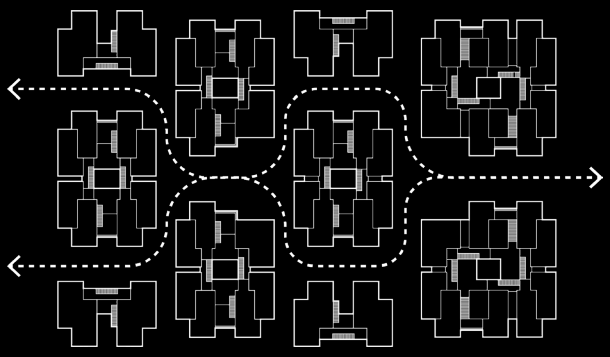
GRADUATION REPORT



Gerji Co-habitable Densification: Urbanization & Nostalgia

_ Towards the collective welfare between original and new residents

Global Housing Graduation Studio
_ Addis Ababa Living Lab

September, 2019- July, 2020

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with special thanks to:

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THESIS STATEMENT

CO-HABITABLE DENSIFICATION
Towards the collective welfare between original and new dwellers

Problem Statement

Ethiopia, with 84% of its population still live in rural areas, is one of the least urbanized countries in the world. Its capital Addis Ababa hosts nearly 4 million people, 1/5 of the country's urban population. The number keeps on increasing rapidly with a population growth rate of 2.9%, contributed by 1.21% natural increase and 1.7% migration . All these factors have led to a resultant housing shortage. Currently, 80% of the urban residents of Addis live in informal housings, while 25% of them are in an overcrowded situation. The topic of urban densification thus has been brought to the table.

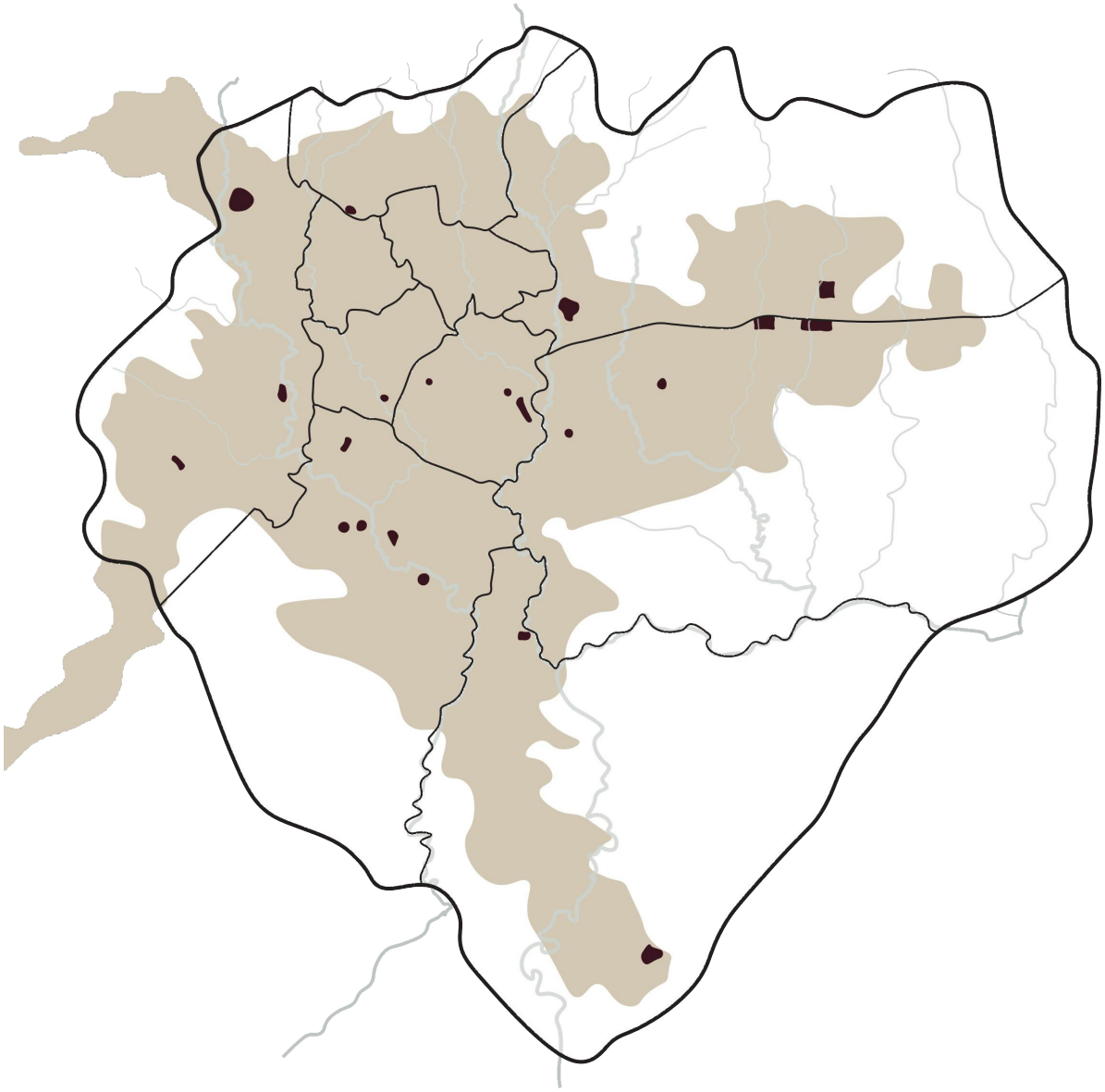
However, Addis Ababa was "never planned to be a city" , therefore also not built in that way. Lacking of urban construction that normally came with European colonization, the city now still faces a challenge of building basic infrastructures like water supply, sanitation, transport, drainage, and health facilities. 25% of the rubbish generated are dumped on the street, drainage channels or vacant plots. And 28.6% of the households experience frequent disruption of water supply, while 23.9% of them have no access to toilet facilities.

To solve the problems of housing shortage and insufficient infrastructures, the Municipality of Addis Ababa carried out an urban renewal program in 2003, which is consisted of two major plans. The first one focuses on the redevelopment of high densified city center, replacing previous slum areas with commercial or office development. And the second is about relocating involved residents from city center to outskirts while also housing urban poor and newcomers, by the Integrated Housing Development Program (IHDP), where condominium housing plays an important role. "The move-out" and "The move-in" are the primary affected groups during this process (sometimes they are the same group of people).

"The move-out", as residents affected by urban upgrading projects, are often offered with two options depends on their financial capacities: either to purchase a guaranteed condominium unit or to be relocated to other low-rent Kebele housings. Nonetheless, condominium is only affordable to about 20% of the people living in Addis, and the rental option of Kebele housing will eventually disappear if all the inner-city informal areas are cleared as the city plan suggests.

For the ones move into condominium housings, although it succeed in providing a large number of housing units within short time period, the practice over ten years has also shown that it failed to meet the initial expectation of improving the dwellers' living standard. The problems occurred are mainly on three aspects: the substandard construction ; the resold or illegally leased units with exorbitant price ; and other social and economic related problems, like residents being dislocated from their jobs and original communities; children have to relocate to a different school; rising living and transportation cost while home production activities are weakened as well as

_ *Grand Housing Project*



Map of Condominium Projects _ 2006

Source: Group research on Addis Ababa, Spatial Mapping, Global Housing Studio 2019

_ *The Urban Renewal Program (2003)*

Redevelopment + Relocation

Integrated Housing Development Program (IHDP)

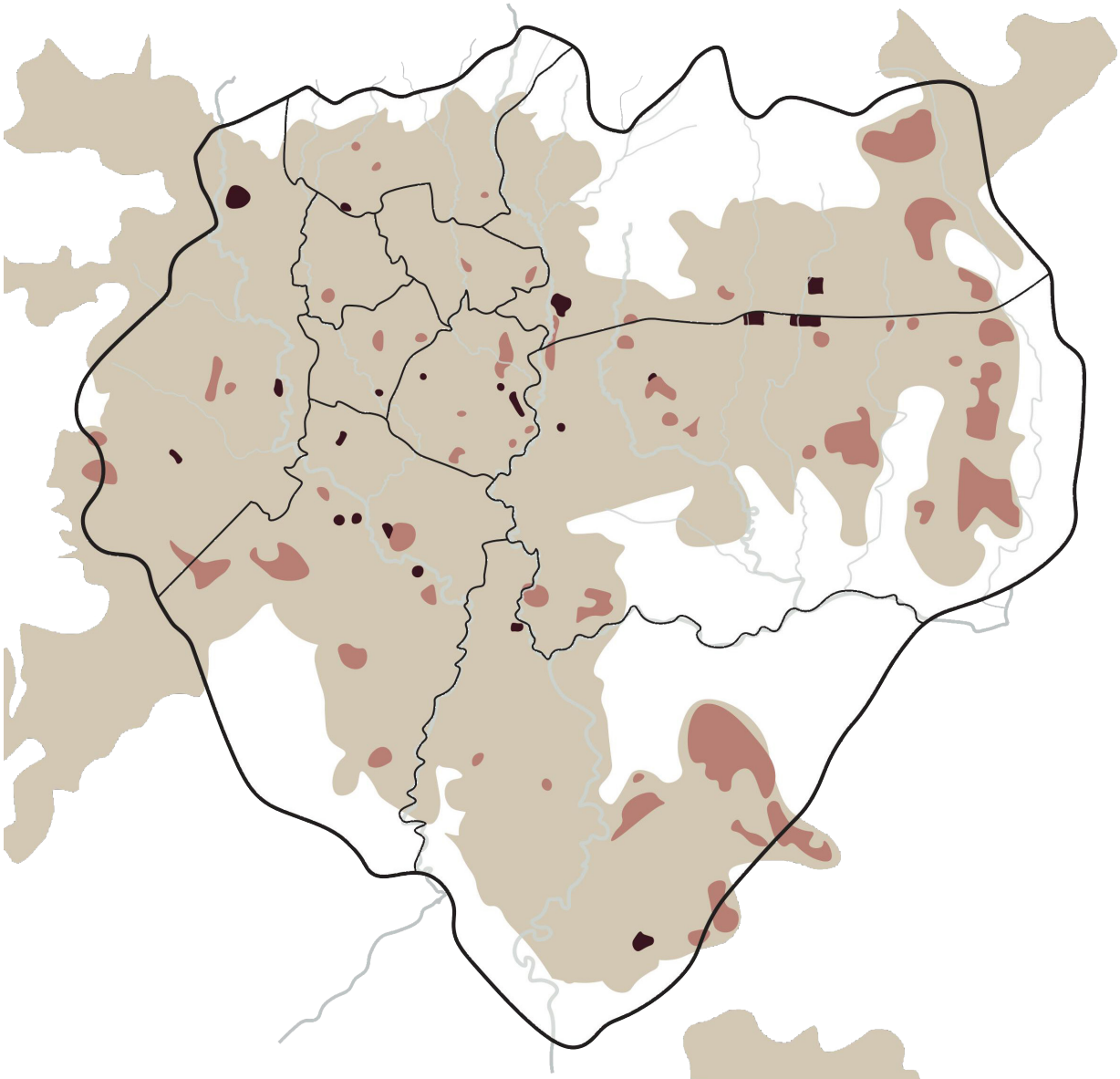
safety concerns. Tensions between old and new dwellers also come up. The new dwellers often find it hard to join the surrounding community. In some cases, they are even been seen as invaders.

These bring to the general problem that the current condominium projects, although succeed in alleviating housing shortage, are found deficient on providing an integrated solution to the housing needs of both original and new inhabitants, as well as improving their life qualities. This has resulted the series of problems above-mentioned, especially the loss of community and the generation of spatial and social segregation.

The general problem is: Condominium housing, as the present-day most possible solution for urban densification, although succeed in alleviating the housing shortage, is found deficient in providing an integrated strategy for the housing needs of both original and new inhabitants, as well as improving their life qualities.

_ *Two Groups of People Involved*

The “Moved out“ / Original Dweller + The “Moved in“ / New dweller



Map of Condominium Projects _ 2016

Source: Group research on Addis Ababa, Spatial Mapping, Global Housing Studio 2019

_ *Problems*

The “Moved out“ / Original Dweller + The “Moved in“ / New dweller

Problems of Two options

“They often find it hard to join the surrounding communities.“

_ *Brief of Housing History in Addis Ababa*

• **Before 1974 revolution:**

In 1962, as much as 58% of the land in Addis Ababa was supposedly owned by only 1,768 individuals, leading to 55% of the housing units being rental (Abate, 2001; Kebbede & Jacob, 1985).

Until about 1974, land in Ethiopia was owned and controlled under two major land holding systems – the rist and gebbar system. Under the rist system, found in many of the northern provinces, individuals had the right to a piece of property as long as they can trace their decent in a community. Those that cannot trace use land as tenants. Under the gebbar system, which existed in many of the southern provinces, land was individually owned with tenancy as a major land holding practice.

the government failed to develop an effective housing policy that can address the shortage of housing, informal (unauthorized) housing including 'yechereka bet' (moon house – often built at night with moon light to evade government detection) proliferated. On the eve of the revolution in 1974, it is believed that as much as three-fourths of the housing units in Addis Ababa had no municipal permits (UN-Habitat, 2007, p. 8).

Yet, although the houses had no permit and were very small
and sub-standard, it is believed that there was no pressing housing shortage when the revolution broke out in 1974 (UNHabitat, 2007, p. 8)

• **1974 revolution:**

nationalization of urban and rural land by the military government transformed the land and housing situation in Ethiopia

Property owners were allowed to retain one house of their choice for residence or any other use and all extra houses were put under the administration of kebeles (the neighborhood administrative units) or the Agency for the Administration of Rental Houses (AARH).

Consequence & reasons
A major consequence of the nationalization of urban land and extra houses was the creation of a critical shortage of housing as the private sector was effectively excluded from participating in housing investment, and the government lacked the capacity and the resources to meet the rising need for housing.

''residential buildings could be produced only by state enterprises, municipal governments, housing cooperatives and individuals who build dwellings for their personal consumption" (Mulugeta, 1995, p. 71)

By mid-1980s, 60.80% of the housing stock in Addis Ababa was rental (see Table 1). Similarly, housing quality was poor and about 44.4% of the housing units were overcrowded

· **1991, EPRDF**
Initially adopted the land and housing policies of the previous government.

Later encourage private sector to participate in housing development on land provided by the government.
Housing supply was sluggish as the private sector remained cautious.
Government owned rental housing run by kebeles remained the dominant source of low-income housing.

• **2002, EPRDF**
Land lease system (how individuals can acquire a piece of land through auction, lottery and the award system)

• **2011**
All property should be consolidated under the lease system.

The duration under the lease system is 99 years for residential housing, 70 years for industry, 60 years for commerce and 15 years for urban agriculture

The lease system has become a major income generator for the Municipality of Addis Ababa. The revenue is used for construction of infrastructure, development of land and subsidizing housing
Construction for the poor.

Source: Addis Ababa, Ethiopia - Africa's diplomatic capital

Zooming into the site of Gerji (Bole sub-city woreda 14), it has an inner-city location which is close by the newly refurbished Bole International Airport, connected to the ring road by a four-lane street. The existing houses on the site were built in the 1980s by Federal Housing Corporation, consist of 319 single-floor households with 3 typologies. There is a clear need of redevelopment, under the pressure of overall urban densification.

The specific problems observed during the site visit could be grouped into two interrelated categories: public space and domestic space, taking the self-built fences as splitting points.

For the public space in Gerji, in terms of urban fabric, the current internal streets are evenly distributed, intersecting with the outer streets in an identical way regardless of their completely different characteristics. These crude street intersections allow the accessibility for all and increase the publicity of the inner part of the site, resulting the lack of privacy and more practical burglary problem. The major public spaces within the site are as well poorly defined. The streets are too wide, lacking of layers and shades. (This is partly because the inhabitants tend to park inside their own yards in consideration of preventing burglary.) The unfavorable factors aforementioned, have led to the results of fence construction and unwillingness of staying in public space thus eventually weakened the social interaction.

Inside the fences, the specific problems for domestic space are less visible than the ones for public space, as the dwellers have solved most of them by building extensions during almost four decades of dwelling, although often with substandard quality. Most of the extensions have an outdoor toilet and a larger kitchen that meets the need of cooking traditional Ethiopian food. This reveals the same kind of neglection of old lifestyle in the original low-cost housing units with condominium housings, which suggests the dwellers can easily adapt a modern way of living. The extensions sometimes also consist bedrooms for the overcrowded houses. It took space from the courtyards and a service back alley from the original scheme, which in a sense is the appropriation of public space.

Contextualize the general problem to Gerji, as a representative case in this background. The specific problem there is to find an alternative solution of densification, which should be able to solve the current deficiencies on the site (problems of now), meanwhile avoiding the mistakes condominium housing has made and meet the expectations from the city level (problems of future). The thing to stress here is the rebuild of community among the locals and new inhabitants.



Research Question

The general research question is how to achieve collective welfare between the locals and new inhabitants, by creating a co-habitable community under the context of urban densification and sufficient infrastructure?

Sub questions:
1. What are the common and conflicting concerns of old and new inhabitants?
2. To what extent the site should be densified?
3. What are the essential infrastructures that are needed for a good quality of life, and how to build them?

Design Hypothesis

Gerji sits on a larger residential area to the southeast of the city center, with Korean Hospital, Good News Church and a middle school to the north. and the planned Adwa park to the south. According to the masterplan of Addis Ababa in 2017 , the site is proposed with mostly high-density mixed residence (R-3) on the southern border and medium density mixed residence (R-2) for the rest. The former requires a Floor area ratio (FAR) from 5 to unlimited, and a high limitation of 70m, while the latter is much lower with 0.5 to 3.5 for FAR, and 35m for height limitation. Under these preconditions, the design goal is to develop an integrated housing project for both the old and new dwellers, bring them together to form a new community, so-called "co-habitable densification". The strategies are:
1. Based on the surrounding conditions, redesign the road system and division of plots (redefine the relation inside and outside the site);
2. Using the new-defined plot as the unit, develop the whole area step by step;
3. Infrastructure and communal space development within the site;
4. Mix of old and new inhabitants, as well as mix of different income groups (including rental option into the design).

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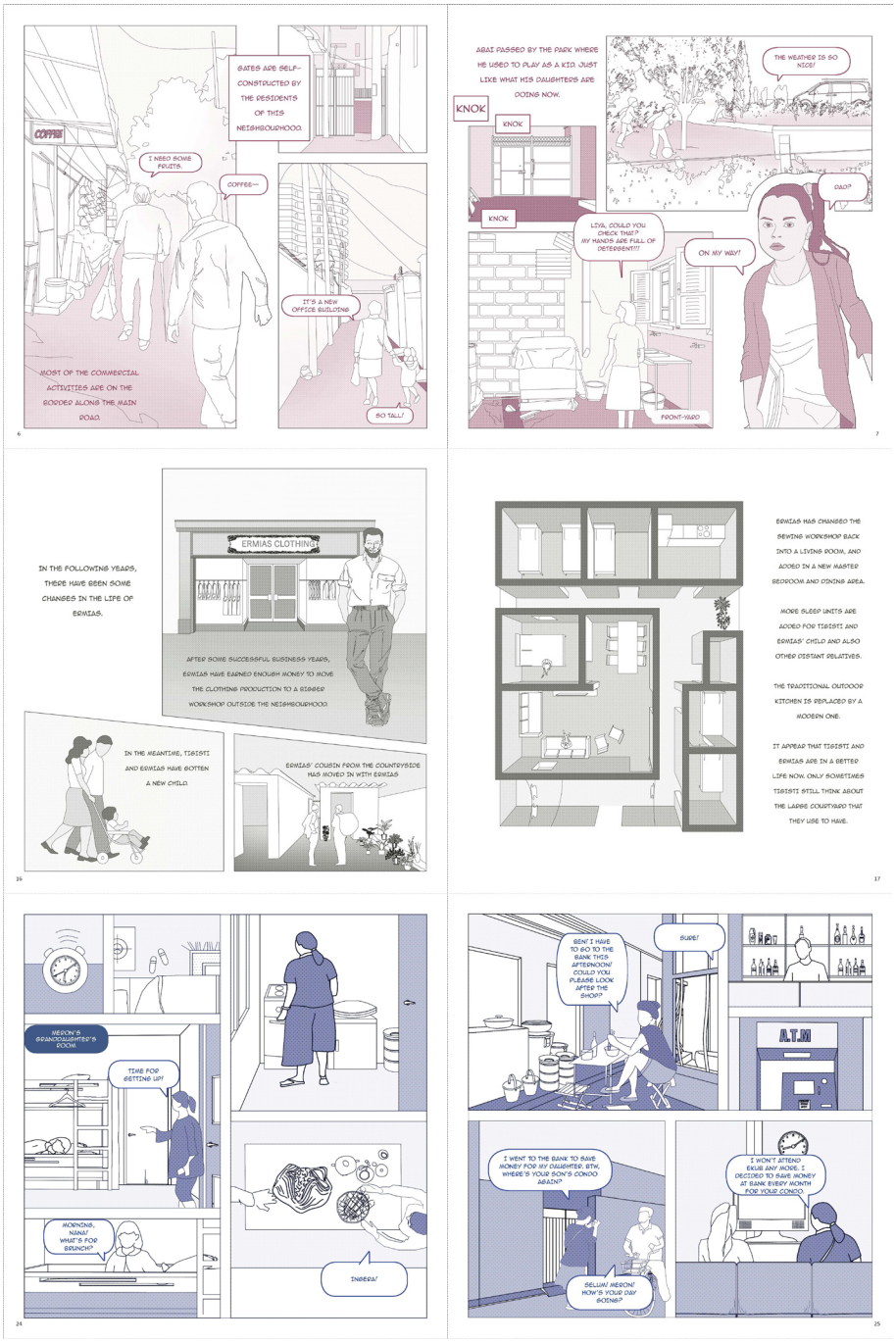
RESEARCH

ARCHITECTURAL ETHNOGRAPHY

_ Graphic Novel _ Rotterdam



In Kolfe, the pictures are telling the story of a slightly substandard living condition: people were collecting water from the puddles on the roadside; the homeless were sleeping on the street under the burning sunlight; the watchtower and fences everywhere implies a sense of unsafety... Unexpectedly, all our interviewees there were happy with their life as well as their neighbourhood. In general, they are having positive attitudes toward their future. (It could be because they are all the formal residents and now belonging to the middle-income group. They are not the poorest of the poor. But the fact that they moved into the site and gradually built and improved their lives is also fascinating.)

_ Graphic Novel _ Addis Ababa



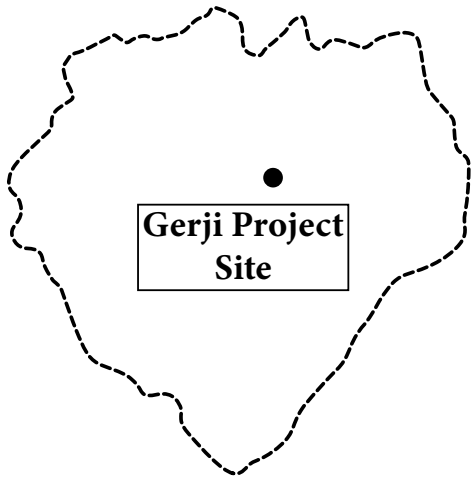
Oude western, however, could be the reversed version of Kolfe. From the first impression, it is like many other places in the Netherlands, with clean streets, proper greenery, even a little bit extra vibrancy. But the interviews revealed the other side of it, with gentrification, drugs and alcohol. According to a lady who lives and works there, "It is really double-sided, the people are nice, but there are also a lot of struggles. It is difficult to see."




Jackros

BACKGROUND _ GERJI

_ Location & Basic Information



Address: Bole sub city woreda 14, Addis Ababa, Ethiopia

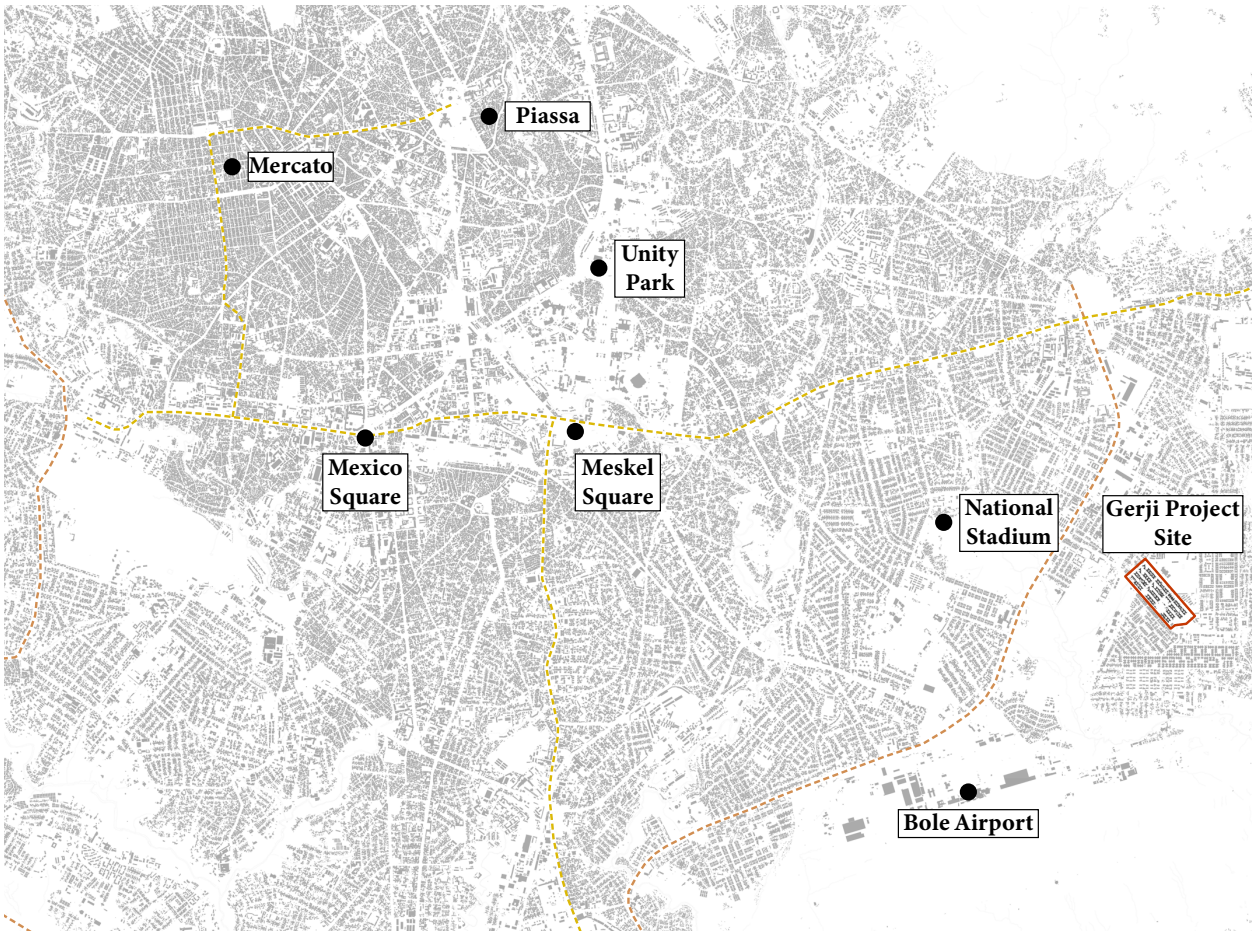
Client: Federal Housing Corporation

Year: 1980s

Site area: **126,000 m² / 12.6 ha**
Site area (plots): 74,745 m²
FAR (est.) : **0.43**

Plots: 318
Household size (est.) : 6
Population (est.) : **1900**
Density: **143 p/ha**

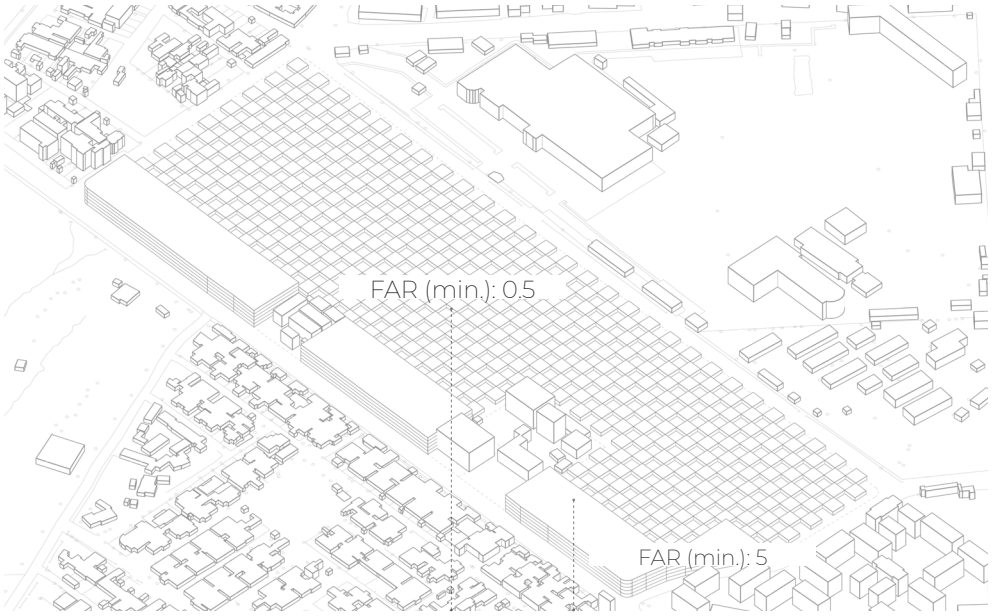
Built area: 32,142.5 m²
Green space: 43,400 m²
% Green area: 34.5% (public + private)



Source: Group research on Gerji site, illustrated by Alex Hewitson.

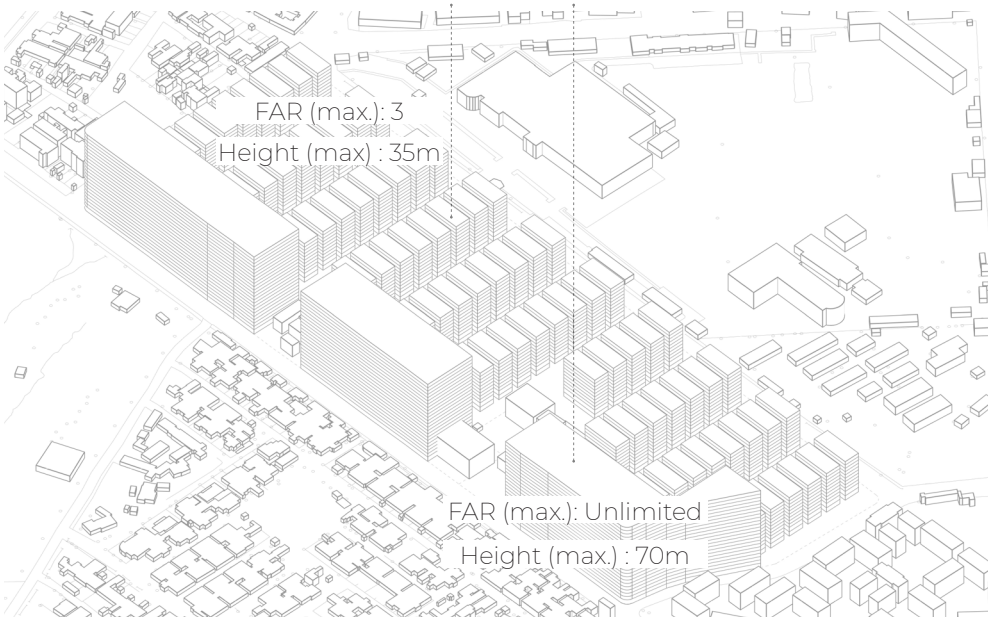
High-density mixed residence (R-3) & medium density mixed residence (R-2)

Scenario of Minimum Density



Scenario of Maximum Density

R-2 R-3



BUILDING REGULATIONS

_Fire

...
*5. In buildings having more than **five floors**, there shall be a safe **escape route** for emergency cases besides the main staircase.*

6. The emergency escape route of a building shall be easily accessible and shall have international standard exit signs posted to indicate the escape route in case of emergency and shall also have alternative power supply for illumination during power interruptions.
...

From: Council of Ministers Building Regulation no.243-2011

_Lift

...
*4. Any building, which is more than **20 meters** above the ground floor, shall be provided with a lift or other similar service.*

5. Lifts shall be made to provide service without interruption
...

From: Ethiopian Building Proclamation No. 624/2009

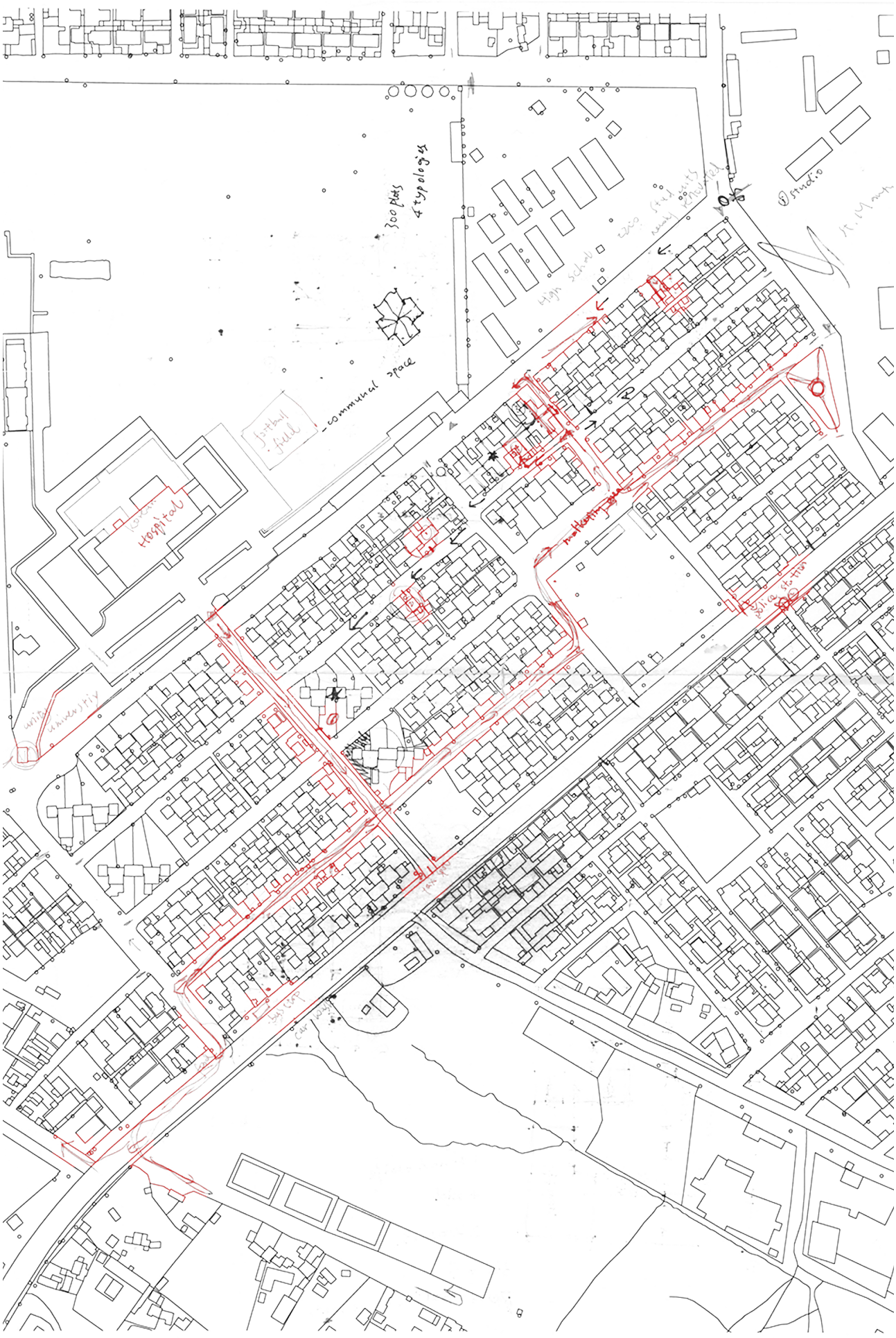
1. Have alternative power source in addition to the main power supply to provide service without interruption;

2. Have batteries which enable users to reach the next floor and to open their doors in cases of unexpected power interruptions;

3. Be suitable for all users including people with disabilities;

4. Have continuous professional follow up, timely inspection and maintenance by a certified entity so as to prevent their interruption as a result of defects and ensure the reliability of its service

From: Council of Ministers Building Regulation no.243-2011


300 plots
4 typologies
communal space
Hospital
Studio
police station

STUDY OF THE NEIGHBOURHOOD

_ External Streets

Main Commercial Street to the Southwest

Four external streets define the outer boundary of the rectangular-shaped Gerji. And the main commercial one to the southwest links the site with the Ring Road and Bole International Airport.



