christopher Alexander says:

> ***"It is the closeness of the builder's yard to the community, its presence as the heart and nucleus of building activity in each local neighbourhood, that is capable of transforming the housing process, making it a thing that has to do with people, and eliminating the idea of housing production as a mechanical and abstract process."*** [106]

The Core also serves as a workshop space where, not only the inhabitants can gain advise from the specialists but also, they can build necessary structural elements themselves. This way the incremental growth can progress in a faster way while reducing the costs connected with hiring professionals. On the top of it, the Core at first serves managerial function, the users meet there together with architects, contractors, and engineers in order to discuss the development of their estate as well as housing design. Once this stage is over, inhabitants use that space to meet and talk about the important matters for the community such as organizing funds or further developments.

Figure 52 Diagram depicting tool "Self-Development".

IN THE CONVERSATION WITH THE NEW COMERS

Target group description & Interviews results

"Good practice hinges on effective communication. A large part of that involves listening, and, importantly, being understood as one who wants to listen. Communication needs not always be verbal: plenty of nonverbal communication takes place and, as in the use of tools such as Participatory Rapid Appraisal (PRA), words are sometimes not the main means of communication."

Sanoff H., Community Participation Methods in Designing and Planning, 2018, p.8.

With that, the author described various tools, such as PRA, that indeed enhance understanding of each party, as well as bring the top and the down closer. However, the majority of the aids take place mostly at the sketch phase of the project and decrease the ability of decision-making of participants in the later stages. In an ideal situation, participants could take a stand in every design stage, not only at the beginning. As follows, to understand where the deficit of communication emerges, one has to come back to the beginning of the process; a collection of user feedback, that is: interviews, semi-structured interviews, on-site workshops, surveys, citizen consolations, serious games, visioning, toolkits, and models 1:1 scale. Such methods are often used only at the beginning of the design process therefore, do not encourage persistent dialogue between users and architects at every phase of the project. This is because:

"A powerless participant has little say in how their story is written in the end."

Yanru, G. and Dion, G.H.L., We want to hear Your Voice, 2019, p.561.

As Yanru Guo and Dion Goh Hoe-Lian, claim in their research We want to hear Your Voice participatory data can often be manipulated; the interviewer may use report building techniques to tell the user's story that may omit nuances. Moreover, it is the researcher who decides on the quantity and quality of information to be provided to the participants. Dynamics brought forth by the power and the powerlessness add to complex relations between the researcher and the participant which results in a design detached from users' needs.[107] A partial solution to that is mentioned by Sanoff[108] and researched by Rachel Luck. Now, the moment that architect decides to exert participatory feedback, they become the narrators of the user's story. Rachel Luck, a Professor at the faculty of Architecture and Engineering Sciences and ethnographic researcher at The Open University, recognizes that semi-structured interviews decrease the possibility of manipulating user feedback as they allow the user to express themselves freely. She proposes that the interviewee should not be asked questions instead, the interviewer should have a checklist of headings, such as aide memoire to steer the discussion by asking questions "But what about 'heading'?".[109] The concept of aide memoire explains how to harvest user feedback, project briefing[110] helps to maintain the possibility for interaction at every stage of the designing process. Her idea is that the second step of project briefing should be documenting interviews so that user opinion could be reviewed and revisited at a later stage.

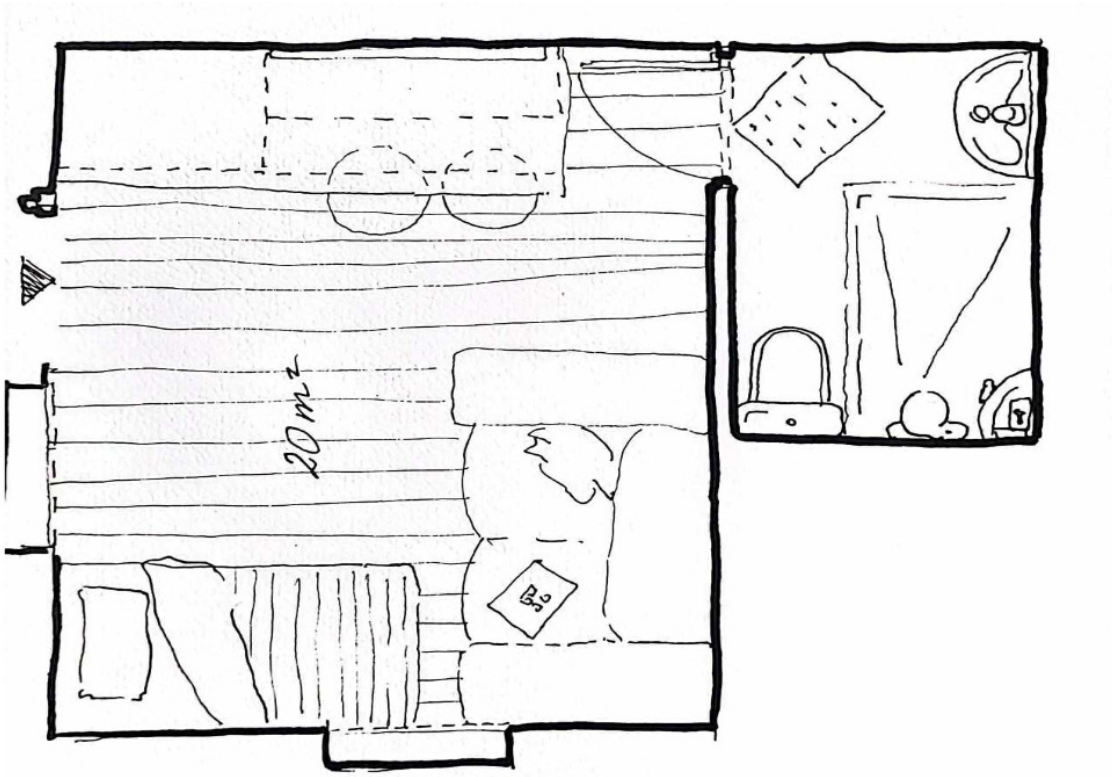


Figure 53 Plan of Sara's (interviewed newcomer) flat.

Figure 54 Sketch of Sara's flat.

In the conversation with Sara, I was able to understand her wantings, needs and plans for the future. The interview with her and other 11 newcomers pointed a direction for design decisions of minimum size dwelling. Below, parts my conversation with Sara, a 30 years old Indonesian woman living in Schiedam, Rotterdam, and sketches of her flat (53) (54).

Me: How satisfied are you with the storage options and organization in your current home?

Sara: ***I do lack storage space. My bedroom and living room and the same space which makes my days blend into one at times.***

Me: Do you think that the current design of the flat is suited to your needs?

Sara: ***I don't think so.***

Me: If so, would you like it to be flexible?

Sara: ***I would like that, but I don't think I would like to change the layout of units myself. I would either ask a contractor or leave it as it is. However, I do think that a flexible plan could help in making the space adjusted to my needs.***

Me: Do you have any preferences regarding the integration of nature into your living environment?

Sara: I don't have specific preferences, but it would be nice to have a balcony. It is hard to find a park nearby so having a small balcony garden would be nice.

Me: What aspects of your current home do you find most functional or practical?

Sara: ***Ironically, since it is small it doesn't require a lot of cleaning, which makes me safe up time that is consumed by work anyway.***

Me: What aspects of your current neighborhood or community do you appreciate?

Sara: ***Probably none? I do not know my neighbors.***

Me: Would you like to be closer to your neighbors then?

Sara: ***I don't need to be friends with them, but I do think that it would be nice to have a place to meet with them.***

Me: How so?

Sara: ***Well, this way we could talk about stuff concerning our building. Like who and when should cleans the corridor, maybe we could have collective laundry room to cut water usage.***

Me: I see. Do you think that your current rent is suitable price for the flat?

Sara: ***I think so. I pay 750€ and I still think it is a lot of money, but good luck finding something cheaper in Rotterdam, let alone Amsterdam.***

Me: You live in Schiedam where you also work. If you could move out from the city and pay half the rent price, would you do it?

Sara: ***As long as the commute time isn't much longer, I would definitely do it.***

Me: And what part of your flat is the easier to be rebuilt to make it more comfortable for you?

Sara: ***Perhaps...The bedroom and living room.***

Me: That is a logical answer. Do you think so because you wouldn't have to move any fixtures eg. sink, toilet etc.?

Sara: ***Yes. It feels costly and easy to mess up.***

Me: If someone prepared a manual for you on how to deal with it and tell your landlord to give it to you the moment you moved in here, would you use it?

Sara: ***I think so. I can always google stuff, but to make sure I don't spoil something, I would have a look.***

Me: And if you were to sacrify your comfort to live more in a more sustainable way, would you do it?

Sara: ***Oh I think, yes. It depends on what these sacrifices would be exactly, but I think it is high time we sacrifice something for the nature since the nature has been sacrificed for us so many times already.***

Me: How do you envision your lifestyle evolving in the future?

Sara: ***I would like to move in with my boyfriend.***

Me: To here?

Sara: ***No, this place is too small. He is going to buy a house in Zoetermeer, where I am going to move in.***

Me: And you plan to commute to your work every day for 1.5hour?

Sara: ***Yes. Commuting to here is still better than burning my money in rent.***

Me: Are there any specific requirements or aspirations you have for your next home in terms of adaptability or longevity?

Sara: ***I am not sure how long the building should last, because maybe we will sell that house in the future. But as long as the place is big I am going to be happy. I would like to have more space for my hobby, which takes a lot of room.***

Me: Speaking of additional space. Maybe you could rent it to gain profit before moving out?

Sara: ***I think it is a good idea but I don't think the house is well adjusted to it.***

Me: How so?

Sara: ***Well for one, it has one staircase so the renters and us would be in each other's spaces.***

Me: Is there anything else that you would like to tell me that I didn't ask you about?

Sara: ***Whatever you design, make sure it has access to greenery! And if the units are supposed to be incremental, make sure that the spaces for growth for safe.***

Considering that the Netherlands has housing crisis and the underlying problem of that is not the lack of available housing, but the lack of affordable available housing, it is the social role of architects to contribute in solving this problem. At the end of the day who needs and looks for housing are people such as starters or new comers. It is important to note that most of that people are outside from the Netherlands and in worse off financial situations. Since the populations who need housing so desperately are of all genders, ages, nationalities, occupations etc. it is best not to define detailed features of new comers other than that all of them arrive in the Netherlands to find shelter with little means to afford it. **The term "newcomers" is inclusive and doesn't necessarily imply a specific time frame. It is a broad term used to describe those who are newly associated with a particular entity or context.**

For the projects 12 newcomers were interviewed. (55) With the semi-structured interview method, I was able to find out what are the disadvantages of their current housing situation and what they would wish to be improved. With some of them, I managed to sketch together improved versions of their homes which was the starting points for my design.

The overall feedback of the interviewees was the blueprint for unit types. The examples of the most infuencial interview and sketches were presented on pages 83-85.

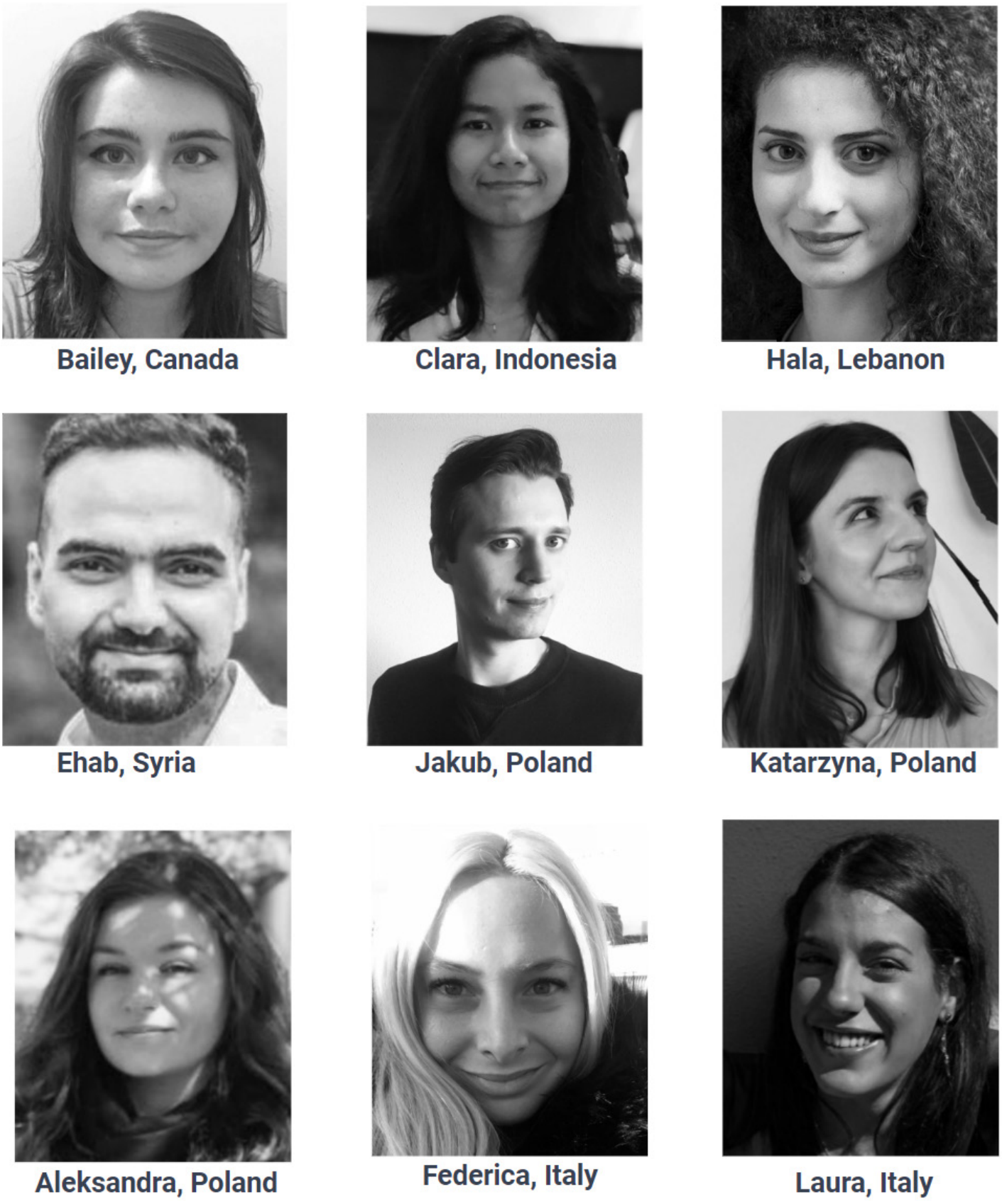


Figure 55 Newcomers who were interviewed by the author.

NEW ECOLOGY

De Zweth’s masterplan

NEW ECOLOGY

The new masterplan for De Zweth

To go against the monotonous and exclusive urban fabric that is already in the zweth, the new masterplan proposes 4 different zones, each providing different urbanity as well as approach to the affordability, this way the village becomes a more inclusive place to the new target demographics. (56)

At the same time today's De Zweth has quite modest program. There is mostly housing and retail on the both sides of the Schie that are disconnected and do not take advantage of the river. Such program does not provide good job opportunities, leisure spaces, amenities etc..

However, this could change with the implementation of the new masterplan, this way De Zweth becomes the center of it, as a place for the new and old inhabitants to meet. The bridge connects the sites of the village, this way the inhabitants have easier access to the amenities and harbour on the other site. The harbour receives good from the city, such as building materials for the housing, the park extend behind the old center of De Zweth becoming a water collector as well as new public space. UIn addition to that a water reservoir supporting the boezem system that is also are leisure space appears in the west part of the masterplan. (57)

Finally, the masterplan proposes 4 different approaches on the affordability that come together along the river as one ecology. The Schie is the central part of the development so that each zone can profit from it to the fullest capacity contrastingly to the current situation that seem not to acknowledge the existence of the river.

Figure 56 4 zones in De Zweth's masterplan.