Photo: Jingfeng Cheng 2019

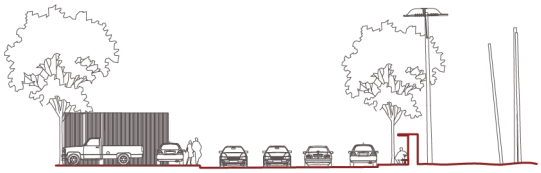
Street Sections _ 1: 500



Section A-A’



Section B-B’



Section C-C’





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ኤዶሚያስ ልዩ የጥርስ
ሕክምና ክሊኒክ
DONT SAY GOLD SAY GL FOREVER A DIVISION
OF IFECHUKWU AND EDOM VENTURES
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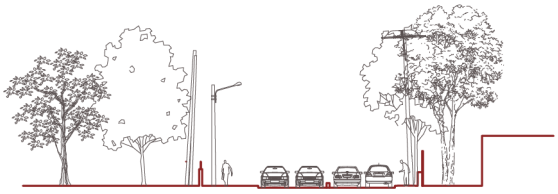
Main Street to the Northwest

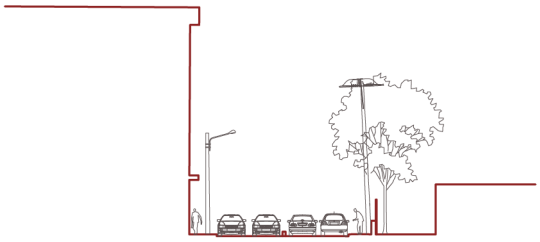
Link to Jacros - Salite Mehret Road and A2 highway.



Photo: Florian Bühler 2019



Section D-D'



Section E-E'

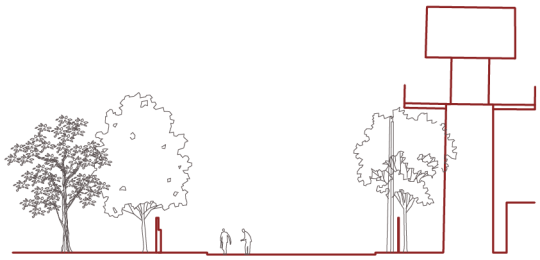


Street to the Northeast

Defined by the fences of public buildings & private houses.



Photo: Florian Bühler 2019



Section F-F'



Street to the Southeast

Between Gerji condominium & FHC Gerji site.



Photo: Florian Bühler 2019



Section G-G'



Section H-H'





_ *Internal Streets*

Pathway between fences.





_ *Public Space*

As the site is mainly occupied by streets and private plots, there is a general lack of public space in gerji. The only two there includes an undefined open space on front of the diplomatic hotel and a small triangular park on the street side.



Undefined open space





Small park where one can enjoy a cup of coffee

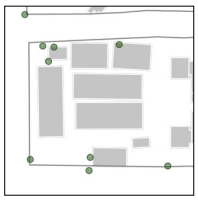




The remarkable water tower

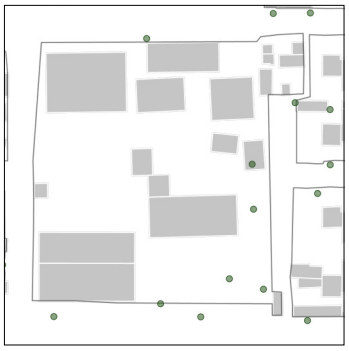


_ *Preserved Buildings According to The Master Plan*



Workshop

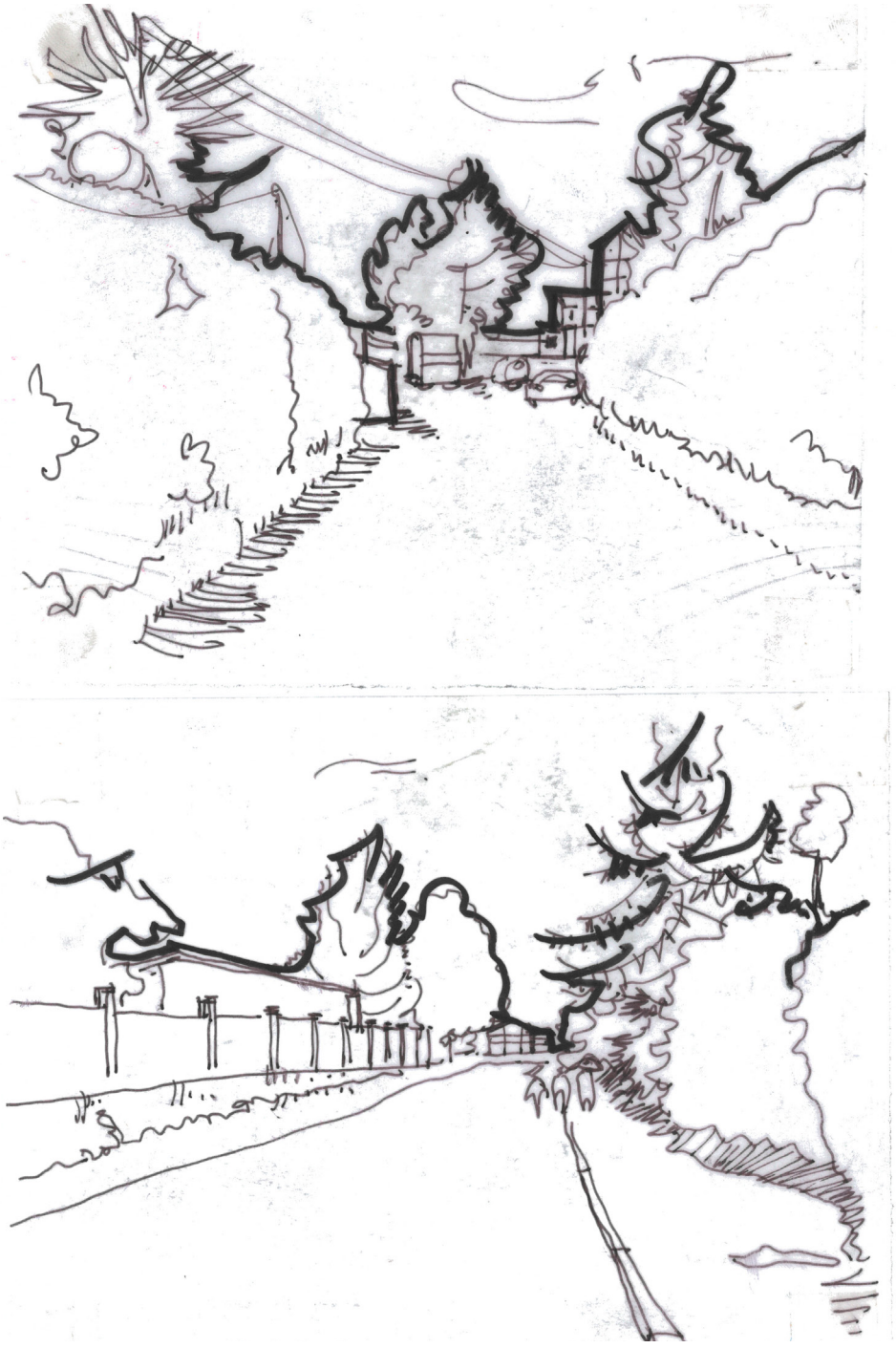




Diplomatic Hotel



_ *Impression of the Neighbourhood*



Source: Group work produced from workshop with EiABC

_ *Activities*

In and around Gerji.

The formal and informal commercial activities.





Grocery next to the open space



Grocery next to the main commercial street

Commerce Related



Window Shop



Cafe



Street Stalls



Street Vendor

Other Activities



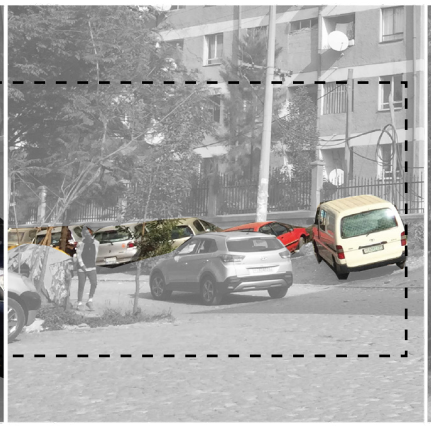
Animal Market



Stacking of Building Materials



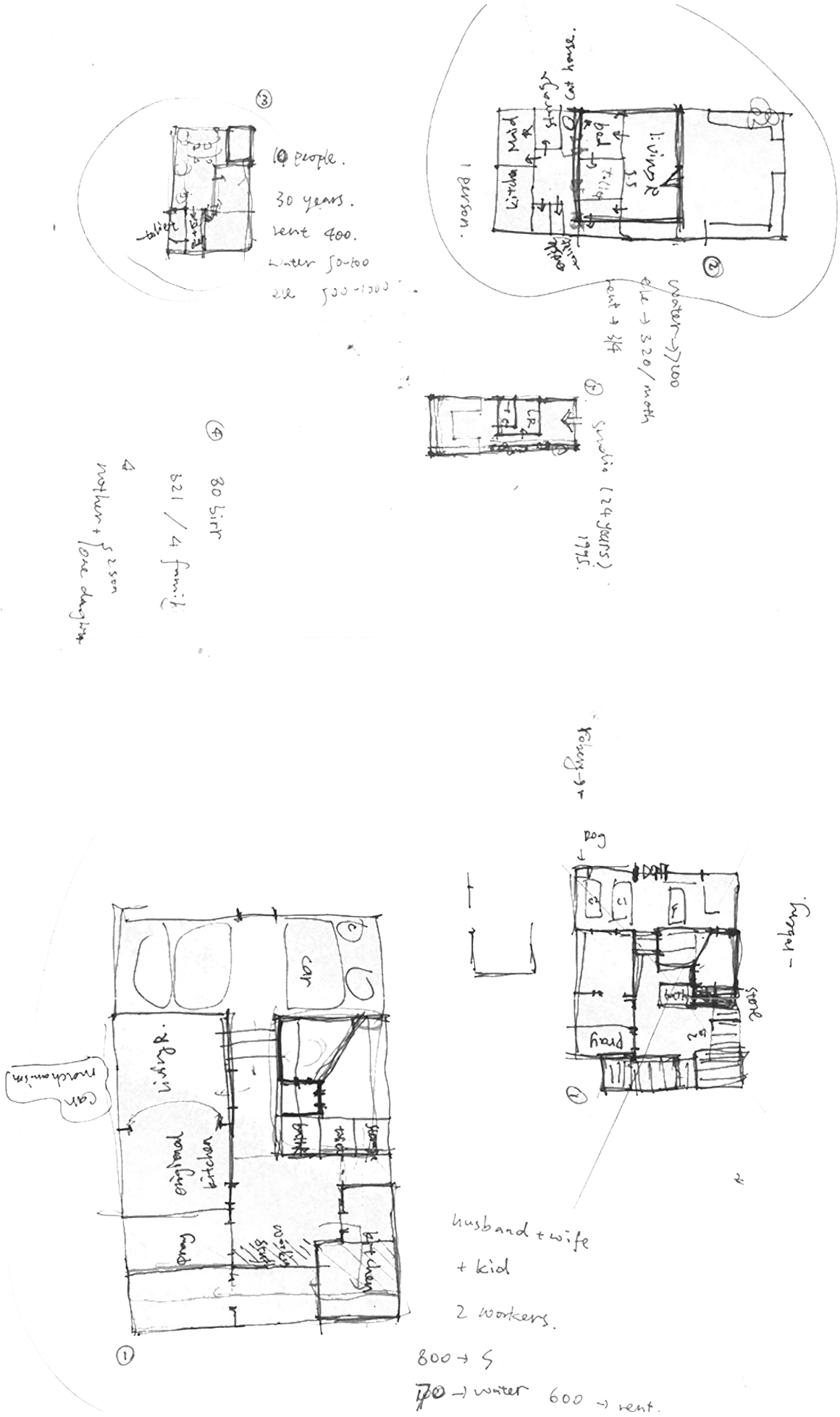
Car wash



Parking



Funeral

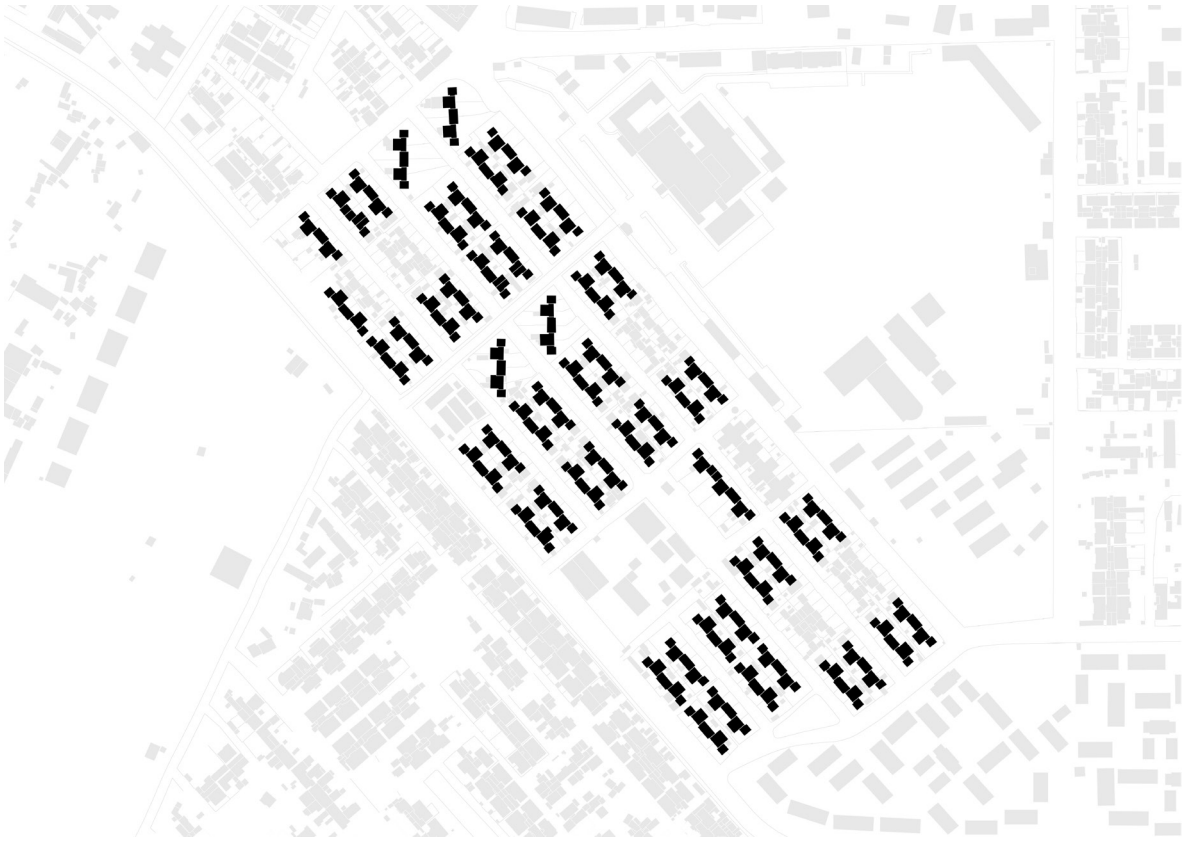


③
10 people.
30 years.
rent 400.
water 50-100
ele 500-1000
toilet
②
1 person.
Kitchen
Maid
storage
cat house.
bed
living R
toilet
water → 7200
ele → 320/ moth
rent → 3/4
①
Sandio (24 years)
1995.
④
30 birr
321 / 4 family
4
mother + 2 son
one daughter
car
living R.
original kitchen
pray
kitchen
car mechanism
①
Kobeng →
Dog
pray
store
- hogan.
husband + wife
+ kid
2 workers.
800 → 5
70 → water
600 → rent.

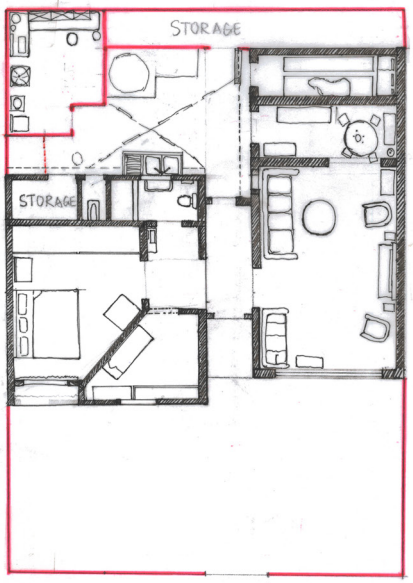
TYPOLOGY STUDY

The single floor houses on the site were built by the Federal Housing Corporation in 1980s. They consist of five typologies, along with conmen construction of “informal” expansions.

_ Two-Bedroom Unit (large)



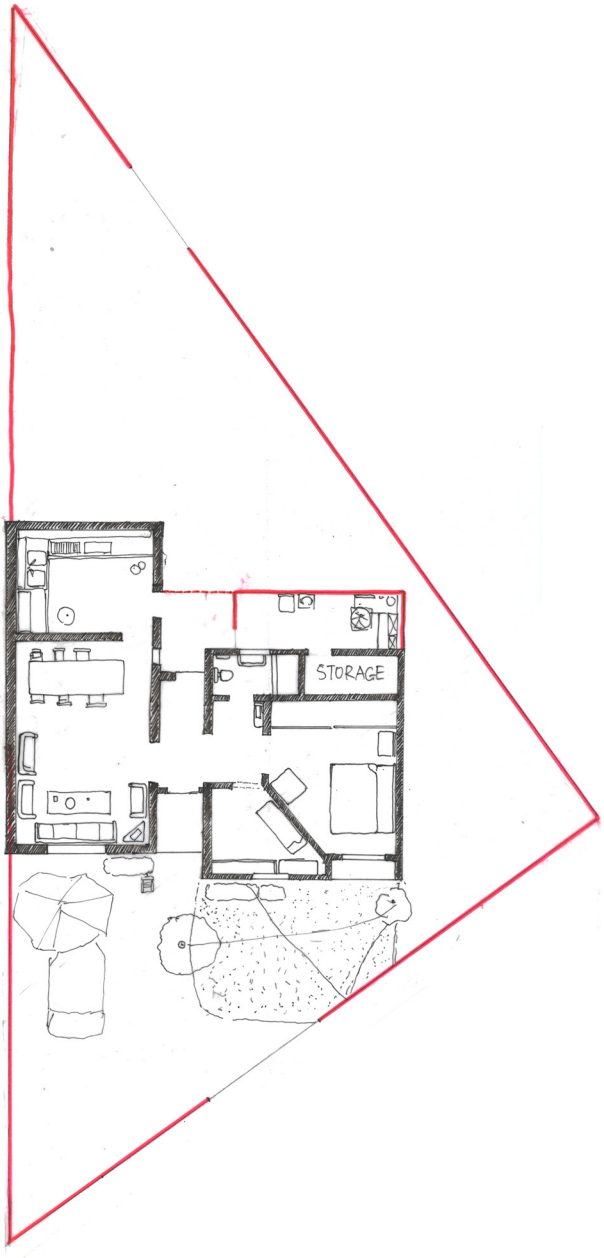
Two-bedroom unit (large) x 214



A typical large two-bedroom unit
1:100









Large two-bedroom unit _ Triangular variation
1:100

_ *Studio (large)*



Two-bedroom unit (large)	x 214
Studio (Large)	x 34









Large studio attached to the two-bedroom unit
1:100

_ *Two-bedroom Unit (small)*

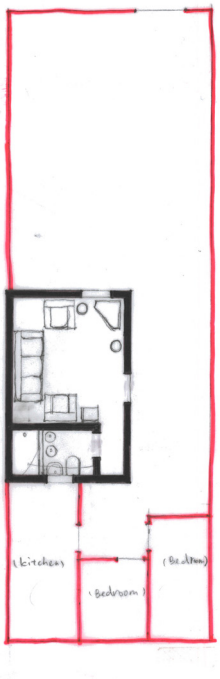


Two-bedroom unit (large)	x 214
Studio (Large)	x 34
Two-bedroom unit (small)	x 36

_ *Studio (small)*



Two-bedroom unit (large)	x 214
Studio (Large)	x 34
Two-bedroom unit (small)	x 36
Studio (small)	x 18



Small studio attached to the two-bedroom unit (small)
1:100









_ *L-shape Unit*



Two-bedroom unit (large)	x 214
Studio (large)	x 34
Two-bedroom unit (small)	x 36
Studio (small)	x 18
L-shape unit	x 16



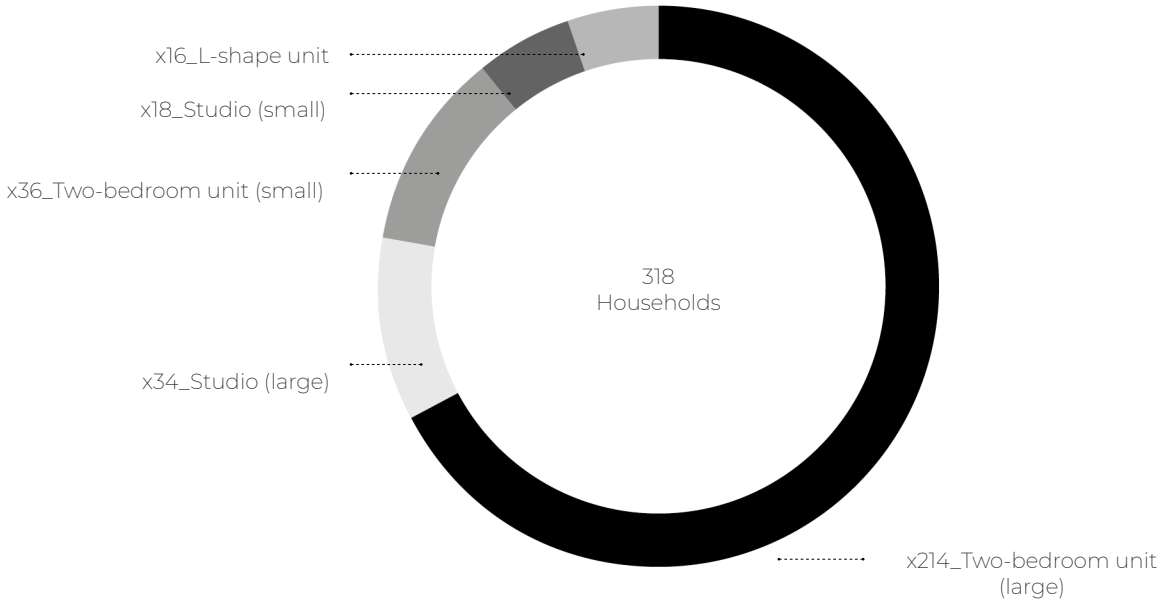


L-shape unit with two regional bedrooms
1:100

_ *Overview of Formal and Informal Construction*



Formal construction
Informal construction
Possible overcrowded households x19



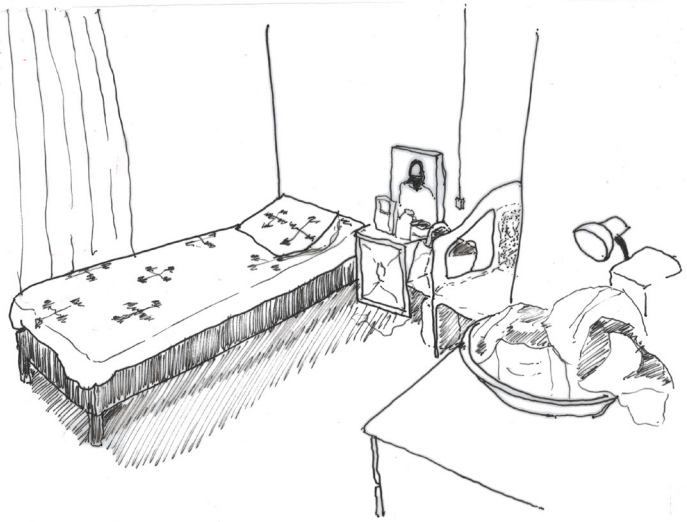
% Original homes: **76%**
% Extensions: **24%**
Average extension: **25 m²**

Plots: **318**
Typologies: **5**
Plot size (range): **135 - 505 m²**
Plot size (median): **215 m²**

_ Skteches from Site Visiting









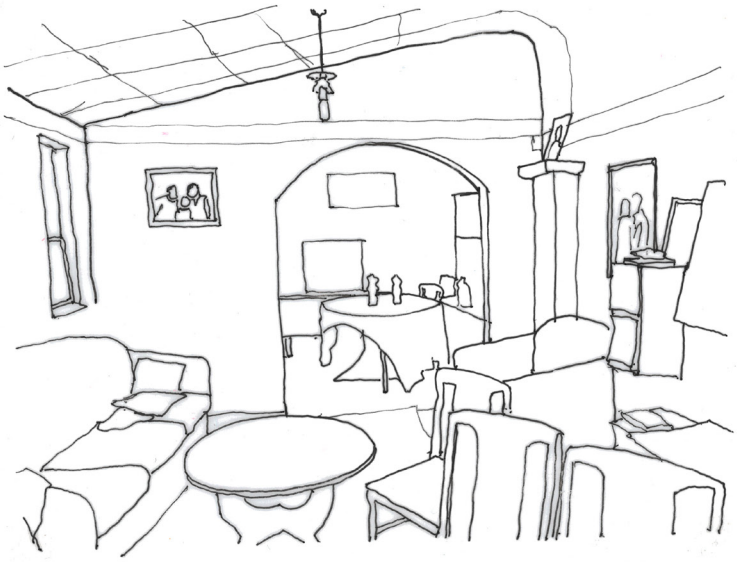
















Source: Group work produced from workshop with EiABC

A COLLAGE OF ADDIS

_Wall


1


2


3


4


5


6


7


8


9


10


11

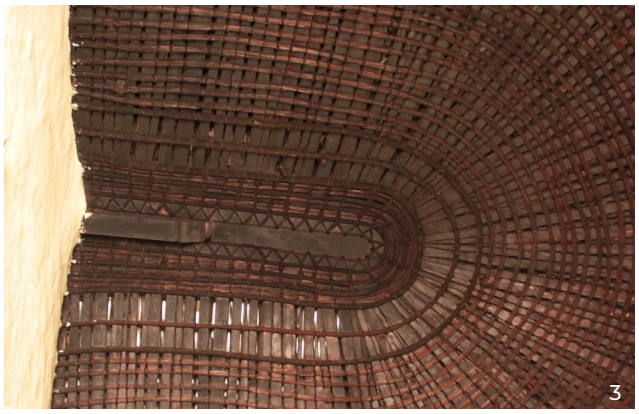
1. A traditional house in Lalibela with mud-stone wall
2. Stone wall in Talian site
3-4. Houses with Chika wall in Addis
5. A stone block wall in Kolfe Low-cost Housing site

6. A wall with plaster finish next to Gerji site
7-8. Wall with paster finish in Klofe Low-cost Housing Site
9. The Bete Giyorgis Churches of Lalibela
10. A stone block wall in Old Palace of Emperor Menelik II.
11. Self-constructed wall with corrugated iron sheet supported by batten

_Traditional Roof Construction


1


2


3


4


5


6

1.Roof of a traditional house in Lalibela
2-3. Old Palace of Emperor Menelik II.
4. Roof of Seven Olives Hotel restaurant in Lalibela
5. Reception Hall
6. Skylight of Dutch embassy with rattan pattern

_Gate





















1-9. Self-constructed gates at different stage of original houses in Gerji
10. Gate of Gerji Condominium Site

_Opening


1


2


3


4


5


6


7


8

1. Window of Gerji Condominium Site
2-3. Klofe Low-cost Housing Site
4. Window shop

5. Old Palace of Emperor Menelik II.
6. A private house close to Gerji site
7. Window of street building next to Gerji 20/80 Condominium Project
8. Window of the Aderash Reception Hall

_Staircase & Railing















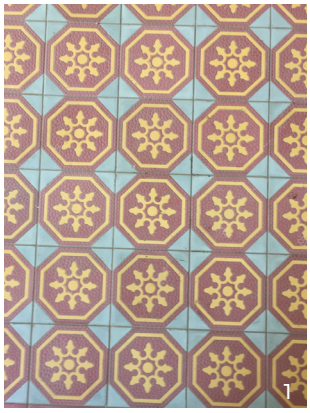




1. Elfin Royal Residence
2-3. Old Palace of Emperor Menelik II.
4. National Museum of Ethiopia
5-6. Entoto Maryam Church

7. Staircase of a residential building next to Hotel Vamos
8. A emergency staircase in Klofe Low-costing Site
9.Staircase of Gerji Condominium Site

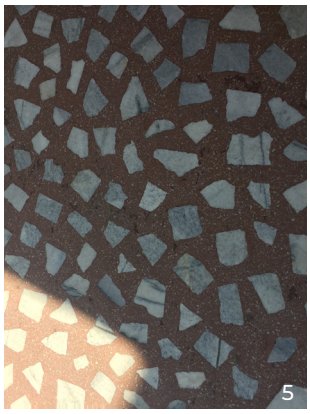
_Paving & Flooring

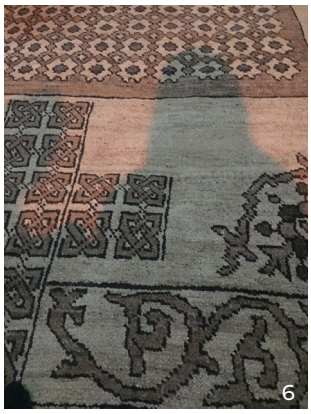










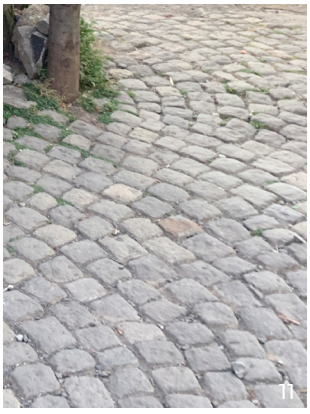














1-2. Paving of Elfin Royal Residence
3-4. /
5. EiABC educational building
6. Carpet of a church in Lalibela

7. Floor tiles of a family house in Kolfe Low-cost Housing Site
8. Backyard paving of a family house in Klofe Low-cost Housing Site
9-10.Old Palace of Emperor Menelik II.
11. Common street paving in Addis, picture taken from Kolfe Low-cost Housing Site
12. Common pedestrian road paving in Addis, colour could be red

THEORIES

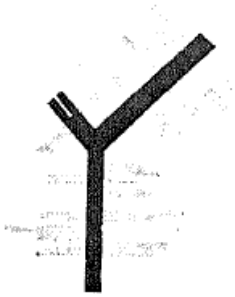
_Investigation on Collective Form _ Fumihiko Maki

Possible ways to conceive large, complex forms.

Three Paradigm of Collective Form



Compositional form



Megaform



Group form

"It is form that evolves from a **system** of **generative elements** in space"

Historical examples of town buildings: (factors determine the spatial organization)

1. Consistent use of basic materials and construction methods as well ass spontaneous but minor variations **i**n physical expression.

2. Wise and often dramatic use of geography and topography.

3. Human scale preserved throughout the town.

4. Sequential development of basic elements. (Dwellings, open spaces between houses, repetitive use of visual elements such as walls, gates, towers.)

Factors of urban neighbourhood prosperity _ Li Han_ A Little bit of Beijing
*Based on the theory of group form

Small (scale):
The units that consist the whole are small enough, to ensure a sufficient number;

Multiple (quantity):
Each unit is relatively independent, to ensure the diversity;

Complementary (connection):
Its relatively small scale makes the complementarity between units inevitable, thereby ensuring a close relationship with each other.

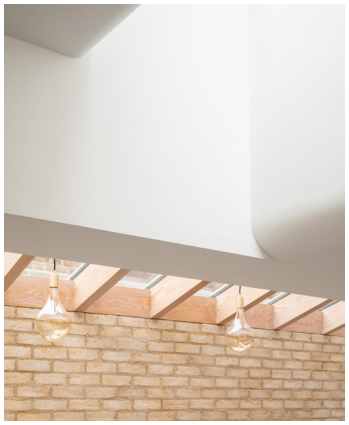
PRECEDENTS

_Vestry Road House Extension









Architects: Oliver Leech Architects

Year: 2019

Location: London, UK

"Oliver Leech Architects has extended a house in south London, adding a kitchen that pairs natural wood and brick with a muted colour palette.

Every new material and surface ties into a colour palette that is consistent through the house. Natural shades, like the pale yellows of the brick and wood, are paired with other soft tones. In the kitchen, cool grey concrete flooring and worktops combine with fern-green cabinets, while the renovated first-floor bathroom brings the pink tones of natural plaster together with pale grey tiles. The aim was to make spaces feel warm but not too overbearing.

"The project was a celebration of simple materials which have been carefully chosen to provide a subtle distinction between the old Victorian property and the new extension," explained studio founder Oliver Leech.

"The soft warm colours of the new brickwork were matched with the cool grey concrete floor to give the project a simple elegance without losing the feeling of a cosy spaces that can be enjoyed throughout the year," he continued.

"Texture also had a key role to play and the materials were chosen to provide tactility as well as visual beauty.""

What I like a lot about this project is its material and colour combination, and the resultant atmosphere. It will be very similar to my graduation project, in sense of the gentle beige hue, brick pattern and interior scale, etc.

Source: https://www.dezeen.com/2020/04/17/oliver-leech-architects-vestry-road-house-extension-new-kitchen

_ *High School Thazin*









Architects: Ackermann+Raff

Year: 2014

Location: Ngwesaung, Myanmar

"The new high school project was developed in cooperation with the German NGO Projekt Burma. It is a two-storey building based on a simple floor plan typology.

The school is constructed with the traditional 'brick noggin structure', a timber frame construction with brick masonry infill on a solid concrete base. The pergola is designed with an ornamental bamboo mesh, which serves as sun protection. Suspended ceilings made of bamboo and glass wool provide good acoustics and create a warm and comfortable atmosphere within the classrooms.

Due to the climate there is no need for glass windows, only for shutters serving as rain protection. With their fold- out mechanic they function as well as sun protection. The timber louvres within the shutters and underneath the roof ensure an excellent air ventilation and prevention against overheating."

This project shows the abundant possibilities of accommodating lights by the use of lightweight local materials in tropical regions. The spaces it created is charming and rich in variety, which could be inspirations for the design of public space in Gerji.

Source: https://www.archdaily.com/534728/high-school-thazin-ackermann-raff

_ *Library for the Community of Muyinga*









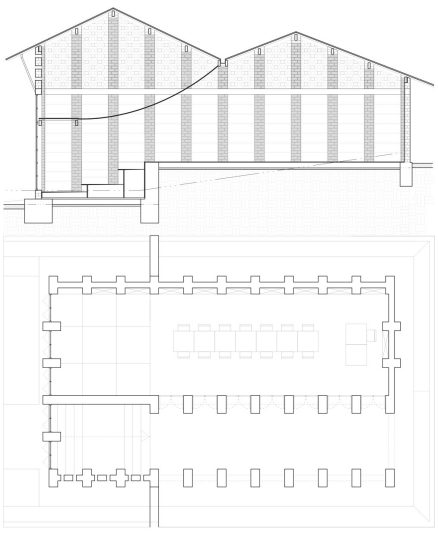
Architects: BC architects

Year: 2012

Location: Muyinga, Burundi

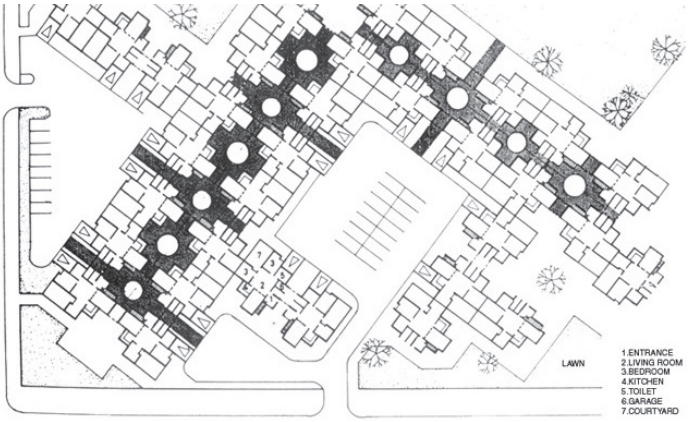
"The first library of Muyinga with budget of 40 000 € for 140m2, part of a future inclusive school for deaf children, in locally sourced compressed earth blocks, built with a participatory approach.