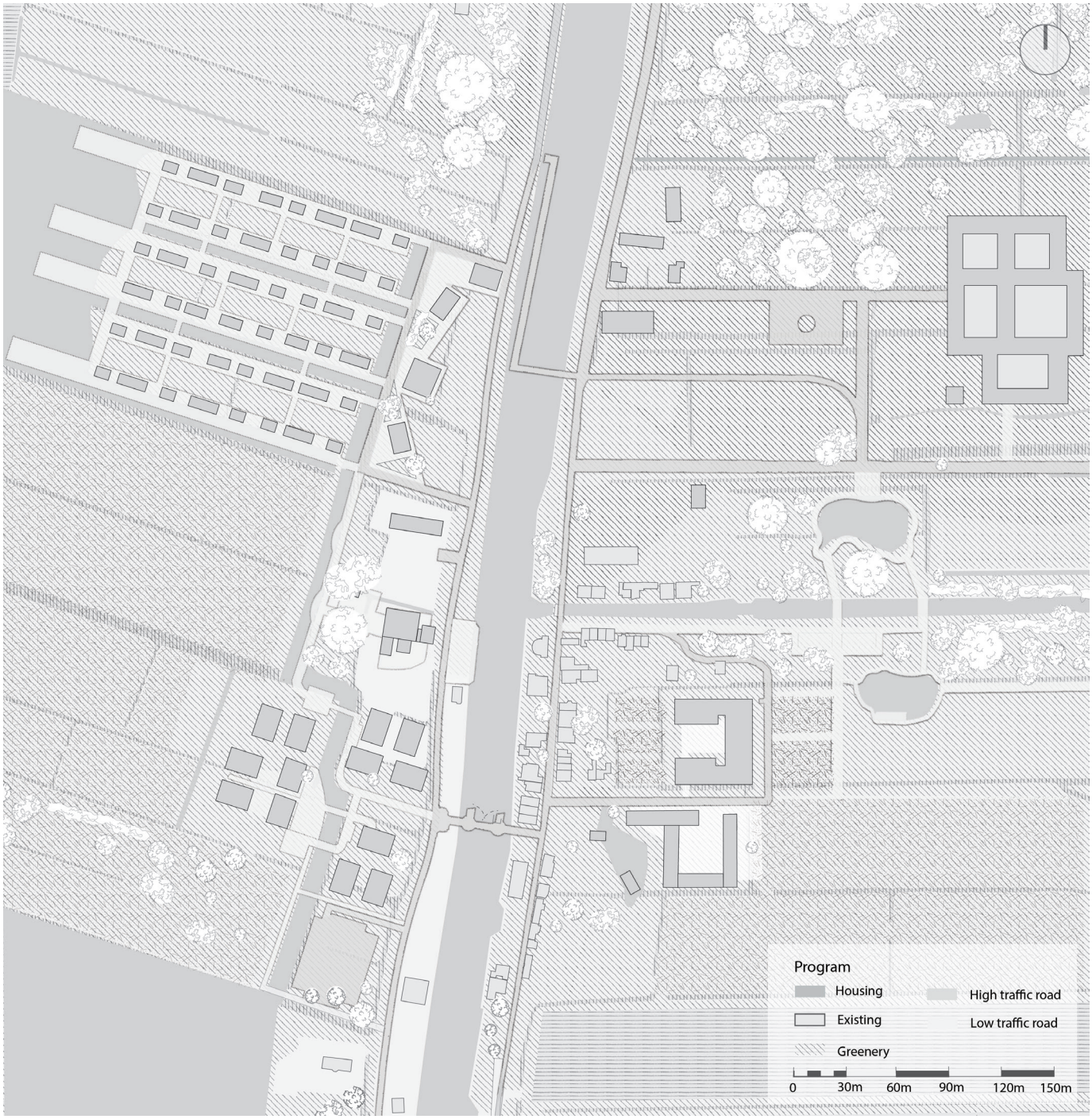
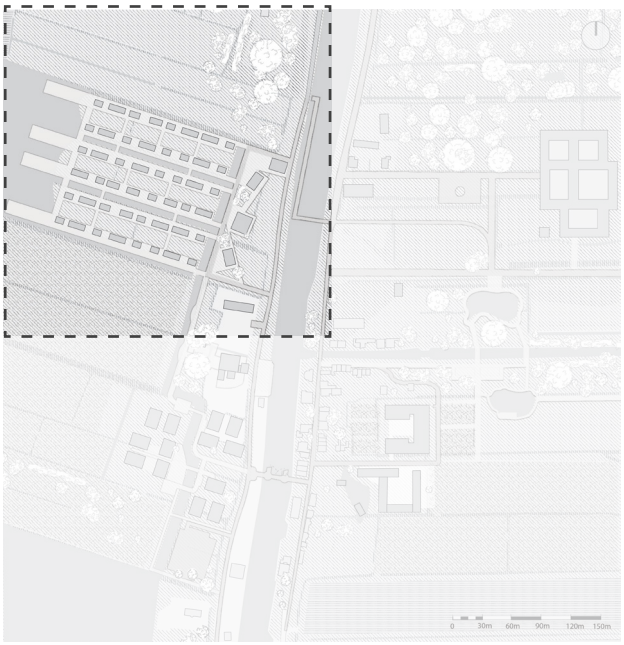
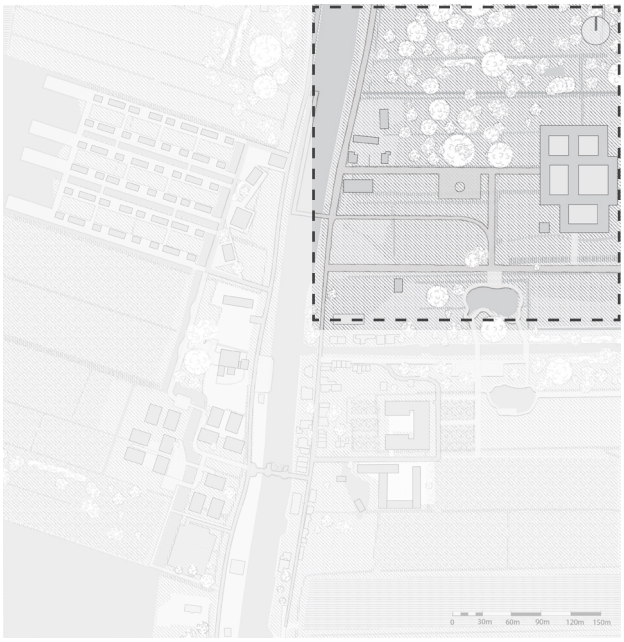


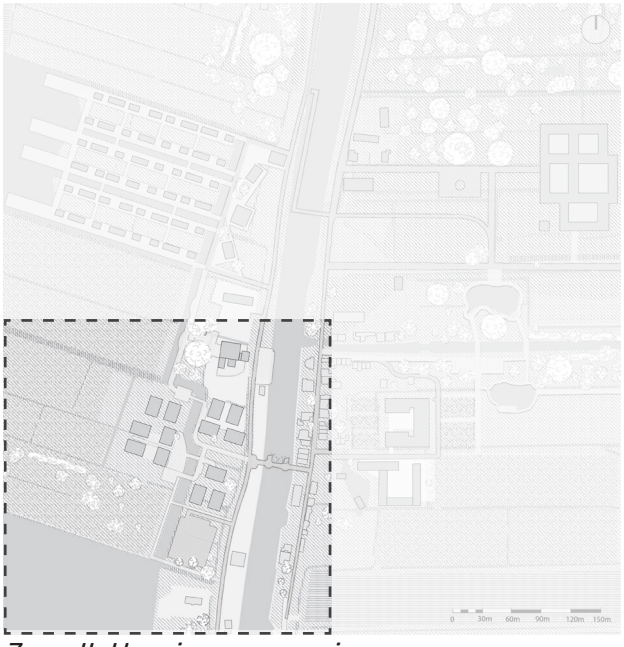
Figure 57 New Ecology. Masterplan.



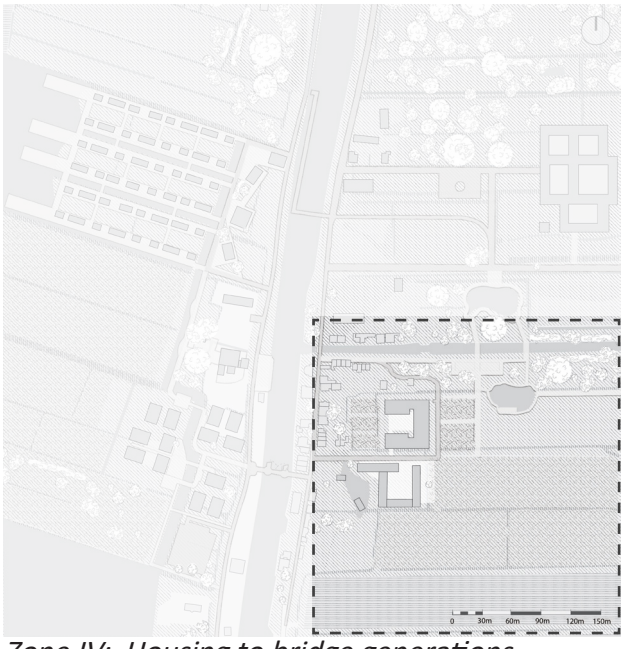
Zone I: Participatory development.



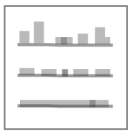
Zone III: Permament affordability in De Zweth.



Zone II: Housing as a service.



Zone IV: Housing to bridge generations.

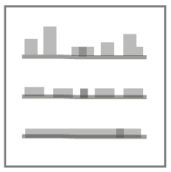

Community Core

MASTERPLAN OF SMALL CHANGE

Incremental development

Tool

The tool that is used for masterplan is Community Core.


Community Core

Incremental development

To adjust the scale and pace of the masterplan to participants' needs and funds the masterplan is seen as a nucleus of progress instead of fixed design.

The development stages can be applied at preferred moment there is no time frame for the to occur. The development stages are as follows:
1. First building that should appear on the site is Community Core so that the site's development can be managed from there and once it is build, the community can meet there and decide about important matters such as further development. It is an idea inspired by Builder's Yard in Mexicali design by Christopher Alexander which he describes as

> ***''Nucleus of building activity in each local neighbourhood, that is capable of transforming the housing process, making it a thing that has to do with people, and eliminating the idea of housing production as a mechanical and abstract process''.***[111]

The nucleus is not only a physical space, but also a mental concept of giving the decisive role to the user to encourage their empowerment.

2. Pilot project should be added to ensure that the building methods and design developed together with the users is viable.

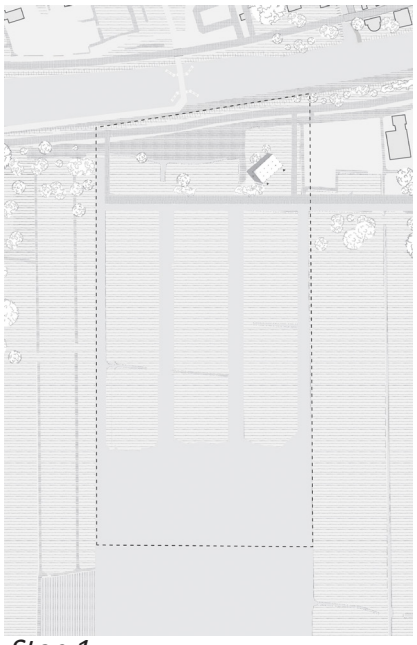
3. In the next step, the pilot project should be aggregated by mirroring it since the aggregation should be simple so that the inhabitants can easily recreate it.

4. The aggregation would continue till the water border. The water body is put there intentionally to be able to stop the growth.

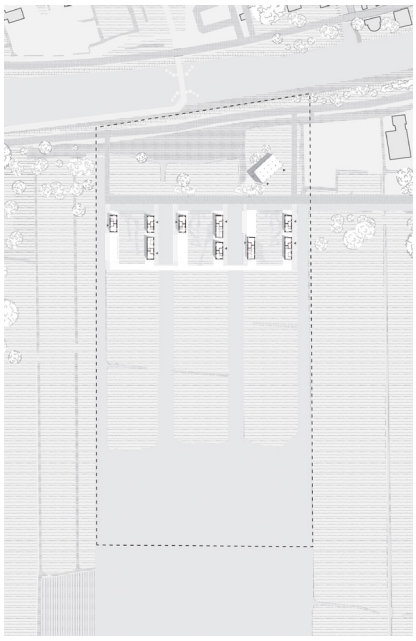
5. Preventing from the further growth isn't the only function of the lake, it also is additional leisure space for the inhabitants, hence decks should be extended into the water body.

6. Last step is to add buildings for amenities, activating the river site.

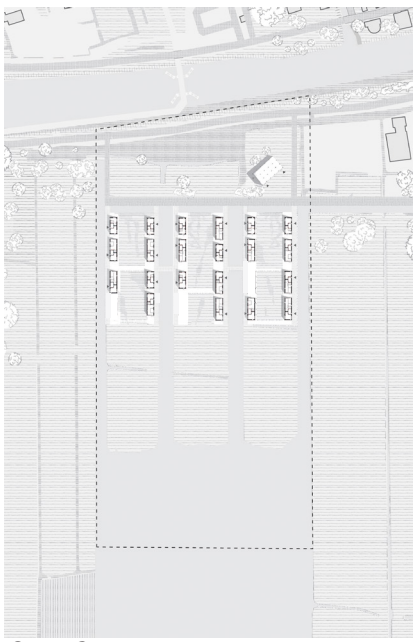
During the last phase, which unfolds over an extended duration, residents experience economic advancement, leading to the gradual expansion of their homes. Consequently, the once-vacant garden spaces undergo appropriation, giving rise to smaller social spaces that fragment the gardens into a series of partially enclosed courtyards. On the top of the users begin to expand their home units vertically. As a consequence of this transition, the scheme experiences a rise in density. Although it may not match the density levels seen in certain case studies, it stands as a competitive counterpart to the developments in Zweth and comparable low-rise structures. Moreover, the inclusion of public amenity space facilitates not just commercial endeavors but also opportunities for modest income generation, making the proposal an attractive departure from traditional mass housing paradigms.



Step 1



Step 2



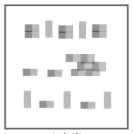
Step 3

Step 4

Step 5

Step 6

Figure 58 Masterplan, scale 1:2000.

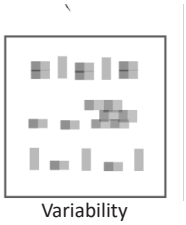

Variability

REALM OF A NEW COMER

Tenure mix

Tool

The tool that is used for units' concept is Variability.


Variability

The inspiration for the smallest unit was taken by real life example - a flat of a new comer Sara (page 77-79). The smallest unit is chosen to be truly small so that they can be more affordable both in therms of footprint as well as construction, so that every newcomer can participate despite their budget. The typology is seen as a stepping stone for low income dwellers who will hopefully be able to afford a larger home in the future.

Unit for a single new comer

The initial typology accommodates up to two separate households. It features a configuration where one household occupies the bottom level, with the potential for expansion by another household of similar size on the upper floor, linked by a communal staircase. (59)

Expansive terrace areas are designated for collective use by all households, serving as venues for communal gatherings such as shared meals. Surrounding gardens are strategically positioned to foster additional communal spaces while also serving as a buffer to ensure privacy. These gardens double as semi-public areas where spices and herbs can be dried.

The layout illustrates the ground floor of one household, offering views of the shared terrace and adjacent unit from the eastern side. For the ground-floor occupancy, the semi-detached typology presents the option of entrances from both the east and west sides, providing flexibility for separate ingress points if required.

Couple unit

The second typology is an extended version of the single new comer unit, designed to accommodate multiple households, whether they share close connections or not. However, if the growth doesn't happen the terrace on the first floor may serve as an additional leisure space that can be appropriated in a preferred manner. On the top of it, on the east and west side of the units, there are extended beams and columns as a semi-formal space for appropriation. Due to enlarged footprint this arrangement of living is suitable for couples and individuals who plan to stay in the neighborhood for a bit longer. (60)

Family unit

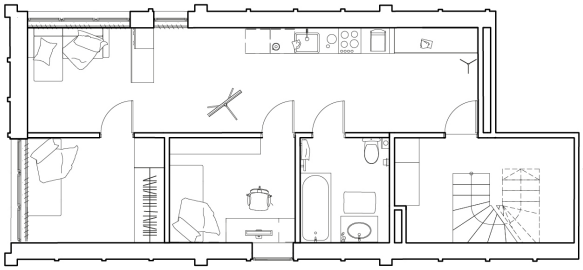
The third typology, is the only one that has the 1st floor occupied before incremental process begins. That is because it is designed for a family with a child or 3 independent roommates. To provide a private connection between the floors, a staircase is added inside the unit. If the inhabitants of the other flat decide upon the same layout, the communal staircase can be removed and turned into communal space, for instance a dining area. (61)

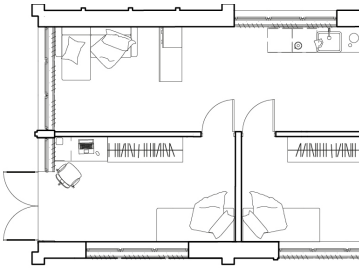
Block

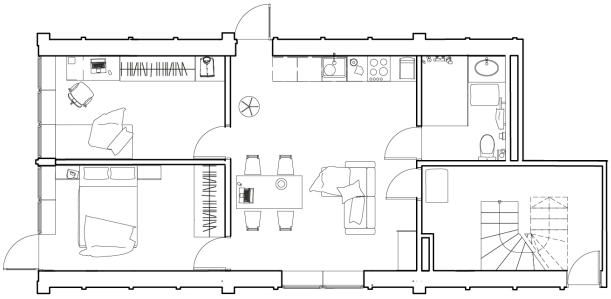
The block typology responds to the entrepreneurial aspirations of the new comers. On the ground floor there are retail spaces that can be rented out or purchase by the inhabitants. This approach not only provides residents with the opportunity to generate additional income but also addresses the current shortage of amenities in Zweth. These inhabitants prefer a more private way of living as the communal spaces are moved from the private units to the central core that overlooks the garden, there are also laundry, dining area and other amenities such as small library. That typology also includes underground parking for the inhabitants from the building as well as the entire neighborhood. The parking consists of two stores so be able to host all the cars. Pedestrians are welcome to go into the patio on the ground floor making it a lively space. (62)

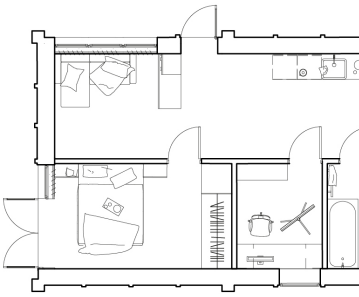
The developed plans are an assumption, a design option rather than a fixed design delivered by the architect to the user. If *Small Change* **was an acquisition project, users would use Floorplan Catalogue to develop the floorplans to their likings. The inspiration for the floorplan design options came from interviews with the new comers. It is a comprehensive interpretation of their wantings and needs that were communicated in the conversations and sketches.**

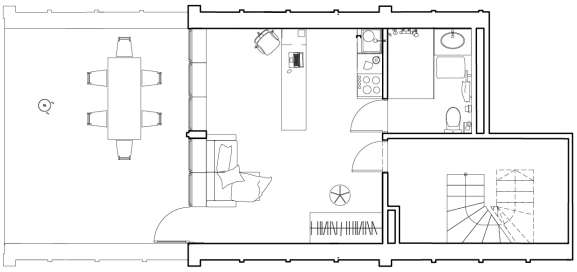
FLOORPLAN CATALOGUE

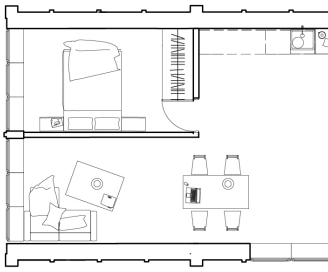


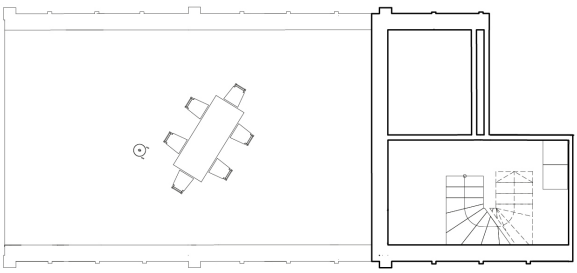


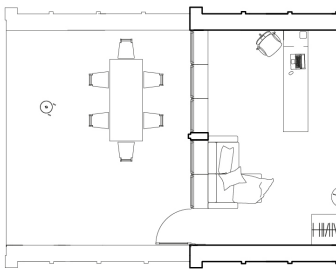


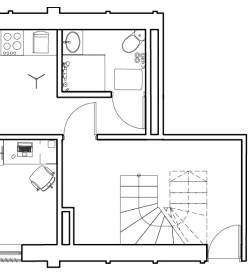


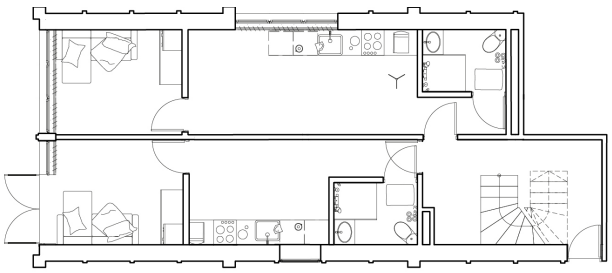


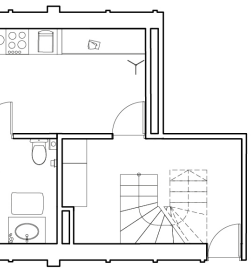


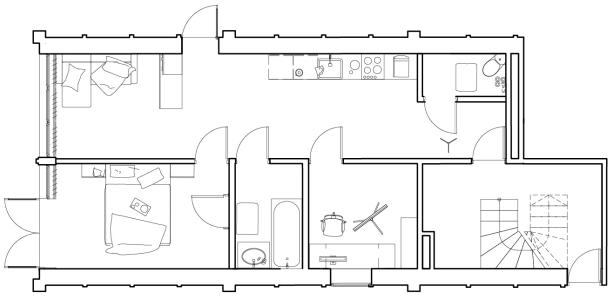


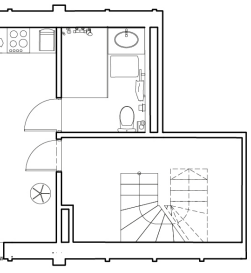


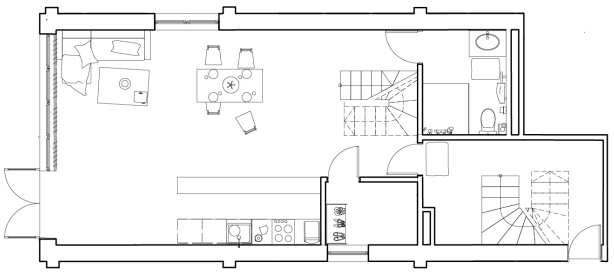


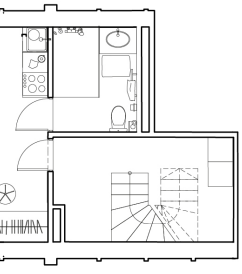


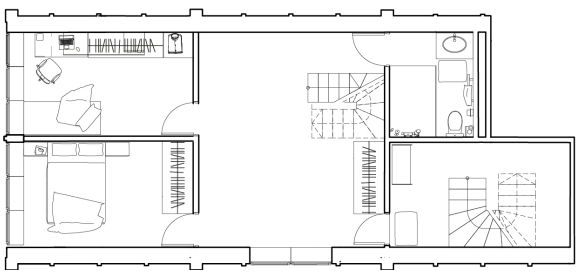


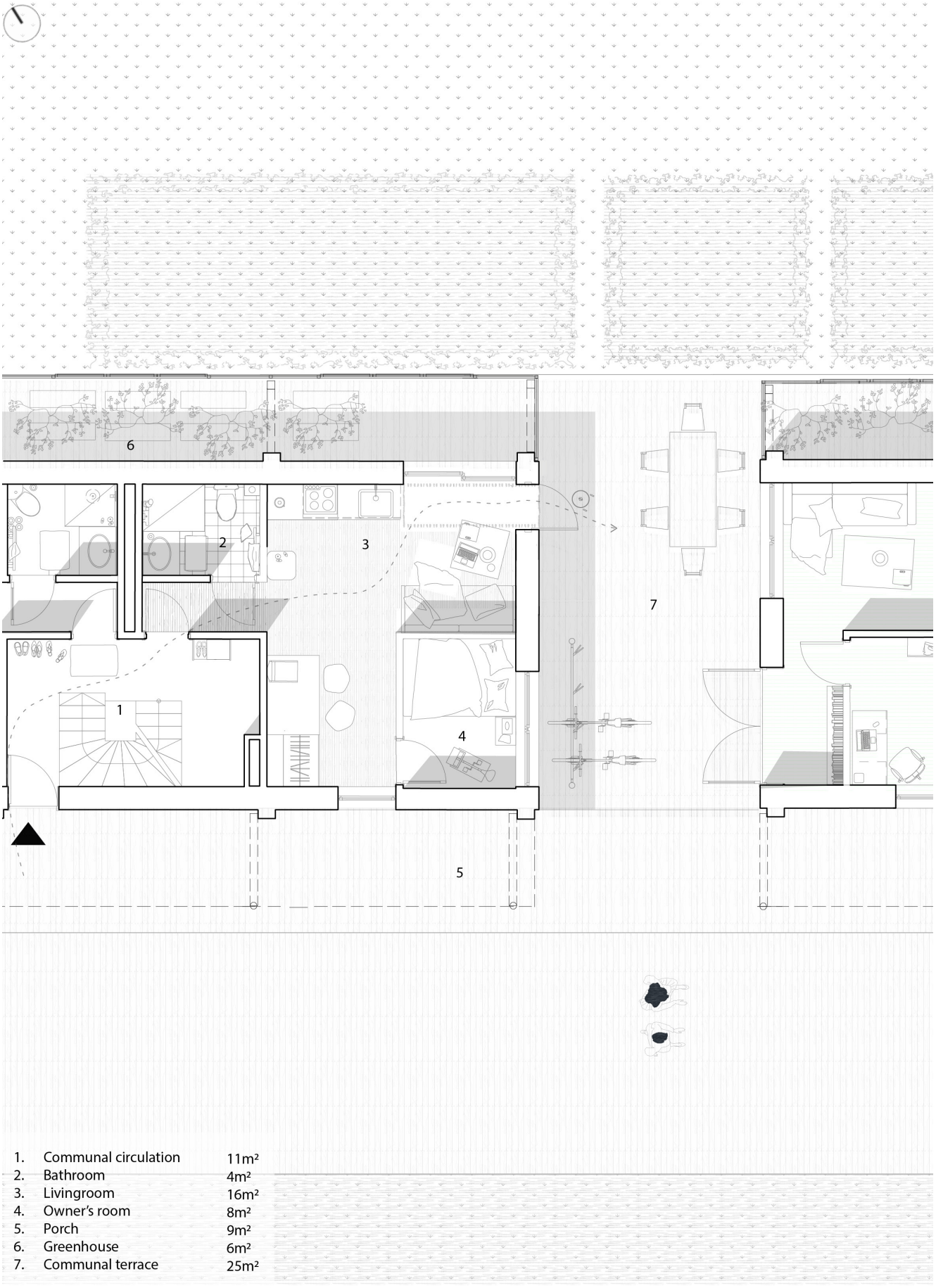






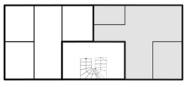


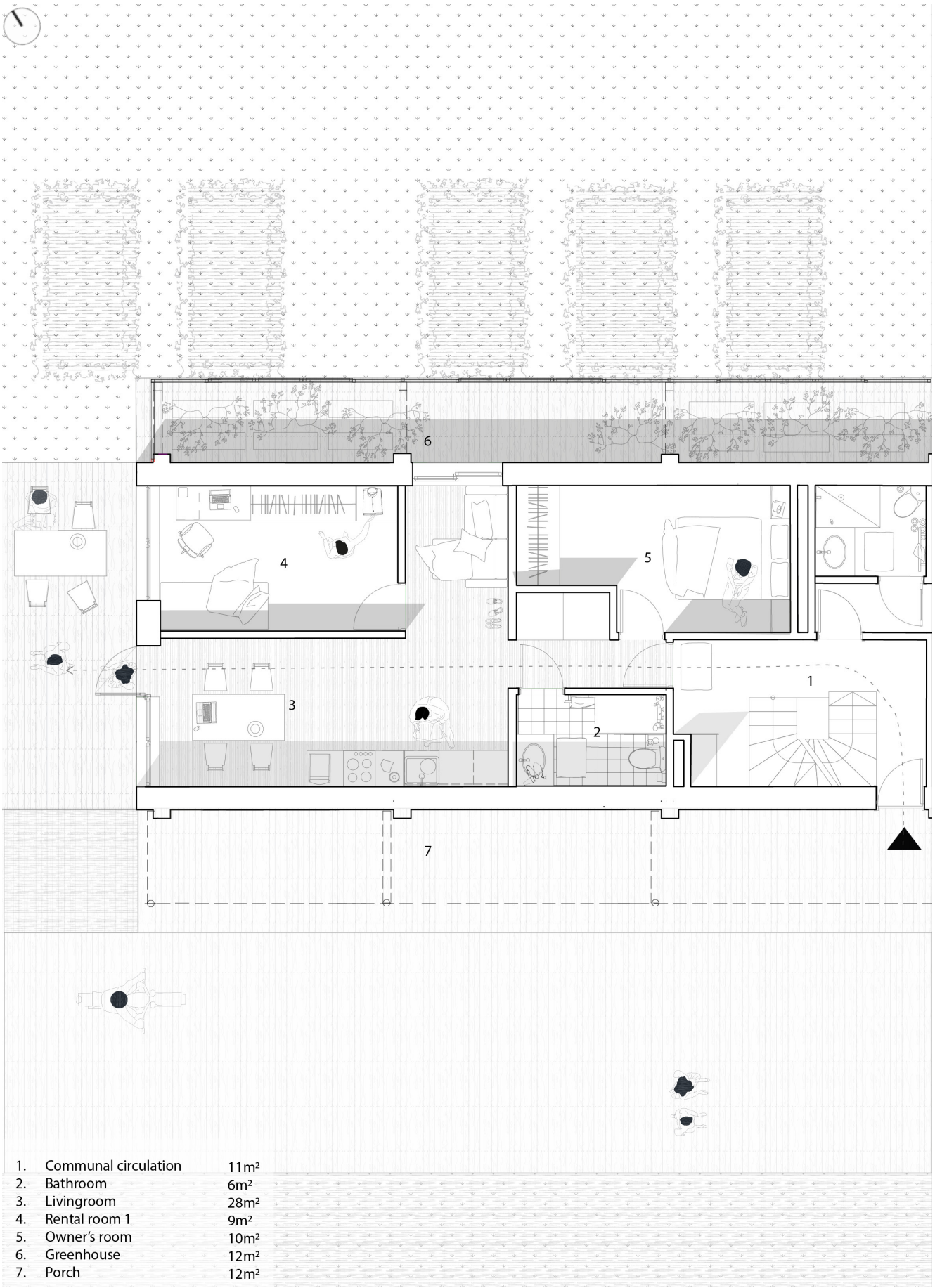




1.	Communal circulation	11m²
2.	Bathroom	4m²
3.	Livingroom	16m²
4.	Owner's room	8m²
5.	Porch	9m²
6.	Greenhouse	6m²
7.	Communal terrace	25m²

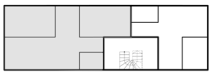
Figure 59 Groundfloor. Single's unit.

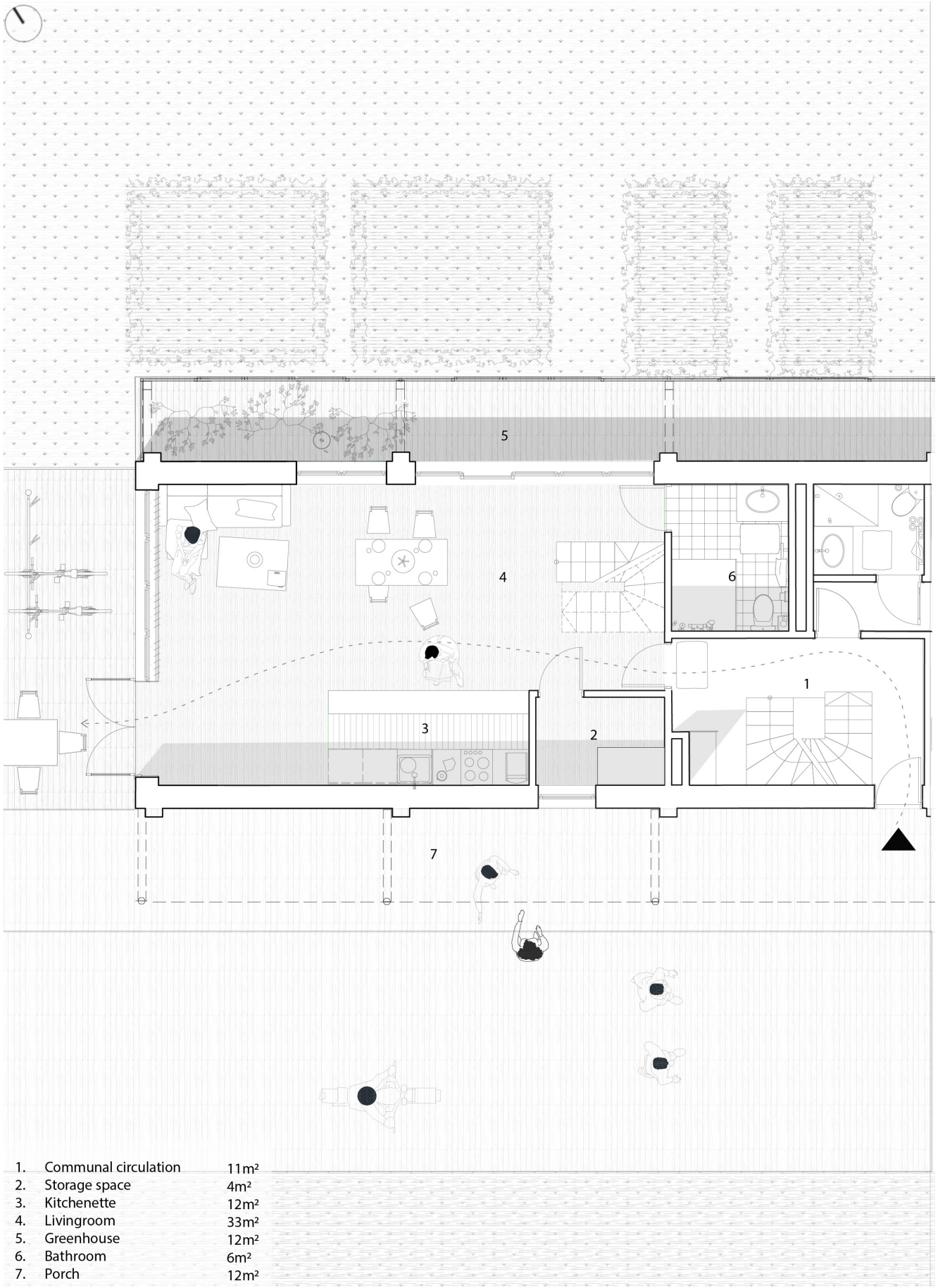




1.	Communal circulation	11m²
2.	Bathroom	6m²
3.	Livingroom	28m²
4.	Rental room 1	9m²
5.	Owner's room	10m²
6.	Greenhouse	12m²
7.	Porch	12m²

Figure 60 Groundfloor. Couple unit.





1.	Communal circulation	11m²
2.	Storage space	4m²
3.	Kitchenette	12m²
4.	Livingroom	33m²
5.	Greenhouse	12m²
6.	Bathroom	6m²
7.	Porch	12m²

Figure 61 Groundfloor. Family unit.