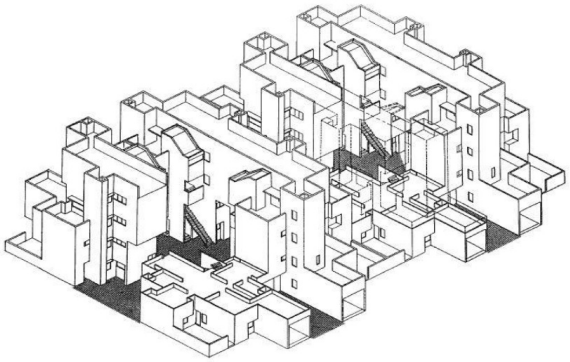
The library is organized along a longitudinal covered circulation space. This "hallway porch" is a space often encountered within the Burundian traditional housing as it provides a shelter from heavy rains and harsh sun. Life happens mostly in this hallway porch; encounters, resting, conversation, waiting - it is a truly social space, constitutive for community relations. This hallway porch is deliberately oversized to become the extent of the library. Transparent doors between the columns create the interaction between inside space and porch. Fully opened, these doors make the library open up towards the adjacent square with breathtaking views over Burundi's "milles collines" (1000 hills). On the longitudinal end, the hallway porch flows onto the street, where blinders control access. These blinders are an important architectural element of the street facade, showing clearly when the library is open or closed. On the other end, the hallway porch will continue as the main circulation and acces space for the future school.

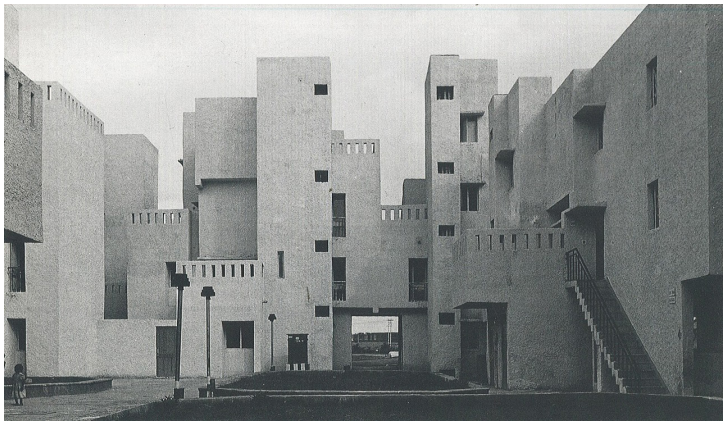


Source: http://architects.bc-as.org/Library-of-Muyinga

_Sheikh Sarai Housing







Architects: Raj Rewal

Year: 1982

Location: New Delhi

"BUILT FABRIC -Low-Rise High-density walk-up apartments, clustered to create internal shaded streets linked by gateways and open courtyards (traditional Indian architectural elements) for public use to resemble a traditional urban settlement, and as an expression of style of the architect. The gateways, a common feature within the project enabled high level of transparency despite being a high-density development rendering it legible for the users.

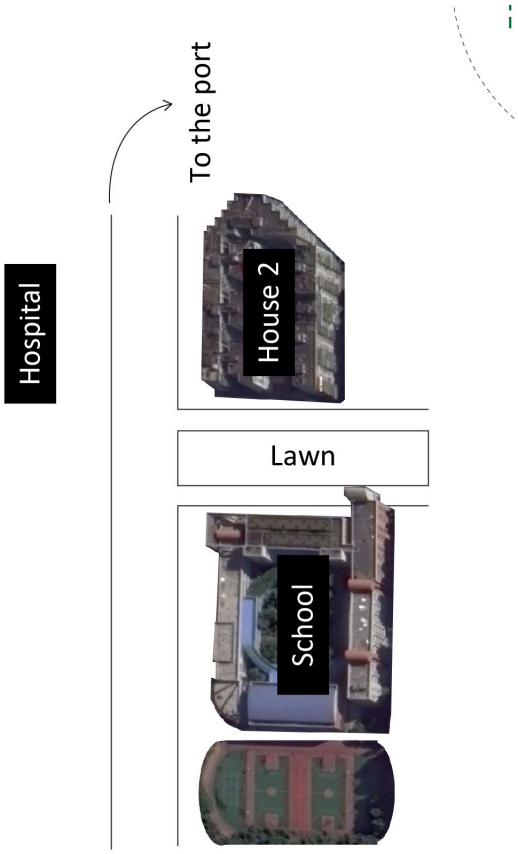
MOVEMENT AND FLOW – Clear demarcation of vehicular and pedestrian streets, restricting the vehicular flow to the peripheries with few access points along the road and enhancing pedestrian flow along the central spine puncturing the built solids. This defined the parking spaces and flow of traffic outside of the housing clusters.

COMMUNITY SPACES – Fostering shared spaces for the community by creating intimate courtyards connected to each other, representing the traditional elements of Indian Architecture. The scale of these courtyards has been Manipulated towards increased social activities and interaction amongst the resident community, serving as social facilitators."

Source: http://www.rajrewal.in/projects/housing-sheikh-sarai.htm
https://www.slideshare.net/MayurWaghulde3/sheikh-sarai-hosing-new-delhi
https://ro-w.tumblr.com/post/37112962383/archilista-raj-rewals-detail
https://samkit-education.blogspot.com/2018/11/research-project-low-cost-housing.html

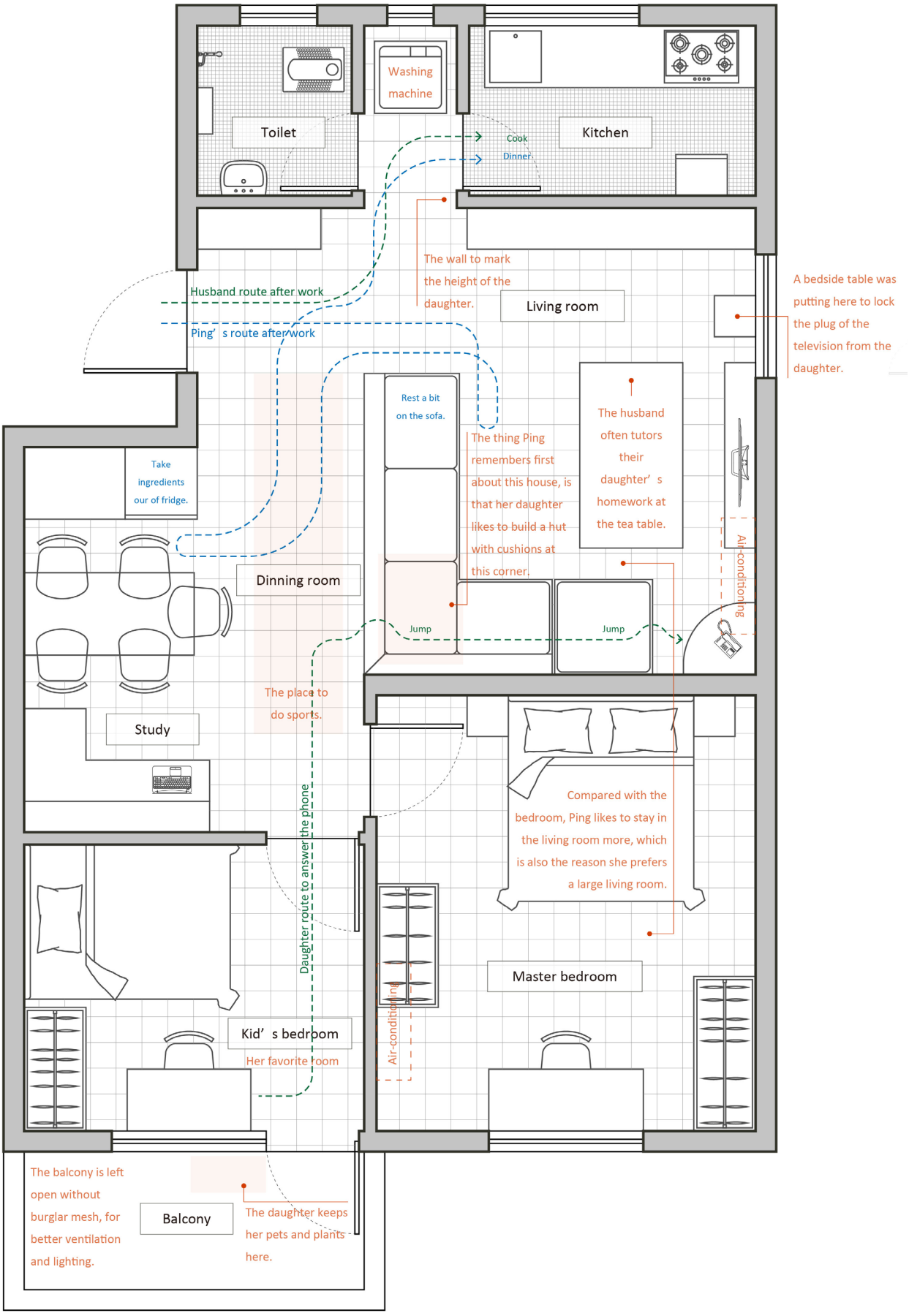
HOME LIFE DIARY

_Lv Yuan Residence

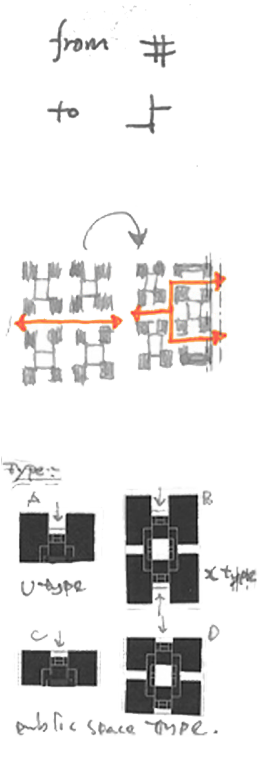


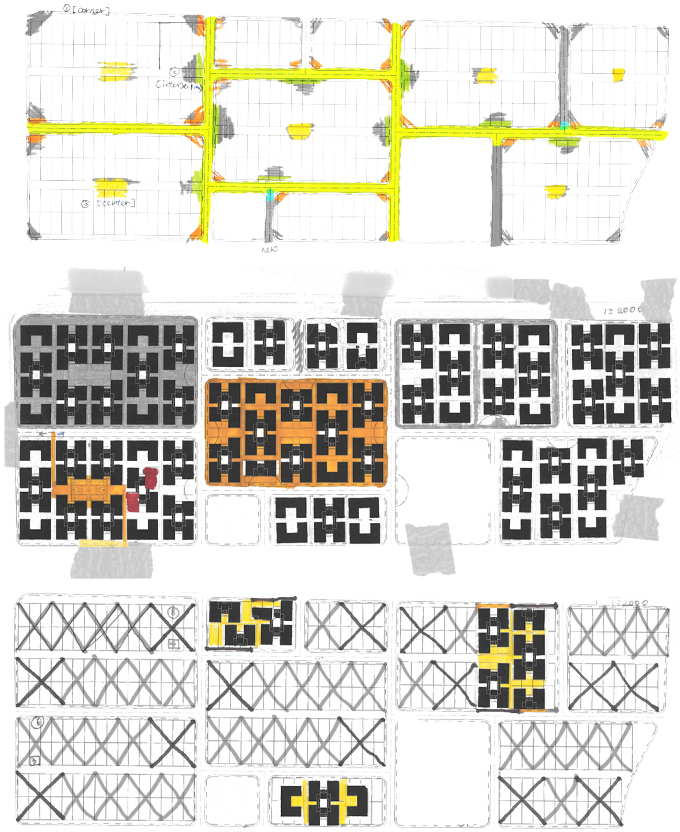
Part of the research I did for Home Life Diary is the “Lv Yuan Residence“. By name it means “the building of green yard“, but the green is actually from the small green tiles on its facade.

It’s in a neighbourhood of primary school, sitting on top of a police station. The building was constructed around 2001, having 9 stories high but without a lift. However, this flaw is compensated by a terrace on the 4th floor (which is also the roof of the police station), and a open staircase. That is often the place where the neighbours meet and build bonds from.


Toilet
Washing machine
Kitchen
Cook
Dinner
Husband route after work
Ping' s route after work
The wall to mark the height of the daughter.
Living room
A bedside table was putting here to lock the plug of the television from the daughter.
Rest a bit on the sofa.
Take ingredients our of fridge.
The thing Ping remembers first about this house, is that her daughter likes to build a hut with cushions at this corner.
The husband often tutors their daughter' s homework at the tea table.
Air-conditioning
Dinning room
Jump
Jump
The place to do sports.
Study
Compared with the bedroom, Ping likes to stay in the living room more, which is also the reason she prefers a large living room.
Daughter route to answer the phone
Master bedroom
Air-conditioning
Kid' s bedroom
Her favorite room
The balcony is left open without burglar mesh, for better ventilation and lighting.
Balcony
The daughter keeps her pets and plants here.

DESIGN





** Sketches of urban strategy principles back to P2 phase*

URBAN STRATEGY

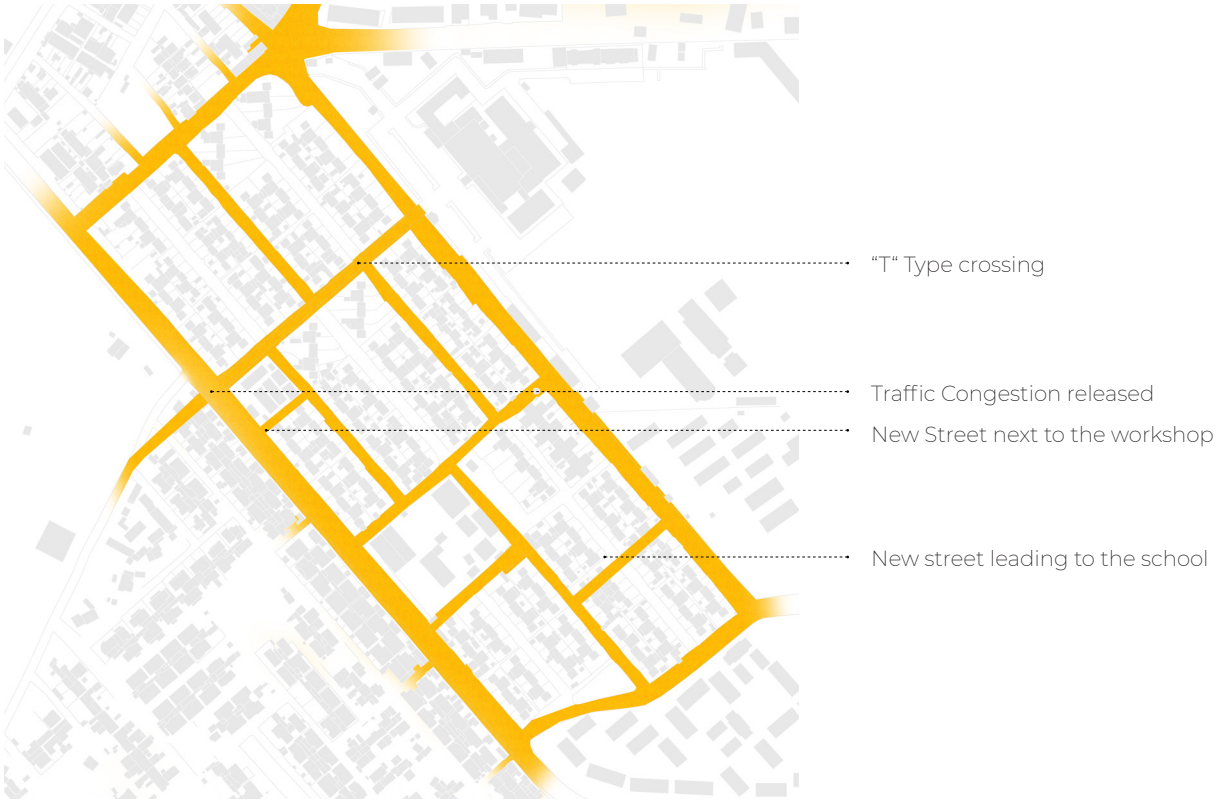
_Adjustment of Urban Fabric

From # to ⊥ .

Original Street Pattern

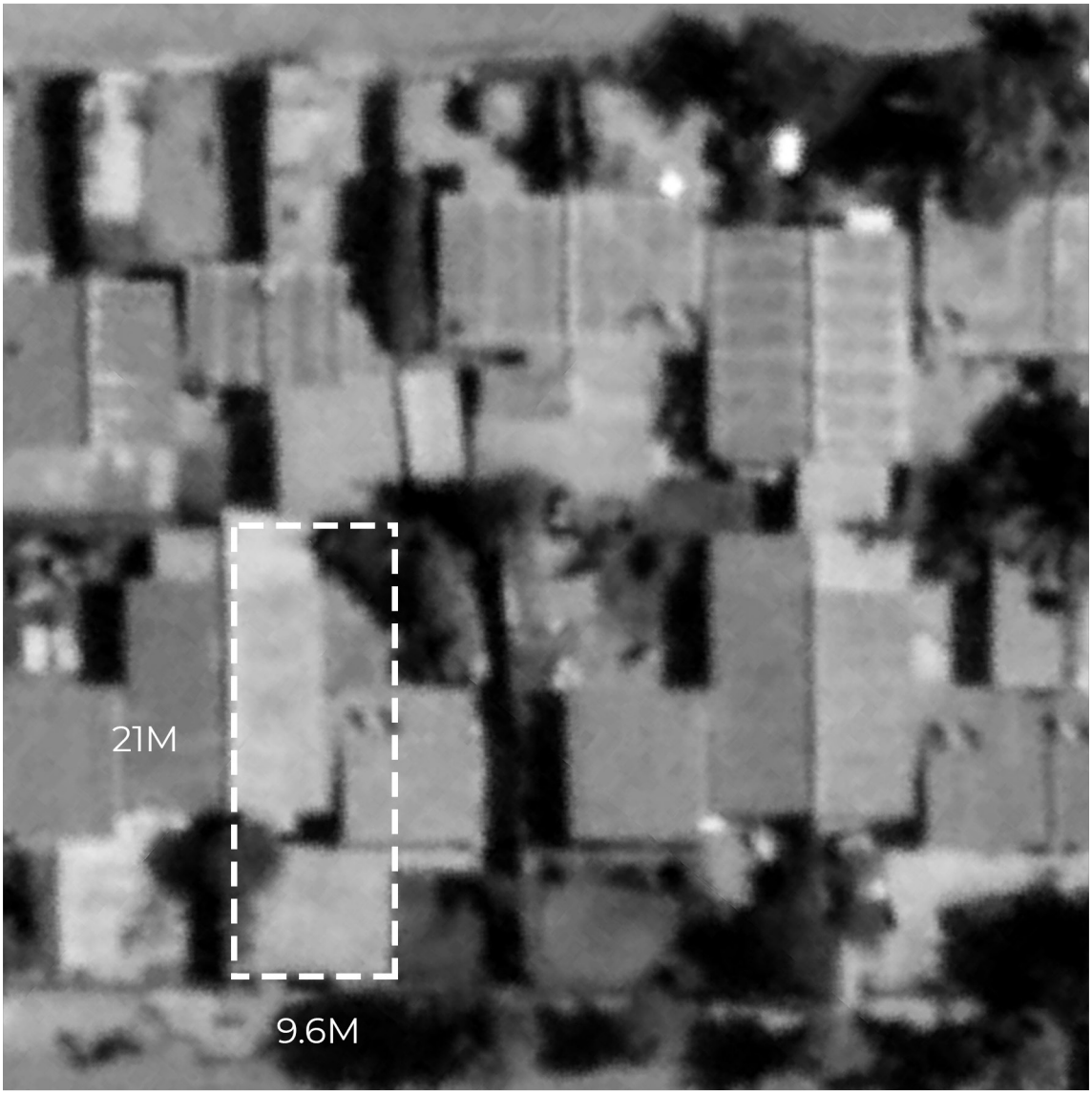


New Street Pattern

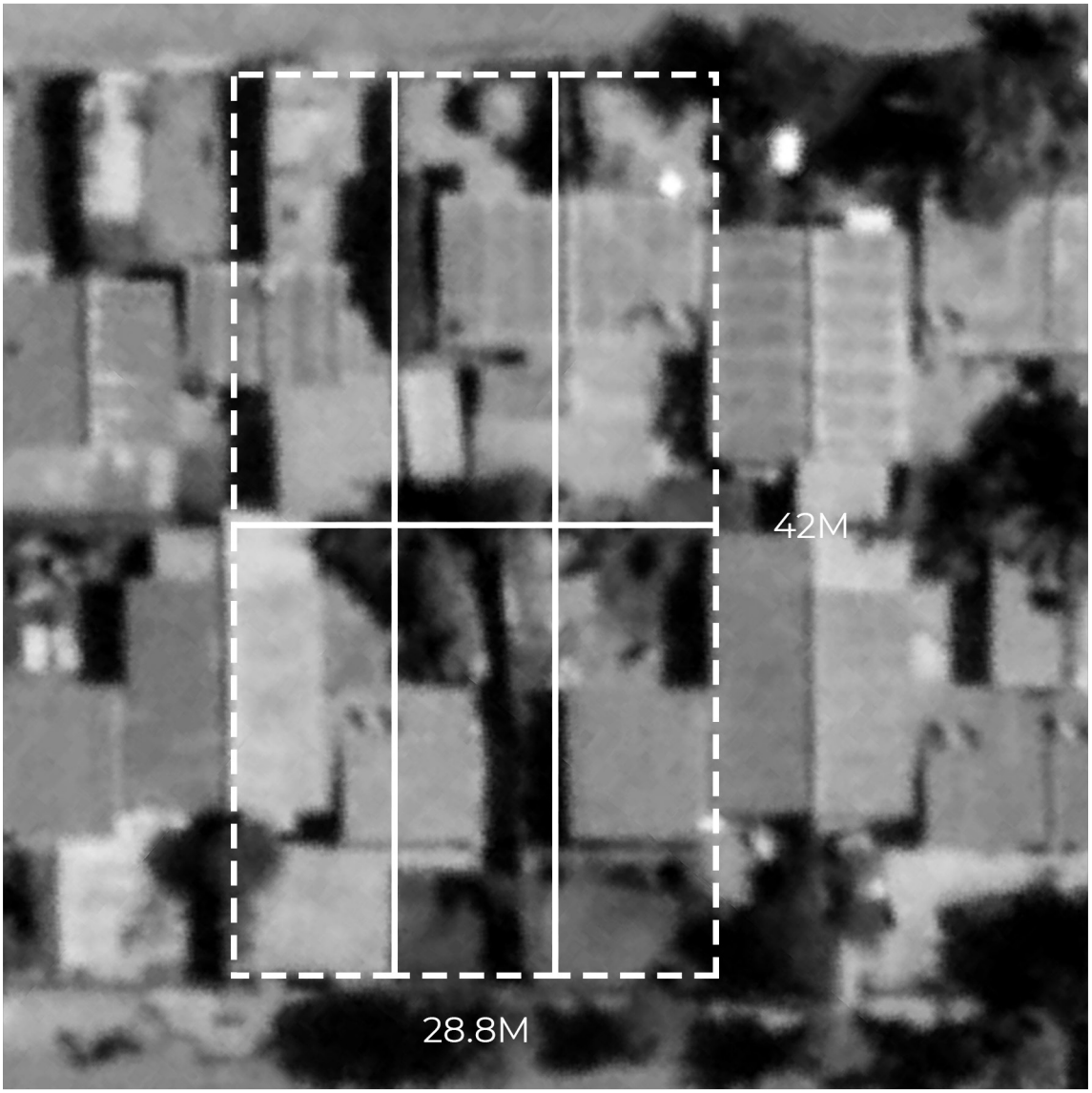


THE PLOTS

_ A Basic FHC Plot



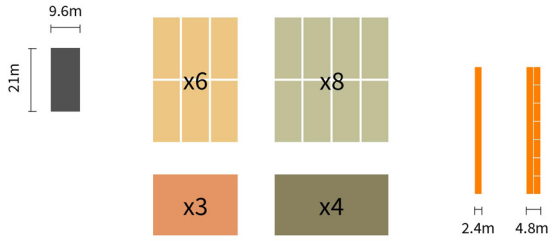
_ *Plot Combination*



_ *Plot Rearrangement for FHC Site*

Taking Gerji as an example

The construction of a new plot system

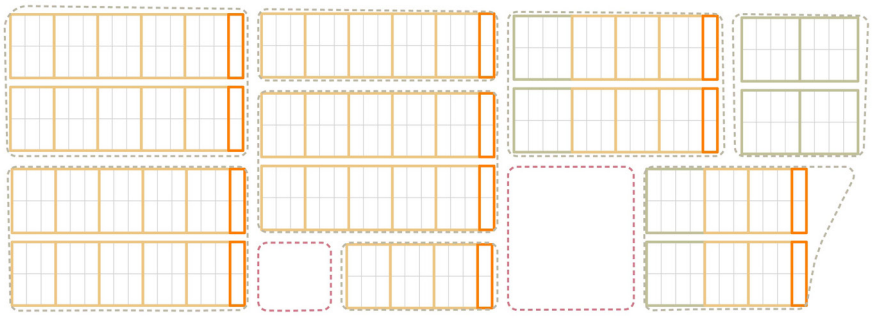


Original plots (9.6m*21m)

Recombination of the original plots, in the cases of **six to one** and **eight to one** for residential use, and their corresponding half size variation.

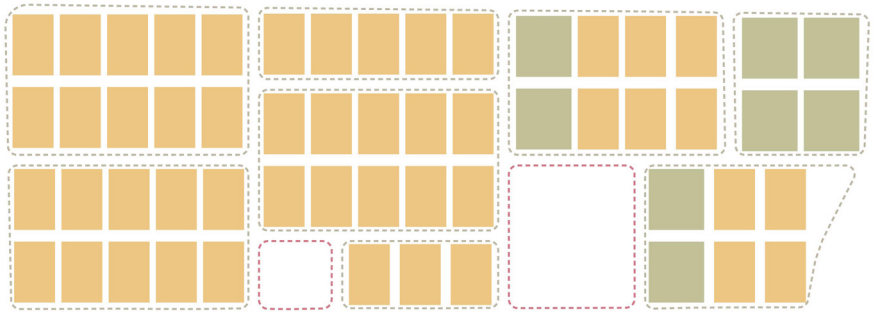
Plots reserved for street construction, with two variations of **2.4m** (1/4 original plot width) and **4.8m** (1/2 original plot width, street with side parking).

Application of the plot system to Gerji

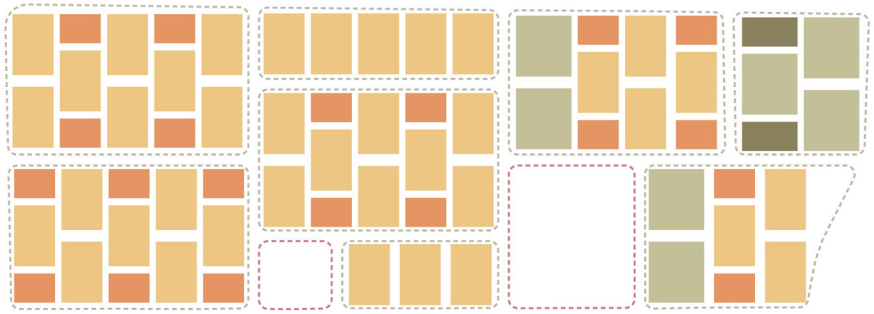


Plot “Six to one”: 48
Plot “Eight to one”: 8
Street Plot: 12

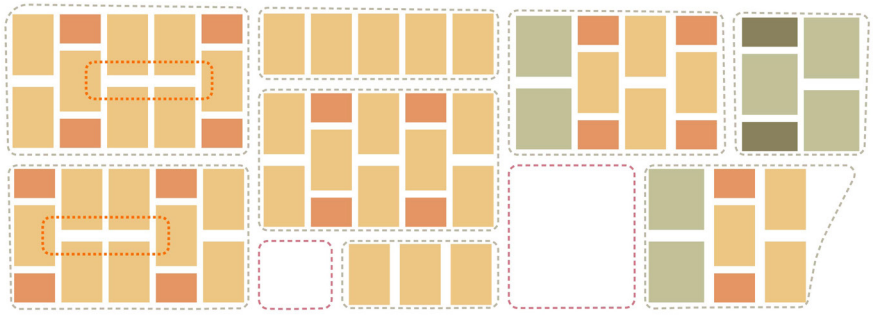
Adjustment of the Plot Rearrangement



Distributing the streets in-between the plots for residential use.
Generating the hierarchy from outer street, to primary inner street, secondary inner street and backside pedestrian street.

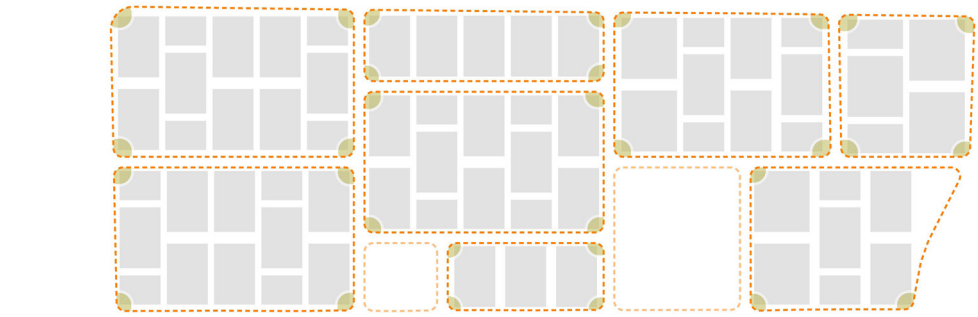


Introducing half size variations to allow stagger placements of the residential plots, thereby breaking the consistency of the pedestrian street.



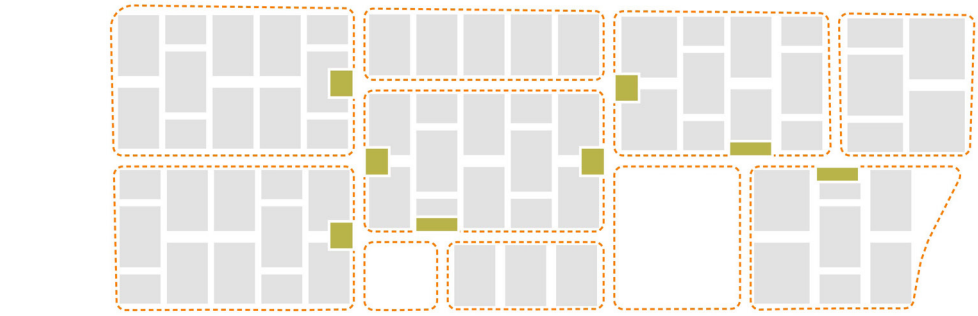
Minor adjustment.

Generation of Public Space



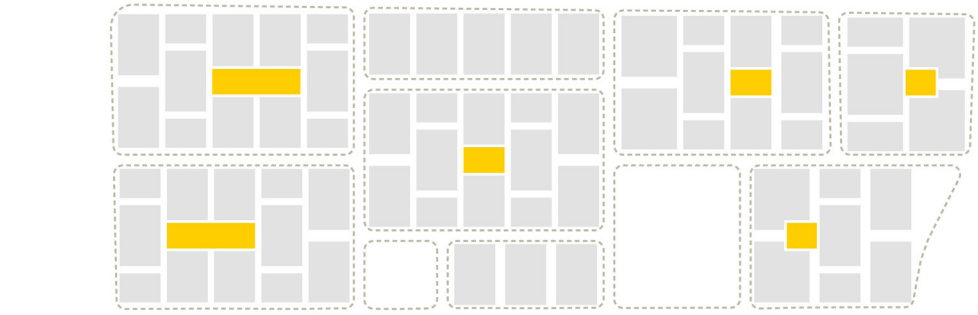
Corner.

+



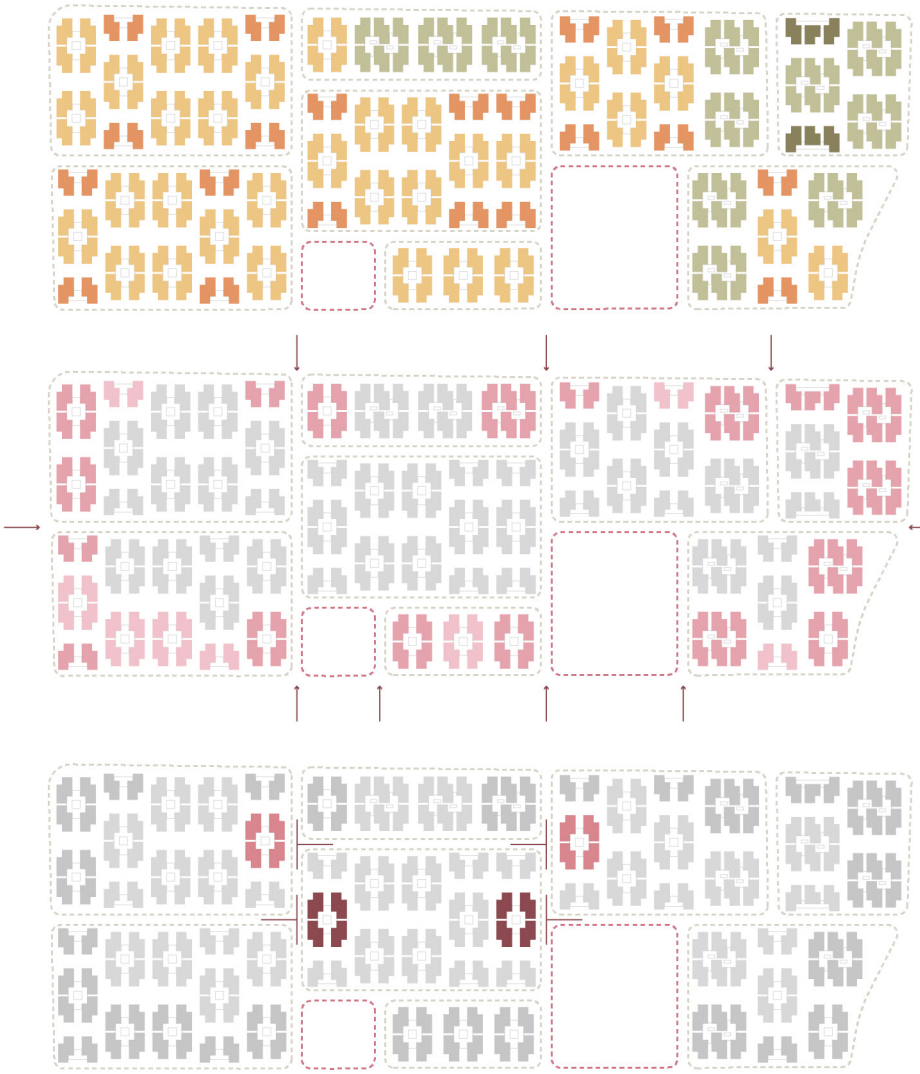
Street end.

+



Inside.

Apply of Building Clusters and The Variations

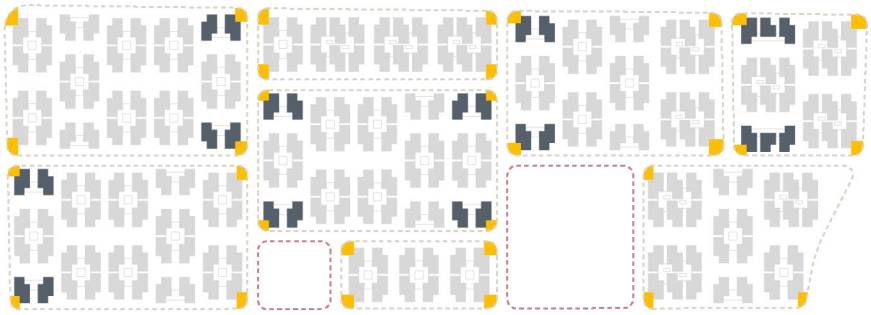


Fitting building clusters into the rearranged plots.