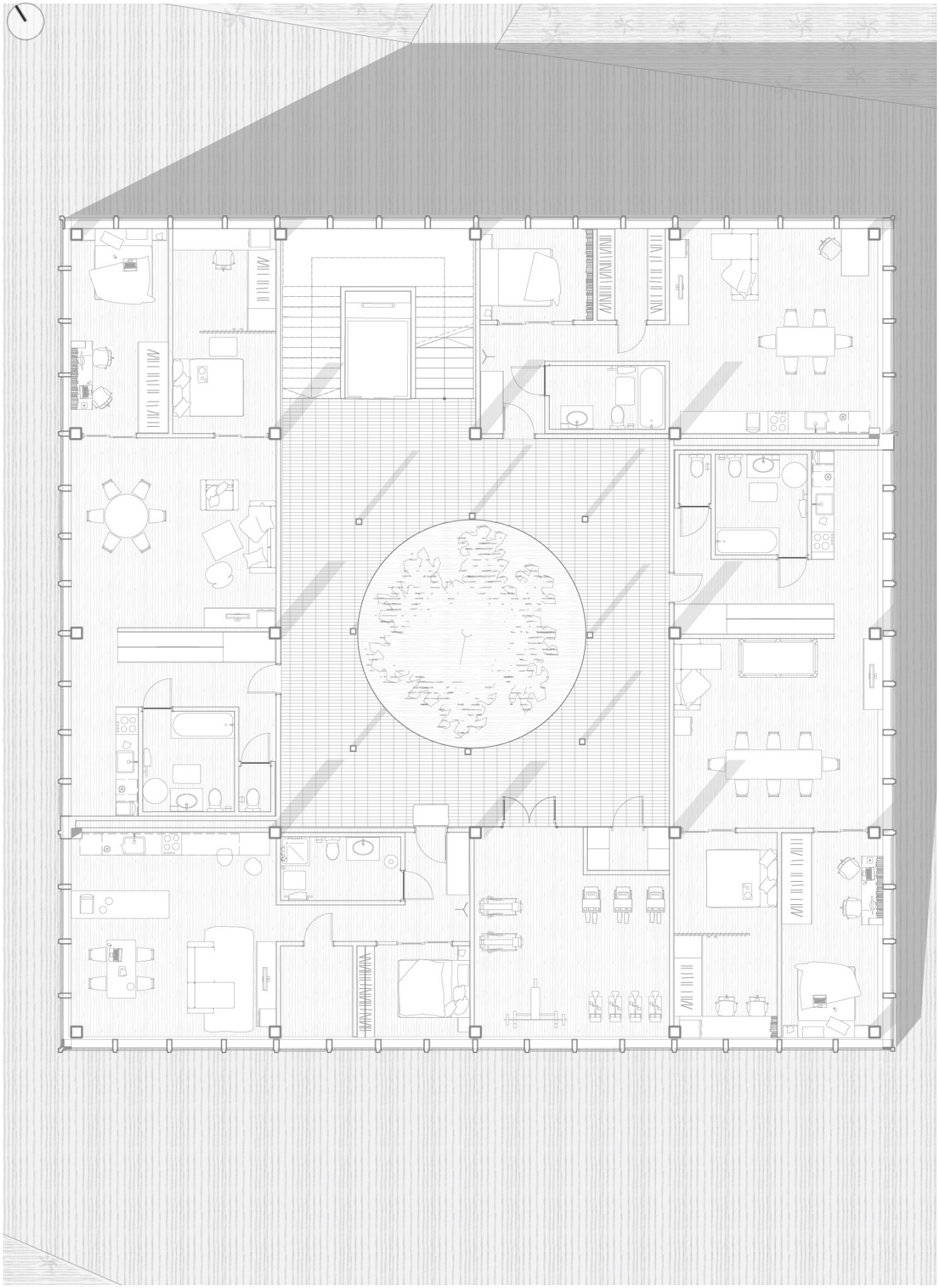
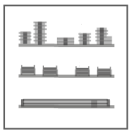


Figure 62 Groundfloor. Block.

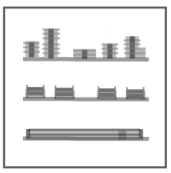

Self-Development

HOUSING AS A PROCESS

Managerial strategy

Tool

The tool that is used for units' concept is Self-Development.


Self-Development

"Substantive and procedural law benefits and protects landlords over tenants, creditors over debtors, lenders over borrowers, and the poor are seldom among the favored parties." [112]

With the following quote John Turner, a pioneering urbanist renowned for his expertise in participatory approaches to urban planning, points out the shortcomings of the top-down approach. To go against the notions reinforced by such an approach, inhabitants of *Small Change* are part of a cooperative. This way they are the main stakeholders and enabled to make managerial and financial decisions about the project, such as material price, rent value etc.. This way, the cooperative becomes the client of the architect forcing upon the process a participatory approach by default, as every member of the cooperative is going to have a say in the final design. On the top of it, the participants are going to meet with specialists such as engineers, contractors etc. which is a special occasion on the contrast to how it is organized in a standard way of designing.

1. Forming community land trust scheme

Future inhabitants become legal entity registered as a cooperative based on rules:

The formation of Cooperative must happen on the basis of Community Land Trust organization to prevent from property cost increase associated with incremental growth based on the resale formula.

Most economically disadvantaged people get housing first

Individual increments can be added only with properties of individual dwellings.

2. Organizing funds

The cooperative applies for loan in the bank, joined credit score allows for sufficient amount. The loan shall be spend on building materials as well as legal and technical advice.

3. Land lease

The land is leased to the cooperative by the government. This way the rent per singular unit is decreased.

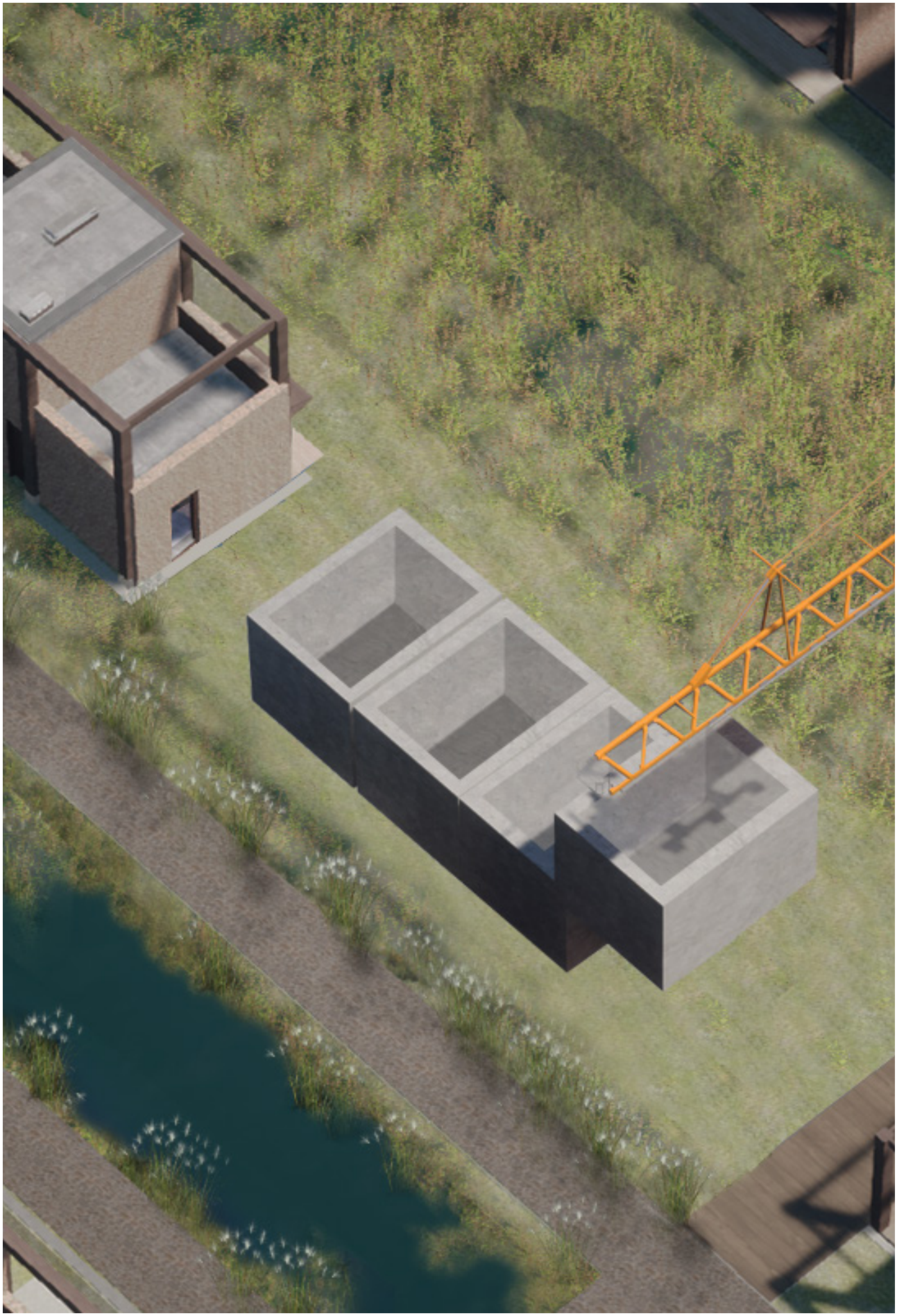
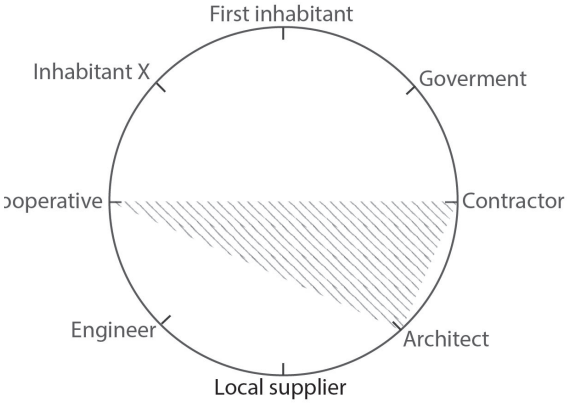


Figure 63 Delivery of prefabricated raft foundation.

Stakeholder analysis

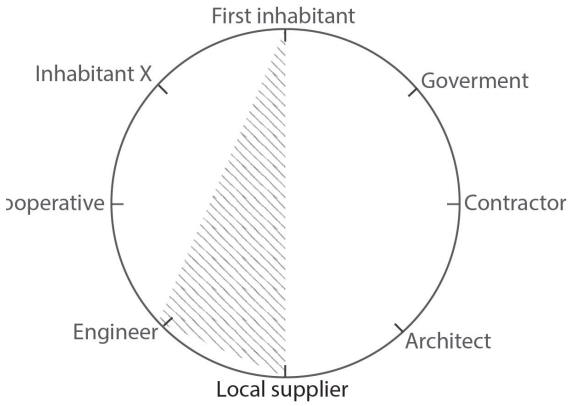


4. Pilot design

Members of the community meet with architect and engineer to discuss design of 4 basic unit types. The users can decide upon number of units, clustering methods, and which units types should be first build based on the demand within the cooperative community. (63)

Figure 64 Placement of the raft foundation.

Stakeholder analysis

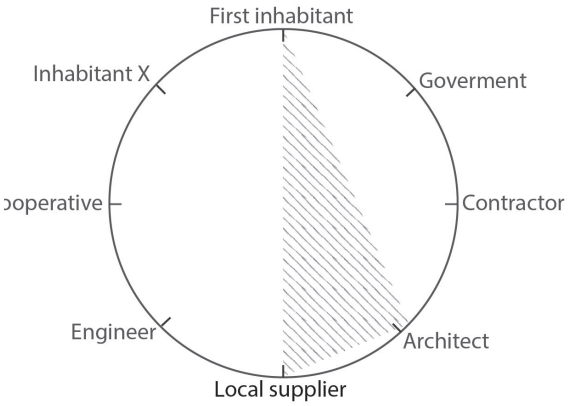


5. Erecting support

The support is erected by experienced contractors. Due to repetitive nature of support it can be erected rapidly and efficiently. The cooperative community supervises the growth. (64)

Figure 64 Support.

Stakeholder analysis

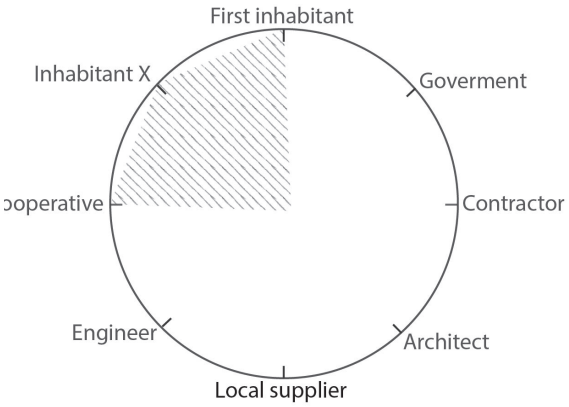


6. Erecting infill I phase 1.

At this point users are welcome to engage in their own developments. They can design facade within predefined framework of support and panel options with assistance of an architect. (65)

Figure 65 Infill.

Stakeholder analysis

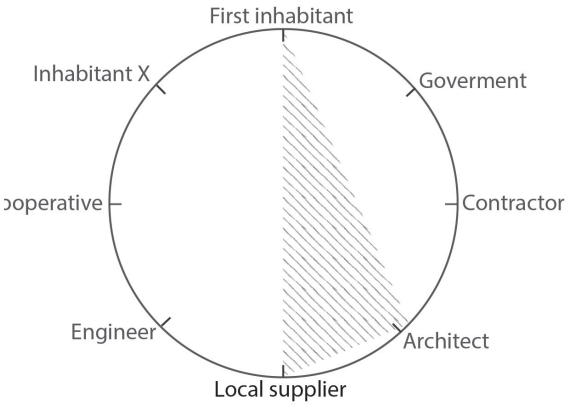


7. Erecting infill I phase 2.

Once inhabitants settle the infill, they can rent the newly divided spaces. This way they can earn back any additional expenses such as materials purchase etc as the payment for infill falls onto individual inhabitants in order to prevent speculations. Each inhabitant is obliged to share a part of the income with the cooperative to cover the expenses such as bank lease, materials for structure and skin or legal and technical advice. The amount should be low as, let's say, each inhabitant owes 2% of the total expense however, in case they decide to leave the cooperative before paying back then, the cooperative is going to rent the entire property of the ex-inhabitant to cover the expenses. If the inhabitant pays back the entire sum then the cooperative shall buy the property from the user. The price includes both shares of the basic unit as well as any cost of any improvements that were done by the inhabitants, which allows them to earn greater profit. (66)

Figure 66 Groundfloor. Block.

Stakeholder analysis

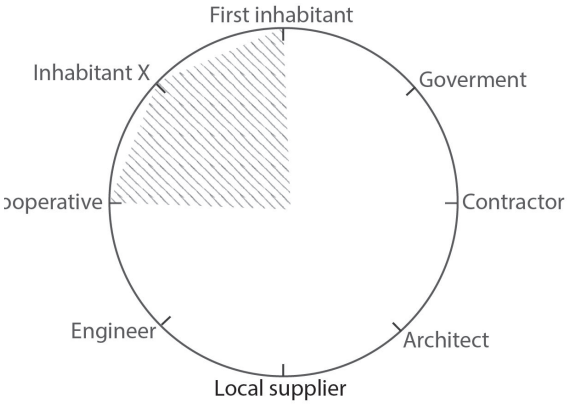


8. Erecting increments

Once the resident earns money through renting the infill, they can extend the unit by 1 or 2 floors to rent or sell the increment further. The increments remain private property of the residents. (67)

Figure 67 Groundfloor. Block.

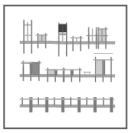
Stakeholder analysis



9. Prevention of price increase. Community land trust scheme.

In case the cooperative wants to welcome new inhabitants, it must be provided that the price of property doesn't increase. Such increase could be motivated by 2 factors: 1. Market prices. 2. Extended property footprint as a result of incremental development. The basic part of the house is built and shared by the cooperative members, so for the new inhabitant to own it, they have to buy shares. However, individual increments shall remain individual property to avoid speculations. In case an inhabitant moves out the part that was extended by them is sold to the cooperative based on market prices, the cooperative can keep on renting the extended part to gain income proportionally. However, if the new inhabitant wants to own the increments then they have 2 options to buy it from the cooperative: 1. Buy shares of the increment to maintain lower cost and shared ownership, 2. Buy based on the resale formula to obtain private ownership of the increment and sell it to the cooperative in the future to gain profit. (68)

Figure 68 Groundfloor. Block.

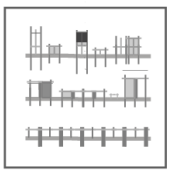

Support-Infill

FROM SUPPORT TO INFILL

Building technology

Tool

The tool that is used for units' concept is Support-infill.


Support-Infill

Hamdi, inspired by John Habraken's theory of support-infill, came up with a detachable partition system for social housing in Adelaide Road. In this project, the building parts are divided into high-tech support, low-tech support and infill. High-tech support requires expertise of specialists under a careful eye of the inhabitant. Low-tech support can be assembled by specialists as well as the inhabitants and infill is simple enough to the point it can be easily assembled by the user.

With help of a physical model, (69) I brought that theory into my design and discovered possibilities for interior design with the restriction that fixtures cannot be further than 3.5m from the shaft. That study concluded in 6 primary layouts (69) of the ground floor, which stem from the configurations of kitchen, bathroom and toilet. The installations are in a technical room in the basement, so when inhabitants hire the contractors while growing their units, the installations can be easily accessible. The technical room and shafts are part of a permanent core. This way inhabitants can place the impermanent interior walls around the core as they please. At this point the involved stakeholders are inhabitants and cooperative.

All necessary installation such as water pipes, savage pipes, ventilation ducts, electricity cables, water buffers, sprinklers for the inhabited ground floor are already included in the core as well as remaining layout of unit while installations for yet to be inhabited first and second floor are included in the core walls and slabs ready to be extended once the user decides to expand the unit.

The project isn't likely to be flooded due to the close proximity to the Schie which is a part of the boezem system however the sedimentation of the soil is a process that will continue, that is because the main soil type there is peat. Hence Midden-Delfland continues to be swampy. The unstable characteristics of the peat are take we use that to the advantage of the project. The prefabricated raft elements are delivered to the site on a boat and placed on the unstable ground allowing them to sink. Raft foundation (68) reduces pressure so it also reduces sedimentation process.

The prefab elements stop to sink the moment they push out enough soil that it weights as much as the elements. This means that the prefabricated elements need to have certain mass and dimensions as follows: 3500mm x 5500mm x 4500mm. (70) This way the building is going to float in the ground. Participants do not actively engage in this phase therefore modularity is important as the structural grid can be decided on prior to design decisions.

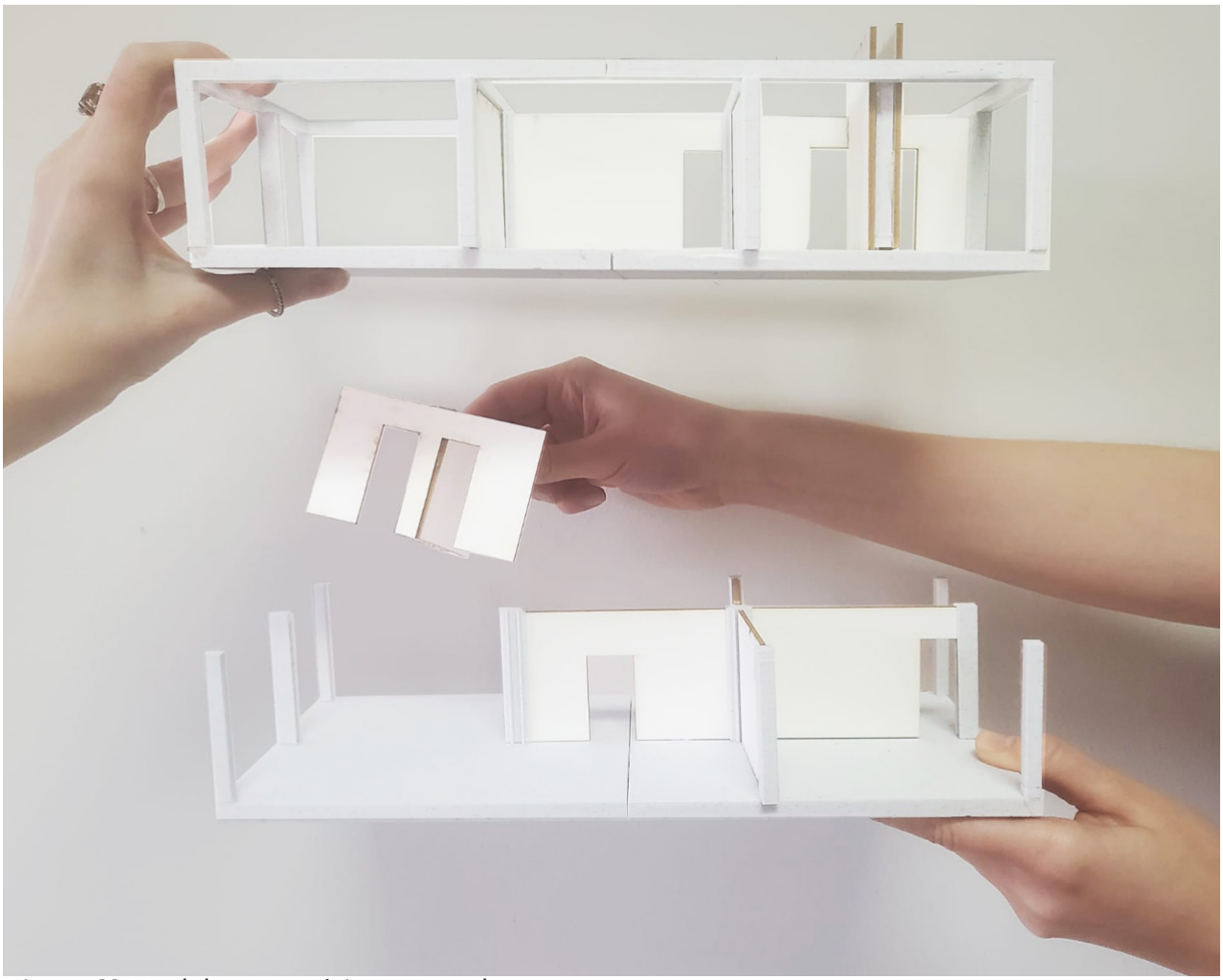
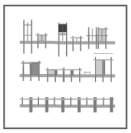


Figure 69 Model as a participatory tool.



Timber columns (71) are placed in 5.5m intervals so that the foundation can be made in advance, before any decisions have to be made about building typologies. Structure must withstand the incremental growth, hence the douglas fir columns and beams of superstructure are robust and have cross section of 400mm x 400mm, not only to be durable against moist climate of Midden-Delfland, but also to provide proper support for the increments. It is crucial that the structure is also visible in the facade, so that it can be easily comprehend by the users. Furthermore, timber elements assembly is modular and faster by employing post joint connections, which are simple compared to the mounting methods typically utilized for materials such as steel and concrete. The structure is part of high-tech support hence main stakeholders at this point are engineers, architects and contractors.

The prefabricated timber frame slabs (72) and roof make up the low-tech support. These require less expertise to put in place and can be carried out by low skilled contractors. Each frame is a module that can be delivered to the site on the lorry and consists of the timber frame and cellulose insulation. Their assembly happens on the site, where necessary equipment such as floor heating&cooling system is added. The cables for heating and cooling are placed in such a way that the inhabitant can easily extend the installation or add new installation.

The modularity of the timber structure isn't just a by-product, in combination with non-load bearing prefab facade panels, it allows users to have their units erected faster, cutting labor costs or even have them assembled in workshop located in the Community Core. Each facade panel (73) of size 4.50 x 3.50 is also modular, they include hemp insulation and are cut with CNC method in a factory and transported to the site. The stakeholders responsible for this phase are architects who decide with inhabitants about panel details so that later on a local supplier can be contacted.

While panels are the internal layers of the facade the outer weather skin is made of reed. the reed requires assembly separately from the panels that is because the lifespan of the reed is 20 years less than the panels which means that these two components need to be easily separated so that the reed can be replaced when reaches its lifespan.

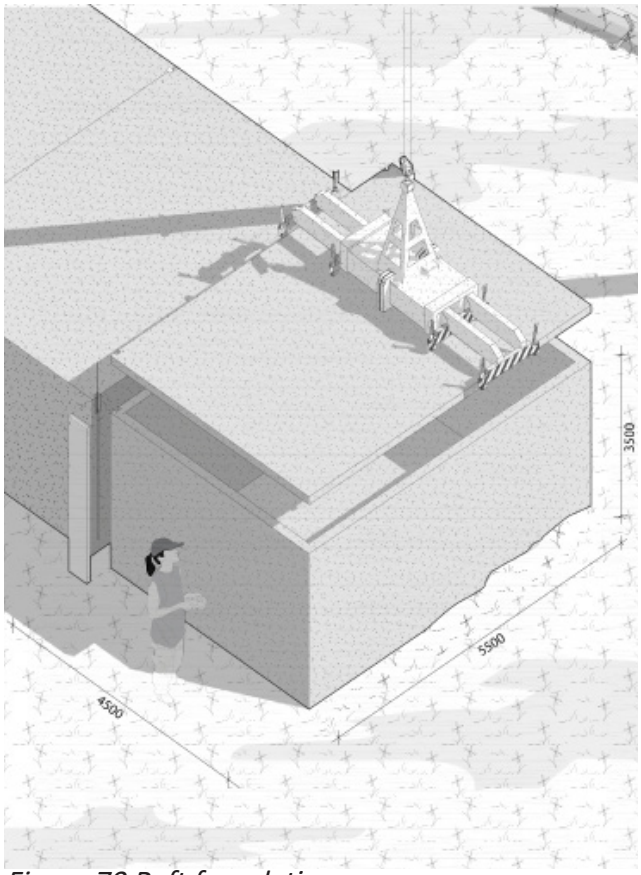


Figure 70 Raft foundation.

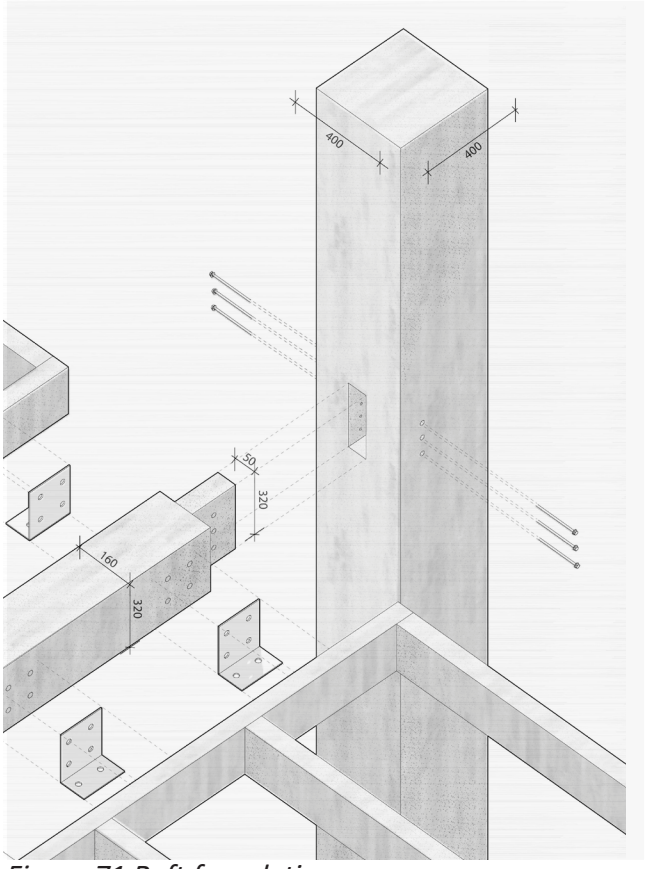


Figure 71 Raft foundation.

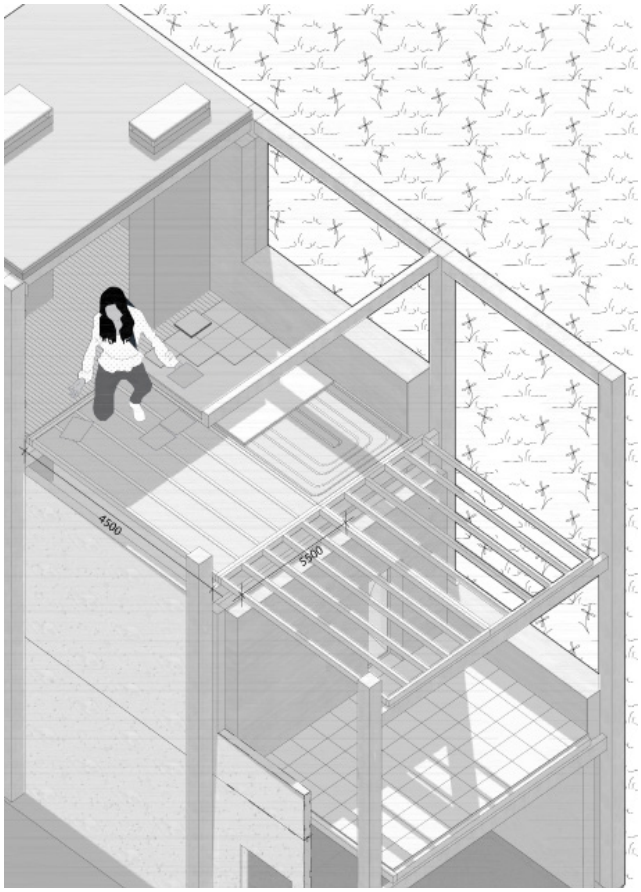


Figure 72 Aseembly of modular floor panels.

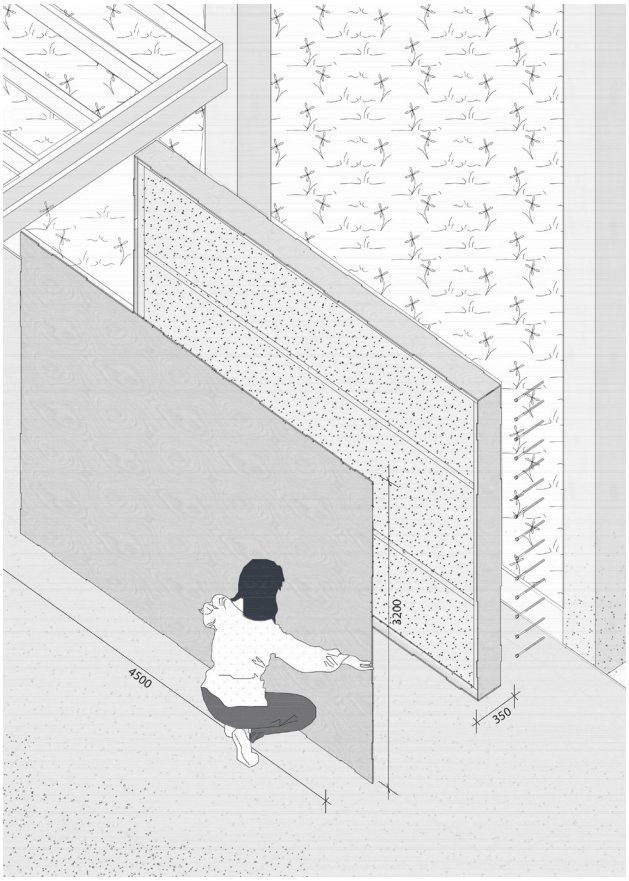
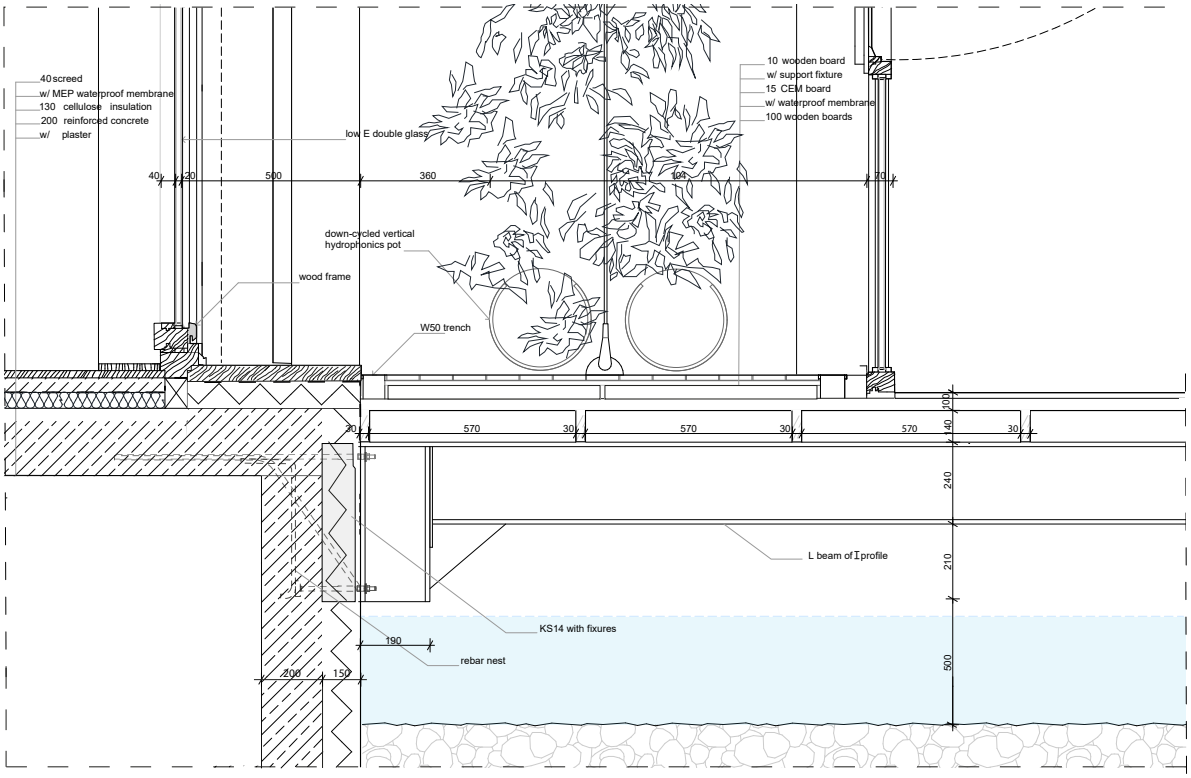
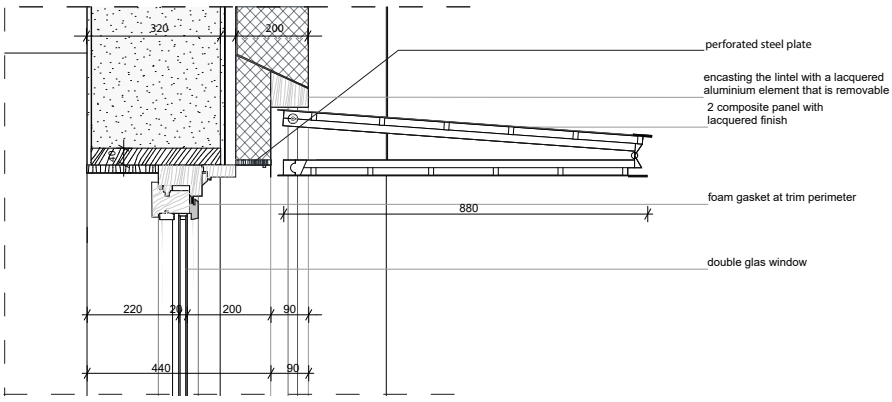
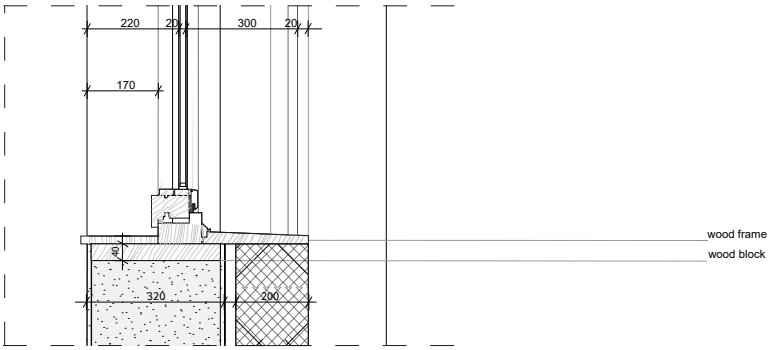
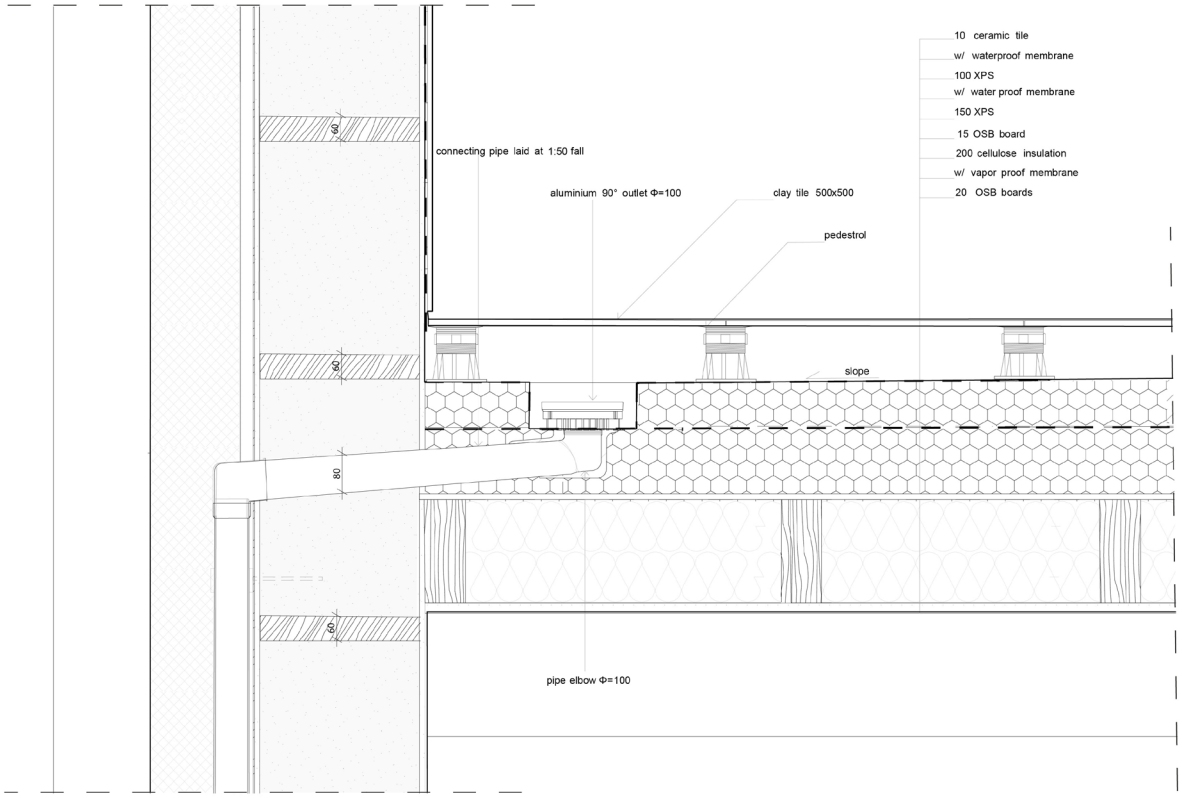