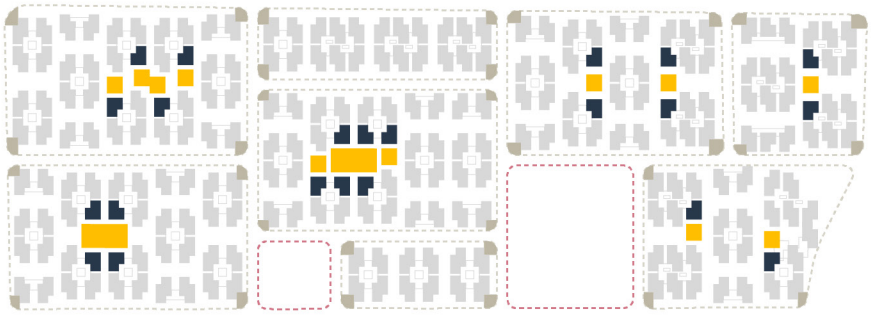
Raise the ones next to main outer streets and site entrances, to allow commercial and public activities at their ground level.

The highest buildings in the site are place at the intersection points of main inner streets, which as well functioning as the orientation landmark.

Building Response to Public Space



Some street-corner buildings flip their direction, thereby to meet the streets' beginning and end with a more friendly gesture.



The set back of residential blocks offering room for public spaces. Their different combination leads to a variety of characteristics.

It is possible to fill a site having a length of $l, l \in \mathbb{N}$ plots with a combination of clusters having a length of 3 plots ("3 plot clusters") and 4 plots ("4 plot clusters") with streets of a widths of 0.25 and 0.5 plots if the following system of linear equations is fulfilled:

$$\text{i)} \quad \underbrace{3 \cdot c_3}_{\substack{\text{total length of} \\ \text{"3 plot clusters"}}} + \underbrace{4 \cdot c_4}_{\substack{\text{total length of} \\ \text{"4 plot clusters"}}} + \underbrace{p_s}_{\substack{\text{total width of} \\ \text{"streets"}}} = l \quad \text{, with } c_3, c_4, p_s \in \mathbb{N}_0 \text{ and } l \in \mathbb{N}$$

$$\text{ii)} \quad \underbrace{0.25 \cdot s_{0.25}}_{\substack{\text{total width of streets} \\ \text{having 0.25 plots width}}} + \underbrace{0.5 \cdot s_{0.5}}_{\substack{\text{total width of streets} \\ \text{having 0.5 plots width}}} = p_s \quad \text{, with } s_{0.25}, s_{0.5}, p_s \in \mathbb{N}_0$$

$$\text{iii)} \quad \underbrace{s_{0.25} + s_{0.5}}_{\substack{\text{number of} \\ \text{streets}}} = \underbrace{c_3 + c_4}_{\substack{\text{number of} \\ \text{clusters}}} - 1 \quad \text{, with } c_3, c_4, s_{0.25}, s_{0.5}, p_s \in \mathbb{N}_0$$

Thereby the variables can be interpreted as:

- l is the number of plots in a row
- c_3 is the number of clusters having a length of 3 plots
- c_4 is the number of clusters having a length of 4 plots
- $s_{0.25}$ is the number of streets having a length of 0.25 plots
- $s_{0.5}$ is the number of streets having a length of 0.5 plots
- p_s is the number of plots used for streets

Below we will proof that our system of linear equations is fulfilled for every $l \in \mathbb{N}$ with $l \geq 10$. In other words every site longer or equal to 10 plots can be filled with a combination of clusters having a length of 3 and 4 plots with streets between them having a width of 0.25 and 0.5 plots depending on the overall length of the site.

Proof. We begin with proofing that there are infinite solutions for our system of linear equations, if we waive the restriction of natural numbers.

Using a matrix notation we can write above (nonhomogeneous) system of linear equations as:

$$\begin{pmatrix} 3 & 4 & 1 & 0 & 0 \\ 0 & 0 & -1 & 0.25 & 0.5 \\ -1 & -1 & 0 & 1 & 1 \end{pmatrix} \times \begin{pmatrix} c_3 \\ c_4 \\ p_s \\ s_{0.25} \\ s_{0.5} \end{pmatrix} = \begin{pmatrix} l \\ 0 \\ -1 \end{pmatrix}$$

Thus, using Gaussian elimination we obtain

$$\left(\begin{array}{ccccc|c} 3 & 4 & 1 & 0 & 0 & l \\ 0 & 0 & -1 & 0.25 & 0.5 & 0 \\ -1 & -1 & 0 & 1 & 1 & -1 \end{array}\right) \sim \left(\begin{array}{ccccc|c} 3 & 4 & 1 & 0 & 0 & l \\ -1 & -1 & 0 & 1 & 1 & -1 \\ 0 & 0 & -4 & 1 & 2 & 0 \end{array}\right) \sim \left(\begin{array}{ccccc|c} -1 & -1 & 0 & 1 & 1 & -1 \\ 0 & 1 & 1 & 3 & 3 & l-3 \\ 0 & 0 & -4 & 1 & 2 & 0 \end{array}\right)$$

Setting $s_{0.25} = x$ and $s_{0.5} = y$ with $x, y \in \mathbb{R}$ we can solve our system of linear equations and obtain for p_s

$$-4 \cdot p_s + x + 2 \cdot y = 0 \Leftrightarrow p_s = \frac{x + 2 \cdot y}{4} = \frac{1}{4} \cdot x + \frac{1}{2} \cdot y$$

For c_4

$$c_4 + \frac{1}{4} \cdot x + \frac{1}{2} \cdot y + 3 \cdot x + 3 \cdot y = l - 3$$

and after reforming

$$\begin{aligned} c_4 &= l - 3 - 3 \cdot x - 3 \cdot y - \frac{1}{4} \cdot x - \frac{1}{2} \cdot y \\ &= l - 3 - \frac{12}{4} \cdot x - \frac{12}{4} \cdot y - \frac{1}{4} \cdot x - \frac{1}{2} \cdot y \\ &= l - 3 - \frac{13}{4} \cdot x - \frac{7}{2} \cdot y \end{aligned}$$

And finally for c_3

$$-c_3 - c_4 + x + y = -1$$

which yields

$$\begin{aligned} c_3 &= x + y - c_4 + 1 \\ &= x + y - l + 3 + \frac{13}{4} \cdot x + \frac{7}{2} \cdot y + 1 \\ &= -l + 4 + \frac{17}{4} \cdot x + \frac{9}{2} \cdot y \end{aligned}$$

$$\begin{pmatrix} c_3 \\ c_4 \\ p_s \\ s_{0.25} \\ s_{0.5} \end{pmatrix} = \begin{pmatrix} -l + 4 + \frac{17}{4} \cdot x + \frac{9}{2} \cdot y \\ l - 3 - \frac{13}{4} \cdot x - \frac{7}{2} \cdot y \\ \frac{1}{4} \cdot x + \frac{1}{2} \cdot y \\ x \\ y \end{pmatrix} = \begin{pmatrix} 4 - l \\ l - 3 \\ 0 \\ 0 \\ 0 \end{pmatrix} + \begin{pmatrix} \frac{17}{4} \\ \frac{-13}{4} \\ \frac{1}{4} \\ 1 \\ 0 \end{pmatrix} \cdot x + \begin{pmatrix} \frac{9}{2} \\ \frac{-7}{2} \\ \frac{1}{2} \\ 0 \\ 1 \end{pmatrix} \cdot y$$

after reforming. Therefore we obtain the solution space

$$\mathcal{L} = \left\{ \begin{pmatrix} 4 - l \\ l - 3 \\ 0 \\ 0 \\ 0 \end{pmatrix} + \begin{pmatrix} \frac{17}{4} \\ \frac{-13}{4} \\ \frac{1}{4} \\ 1 \\ 0 \end{pmatrix} \cdot x + \begin{pmatrix} \frac{9}{2} \\ \frac{-7}{2} \\ \frac{1}{2} \\ 0 \\ 1 \end{pmatrix} \cdot y, \text{ with } x, y \in \mathbb{R} \right\}$$

for our system of linear equations, if we waive the restriction of natural numbers.

Thus now it only remains to show that there are always $x, y \in \mathbb{R}$ so that $c_3, c_4, s_{0.25}, s_{0.5}, p_s$ are natural numbers for ever $l \in \mathbb{N}$ with $l \geq 10$.

For

$$c_3 = 4 - l + \frac{17}{4} \cdot x + \frac{18}{4} \cdot y = 4 - l + \frac{17 \cdot x + 18 \cdot y}{4}$$

this is fulfilled if and only if $17 \cdot x + 18 \cdot y$ is a multiple of 4.

For

$$c_4 = l - 3 - \frac{13}{4} \cdot x - \frac{14}{4} \cdot y = l - 3 - \frac{13 \cdot x + 14 \cdot y}{4}$$

this is fulfilled if and only if $13 \cdot x + 14 \cdot y$ is a multiple of 4.

For

$$p_s = \frac{1}{4} \cdot x + \frac{2}{4} \cdot y = \frac{x + 2 \cdot y}{4}$$

this is fulfilled if and only if $x + 2 \cdot y$ is a multiple of 4.

For $s_{0.25} = x$ and $s_{0.5} = y$ this is directly fulfilled if x and y are natural numbers.

Thus choosing $x = 0$ and $y = 2$ we obtain

$$c_3 = 4 - l + \frac{17}{4} \cdot 0 + \frac{18}{4} \cdot 2 = 13 - l$$

and

$$c_4 = l - 3 - \frac{13}{4} \cdot 0 - \frac{14}{4} \cdot 2 = l - 10$$

as our total number of clusters having a length of 3 plots c_3 must be greater or equal 0, we get $l - 10 \geq 0$ which is fulfilled if and only if $l \geq 10$.

As an example for better visualization: For l = 10 we would have, $c_3 = 13 - 10 = 3$, $c_4 = 10 - 10 = 0$, $s_{0.25} = 0$ and $s_{0.5} = 2$, meaning if the site has a length of 10 plots we can fill it with 3 "3 plot clusters" and two streets of width 0.5 plots each.

Note that according to c_3 also the total number of clusters having a length of 4 plots c_4 need to be greater or equal to 0 and therefore $13 - l \geq 0$ which is fulfilled if and only if $l \leq 13$. However for $l \geq 14$ the "next bigger pair of x and y" – $x = 2$ and $y = 1$ – can be chosen, which would give us

$$c_3 = 4 - l + \frac{17}{4} \cdot 2 + \frac{18}{4} \cdot 1 = 17 - l$$

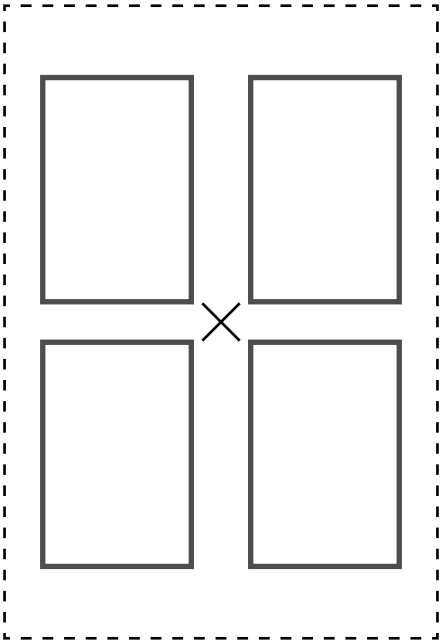
and

$$c_4 = l - 3 - \frac{13}{4} \cdot 2 - \frac{14}{4} \cdot 1 = l - 13$$

and therefore the interval between $13 \leq l \leq 17$. This can be iterated to cover every $l \geq 10$.

As we took the values out of the solution space, the proof of our claim follows now directly through the principle of mathematical induction. □

WITHIN A NEW PLOT

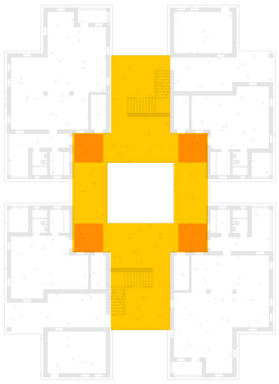


_ *The Cluster Prototype*

Building Cluster

Circulation System = Communal space + Dwelling Blocks

Ground Floor

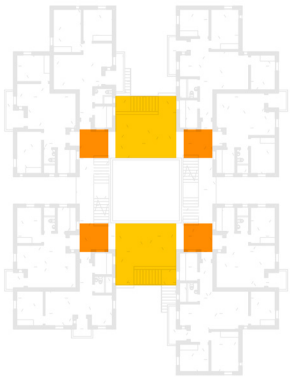


Courtyard

&

Entrance pocket

First Floor



Terrace as the second ground level.

&

Space on front of each apartment.

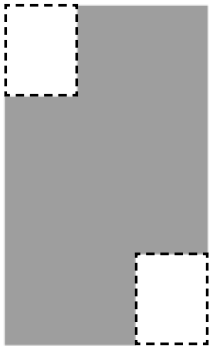
Top Floor



Roof terrace.

Giving space to public exterior / neighbourhood

Outwards

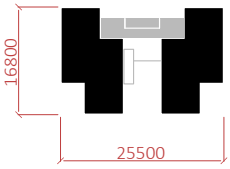


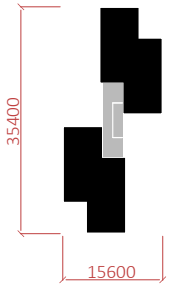
Inwards

Connecting to circulation system / communal space

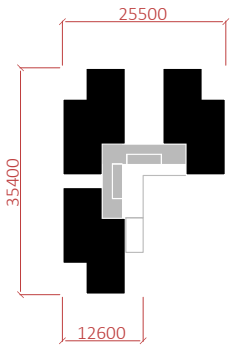
_Possible Combinations of Dwelling Blocks with Circulation System

X3

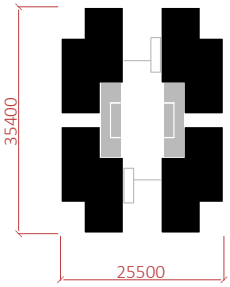




X4

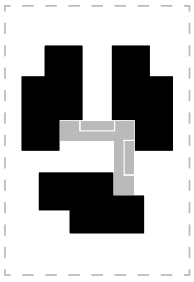


X5



X6

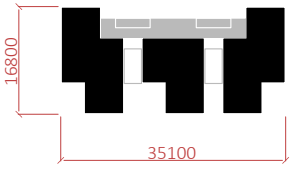
Examples of other posibilities:

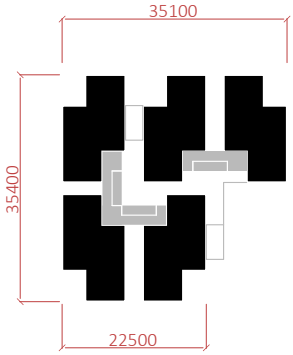


This is an attempt to explore the possibilities of fitting the prototype into different-sized plots.

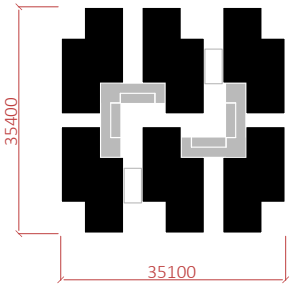
"X6" and "X8", along with their halved scenario "X3" and "X4", are more compact and efficient, thereby chosen to be the common cases for Gerji. As for "X5" and "X7", they could be the possible solutions for sites with irregular shapes.

X4

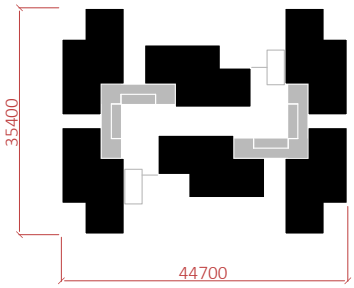




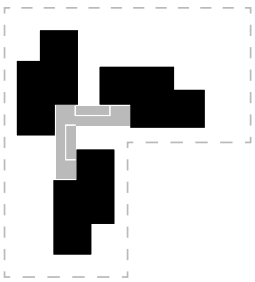
X7

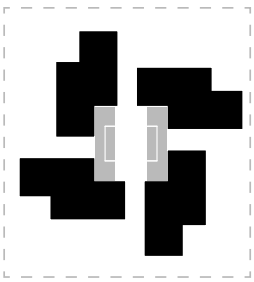


X8



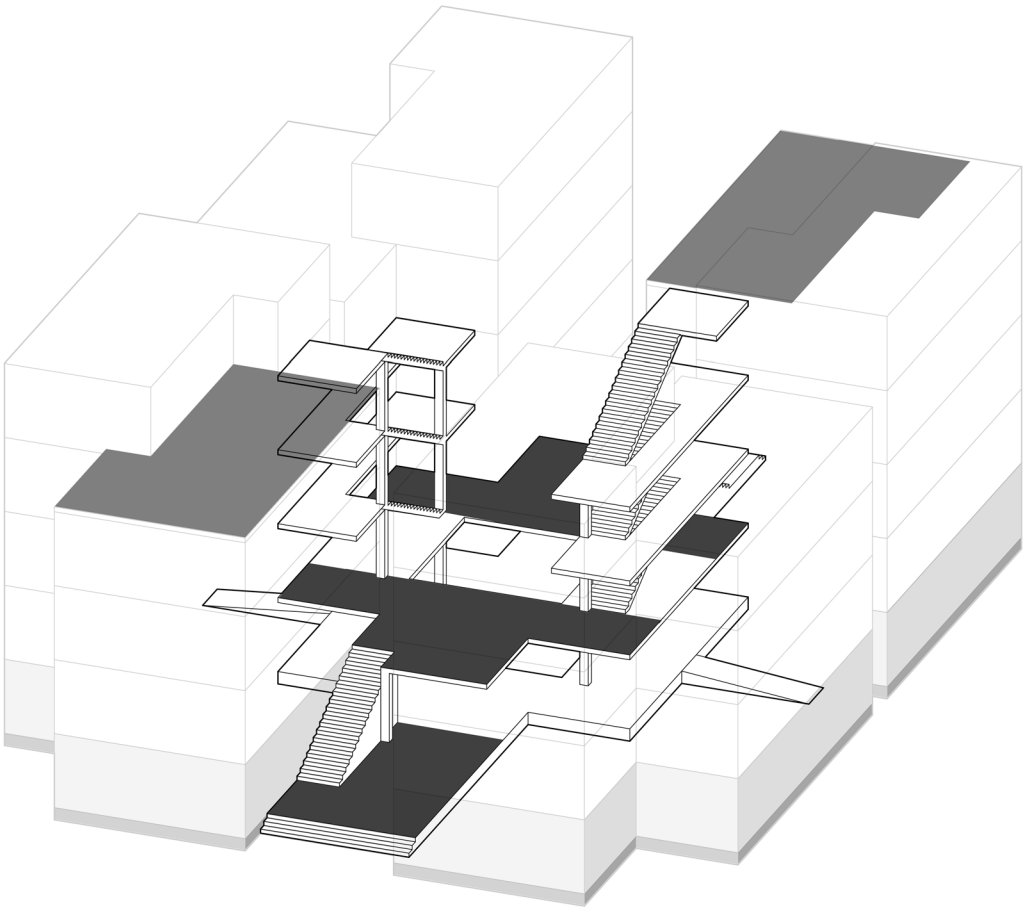
X10





_Variations of The Cluster Prototype

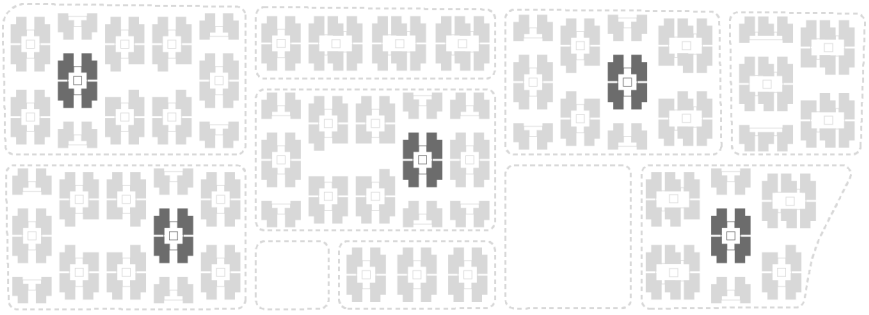
_ “6 to 1“ Plot



X Type - Typical _ 1:250

Scale 1:250

0 5m 10m 15m 25m



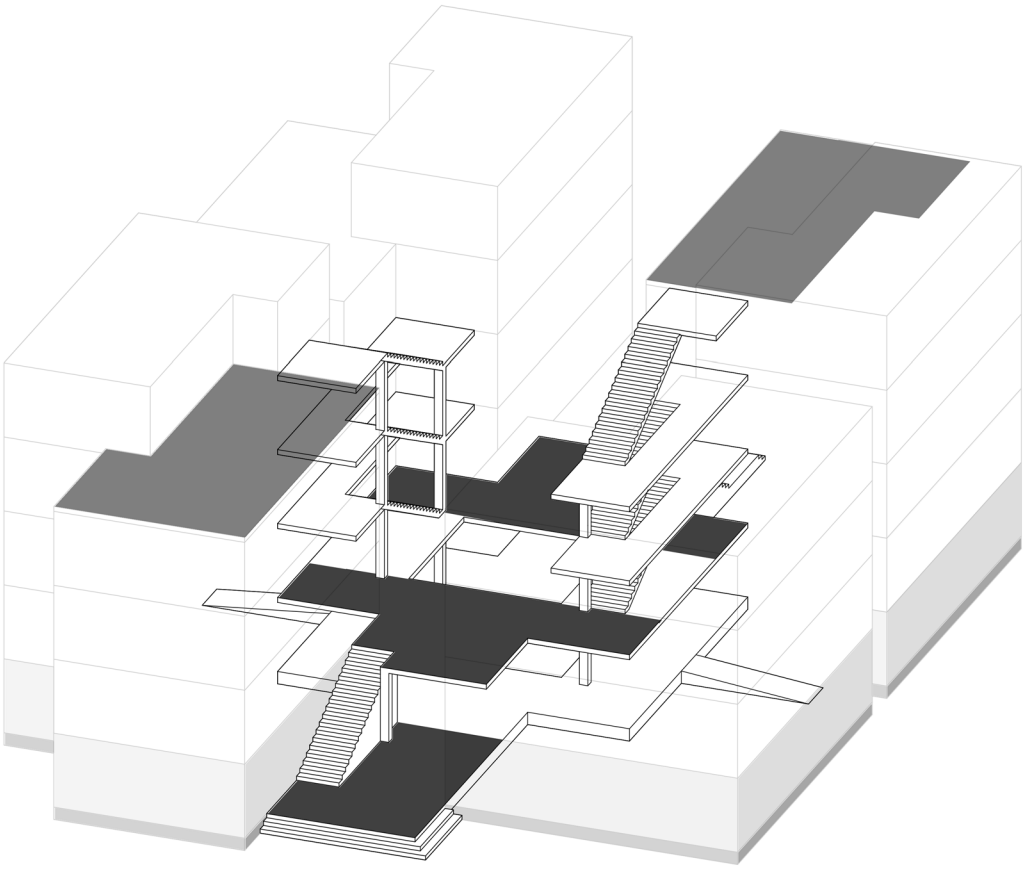
The prototype.

Upper levels offer: total **1844.64 m²** living area for **22** households

Original dweller accommodated: **6** households / **790.56 m²**

New dweller accommodated: **16** households / **1054.08 m²**

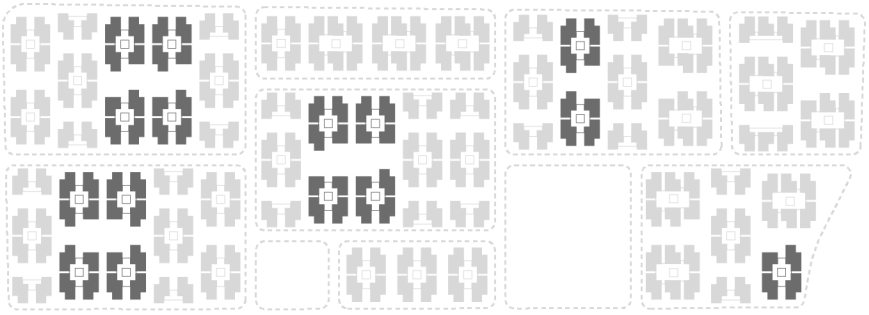
Ground floor space offered: **527.04 m²** with **2.7m** floor height



X Type - Corner _ 1:250

Scale 1:250

0 5m 10m 15m 25m



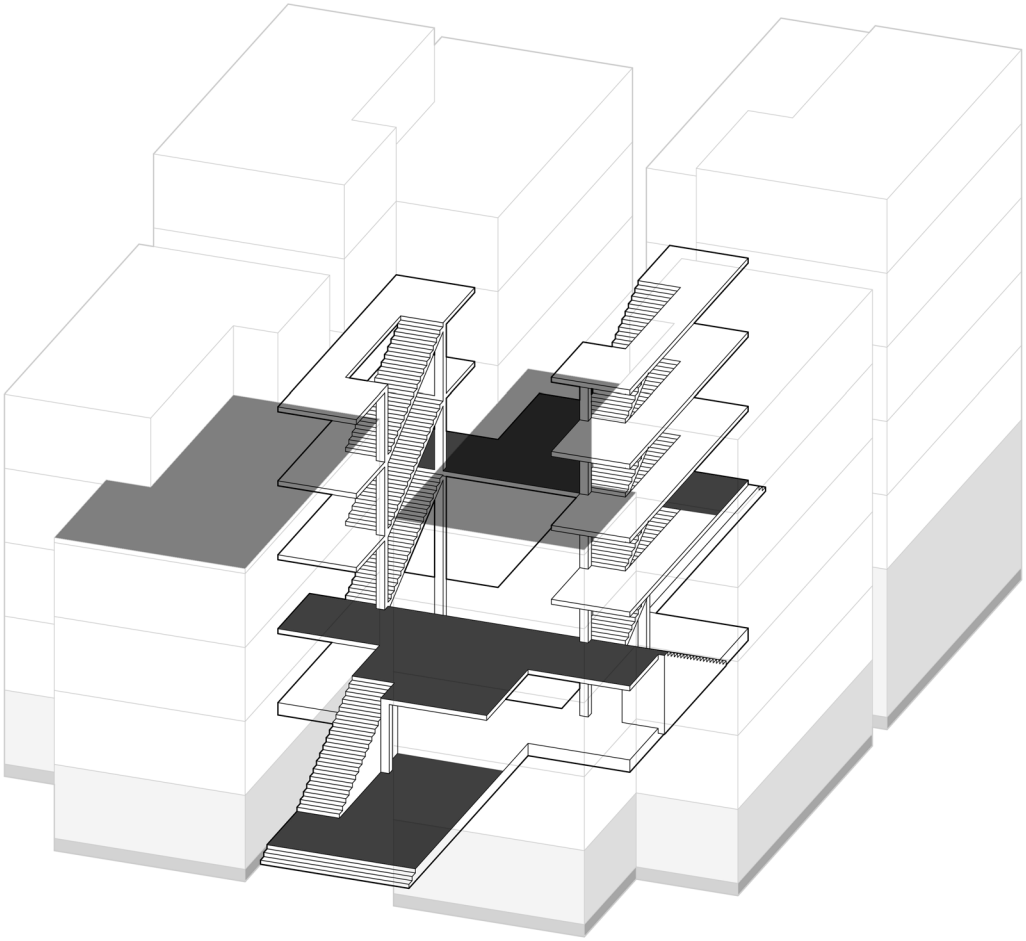
The corner type clusters are the corners of the public space. They are also the most common case in the Gerji site.

Upper levels offer: total **1675.45 m²** living area for **20** households

Original dweller accommodated: **6** households / **790.56 m²**

New dweller accommodated: **14** households / **884.89 m²**

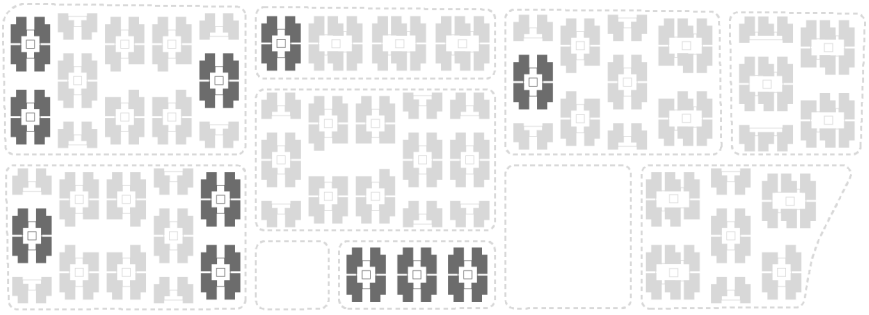
Ground floor space offered: **527.04 m²** with **2.7m** floor height



X Type - Commerce _ 1:250

Scale 1:250

0 5m 10m 15m 25m



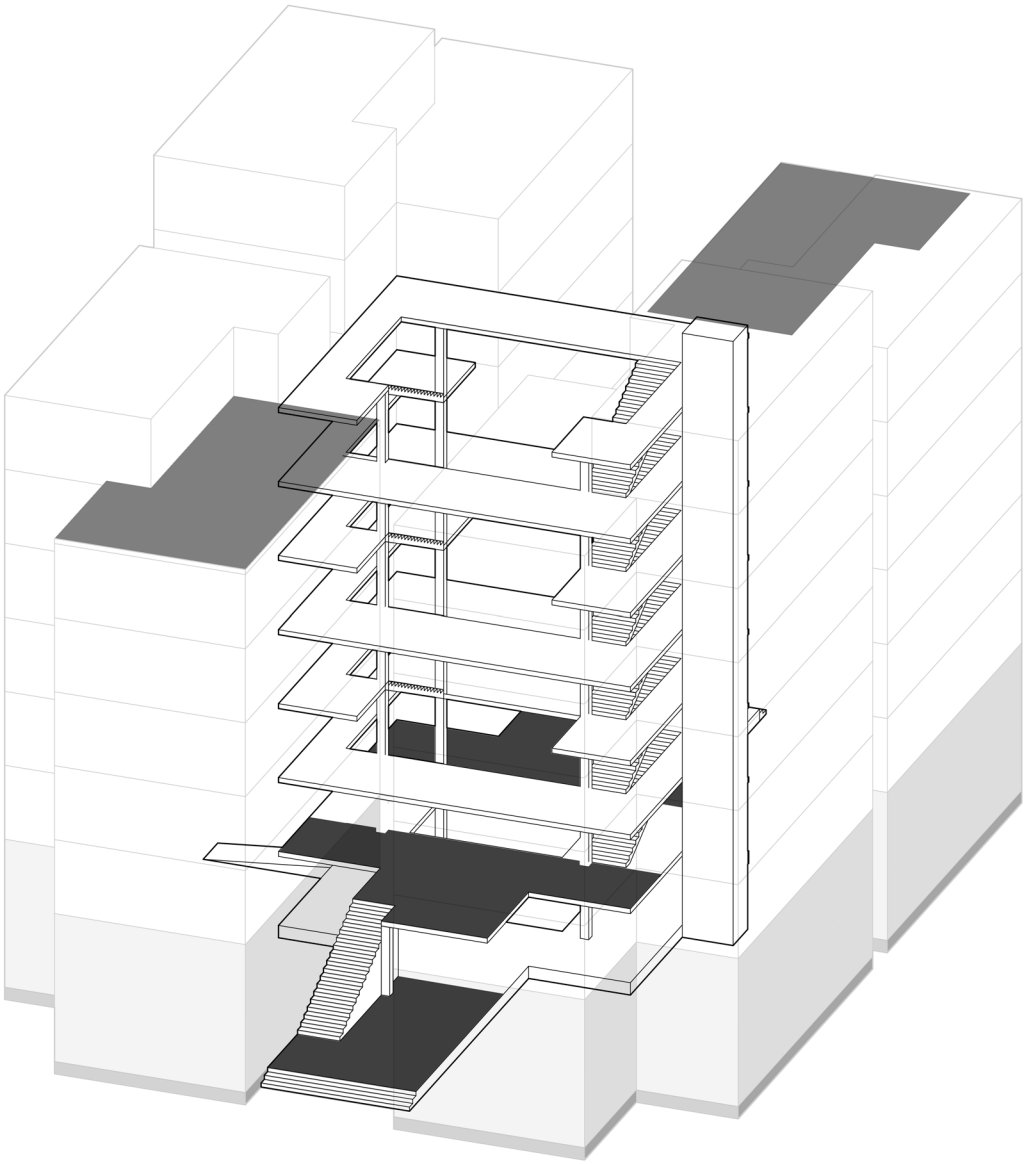
Close to main external commercial streets.

Upper levels offer: total **2108.16 m²** living area for **26** households

Original dweller accommodated: **6** households / **790.56 m²**

New dweller accommodated: **20** households / **1317.6 m²**

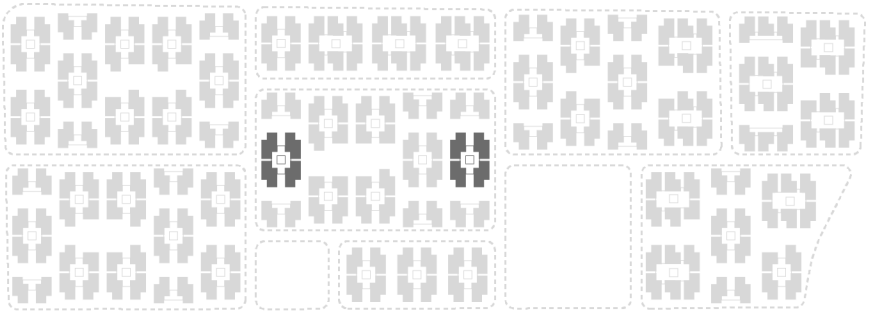
Ground floor space offered: **263.52 m²** with **2.7m** floor height
& **263.52 m²** with **5.4m** floor height



X Type - Tower _ 1:250

Scale 1:250

0 5m 10m 15m 25m



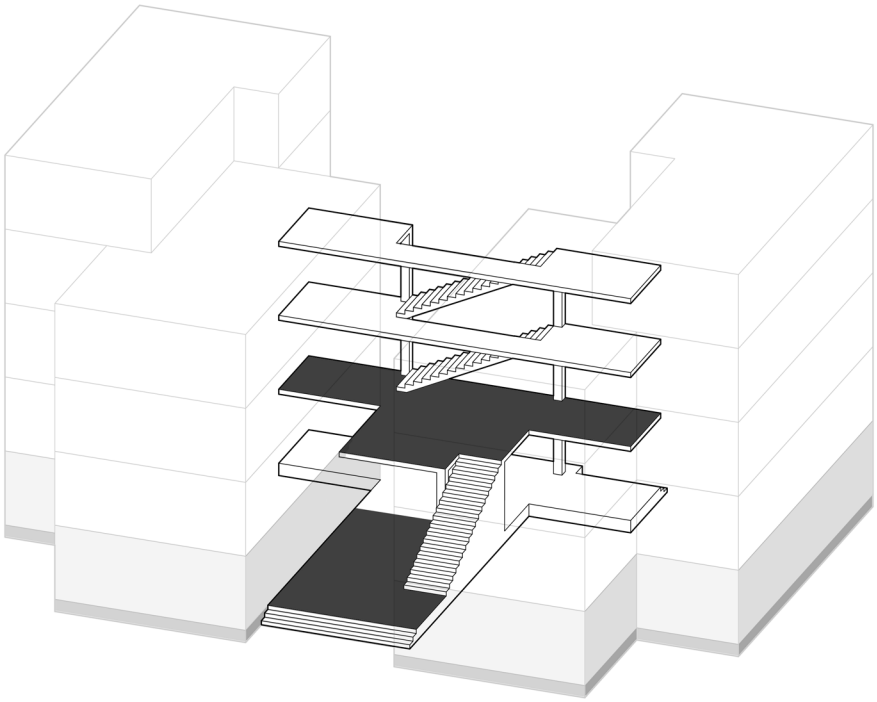
On the centre of the site.

Upper levels offer: total **3162.24 m²** living area for **42** households

Original dweller accommodated: **6** households / **790.56 m²**

New dweller accommodated: **36** households / **2371.68 m²**

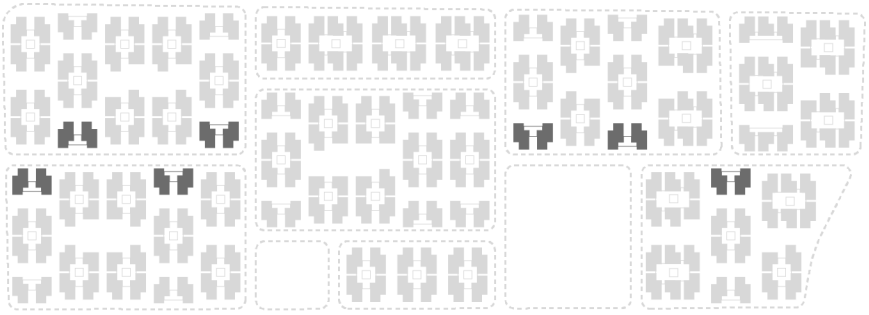
Ground floor space offered: **527.04 m²** with **5.4m** floor height



U Type - High Income _ 1:250

Scale 1:250

0 5m 10m 15m 25m



Along the central spine.