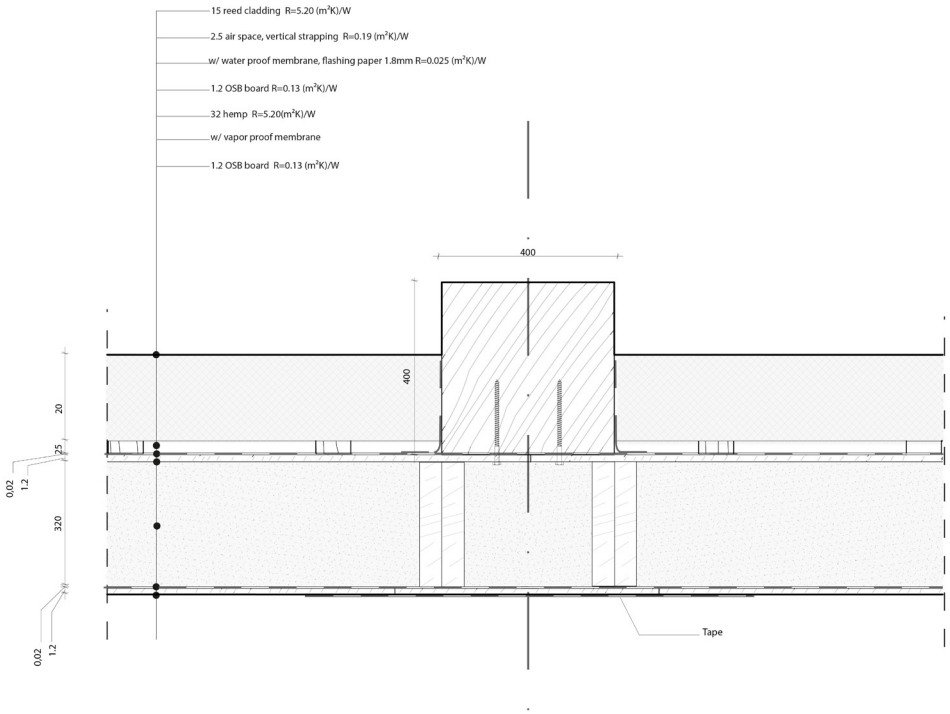
Figure 73 Prefabricated wall panels.

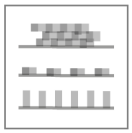

40 screed
w/ MEP waterproof membrane
130 cellulose insulation
200 reinforced concrete
w/ plaster
low E double glass
10 wooden board
w/ support fixture
15 CEM board
w/ waterproof membrane
100 wooden boards
down-cycled vertical hydrophonics pot
wood frame
W50 trench
L beam of I profile
KS14 with fixures
rebar nest
40
20
500
360
100
70
570
30
100
140
240
210
500
190
200
150


320
200
perforated steel plate
encasting the lintel with a lacquered aluminium element that is removable
2 composite panel with lacquered finish
foam gasket at trim perimeter
880
double glas window
220
20
200
90
440
90


220
20
300
20
170
wood frame
wood block
40
320
200


10 ceramic tile
w/ waterproof membrane
100 XPS
w/ water proof membrane
150 XPS
15 OSB board
200 cellulose insulation
w/ vapor proof membrane
20 OSB boards
connecting pipe laid at 1:50 fall
aluminium 90° outlet Φ=100
clay tile 500x500
pedestrol
slope
pipe elbow Φ=100
60
60
80
60


15 reed cladding R=5.20 (m²K)/W
2.5 air space, vertical strapping R=0.19 (m²K)/W
w/ water proof membrane, flashing paper 1.8mm R=0.025 (m²K)/W
1.2 OSB board R=0.13 (m²K)/W
32 hemp R=5.20(m²K)/W
w/ vapor proof membrane
1.2 OSB board R=0.13 (m²K)/W
400
400
20
25
1.2
0.02
320
1.2
0.02
Tape



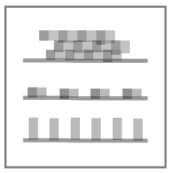
Aggregation

WATER MANAGEMENT

Story of a cluster

Tool

The tool that is used for units' concept is Aggregation.



Aggregation

Charles Correa's architectural philosophy is deeply rooted in socio-economic principles. He opposes the use of prefabricated system building, arguing that it hinders individual involvement in home construction and diverts resources from the rich pool of artisanal craftsmanship available in local markets. As a result, the structures in Belapur are modest, typically one or two stories high, and constructed using traditional methods. These buildings serve as basic frameworks that allow families to personalize their living spaces according to their unique lifestyles.

Correa emphasizes the importance of privacy for families within their homes. He contends that in the Indian context, the inclusion of "open-to-the-sky space" is essential for nurturing a sense of intimacy.

Along the courtyards, each cluster has spaces that allow the inhabitants to meet. For instance, families sharing the same staircase to access communal courtyards fosters a sense of closeness among them. Moreover, the repetition of courtyard clusters within the Belapur project imbues each cluster with a unique identity, contributing to the overall distinctiveness of the development and enhancing social interactions.

In Belapur, Correa used courtyards to provide scales of privacy while maintaining neighborhood bonds. In *Small Change* the greatest level of privacy outside of the house are the outter terraces that also can be built up into part of the house.

The semi private space are shared porches, staircases, green houses and common terraces.

Finally, the courtyard is the most open and public space, it is space for controlled appropriation. The courtyard is essentially a reed garden so that the porous characteristics of the reed help to absorb excessive water, the wet environment of the garden is what helps to control growth in that area allowing people to only built small elements such as gazebos or decks. (74)

This way a cluster is combination of formal, semi-formal and informal areas where the degree of informality is closely related with the level of privacy. The more informal the space, the less private it becomes allowing inhabitants to engage in developing new structures together.

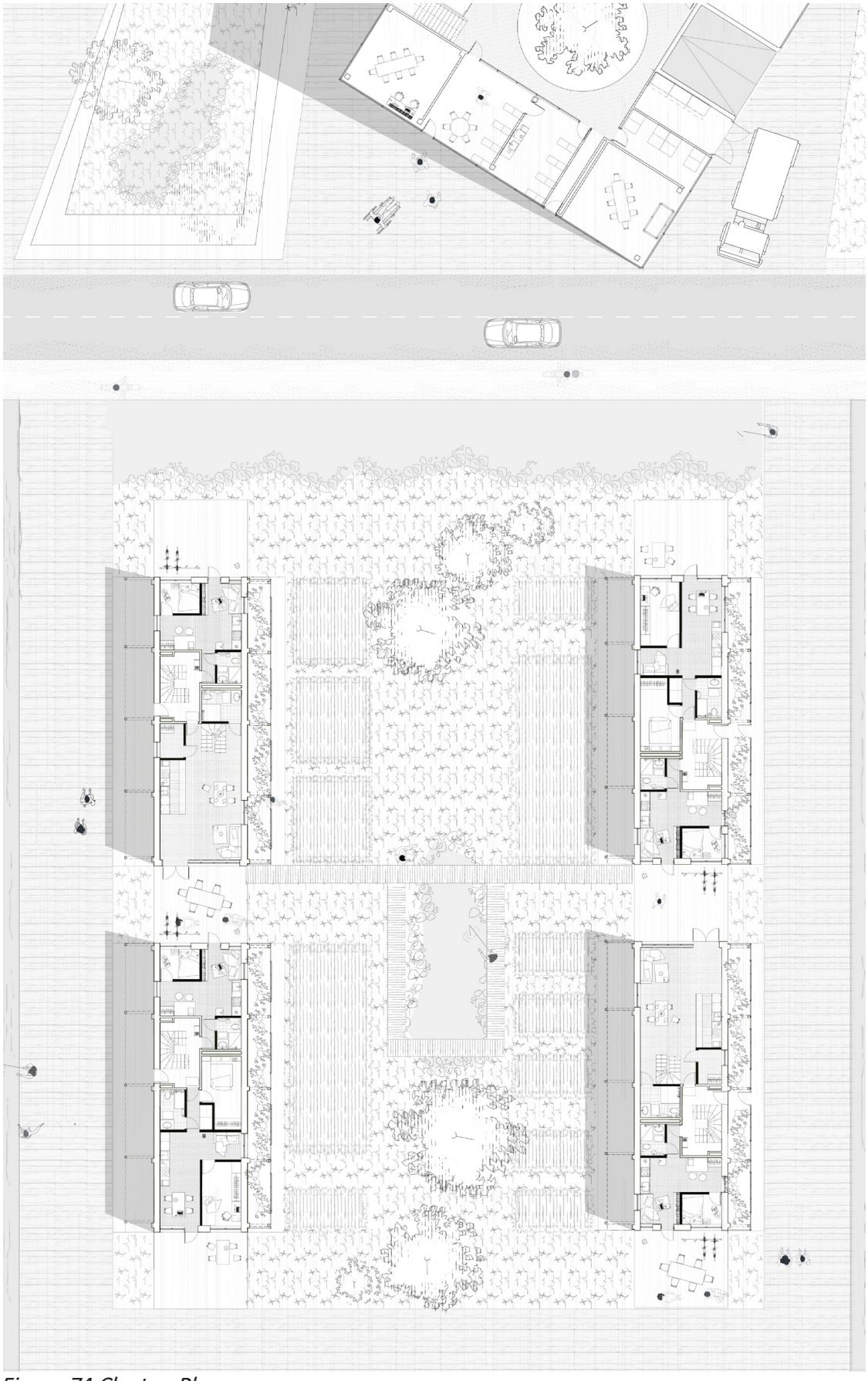


Figure 74 Cluster. Plan.

While the idea of households surrounding a common courtyard is borrowed from Belapur, the connection of the cluster to the public roads is inspired by La Presita, where each of the cluster would connect to a pedestrian road on the site.

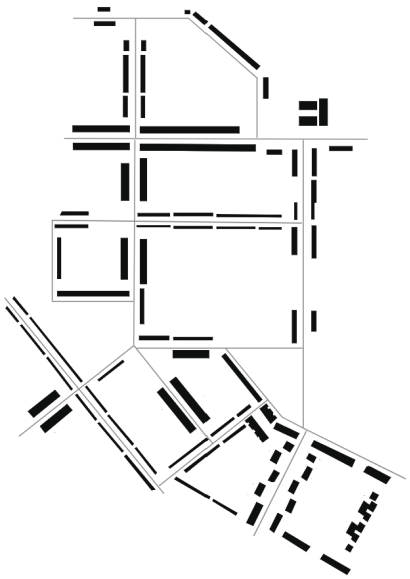


Figure 75 Masterplan. La Presita, Sinaloa, Mexico.

Like in the masterplan of La Presita, the garden space inside the cluster is the private zone for the inhabitants that is connected to the public streets. Here, a variety of functions common to everybody in the neighborhood can be found incrementally developed shops, leisure spaces along the canal, meeting spaces and the pedestrian zone is separate form from the vehicular access routes which is alongside of the main amenities zone.

The pedestrian street is 5m wide, to allow comfortable flow of people while ensuring that a car can also pass by if needed. In addition to that the canal provides leisure space where users can stop by to feed the ducks and chat.

It is imagined that different clusters are built at different times following an incremental process. The fact that the clusters are separated minimizes the impact of construction on a neighboring cluster.

Figure 76 Cluster. Axonometric view.

In the masterplan each cluster is open to create a clear connection between the amenities front with the lake at the back, this way public spaces are equally located both in the west and east site of the masterplan providing equal accessfrom the clusters. At the same time amenities being in the front can crealy connected to the existing functions such as post office, the river and center of De Zweth. it is imagined that the front with amenities is a lively place and attracts the attention of passers by, whose curiosity may lead them to discover the new housing development.

The Schie

The River Schie acts as a natural drainage channel, helping to collect and convey excess water from rainfall and other sources. This water is then channeled into the boezem system, where it can be stored or directed to other areas as needed to maintain optimal water levels and prevent inundation of surrounding lands. Additionally, the river contributes to the overall ecological health of the boezem system by providing habitat for aquatic species and supporting biodiversity within the waterways. Its flow helps to maintain water quality and circulation, essential for the health of both aquatic ecosystems and the surrounding landscape.

The canals

Canals are designed to divert excess water away from low-lying or waterlogged peat. By channeling water away from these areas and towards the reservoir, canals help to alleviate waterlogging and reduce soil moisture content. This sub-system which consists of canals and resevoir also serves as water source for heat-pump in each of the household.

The reed beds

Red beds have a porous structure, with pore spaces between mineral grains. This porosity allows rainwater to infiltrate into the rock, where it is stored temporarily. Additionally, the permeability of red beds, determined by the connectivity of pore spaces, influences how quickly water can move through the rock, reducing surface runoff and slowing the flow of water into rivers and streams.