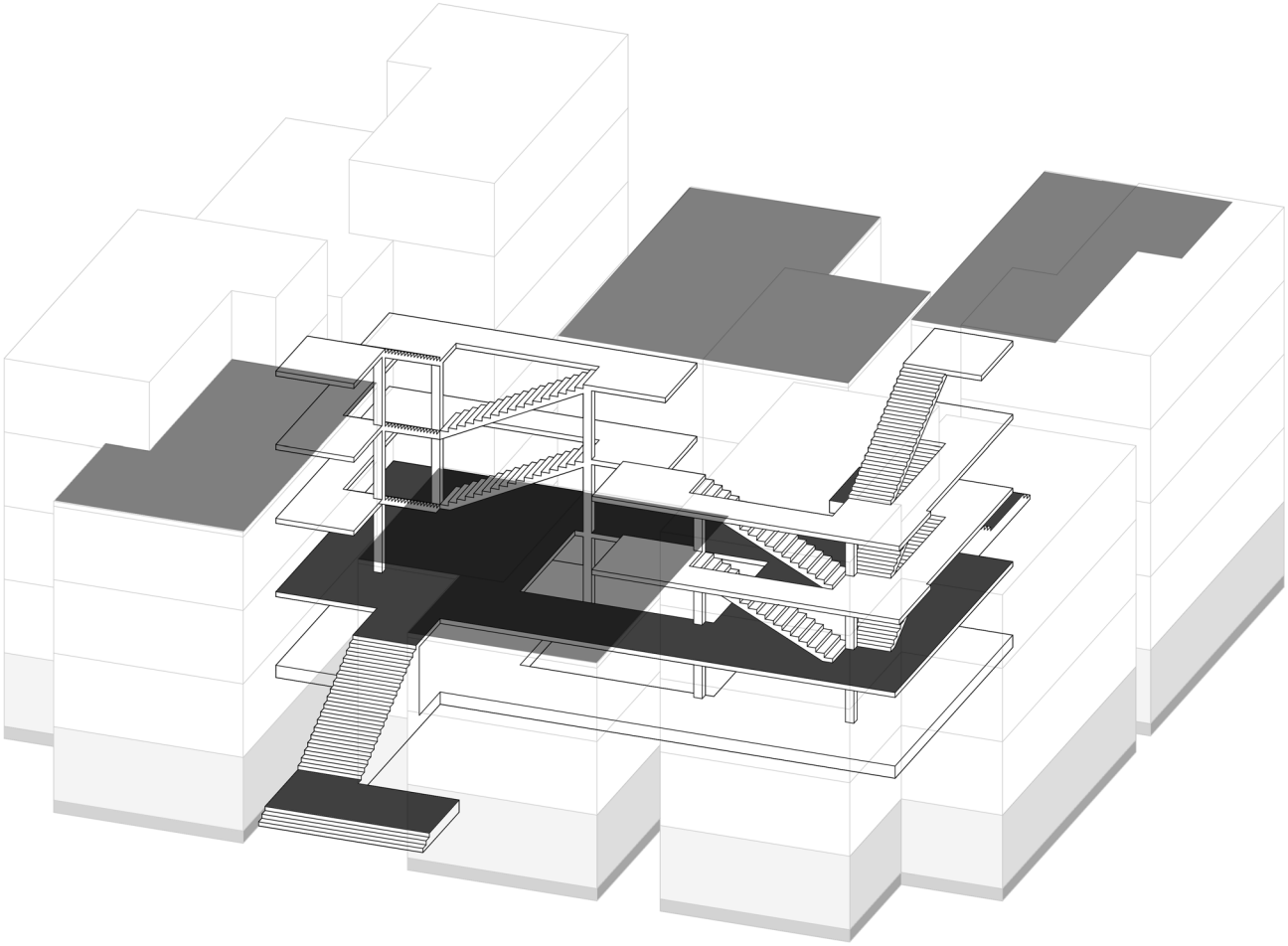
Upper levels offer: total **922.32 m²** living area for **7** households

Original dweller accommodated: **3** households / **395.28 m²**

New dweller accommodated: **4** households / **527.04 m²**

Ground floor space offered: **263.52 m²** with **2.7m** floor height

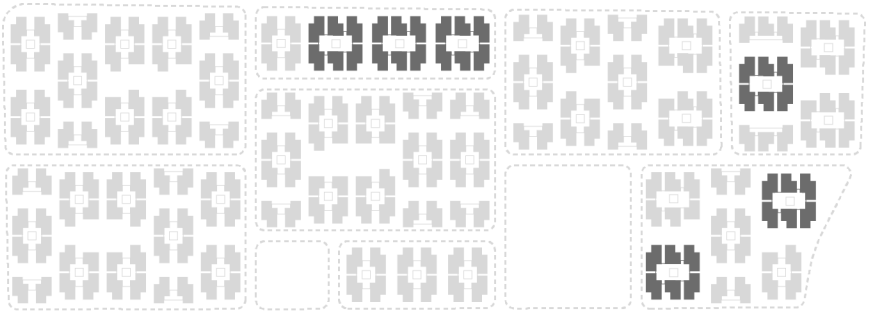
_ “8 to 1“ Plot



H Type - Typical _ 1:250

Scale 1:250

0 5m 10m 15m 25m



On the plots that are combined from 8 plots each.

Upper levels offer: total **2712.08 m²** living area for **28** households

Original dweller accommodated: **8** households / **1054.08 m²**

New dweller accommodated: **20** households / **1658 m²**

Ground floor space offered: **799.02 m²** with **2.7m** floor height

MASTER PLAN

_Mater Plan _ 1:2000



Plot “6 to1“:

X Type _ Typical : x9

X Type _ Corner: x15

X Type _ Commerce: x7

X Type _ Tower: x2

U Type: x20

Plot “8 to1“:

X’ Type _ Typical : x6

X’ Type _ Corner: x5

U’ Type: 2

Households: from 318 to **1679**

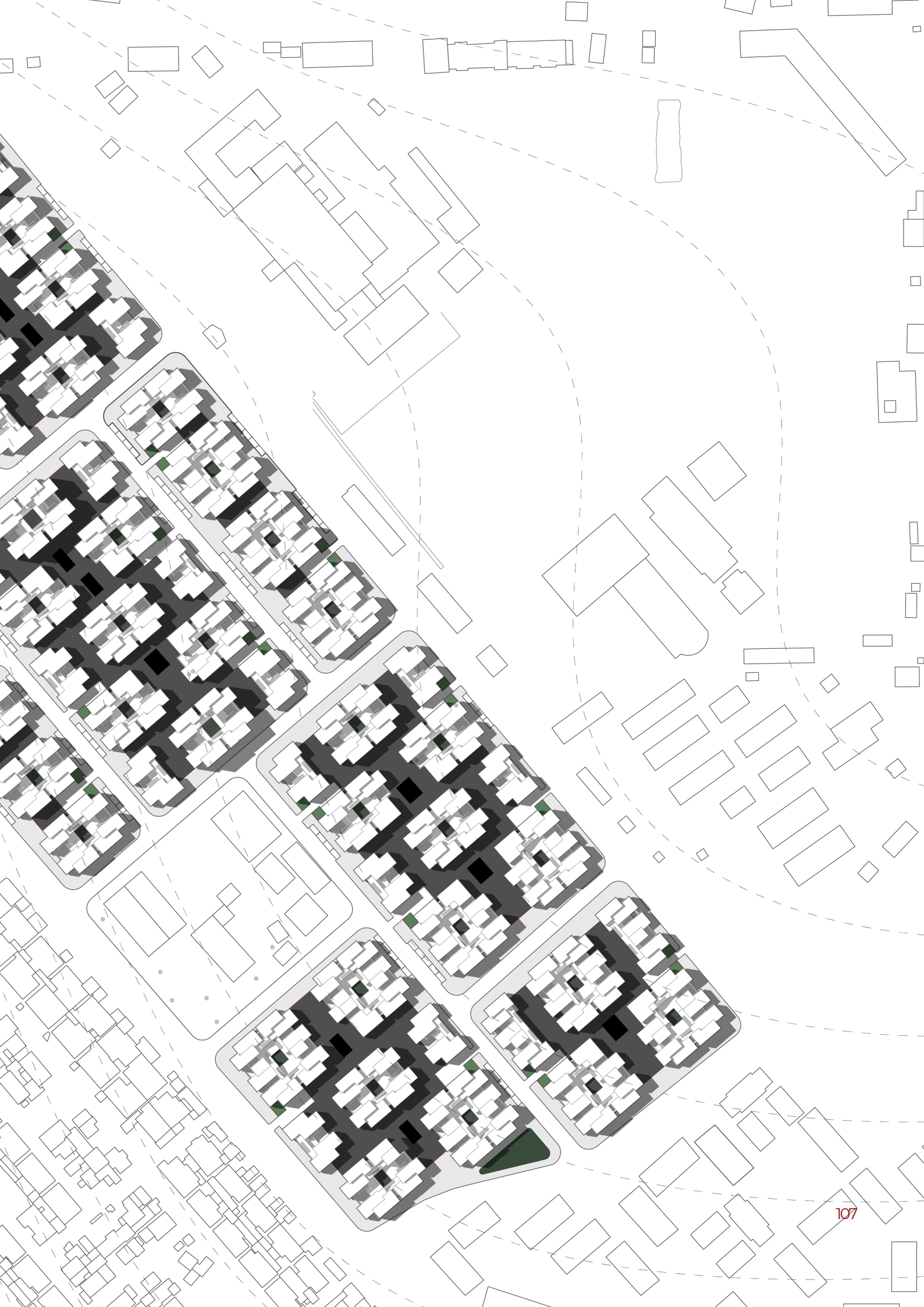
FAR: from 0.43 to **1.417**

Population (est.) : from 1900 to **8000**

Density: from 143 to **666** p/ha (**133** households/pa)

Scale 1:2000

0 20m 60m 100m 200m



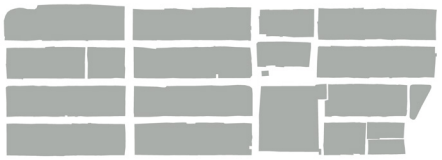

Scale 1:2000
0
20m
60m
100m
200m



_ *Phasing*

From outer to Inner, dynamic to static,
public to private.