The reservoir

The reservoir plays a crucial role in supporting local water systems of De Zweth by providing a reliable source of water all year. The water in winter is used in heat pump where its temperature is raised s that it can be used for floor heating. In the summer, water temperature is cool enough that it does not have to be cooled down in heat pump so it is used for passive cooling.

Use of water to create attractive public spaces is an intentional gesture. The connection to the Schie, reed beds and water reservoir create a water collecting system. Each of reed beds that are the central part of the cluster acts like a water collecting sponge. They land between the river and the reservoir collect water in case of a flood, ensuring that the masterplan does not sink and somewhat floats in the wet landscape of Midden-Delfland.

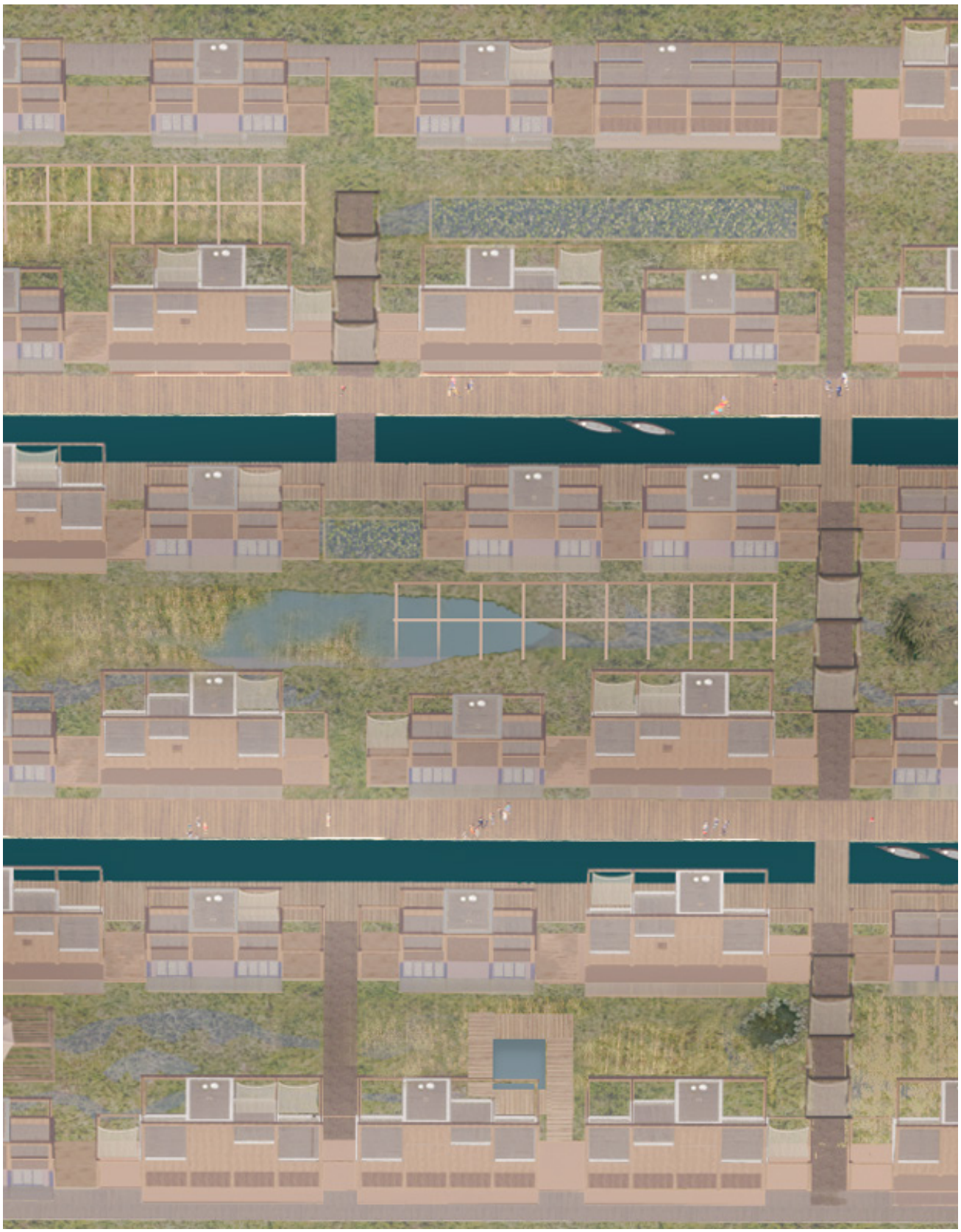
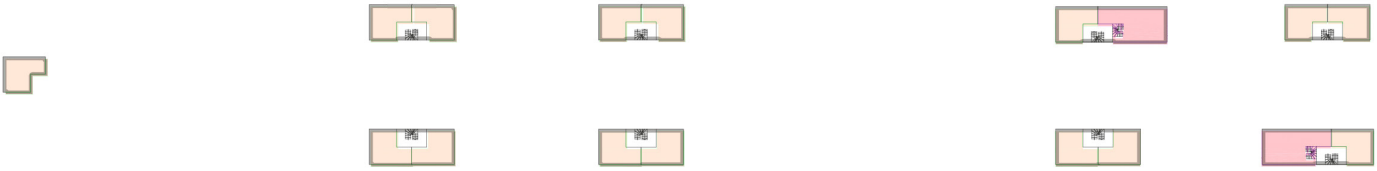
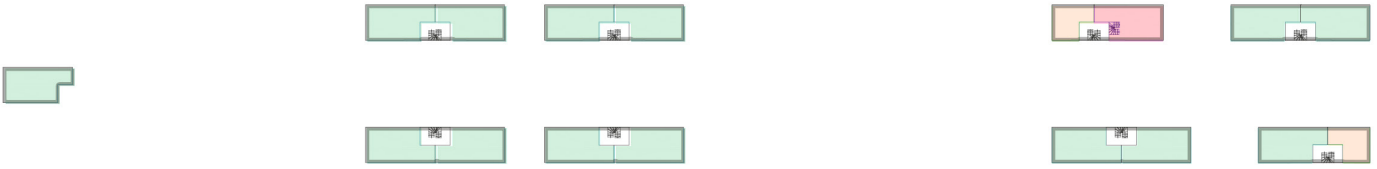
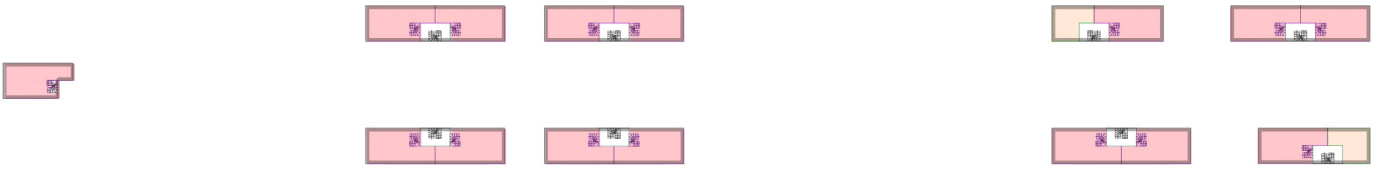
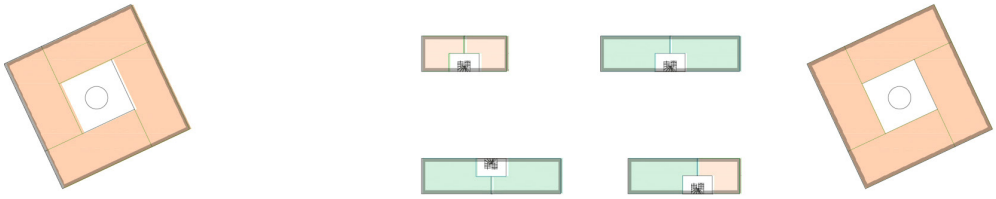


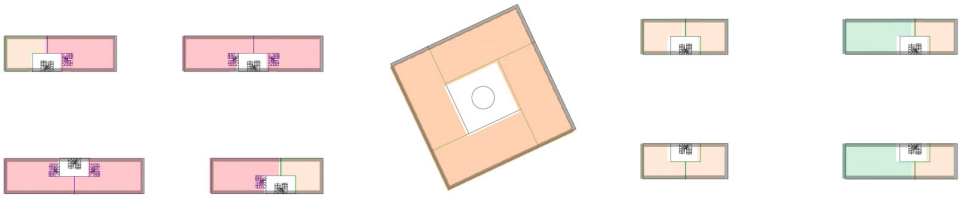
Figure 77 Cluster in the scale of the masterplan.











LIFE CYCLE ANALYSIS

Global Waring Potential & Life cycle stages A1 - A5

Building life cycle stages are the different periods of a building's lifetime. For instance: raw material harvesting, manufacturing of products, use phase of the building, end of life. In the European markets, the building life cycle stages are defined by EN 15978 and EN 15804 standards, which can be included in LCAs.

Primary strategy to reduce carbon footprint is comparison of **Global Warming Potential**[*1] [CO_2kg/m^2] of life cycle stages A1 - A5.

$$GWP = \frac{\int_0^N F_{gas}(t)dt}{\int_0^N F_{CO_2}(t)dt} = \frac{Greenhouse\ Gas\ Emission\ [CO_2kg]}{Gross\ Floor\ Area\ [m^2]}$$

Calculation of Global Warming Potential (GWP) was chosen as the measuring mean because it includes all 21 impact categories according to EN 15804A1 + A2 on the contrast to other formulas such as MilieuPrestatie Gebouwen (MPG) which is the Dutch indicator for carbon emissions. MPG does not include embodied carbon emissions which often makes the calculation inaccurate. For instance, according to this method, wood often is more emissive than concrete which can be easily proven incorrect.

The emphasis on the phases A1 - A5 allows for more realistic result because as the research shows 80-85% of Global Warming Emissions occur during these phases.[111] On the top of it, phase B1 to C4 are often a speculation since those have to do with how the building is used by the inhabitants which is often measurable long term, usually after the end of life of materials or the end of life of the building. (78)

Life-cycle stages according to the EN standard:

A1: Raw material extraction and processing of secondary material input (e.g. recycling processes)

A2: Transport to the manufacturer

A3: Manufacturing

A4: Transport to the building site

A5: Installation into the building.

Module A1, A2, and A3 may be declared as one aggregated module A1-A3. All stages include the provision of all materials, products, and energy, as well as waste processing up to the end-of-waste state or disposal of final residues during the product stage. The assessment takes only the building and its parts into account, but not furniture or appliances, for example.[112]

1. - Index to measure of how much infrared thermal radiation a greenhouse gas would absorb over a given time frame after it has been added to the atmosphere (or emitted to the atmosphere). [112]

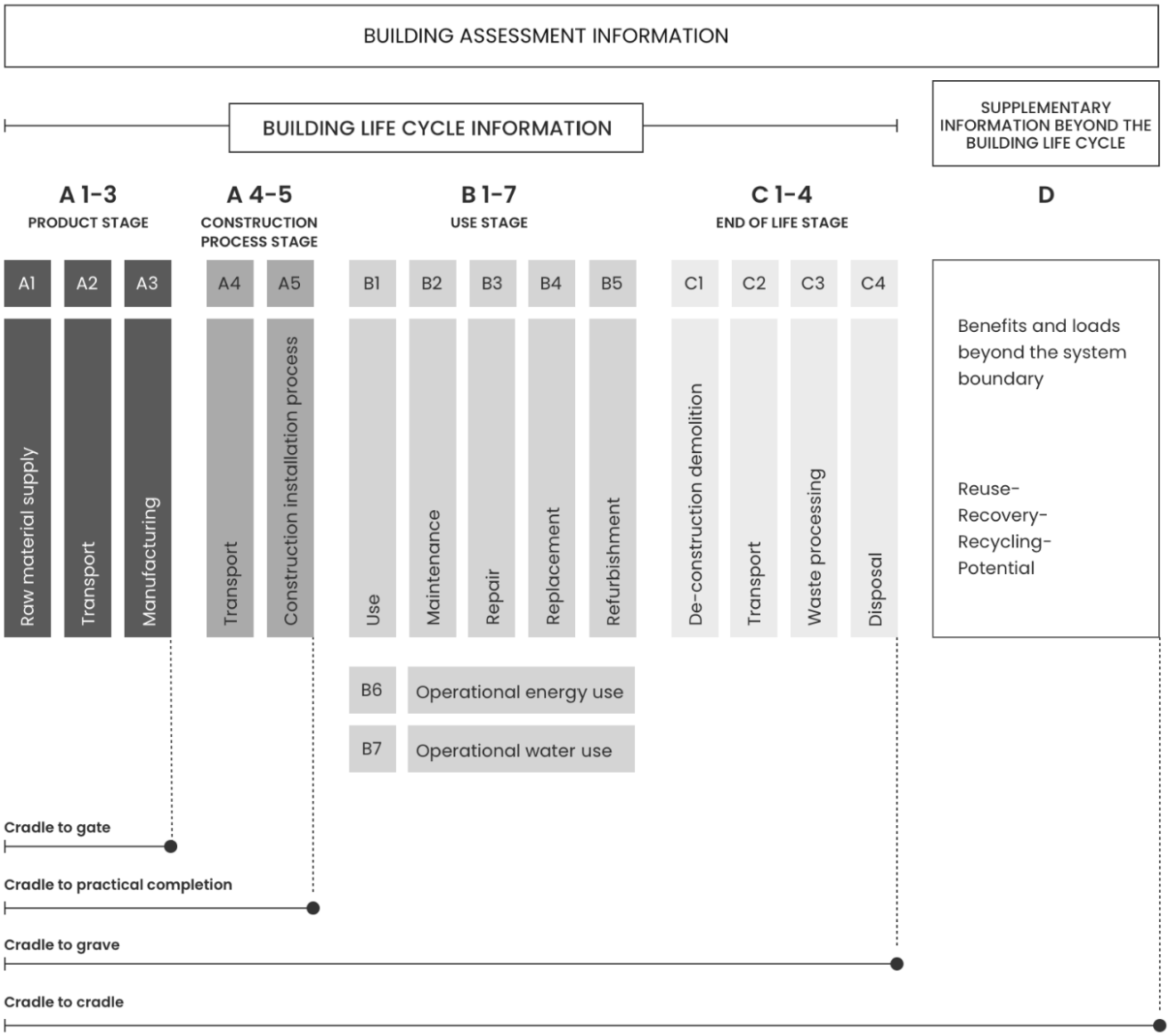


Figure 78 Life cycle stages.

AVERAGE EMISSIONS IN THE NETHERLANDS

Emissions according to Paris Proof

According to Paris Proof carbon footprint [CO_2kg/m^2] in 2030 for new-built multi-family housing is supposed to be **184 CO_2kg/m^2** for all European Union countries. In the Netherlands, in 2024 it is **741 CO_2kg/m^2** on average. (79) **That is often because of installations for water and energy supply, reinforced concrete pile foundation characteristic for the Netherlands and lack of use of biobased materials in common practice.** If these values are not going to be decreased many European countries, including the Netherlands, will be unable to build and renovate buildings, hence in this project it was crucial to aim for carbon negative design.

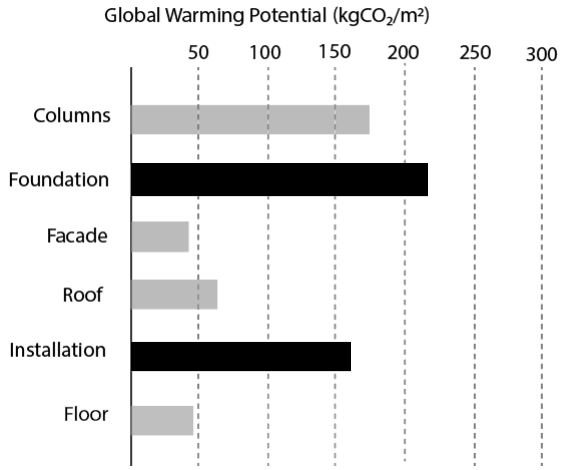
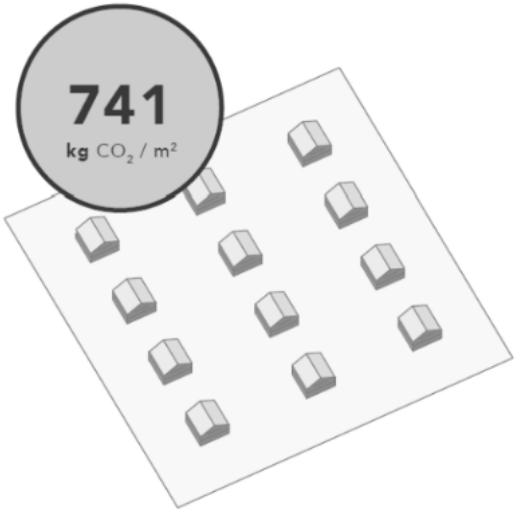


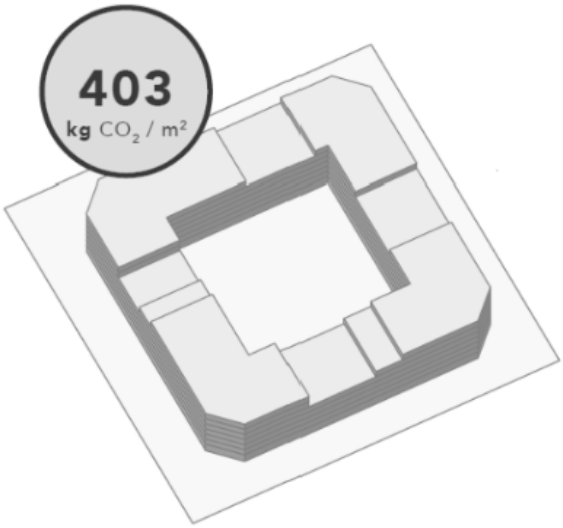
Figure 79 Average GWP values per structural element of new-built multi-family housing.