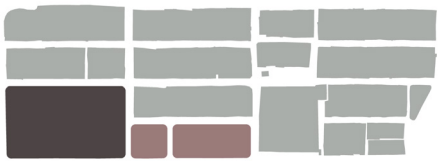
Original street block



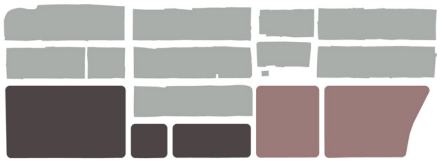
Phase 1

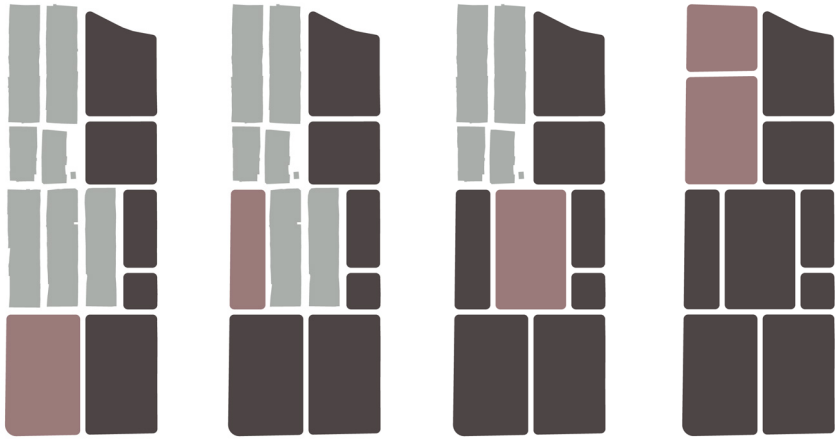


Phase 2

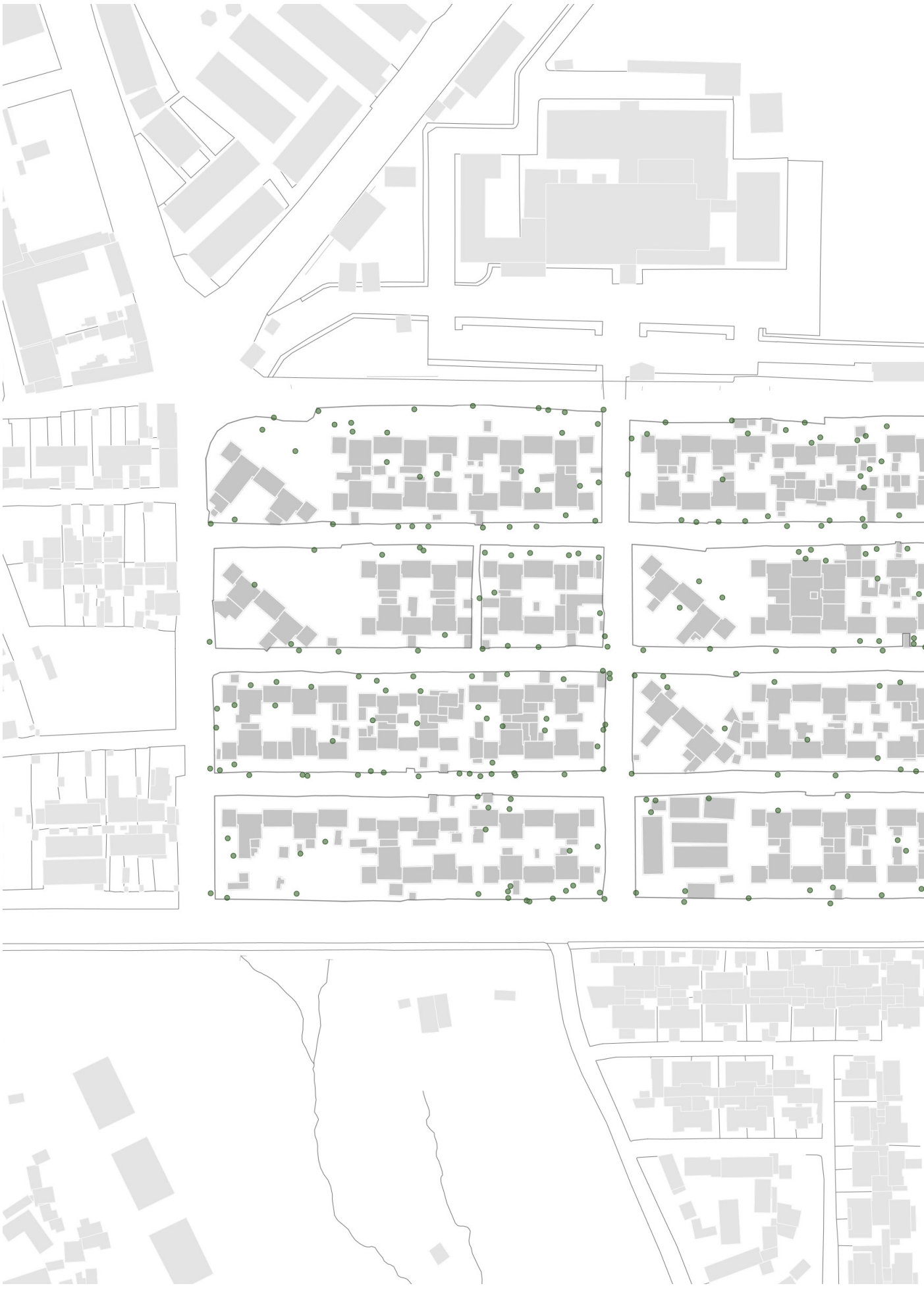


Phase 3



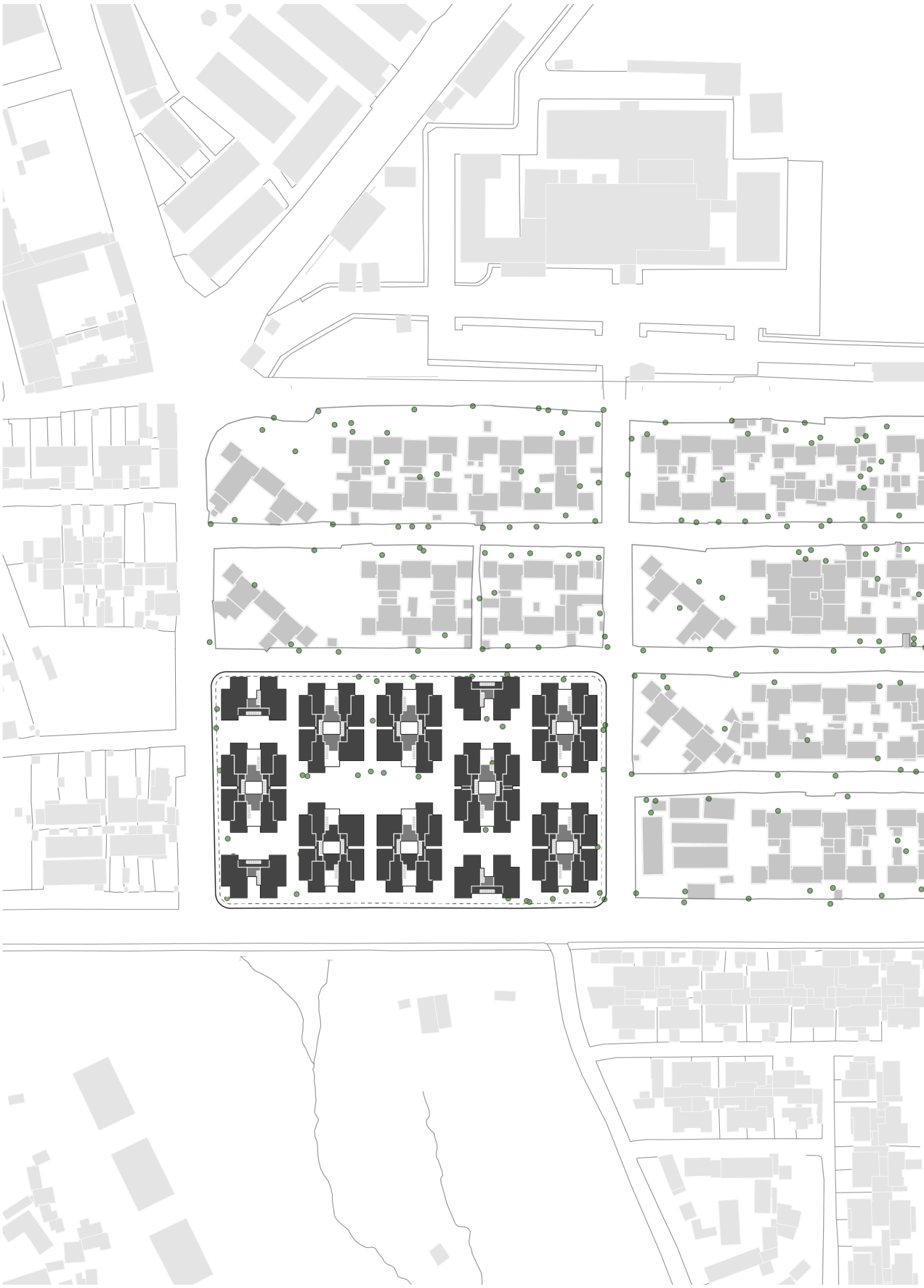


Phase 4 Phase 5 Phase 6 Phase 7

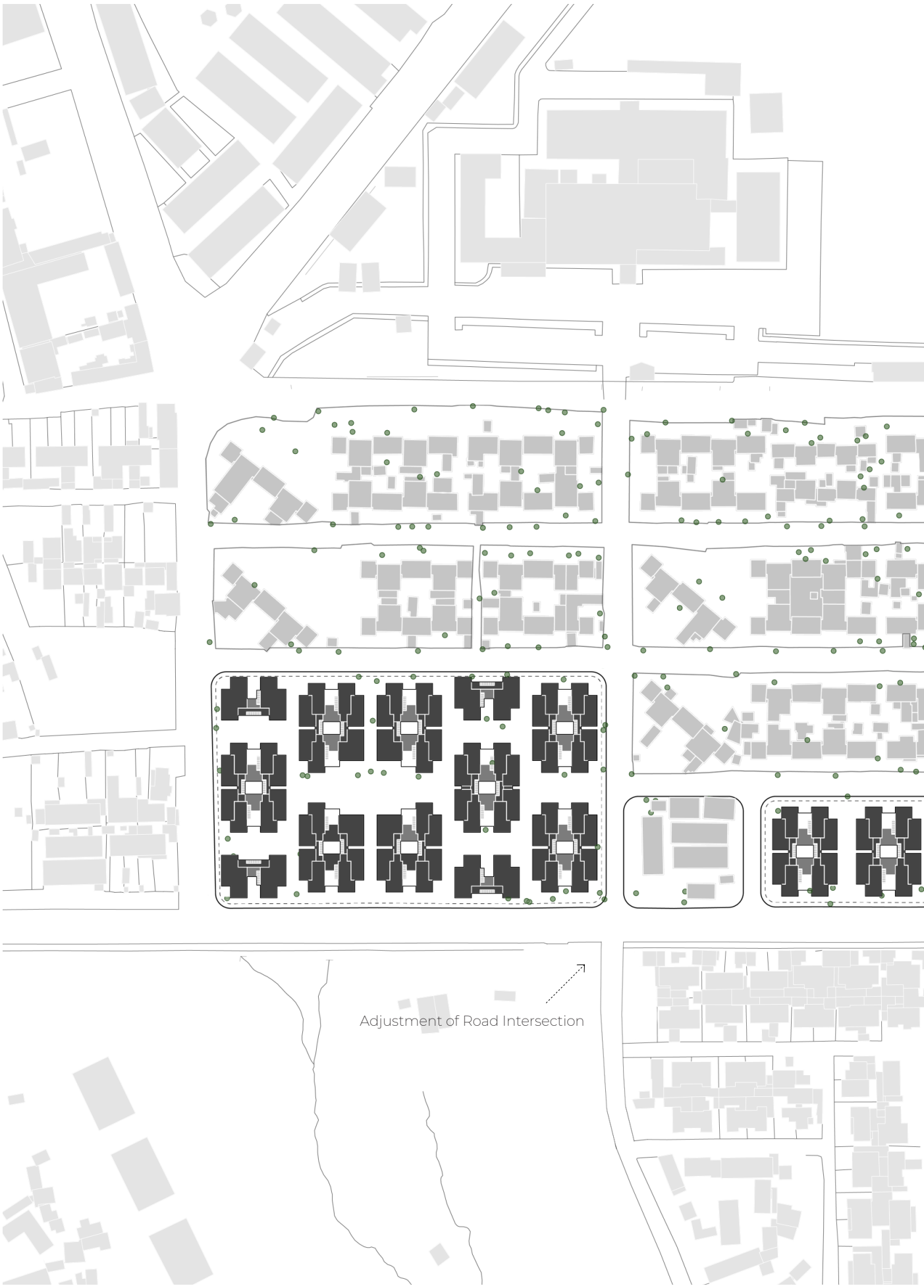


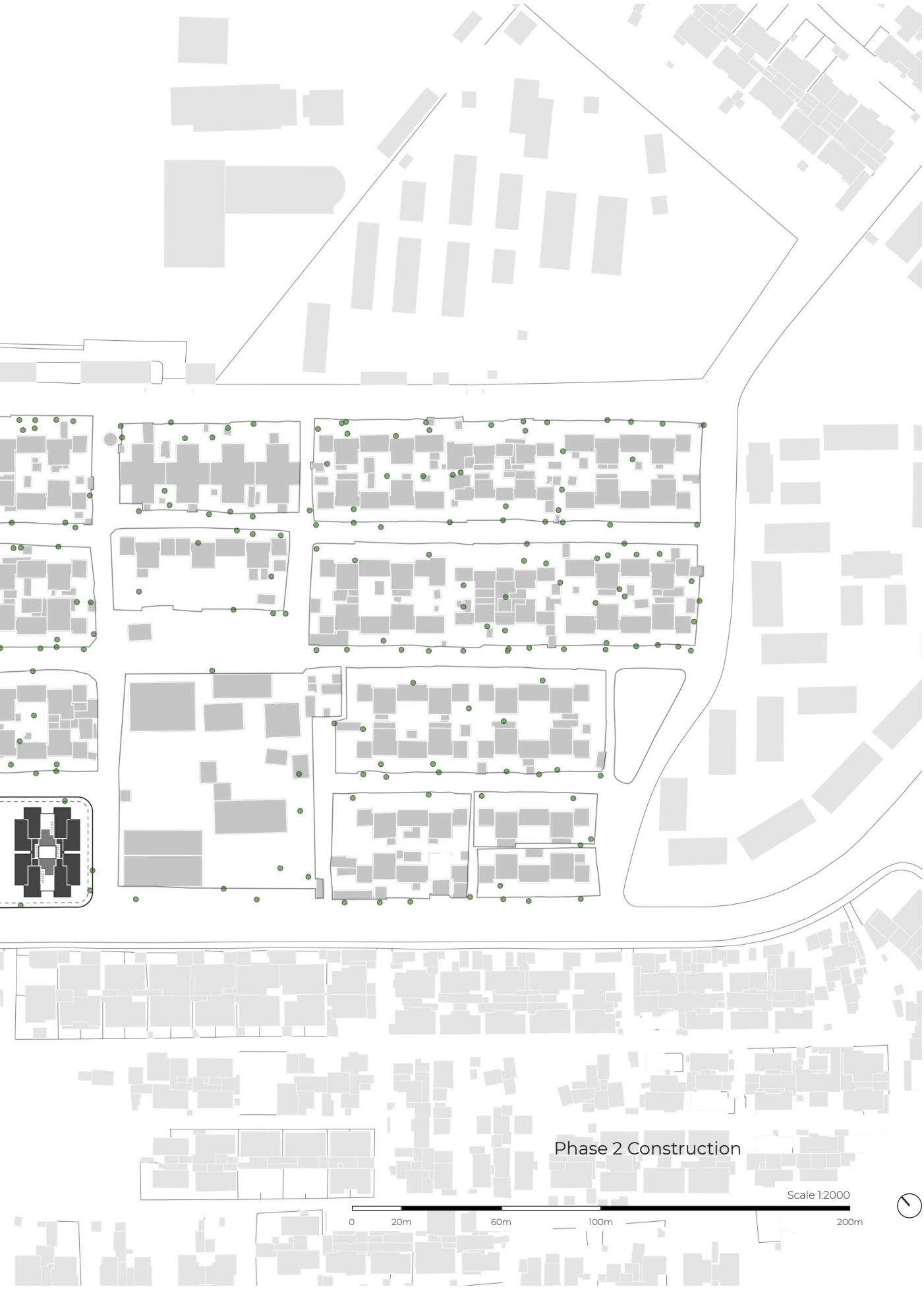


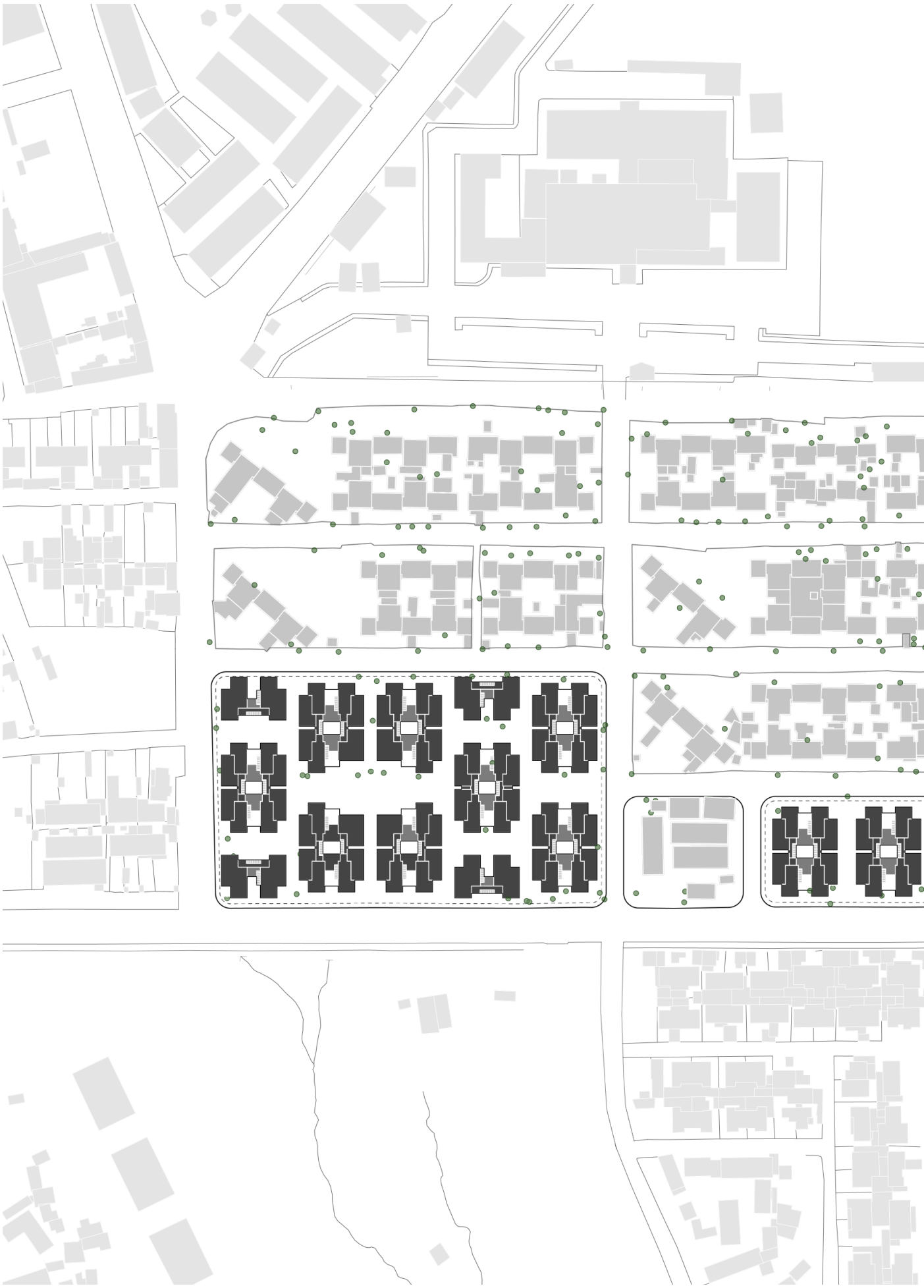
Current Site Condition



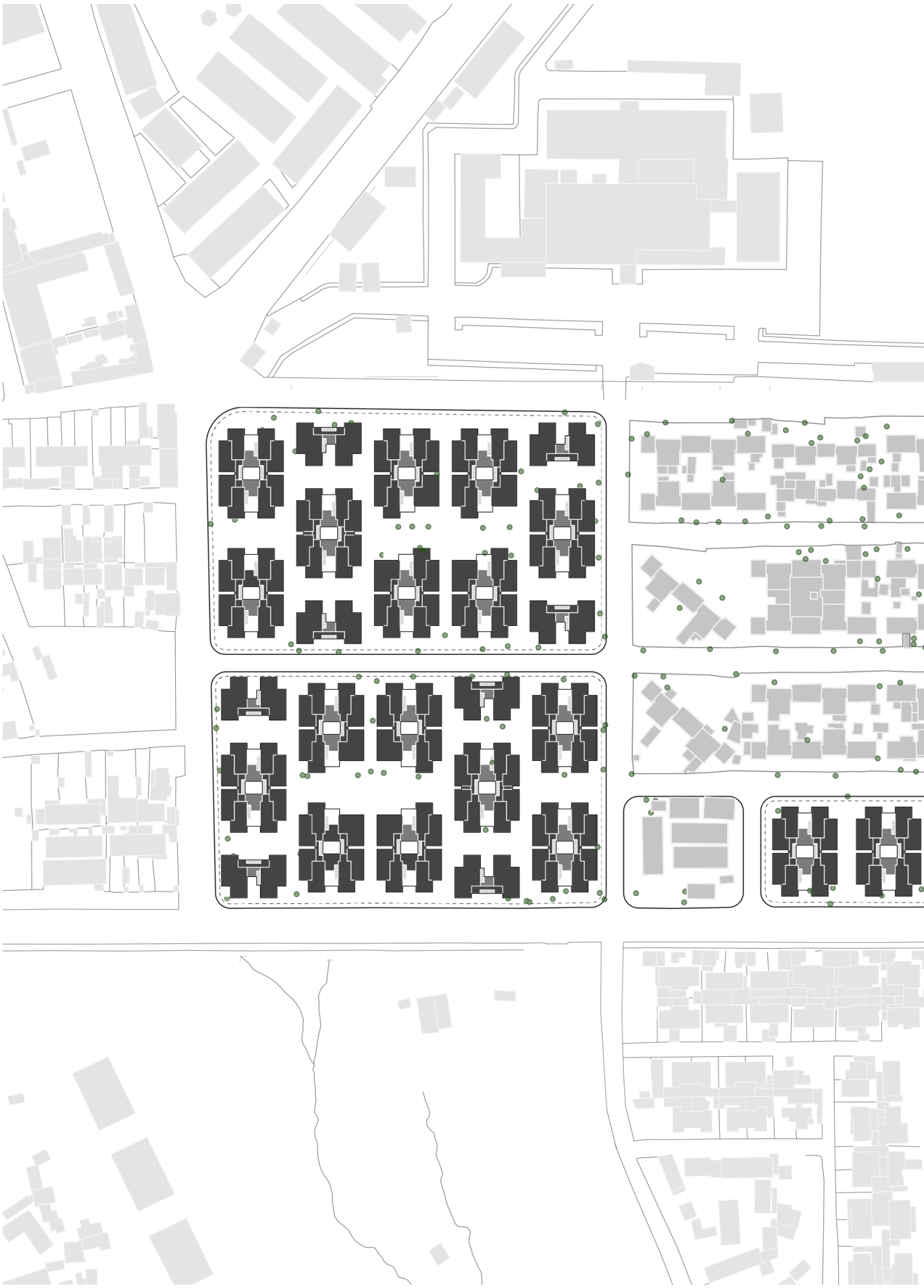

Phase 1 Construction
Scale 1:2000
0
20m
60m
100m
200m


Adjustment of Road Intersection

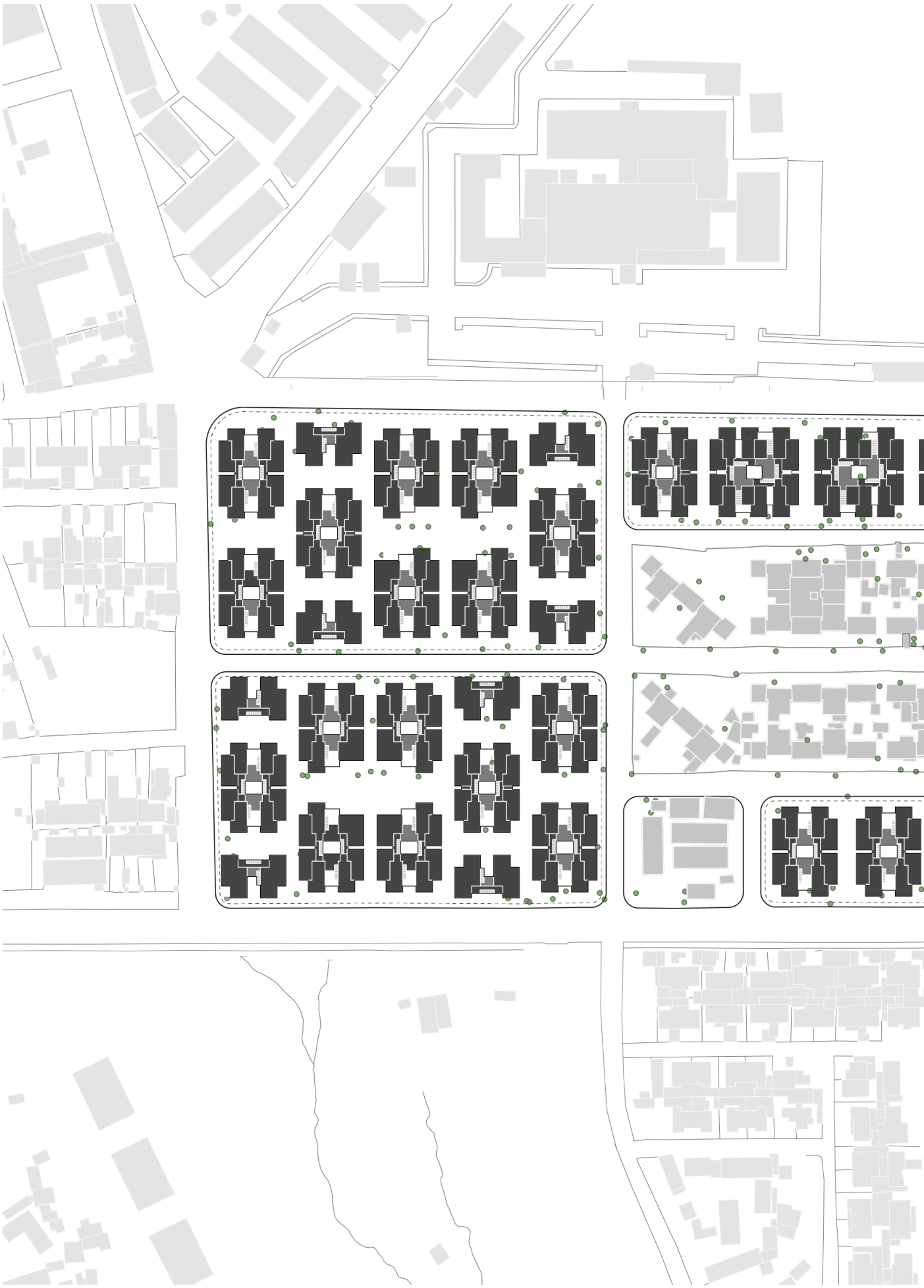

Phase 2 Construction
Scale 1:2000
0
20m
60m
100m
200m



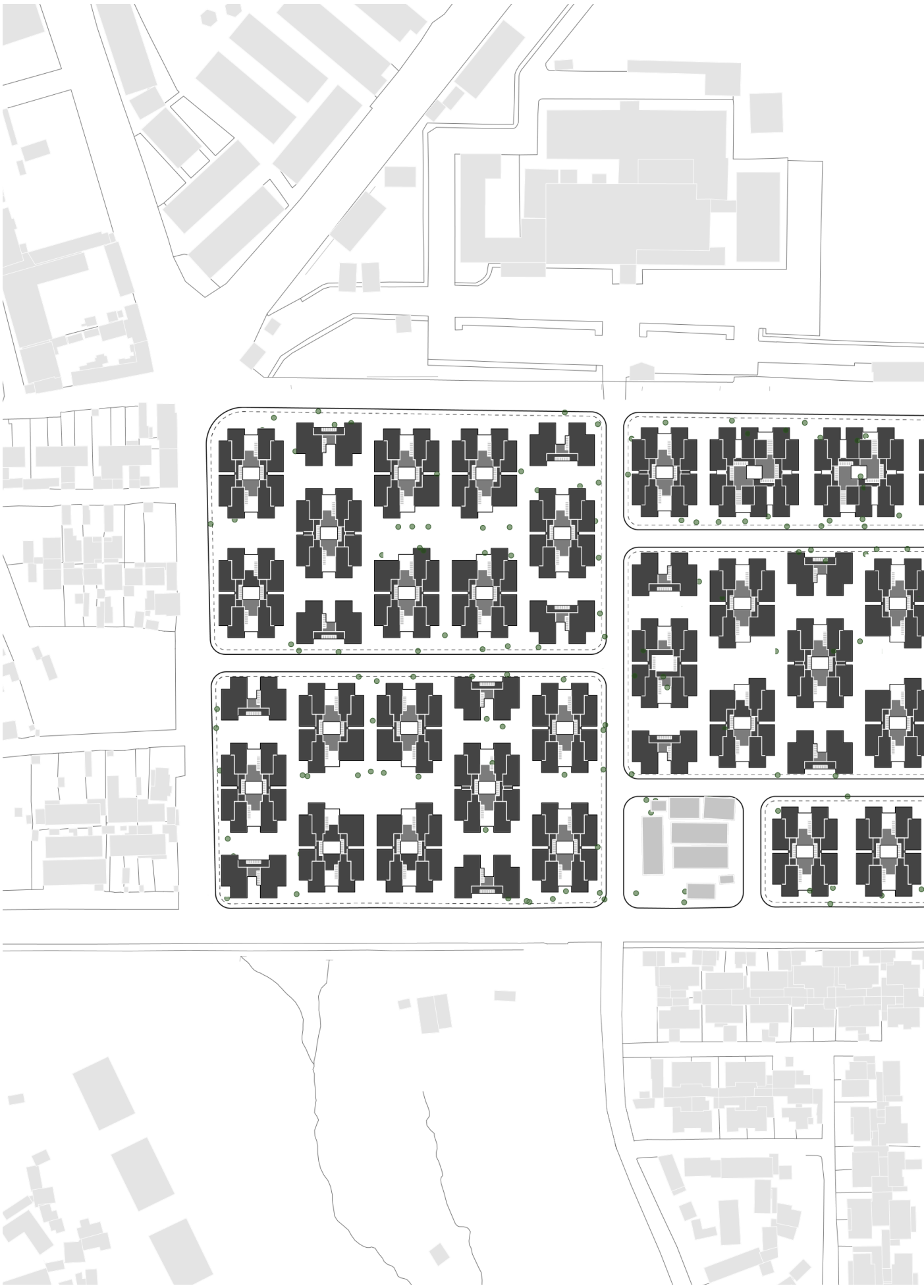

Phase 3 Construction
Scale 1:2000
0
20m
60m
100m
200m



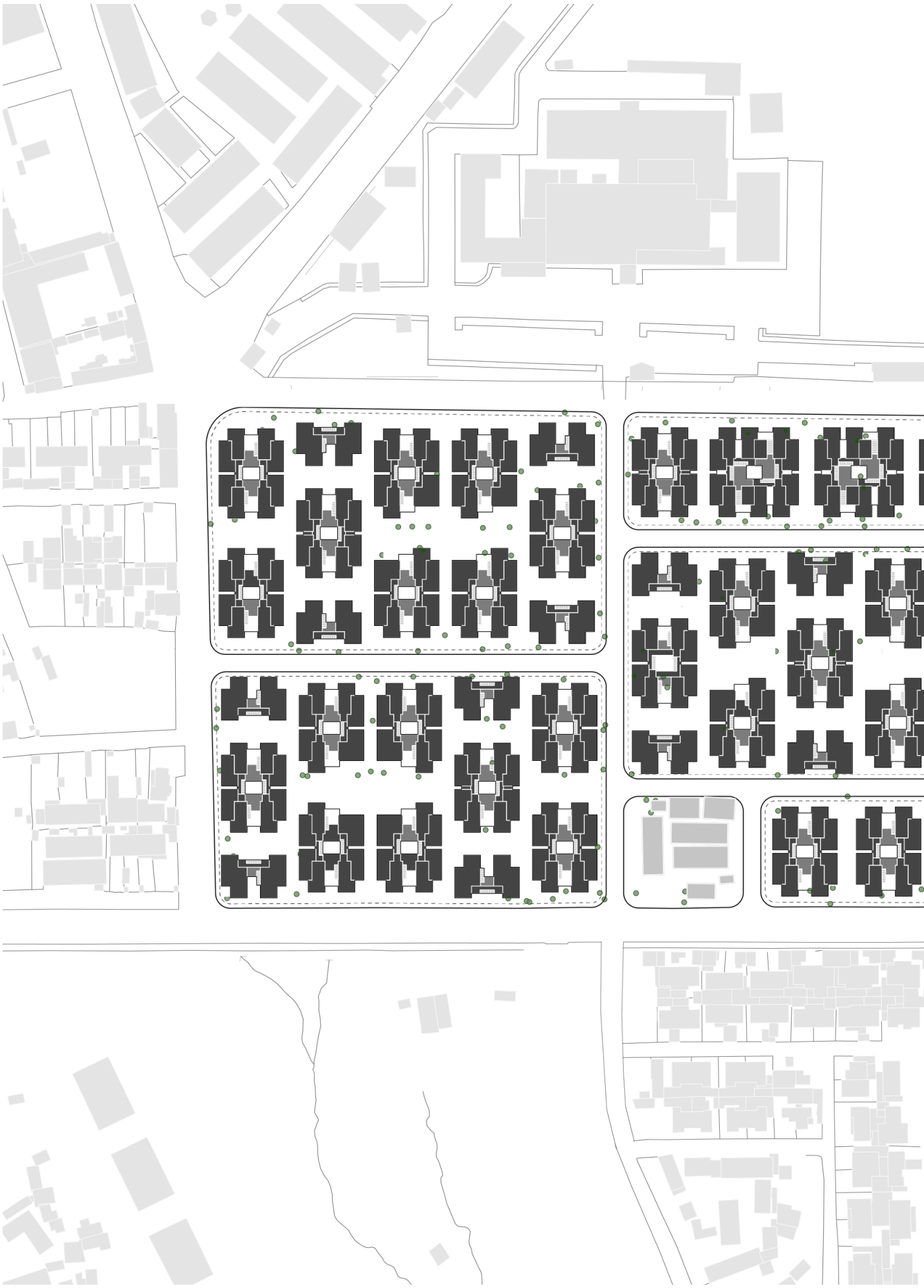

Phase 4 Construction
Scale 1:2000
0
20m
60m
100m
200m




Phase 5 Construction
Scale 1:2000
0
20m
60m
100m
200m




Phase 6 Construction
Scale 1:2000
0
20m
60m
100m
200m




Phase 7 Construction
Scale 1:2000
0
20m
60m
100m
200m

NEIGHBOURHOOD



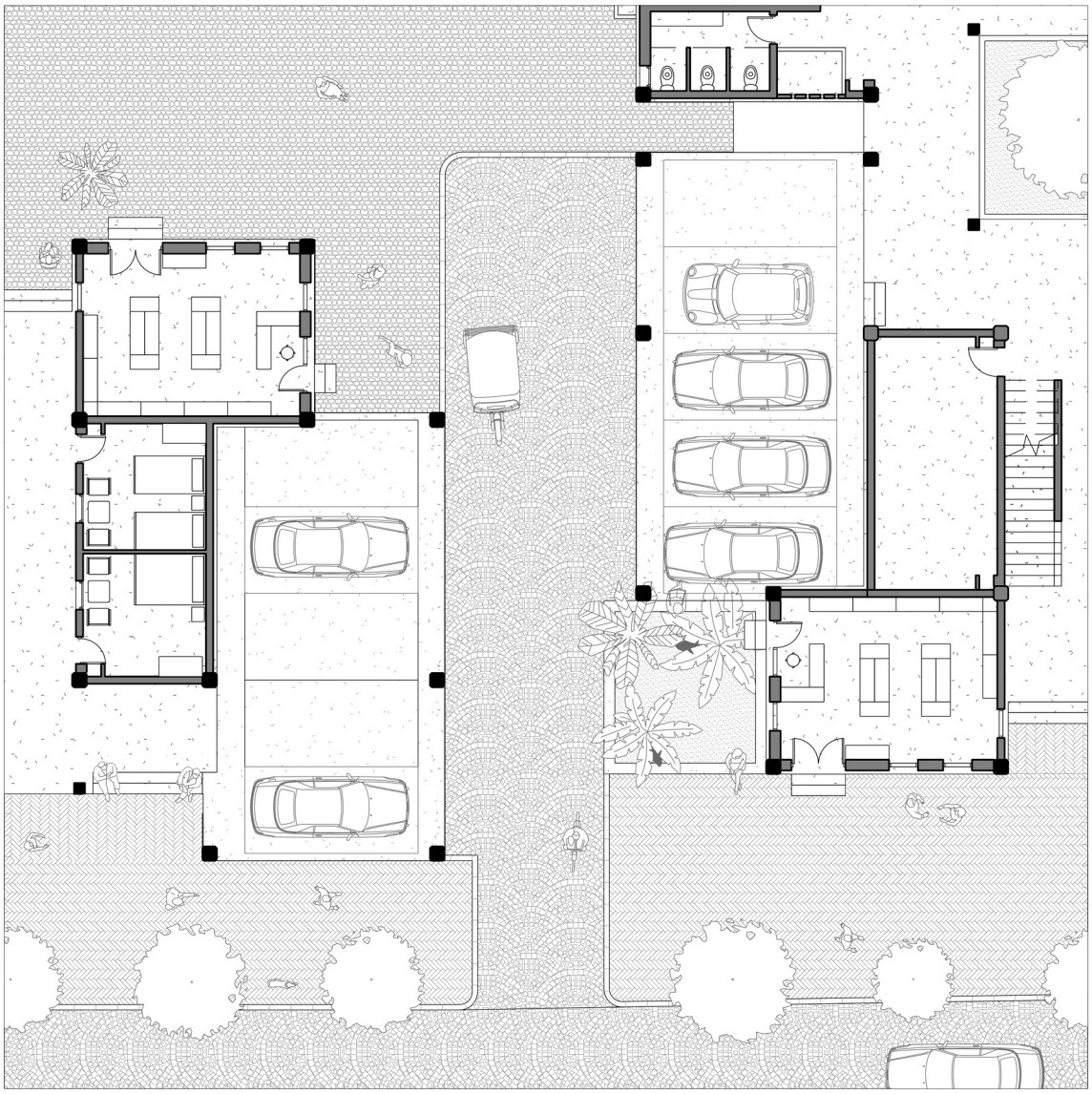
_Zoom in: Phase 1 Construction _ GF Plan 1:500





_Zoom in: Phase 1 Construction _ 1F Plan 1:500

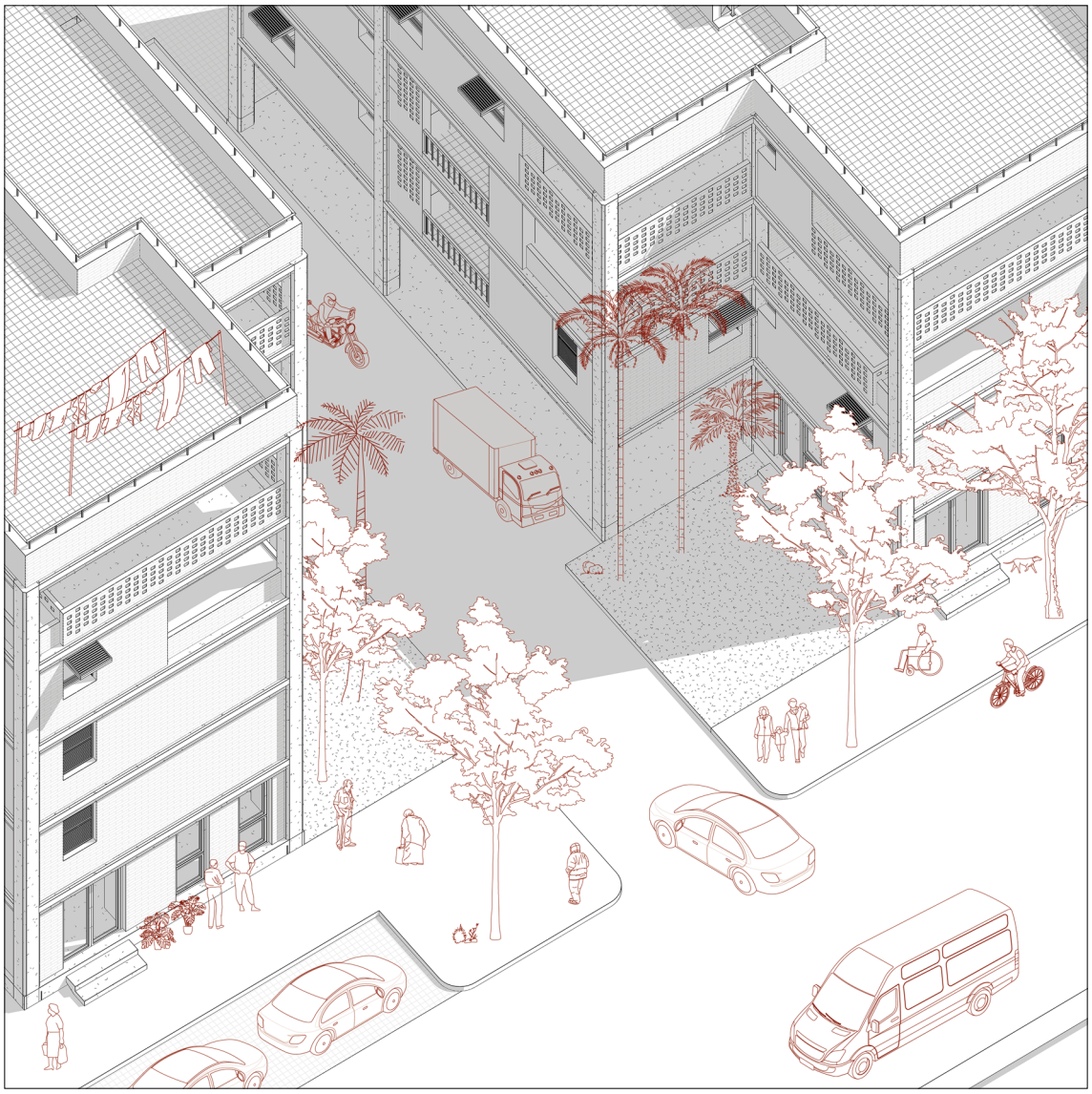

DN



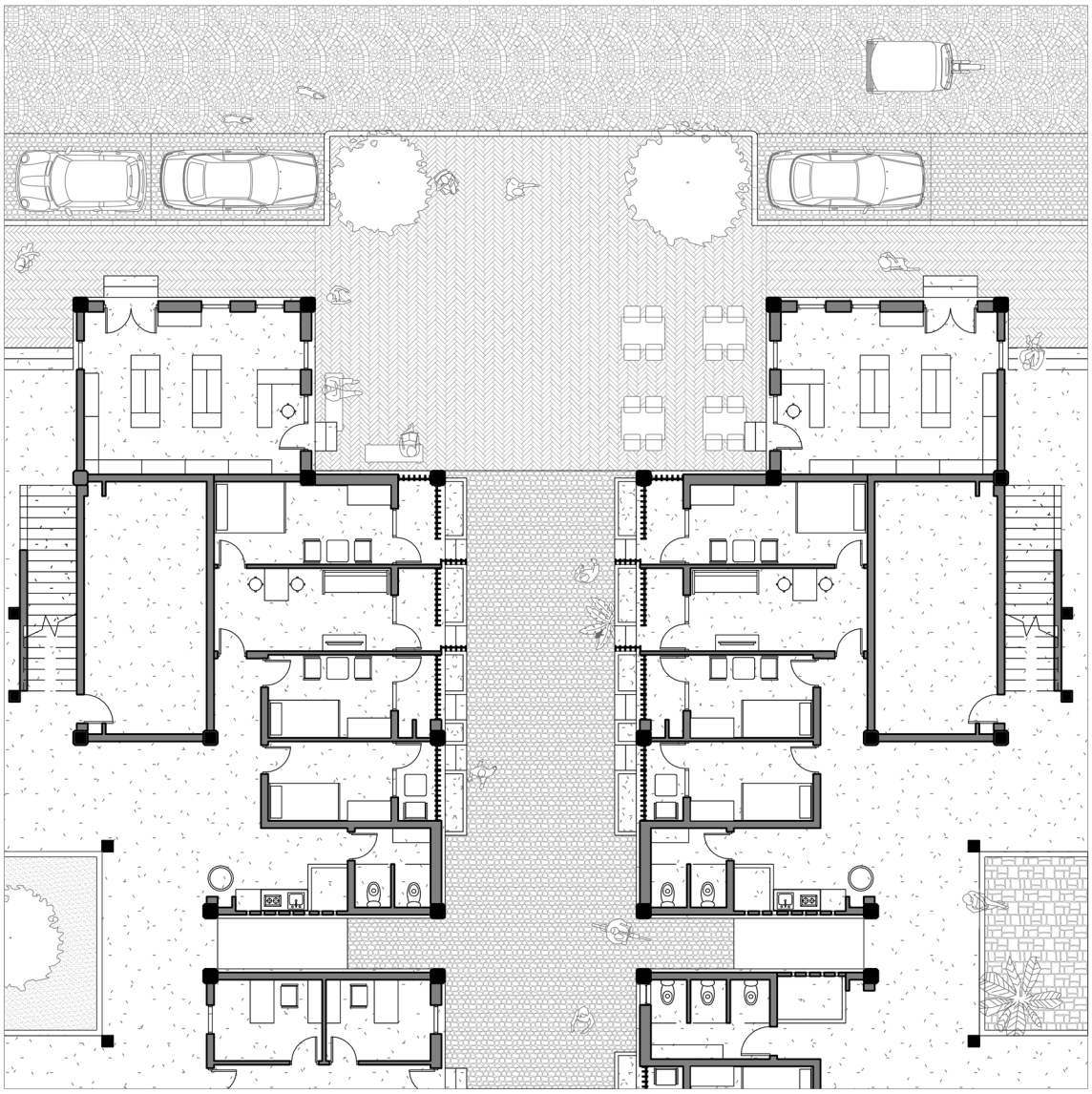
Vehicle Pocket _ 1:200

Scale 1:200

0 2m 6m 10m 20m



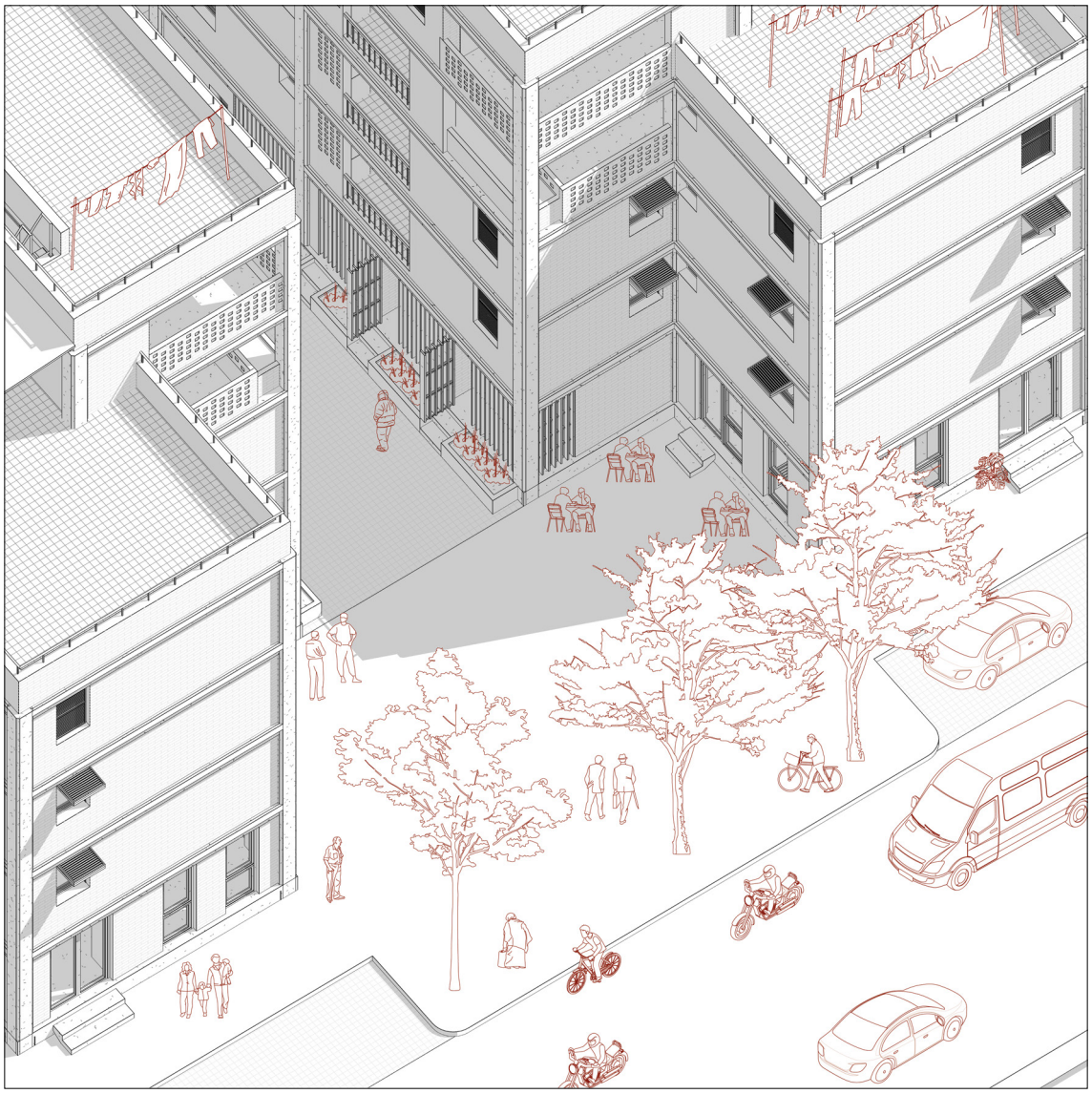
Vehicle Pocket _ Isometric View



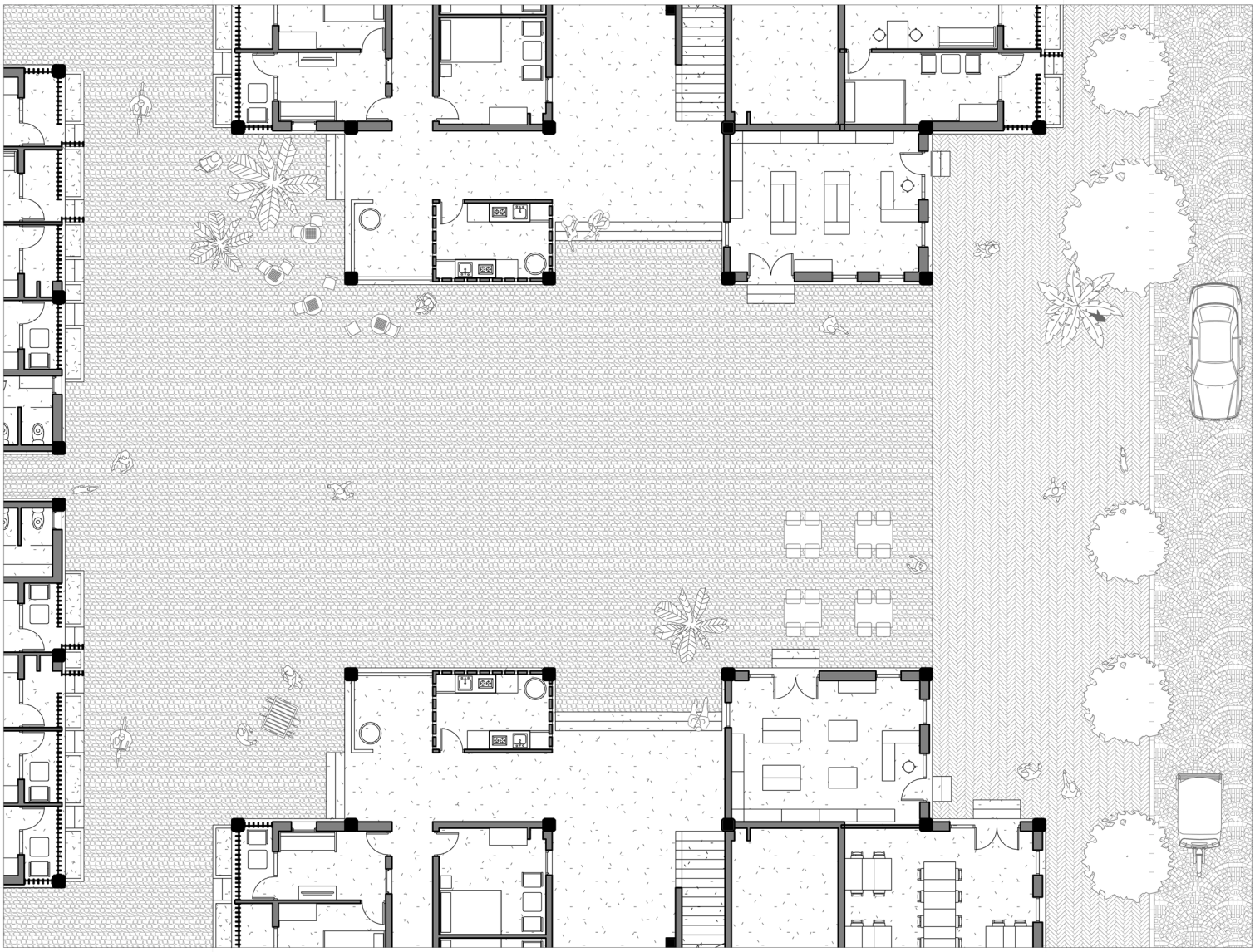
Pedestrian Pocket _ 1:200

Scale 1:200

0 2m 6m 10m 20m



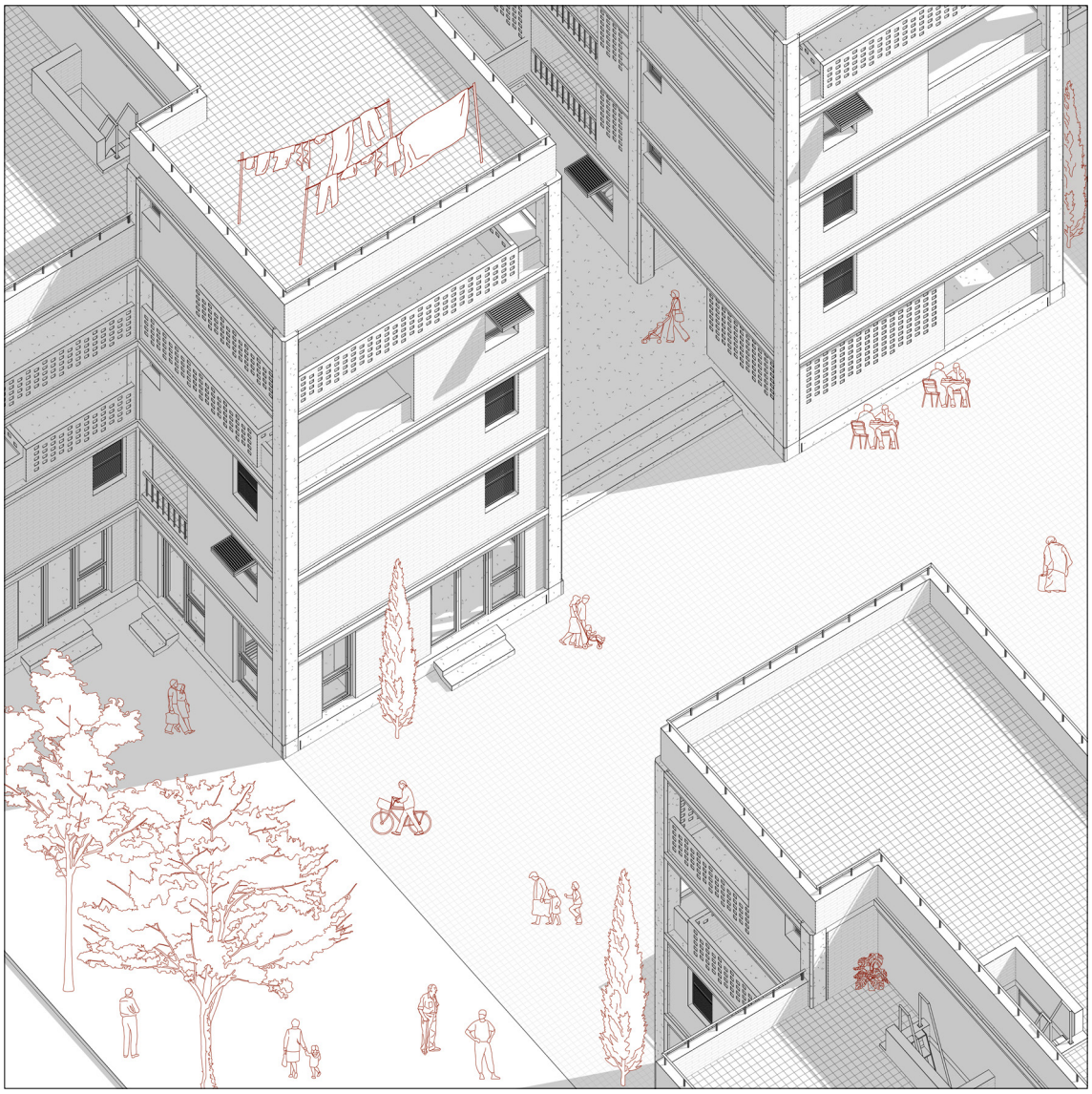
Pedestrian Pocket _ Isometric View



Public Space In-between Building Clusters _ 1:200

Scale 1:200

0 2m 6m 10m 20m



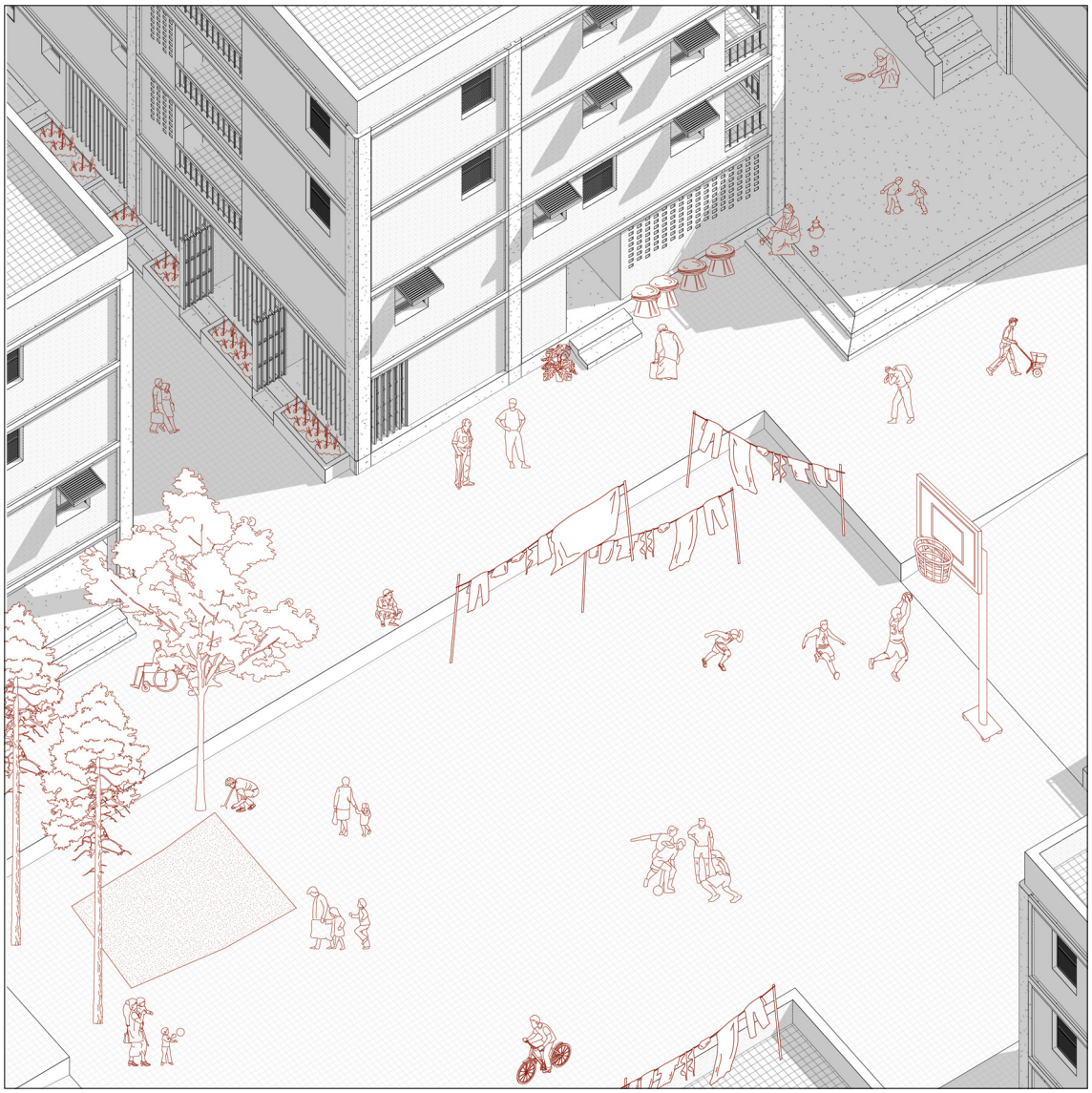
Public Space In-between Building Clusters _ Isometric View



Enlarged Centre Public Space _ 1:200

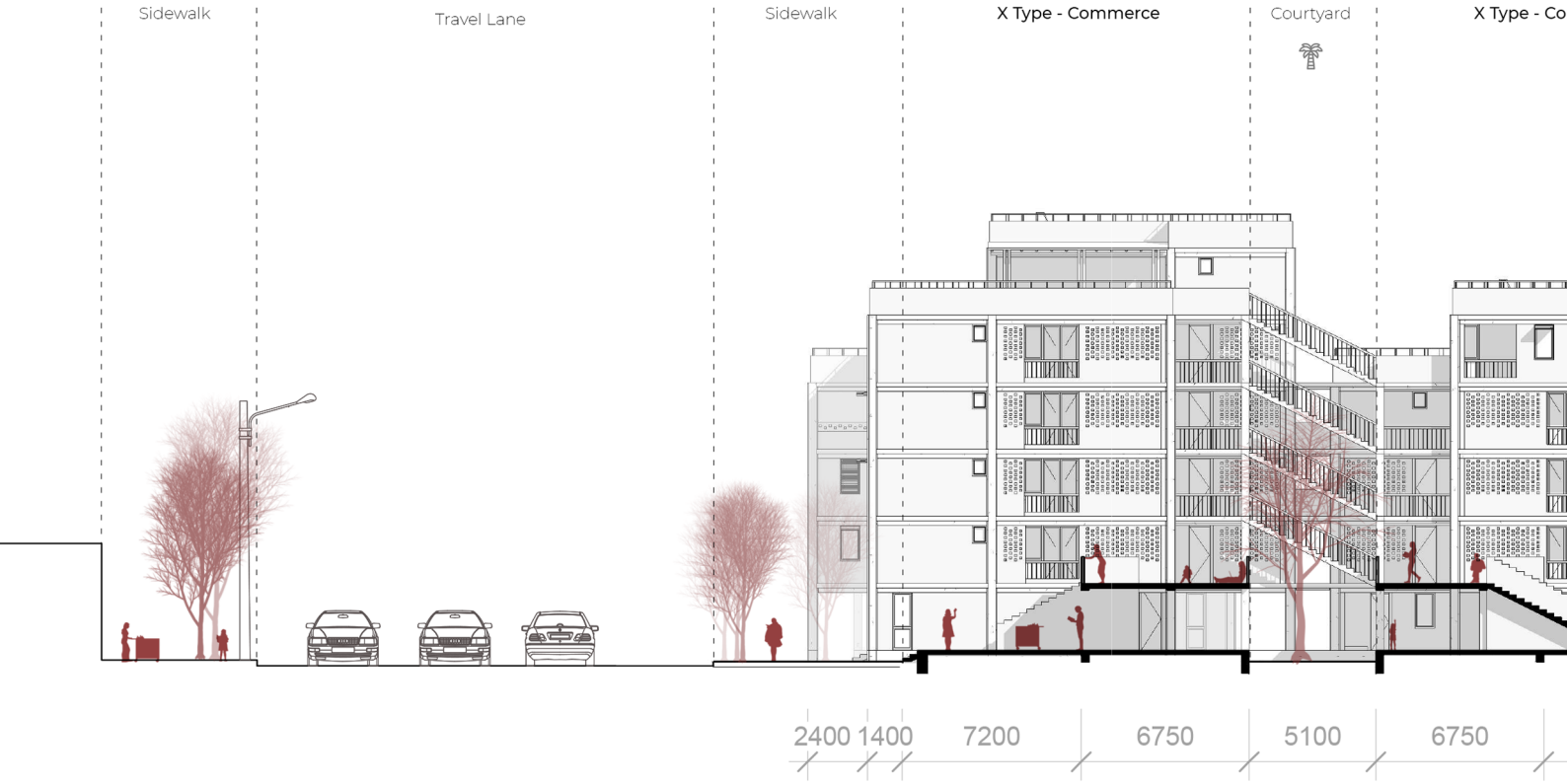
Scale 1:200

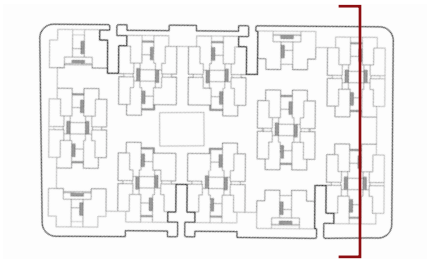
0 2m 6m 10m 20m



Public Space In-between Building Clusters _ Isometric View

_Section Through Neighbourhood _ S1







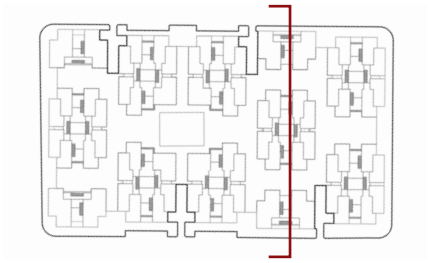
X Type Commerce + X Type Commerce _ 1:300

Scale 1:300

0 2m 6m 10m 20m 30m

_Section Through Neighbourhood _ S2





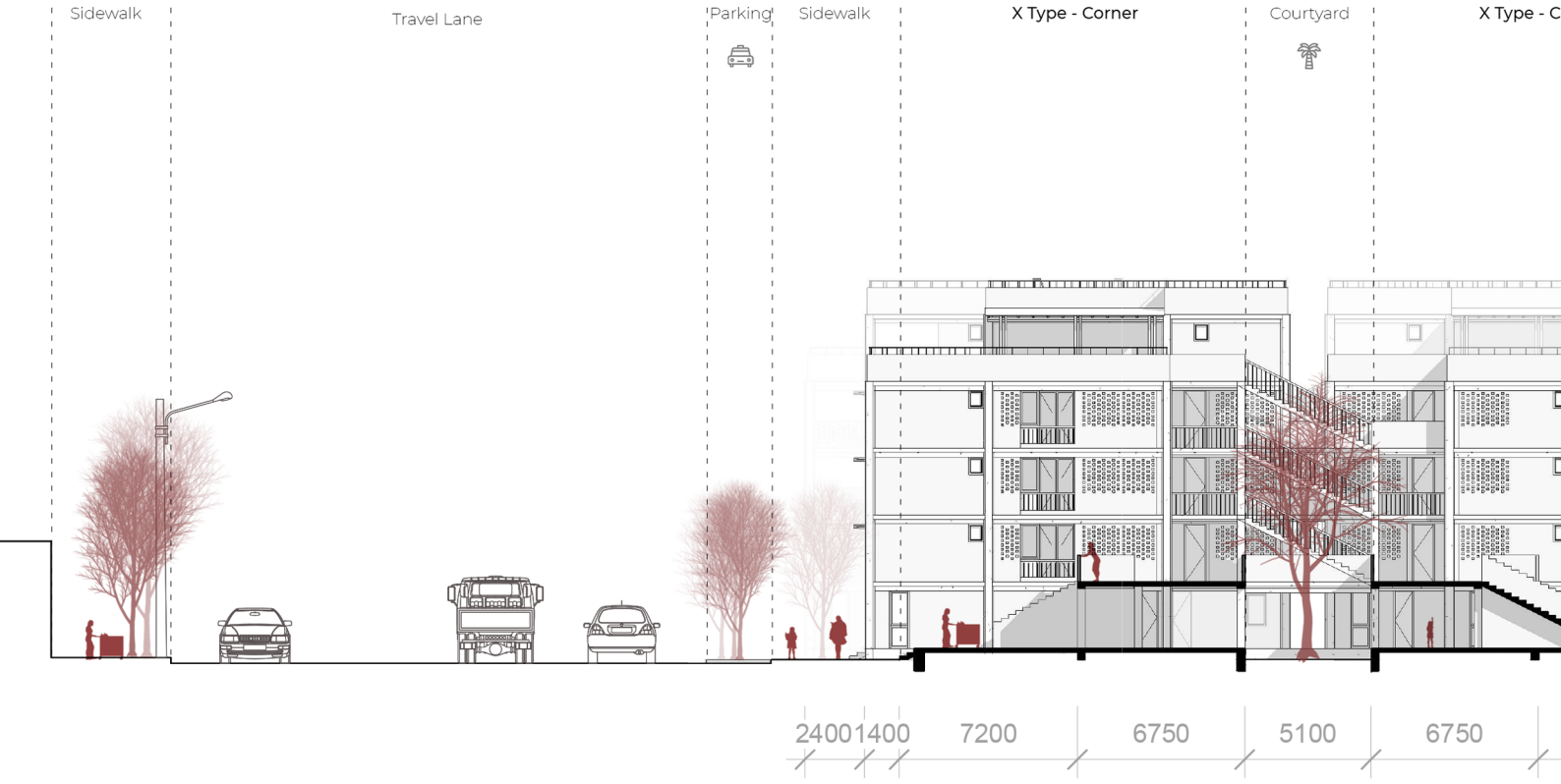


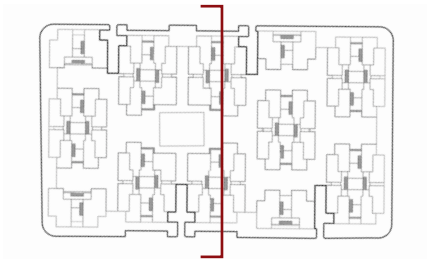
U Type + X Type Typical + U Type _ 1:300

Scale 1:300

0 2m 6m 10m 20m 30m

_Section Through Neighbourhood _ S3



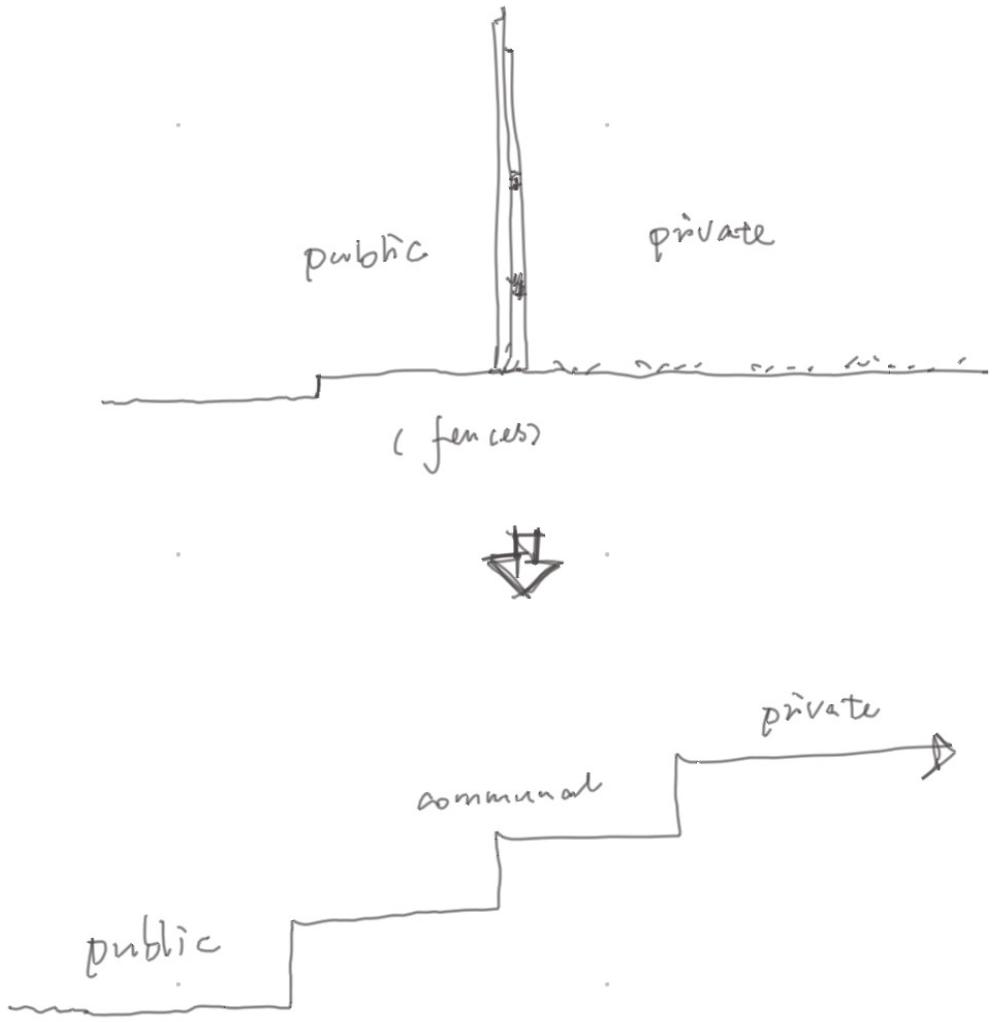




X Type Corner + X Type Corner _ 1:300

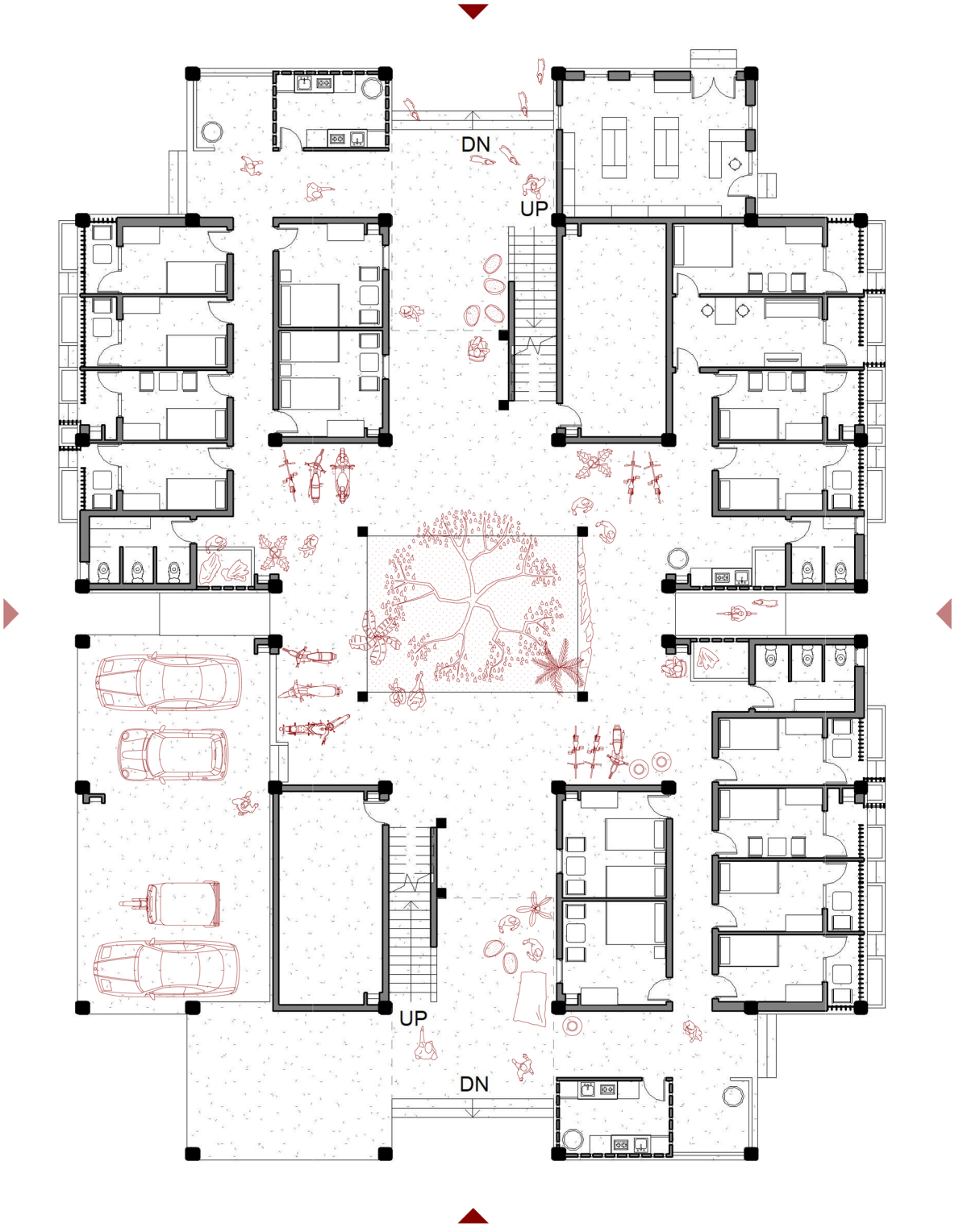
Scale 1:300

0 2m 6m 10m 20m 30m


public
private
(fences)
private
communal
public

THE CIRCULATION SYSTEM INTEGRATED WITH COMMUNAL SPACE

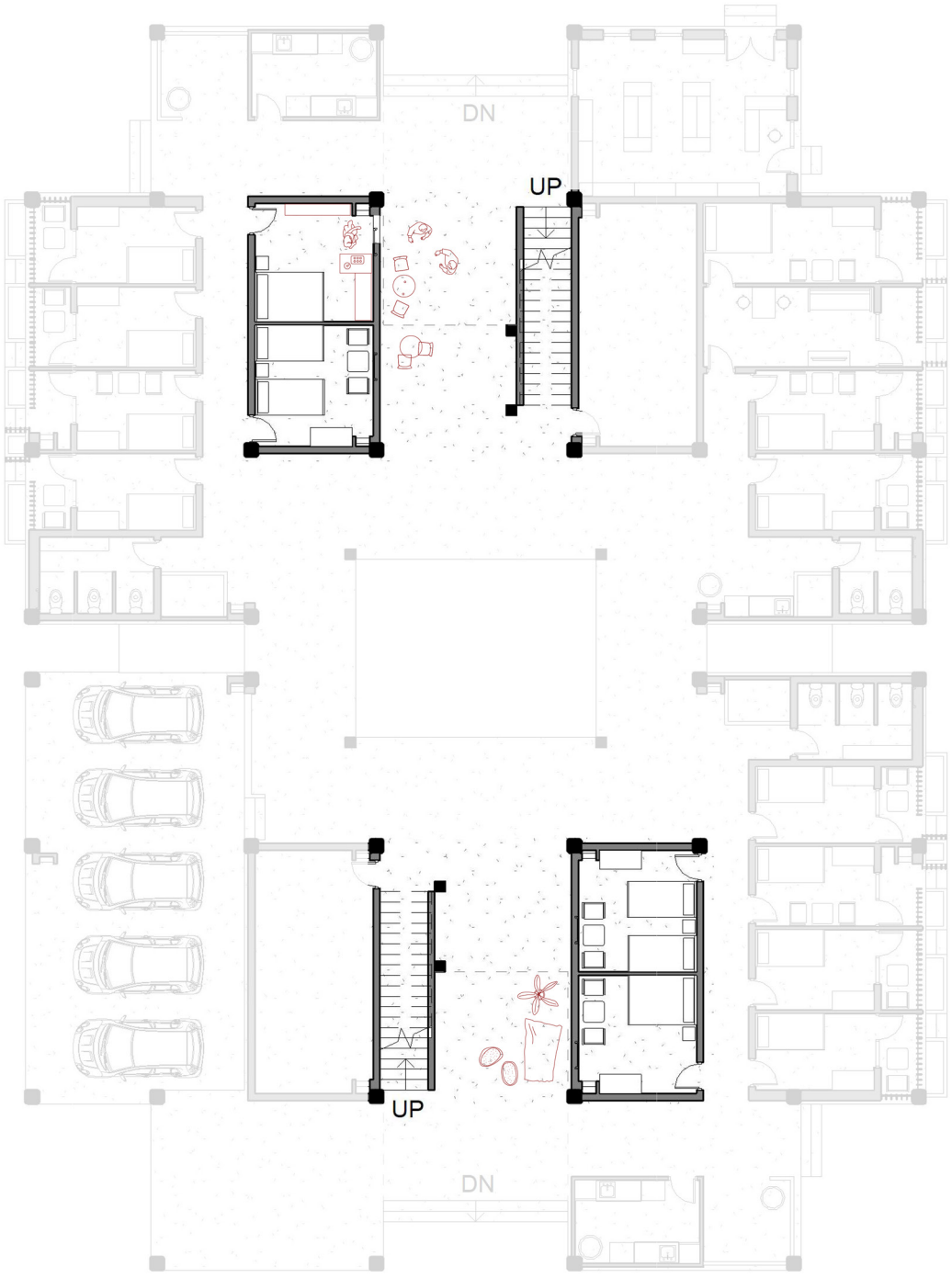
_X Type - Typical _ Ground Floor Plan: Transition Between Public & Communal



Ground Floor Plan _ 1:200

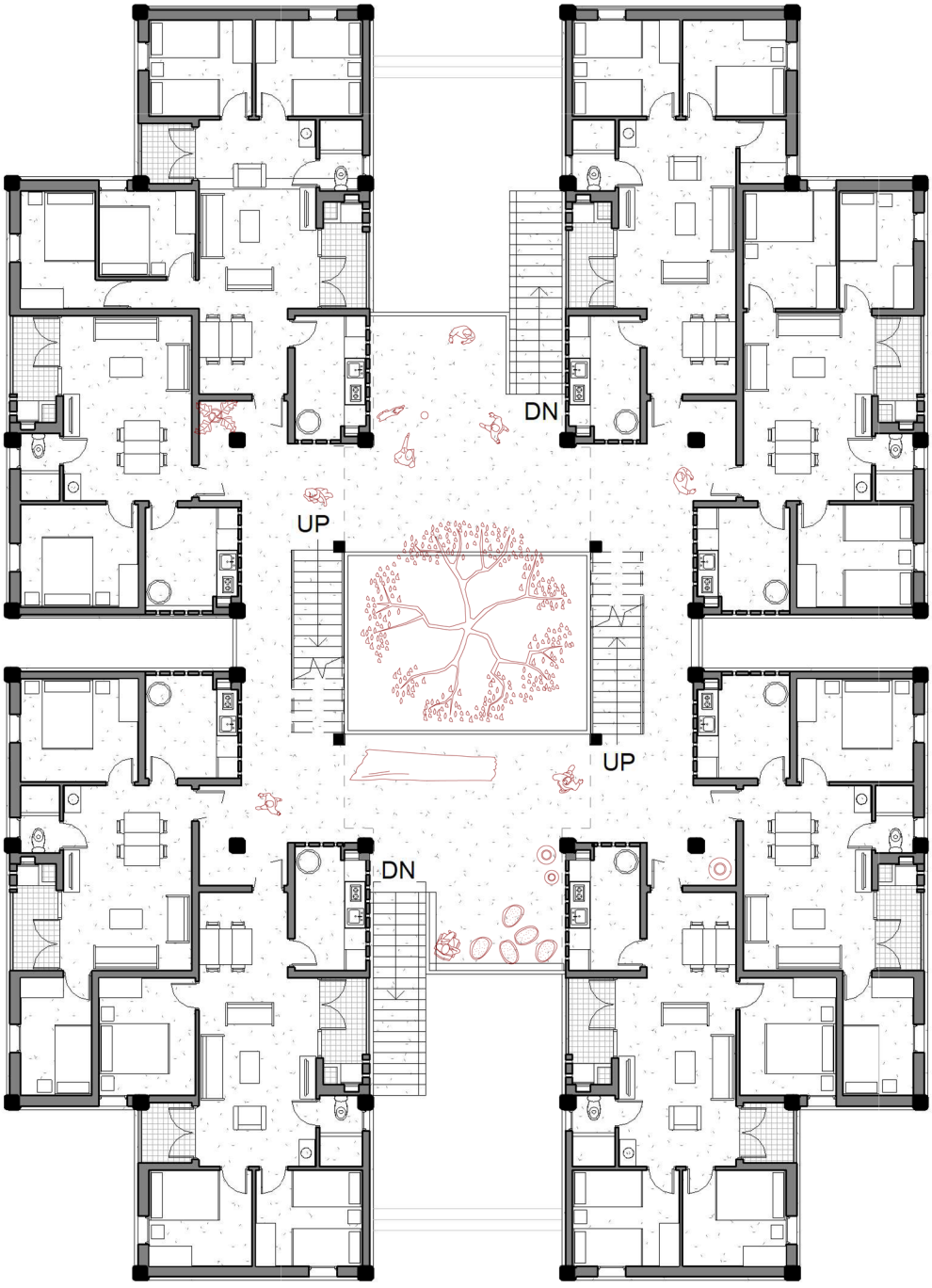
Scale 1:200

0 2m 6m 10m 20m



Appropriation

_X Type - Typical _ 1st Floor Plan: The Lifted Street Level



First Floor Plan _ 1:200

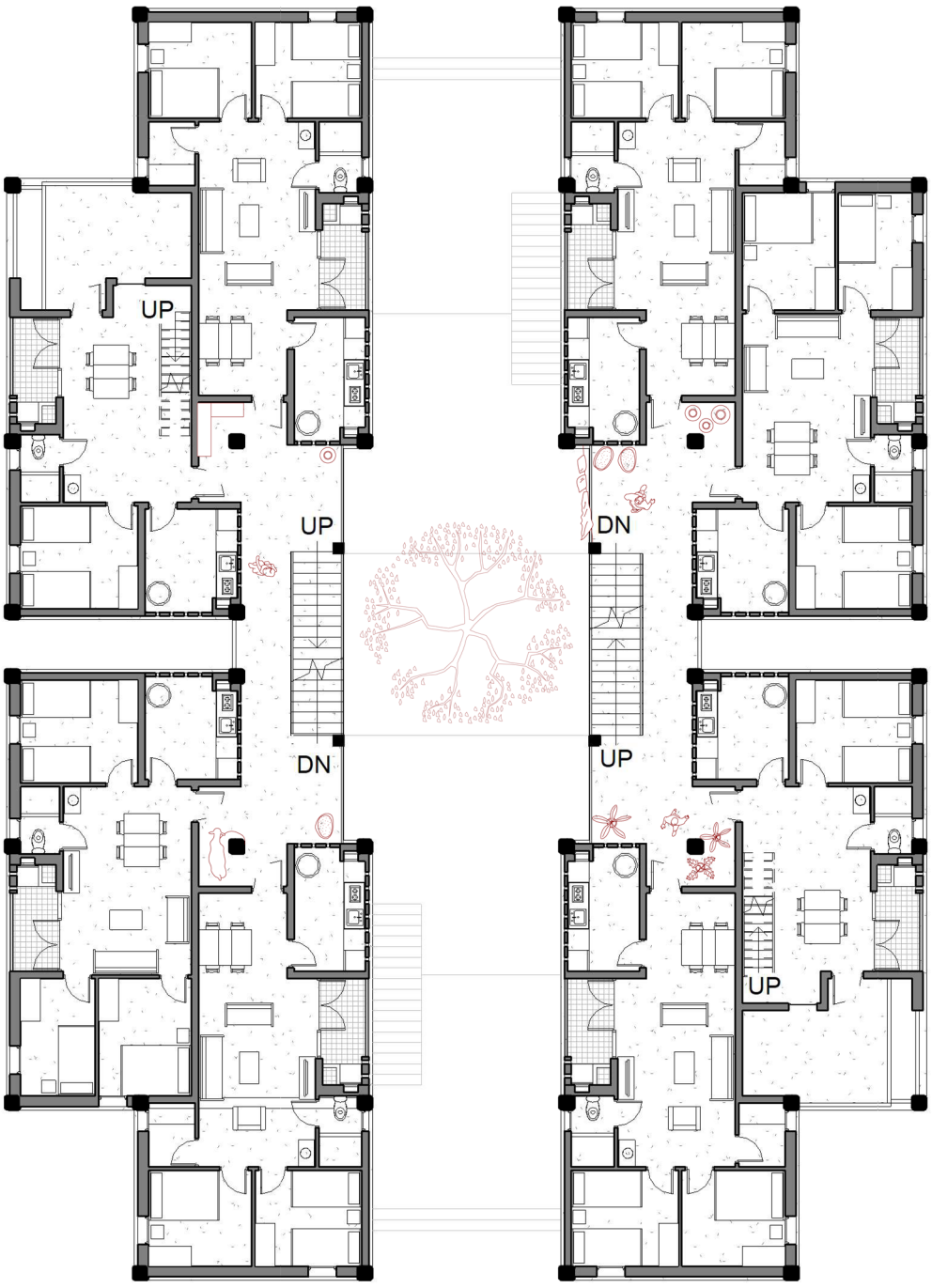
Scale 1:200

0 2m 6m 10m 20m



Appropriation

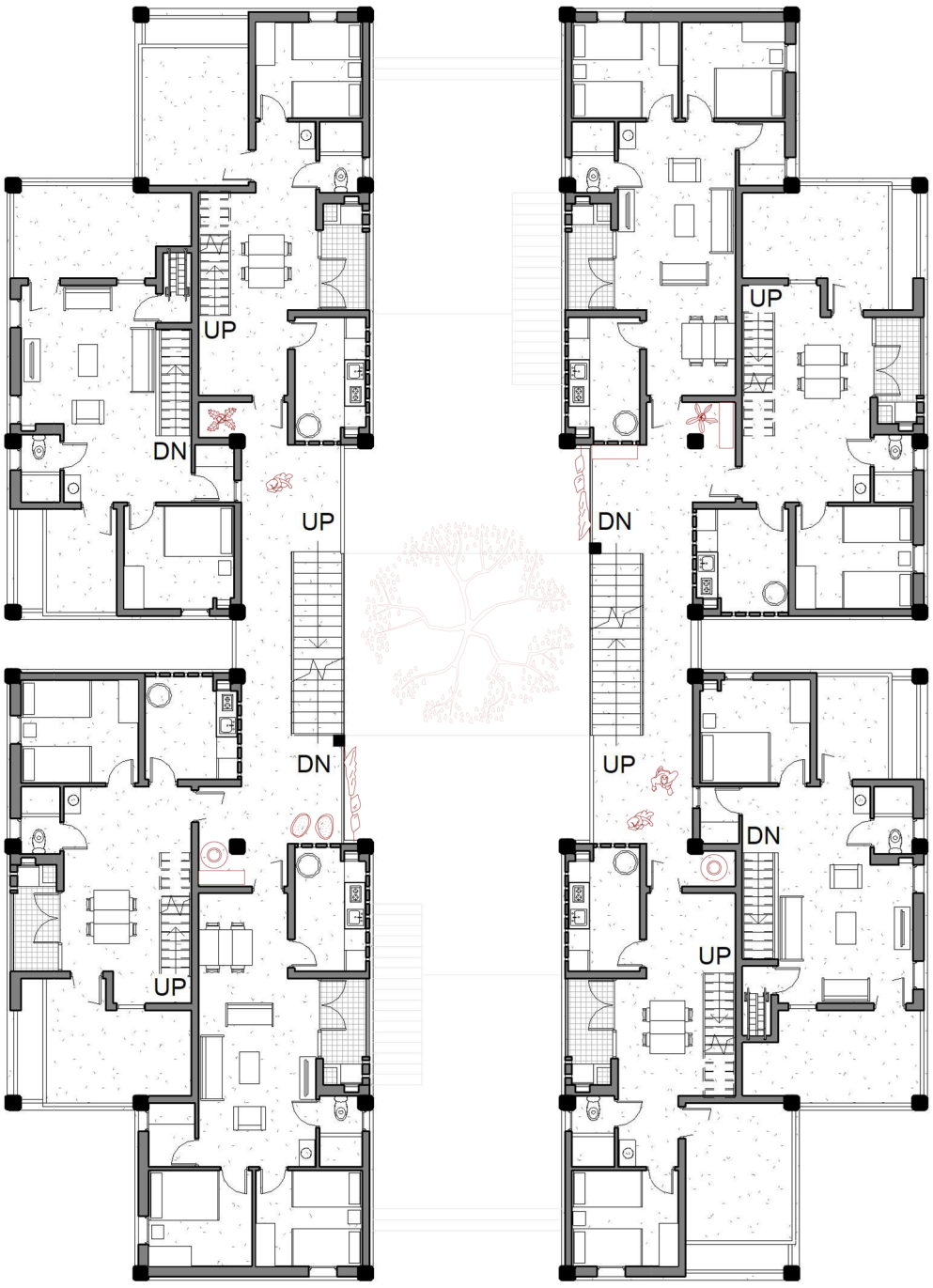
_X Type - Typical _ 2nd & 3rd Floor Plan: Threshold of Private Realm