In addition to that, there is a lot of misconceptions about relevance of material's life span and carbon footprint. It is important to note that virgin materials that have low carbon emissions in phases A1 - A5 and shorter life span are far more sustainable than materials with high CO_2 emissions in those phases and long life span.

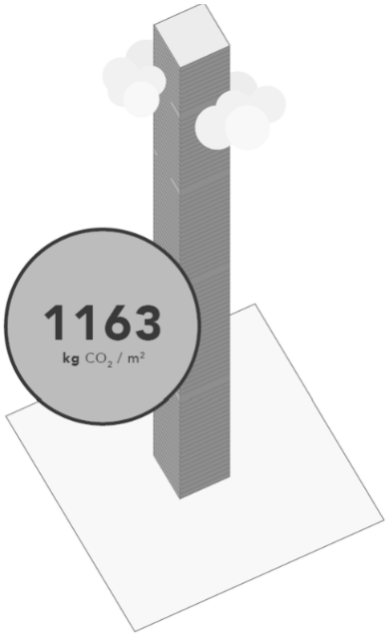
For instance, Dutch brick (150 years) has a long life span than douglas fir timber (50 years) transported from Germany however, CO_2kg/m^2 emissions of the latter material in phases A1 - A5 are -650 CO_2kg/m^2 while for the brick it is 60 CO_2kg/m^2. As follows, timber can be replaced 10 times before it emits as many tones of CO2 a brick in the process of transport, manufacturing, and construction on the site.



no. of units ***24***
CO_2 eq. ***3 201 120 kg***
floor area ***4 320 m²***
plot area ***20 000² m²***



no. of units ***370***
CO_2 eq. ***28 808 858 kg***
floor area ***71 846 m²***
plot area ***20 000² m²***



no. of units ***104***
CO_2 eq. ***82 388 803 kg***
floor area ***70 841 m²***
plot area ***20 000² m²***

Figure 80 Average emissions of basic typologies: Single family housing, cluster, tower.

GLOBAL WARMING POTENTIAL OF SMALL CHANGE

Final carbon footprint calculation

Modularity of the facade enables the creation of a closed-loop system where materials and components of the modules are continuously circulated and reused within the economy. The modules were designed with end-of-life considerations in mind therefor they can be disassembled and trasported back to the manufacturer where OSB boards and hemp insulation can be recovered and timber studs can be re-used. This closed-loop approach minimizes waste generation, reduces environmental impact, and promotes resource conservation.

Harnessing water from the site from canal and through rainwater harvesting and use of greywater for watering reed beds decreases dependency on external resources. Natural shading like canopy and shutters mitigate heat gain, enhancing thermal comfort without excessive energy expenditure. On the other hand, the gained heat, such as warm shower water is a part of closed loop system that allows the water to be reused for showering again.

By utilizing water collecting system that consists of reed beds, lake, canals and boezem. Water for non-potable purposes such as irrigation, cooling, landscaping, or toilet flushing, allows the pressure on natural water sources tobe reduced. This way the water excess is stored preventing from flooding and during drier season the collected water serves as a supply that can be used in housing.

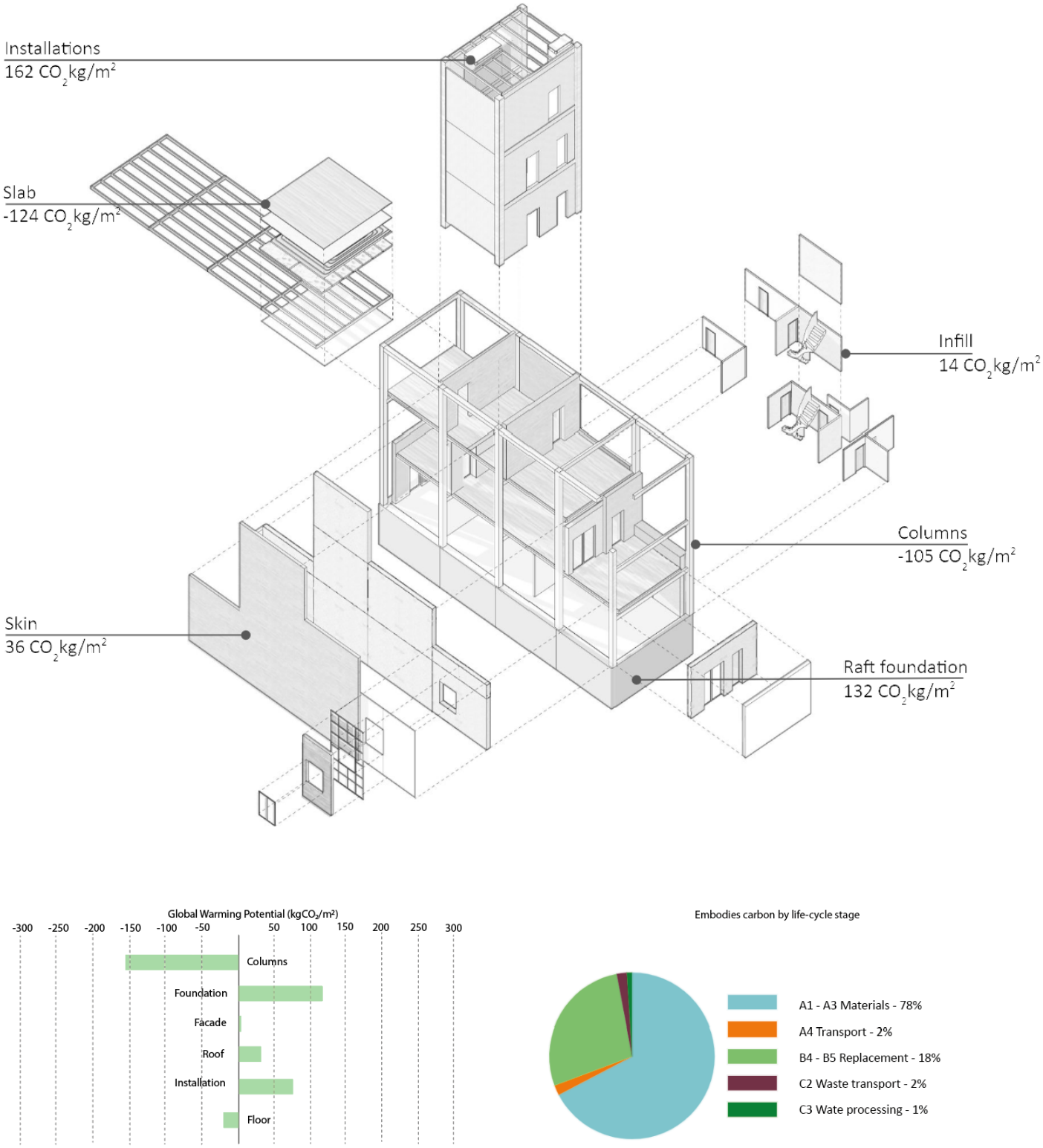


Figure 81 Average emissions of basic typologies: Single family housing, cluster, tower.

CARBON FOOTPRINT CALCULATION

Comparison of design options for structure

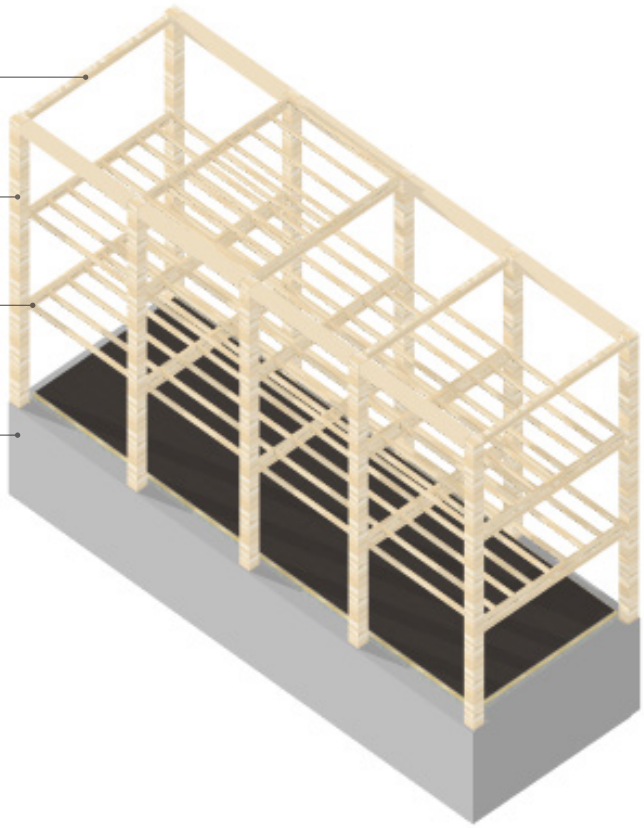
Option 1 **Timber frame**

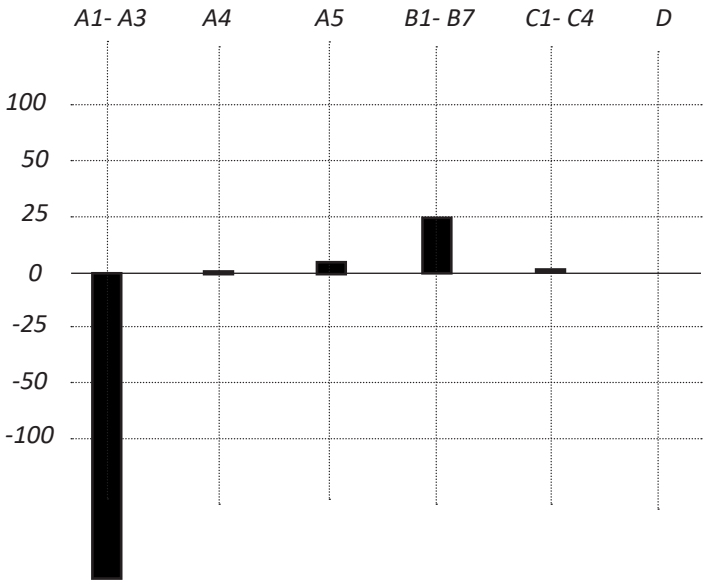
Glulam beam
-750 CO_2kg/m²

Glulam column
-750 CO_2kg/m²

CLT floor frame
-520 CO_2kg/m²

reinforced concrete foundation
365 CO_2kg/m²





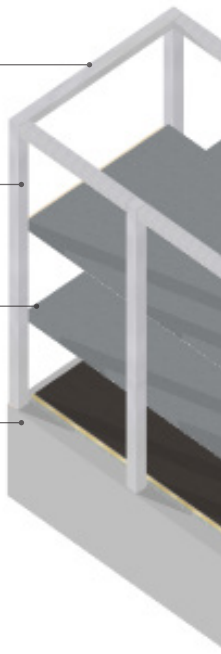
Opt

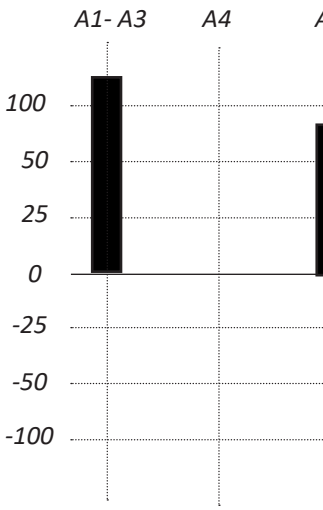
Concrete C30/35 beam
162 CO_2kg/m²

Concrete C30/35 column
355 CO_2kg/m²

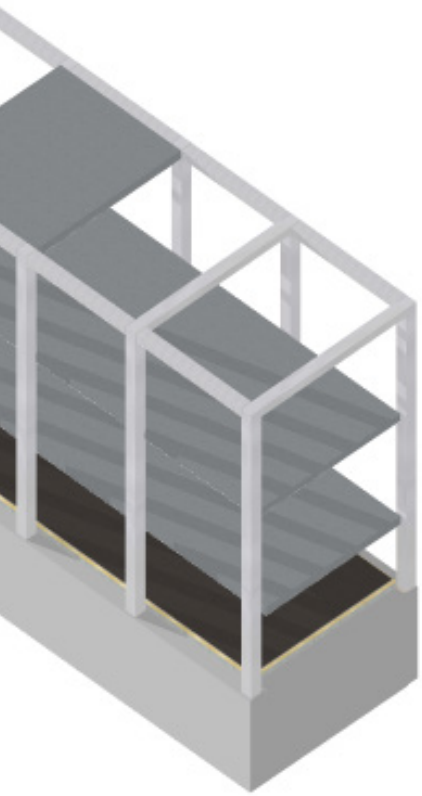
Aerated concrete floor
72 CO_2kg/m²

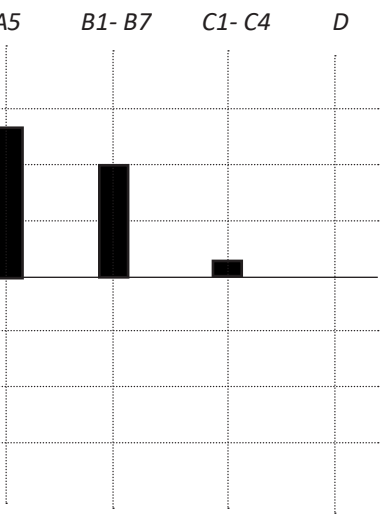
reinforced concrete foundation
365 CO_2kg/m²



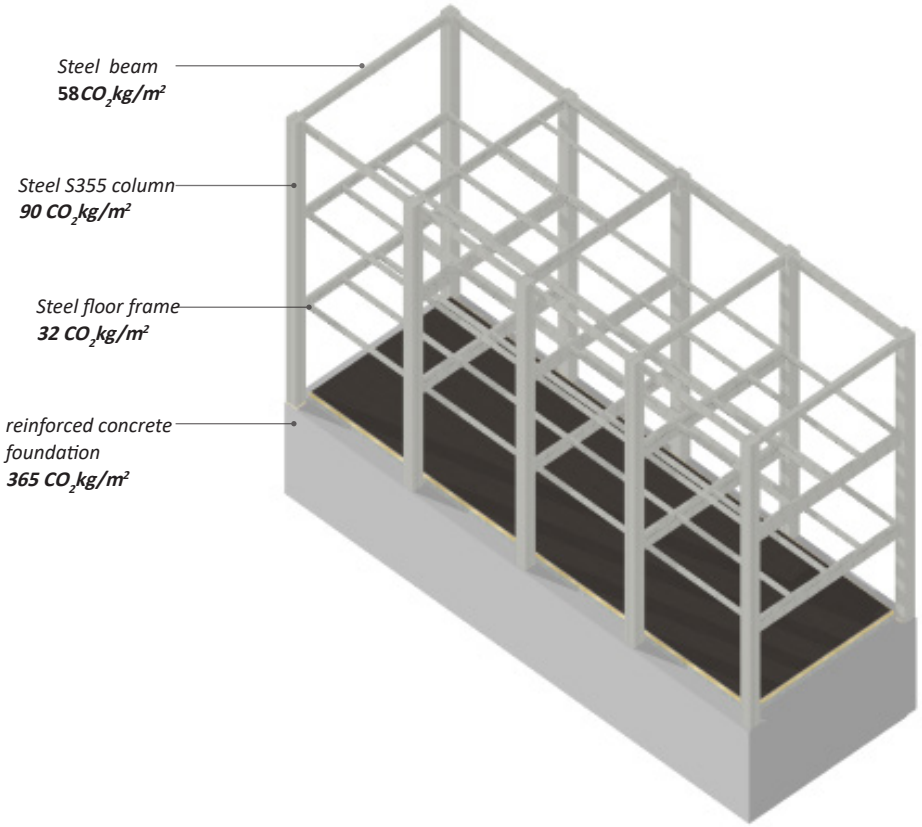


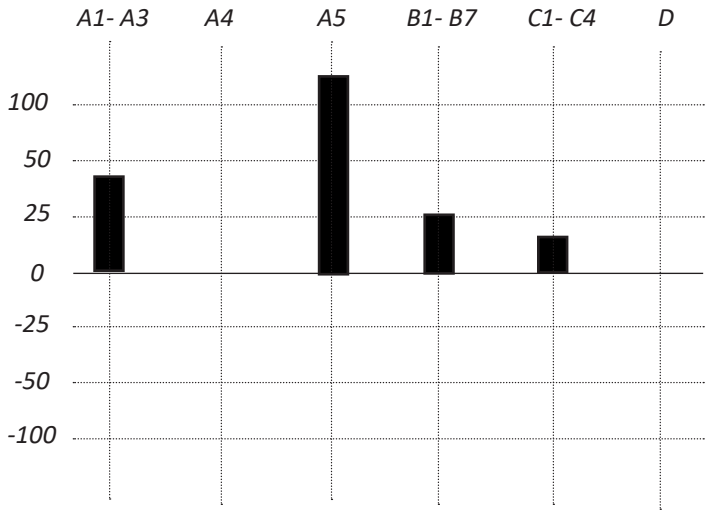
ion 2 **Concrete frame**





Option 3 **Steel frame**





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