Second Floor Plan _ 1:200

Scale 1:200

0 2m 6m 10m 20m



Third Floor Plan _ 1:200

Scale 1:200

0 2m 6m 10m 20m

_X Type - Typical _ 4th & 5th Floor Plan: Communal & Private Roof Terrace



Forth Floor Plan _ 1:200

Scale 1:200

0 2m 6m 10m 20m



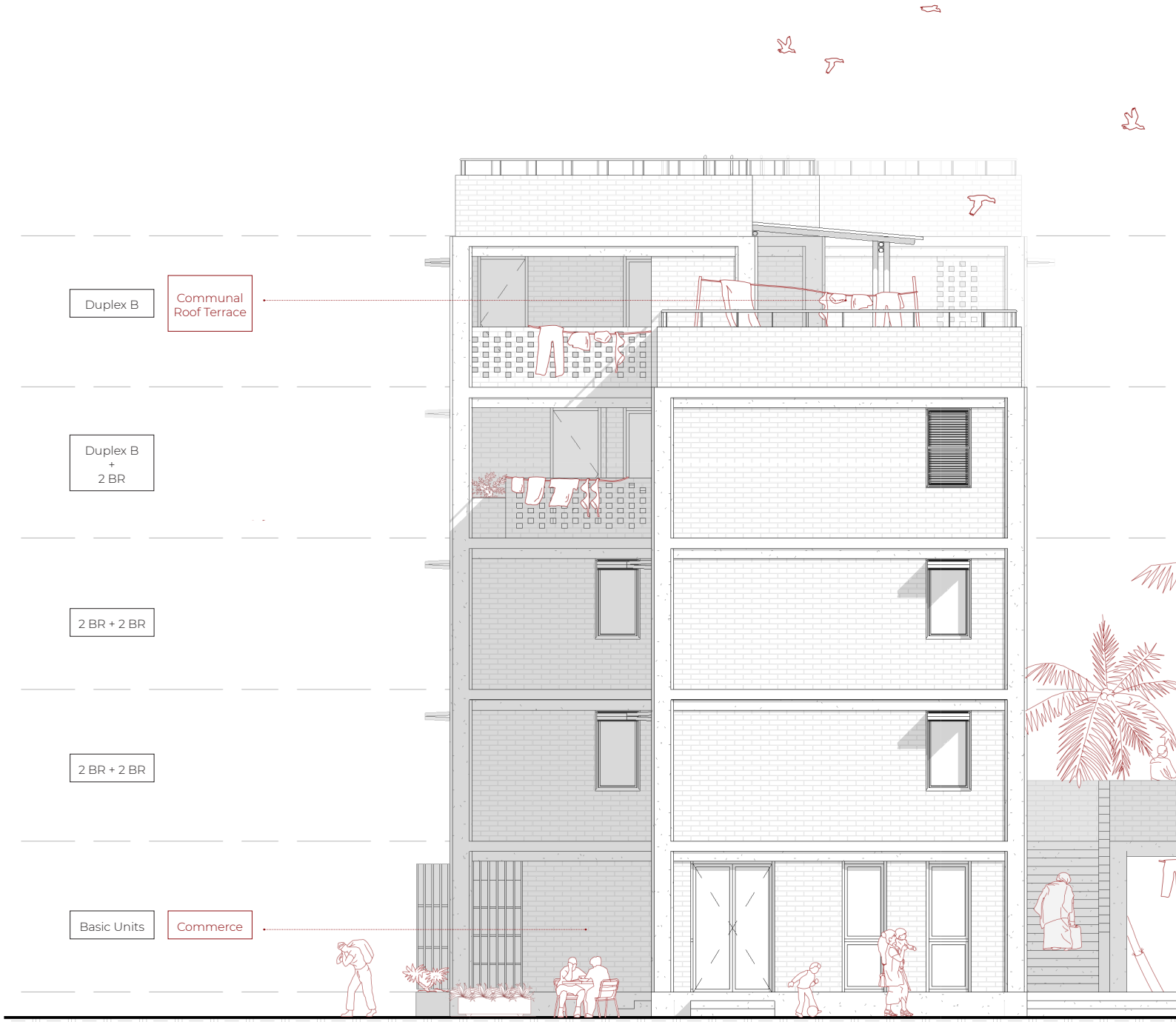
Fifth Floor Plan _ 1:200

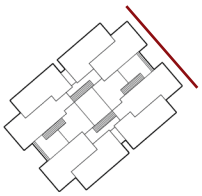
Scale 1:200

0 2m 6m 10m 20m

_X Type - Typical _ Elevation: A Free Combination

Northeast Elevation _ 1:100





5th Floor
13950

Duplex A

4th Floor
11250

Duplex A
+
Duplex B

3rd Floor
8550

Duplex B
+
2BR

2nd Floor
5850

Communal
1F Terrace

4BR + Studio

1st Floor
3150

Basic Units

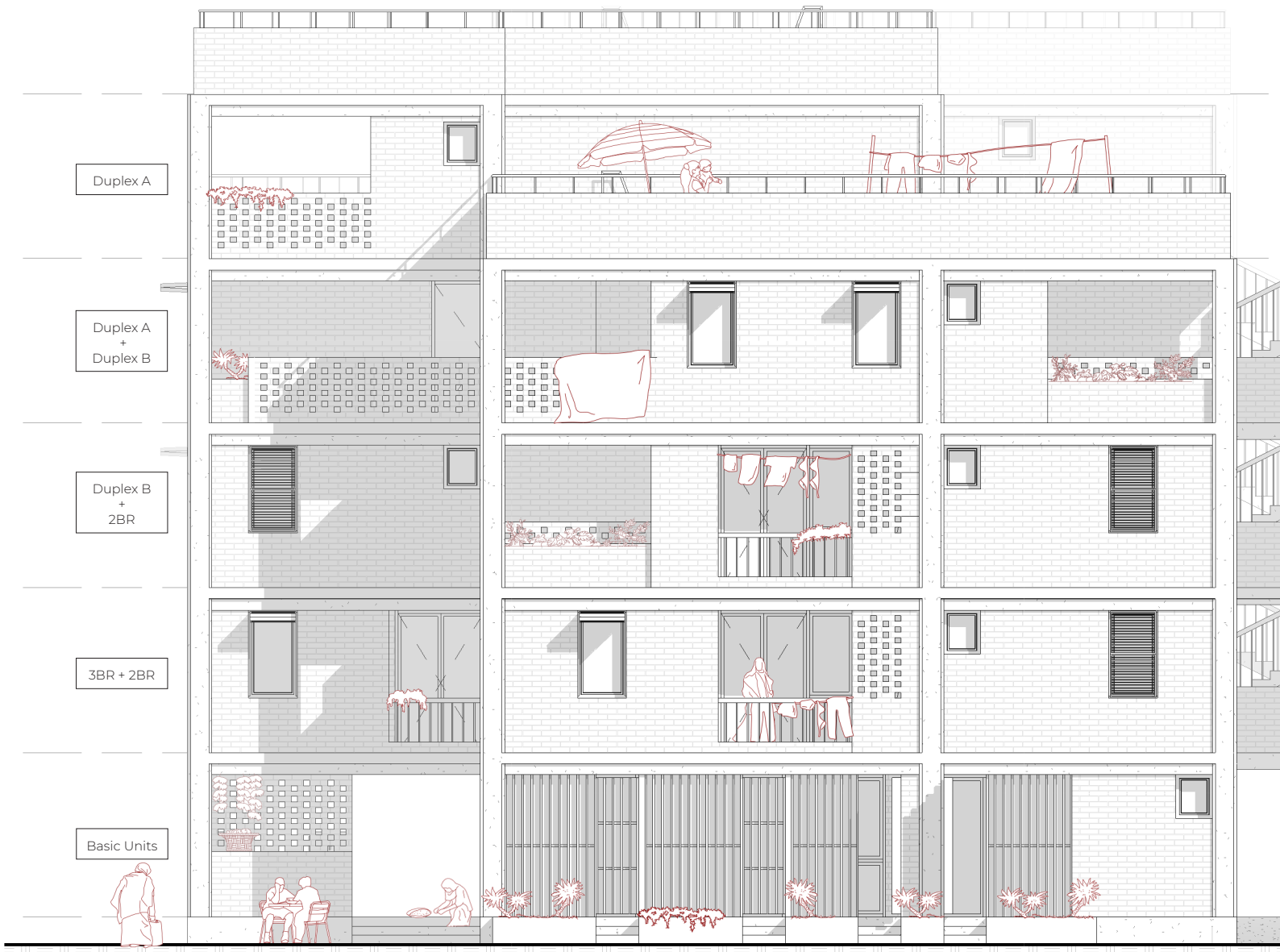
Ground Floor
450

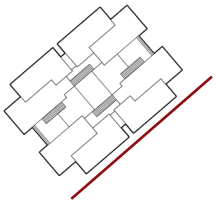
GF_Street Level
0

Scale 1:100

0 1m 3m 5m 10m

Southeast Elevation _ 1:100





Communal Roof Terrace

5th Floor
13950

Duplex B

4th Floor
11250

Duplex B
+
2 BR

3rd Floor
8550

2 BR + 2 BR

2nd Floor
5850

2 BR + 2 BR

1st Floor
3150

Basic Units

Ground Floor
450

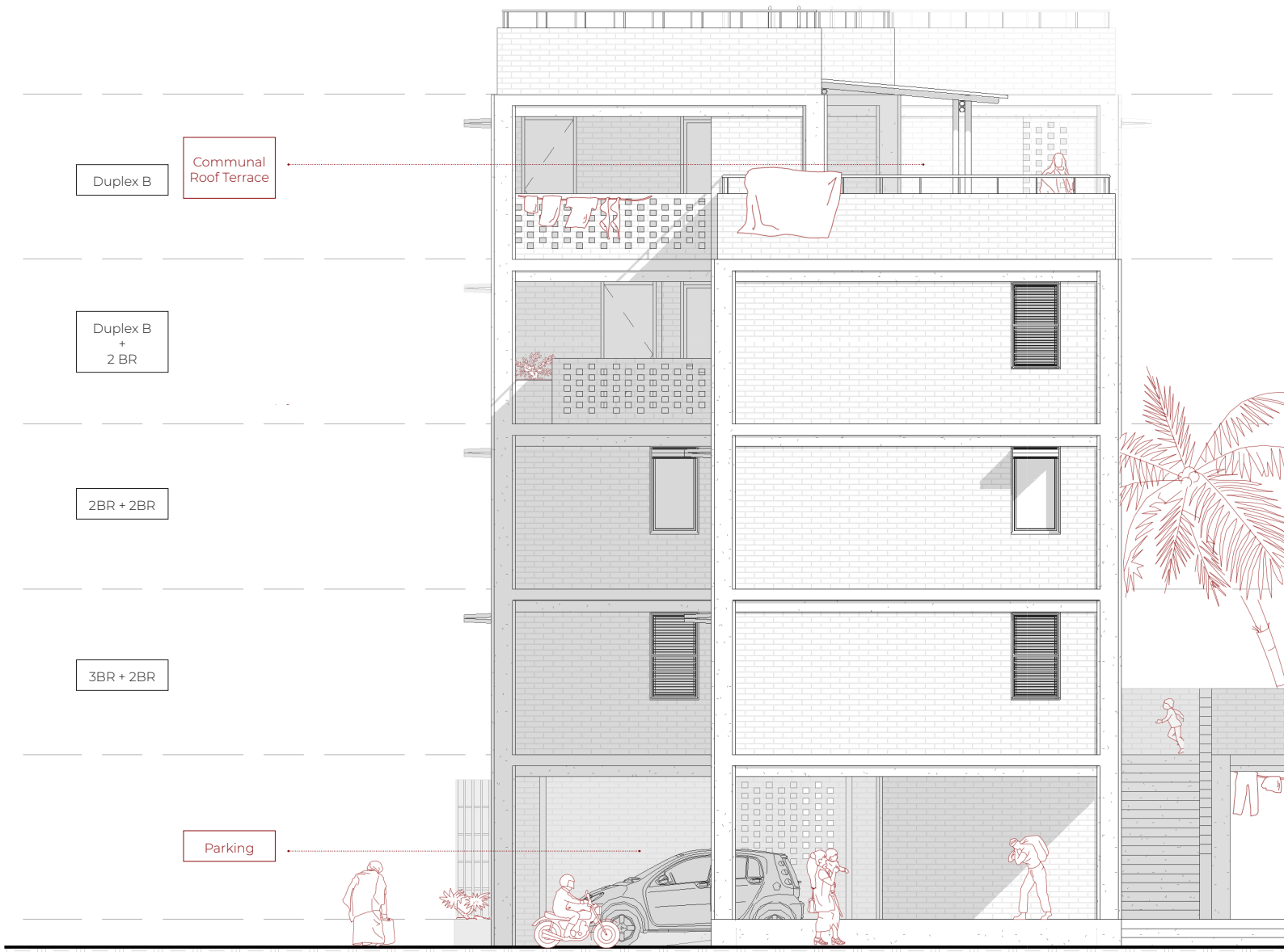
FF Street Level
0

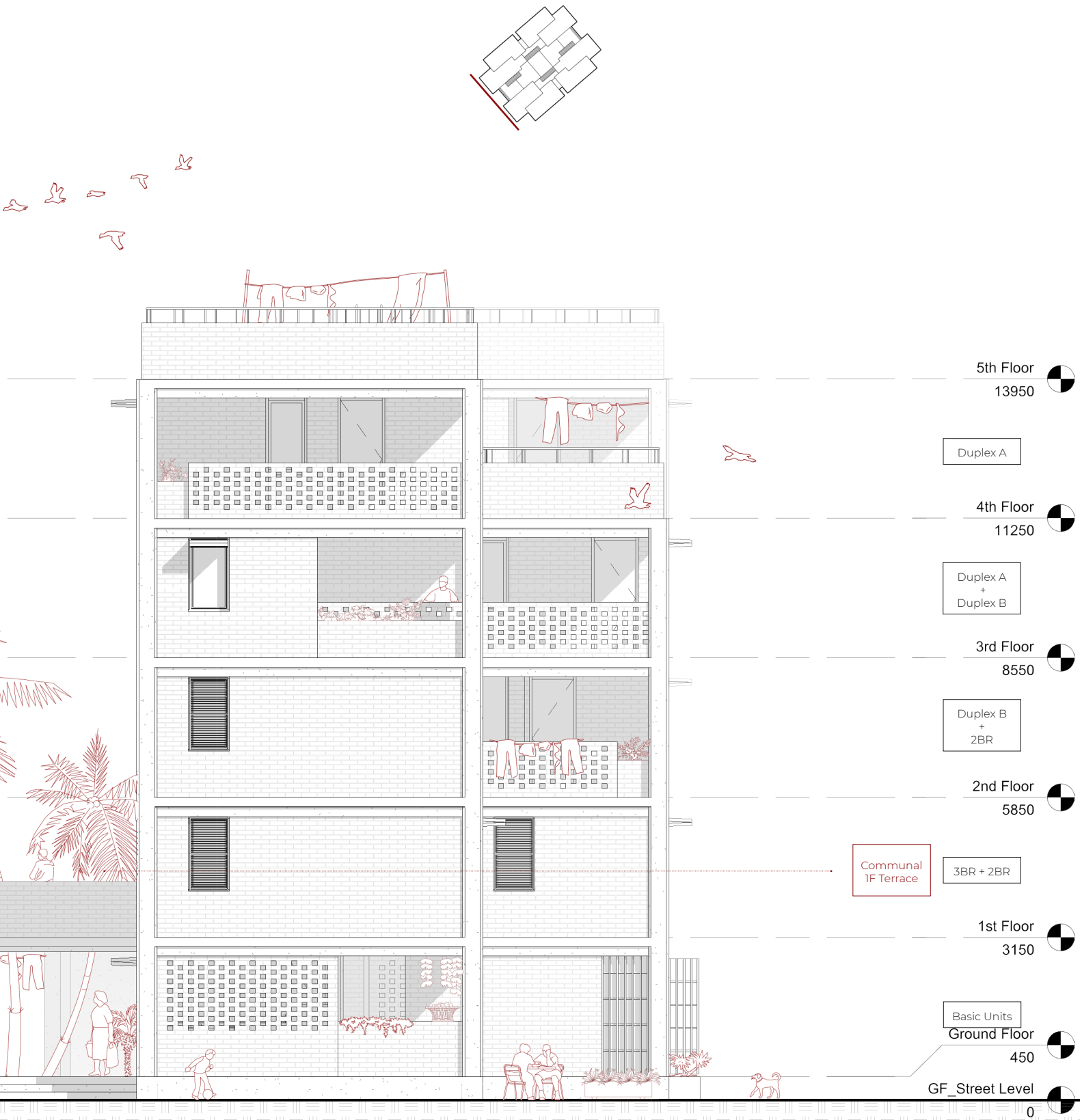
Commerce

Scale 1:100

0 1m 3m 5m 10m

Southwest Elevation _ 1:100



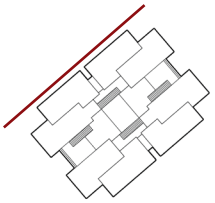


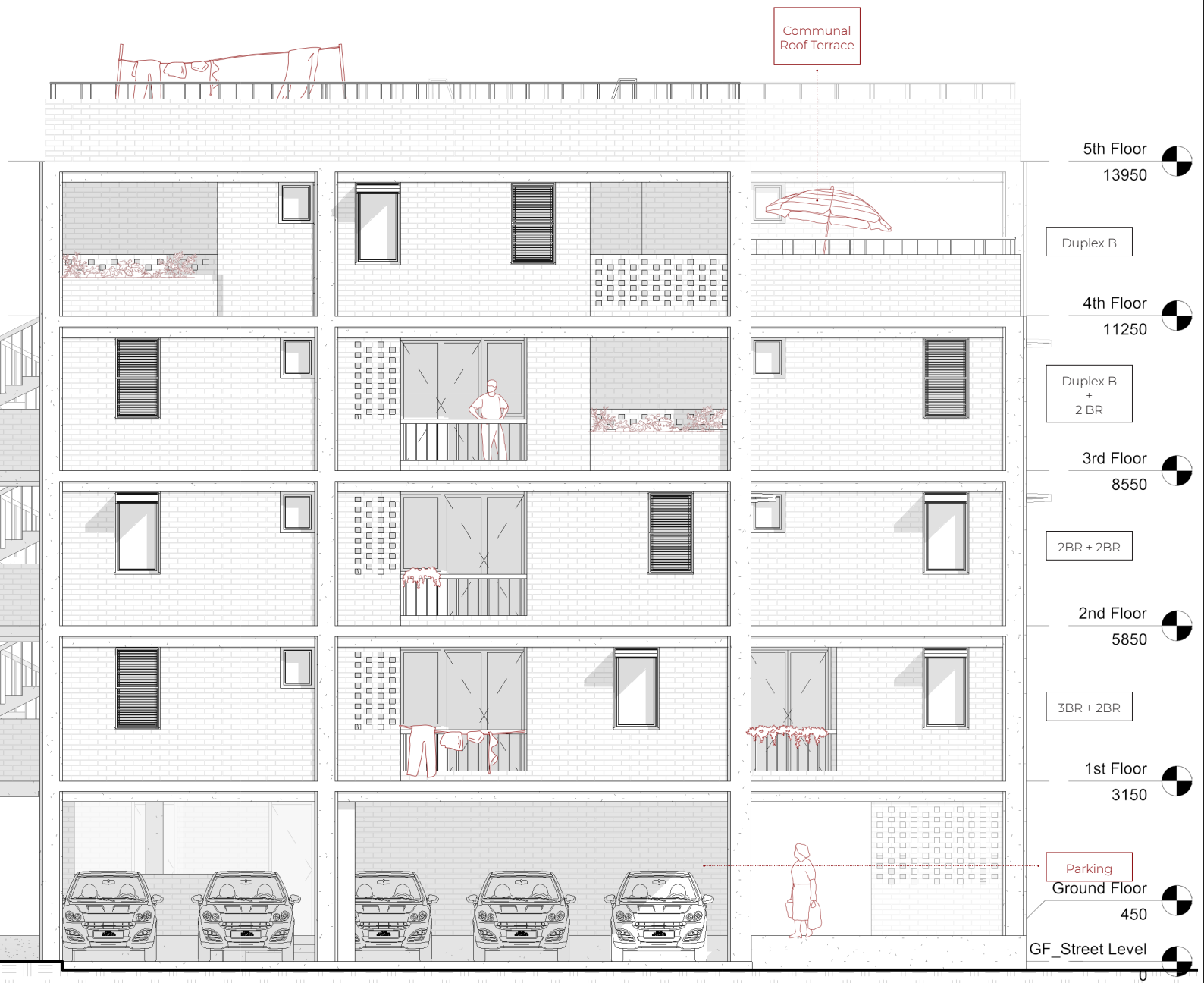
Scale 1:100

0 1m 3m 5m 10m

Northwest Elevation _ 1:100



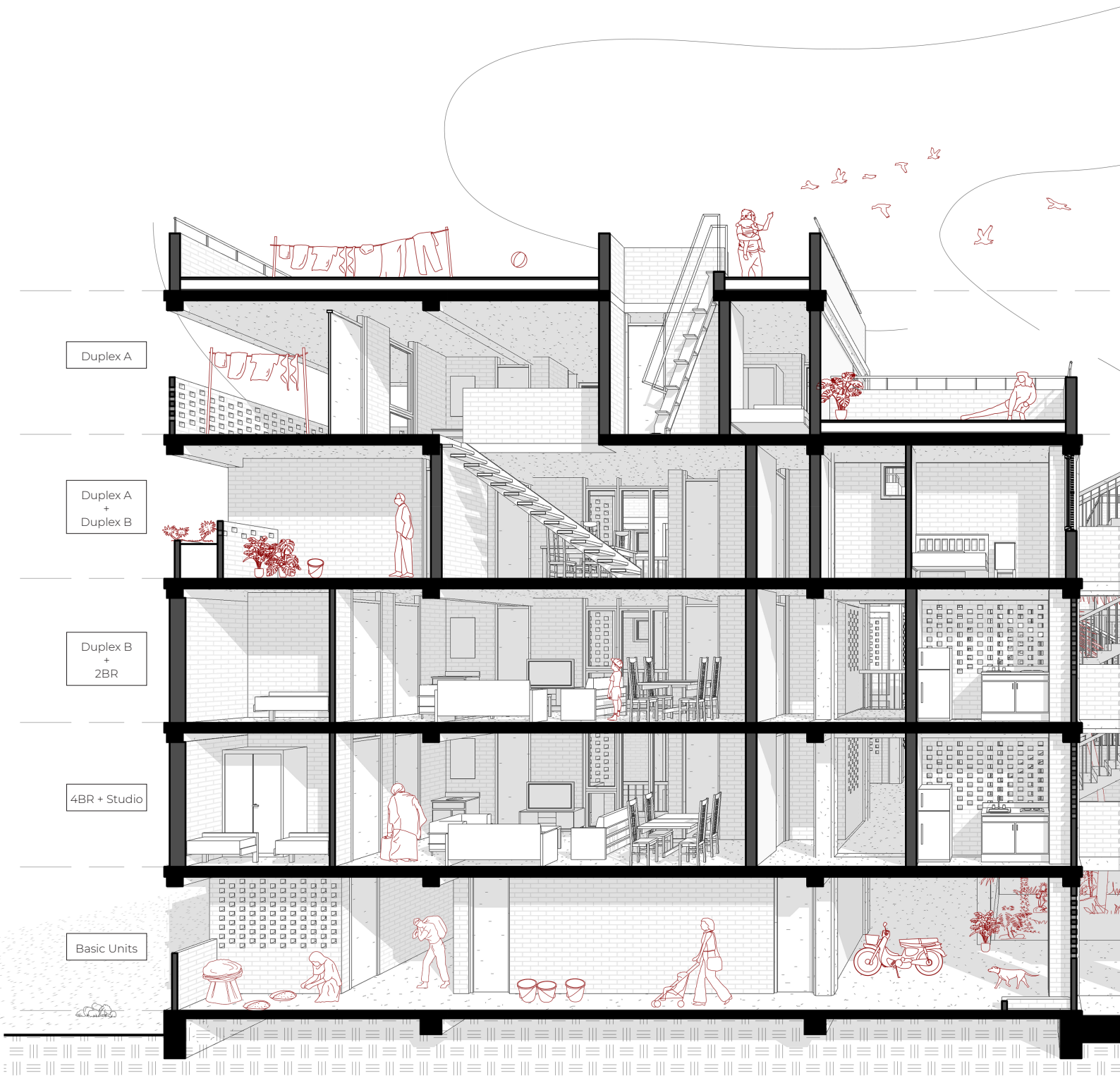


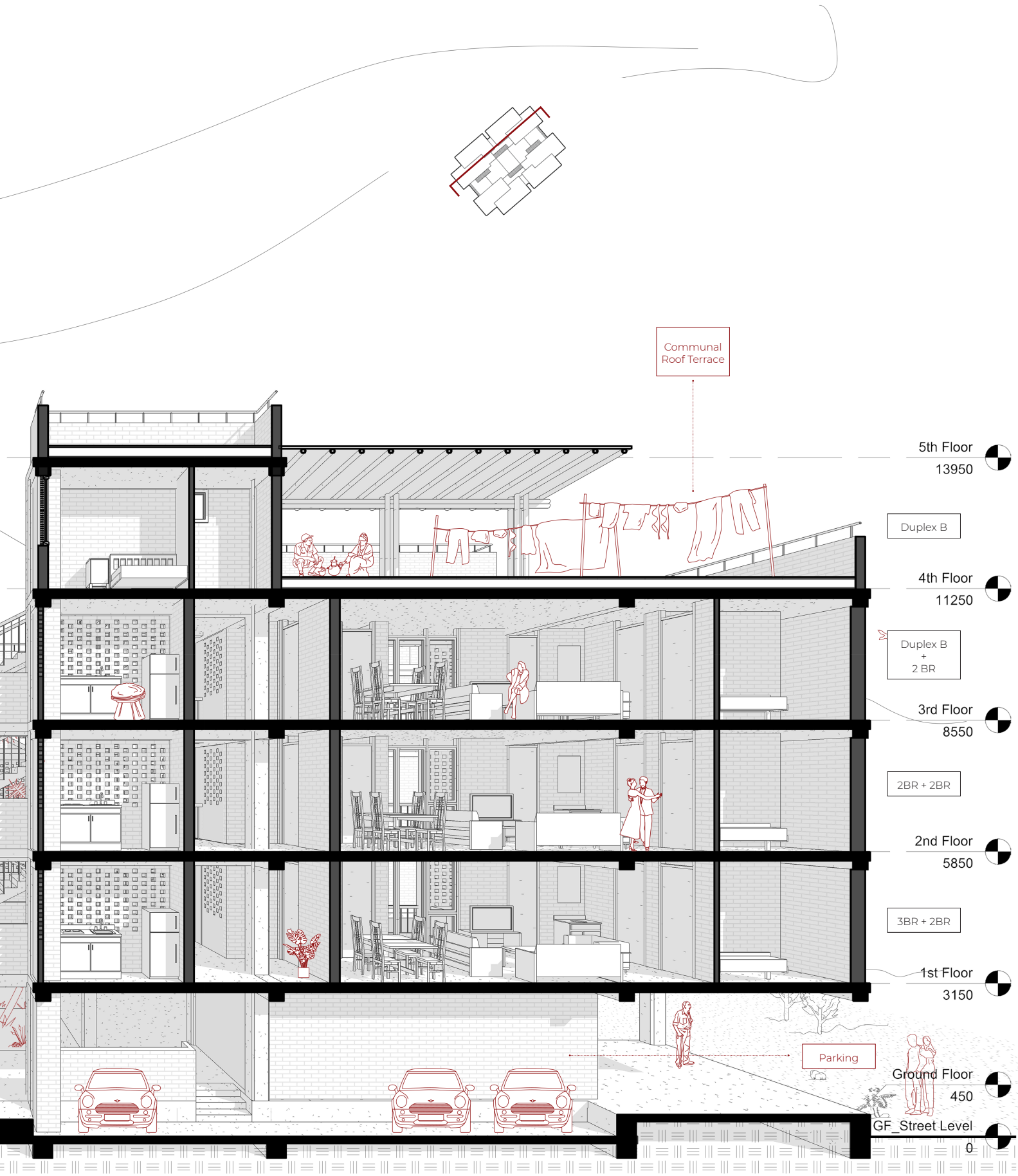


Scale 1:100

0 1m 3m 5m 10m

_X Type - Typical _ Section Through Units

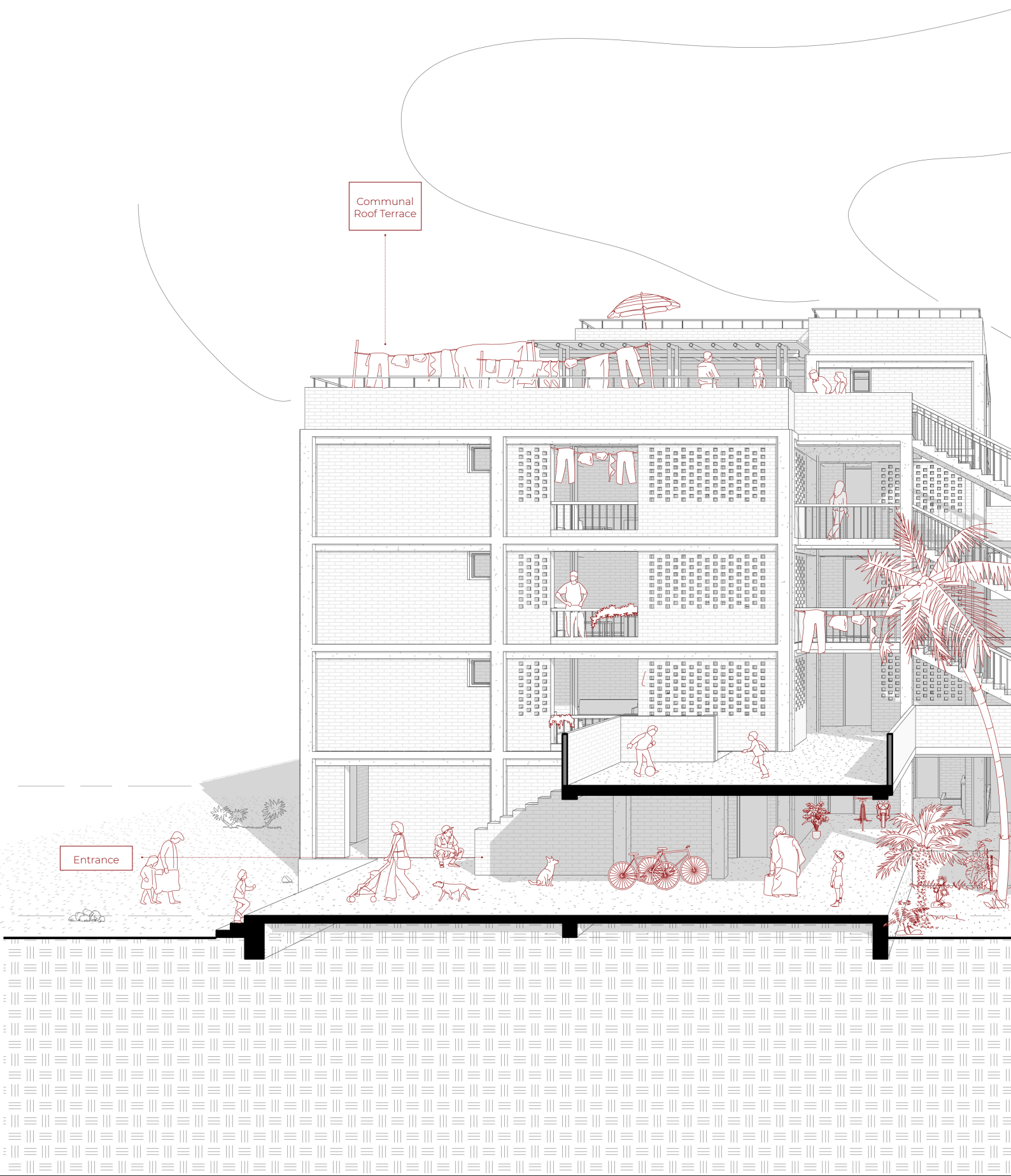


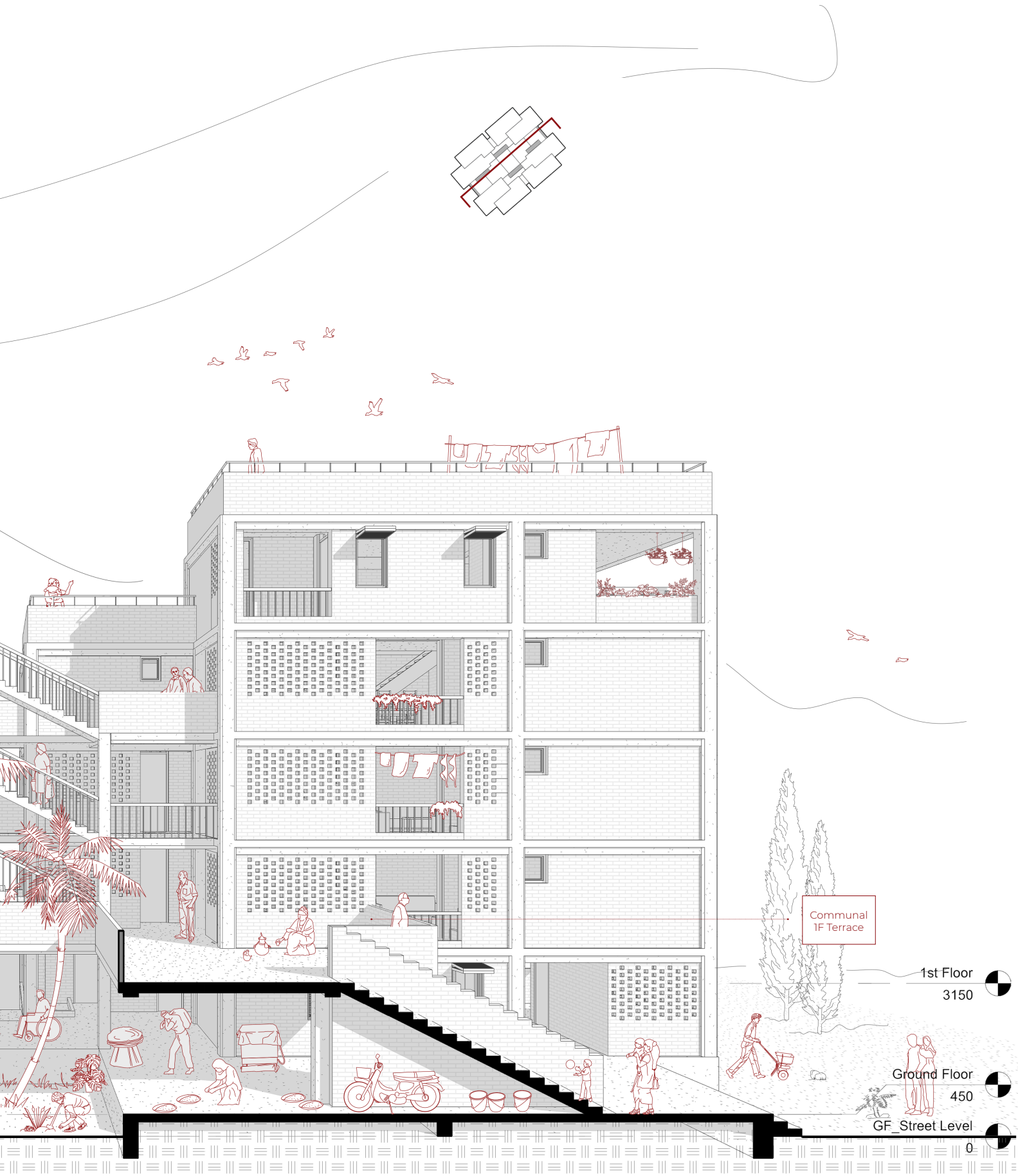


Scale 1:100

0 1m 3m 5m 10m

_X Type - Typical _ Section Through Communal Space




Communal
1F Terrace
1st Floor
3150
Ground Floor
450
GF_Street Level
0
Scale 1:100
0
1m
3m
5m
10m


sublet
BR
BR
LR
K
T
T
DR
K
LR
DR
BR
BR
LR
DR
T
DR
LR
BR
BR
BR
pipe
light wall
glass
Door
LR
DR
K
T
T
K
K
T
BR
Study
Studio.
K
DR
BR.2
BR.1
LR
3BR + Studio.

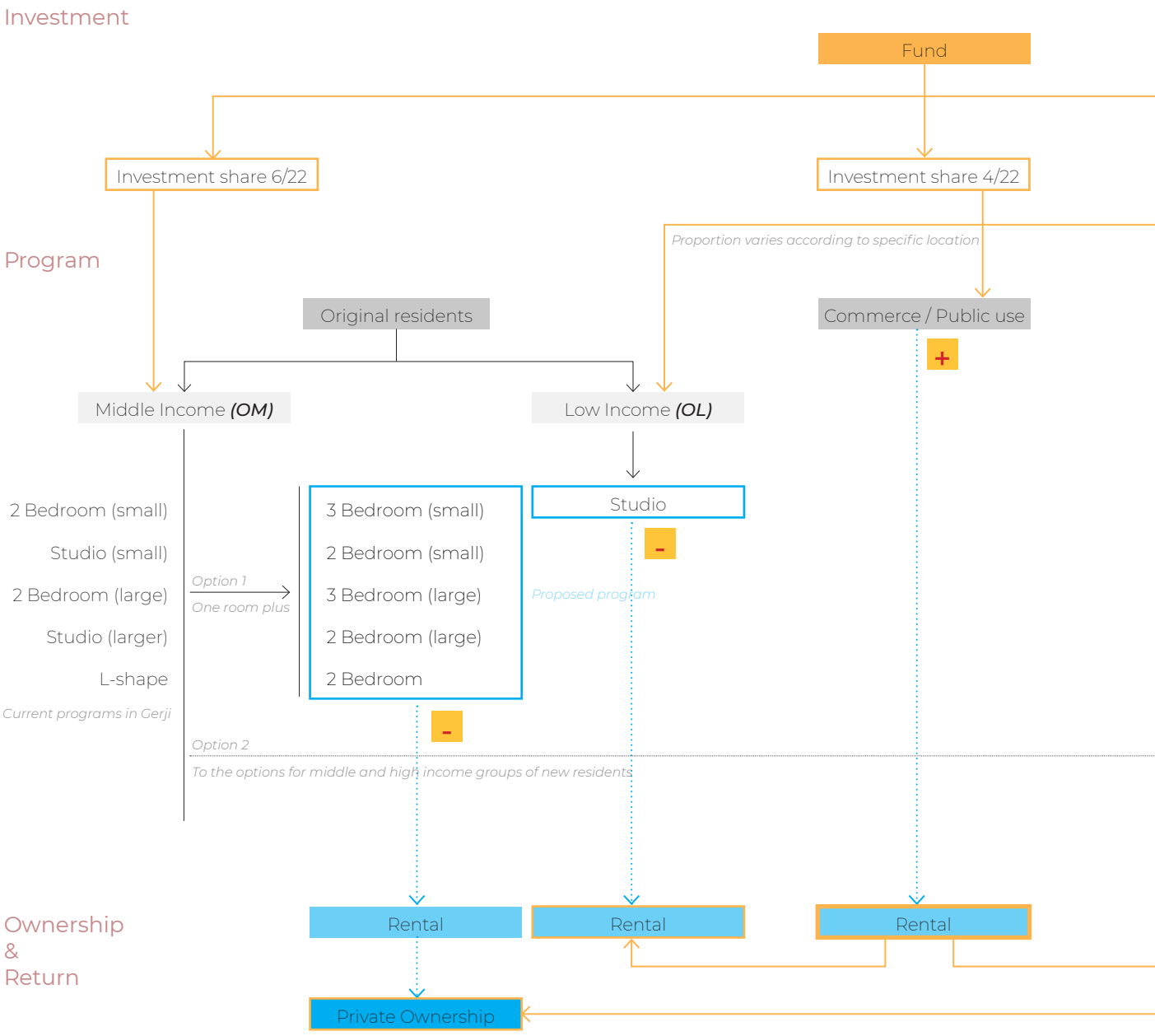
131.76 m2

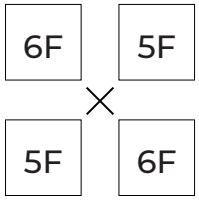
THE DWELLING BLOCKS

MANAGERIAL STRATEGY

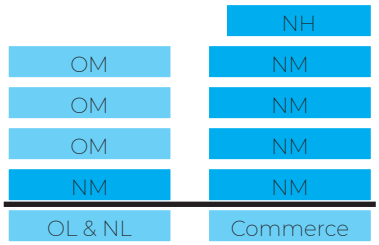
_ *Financing Scheme of A Typical Building Cluster*

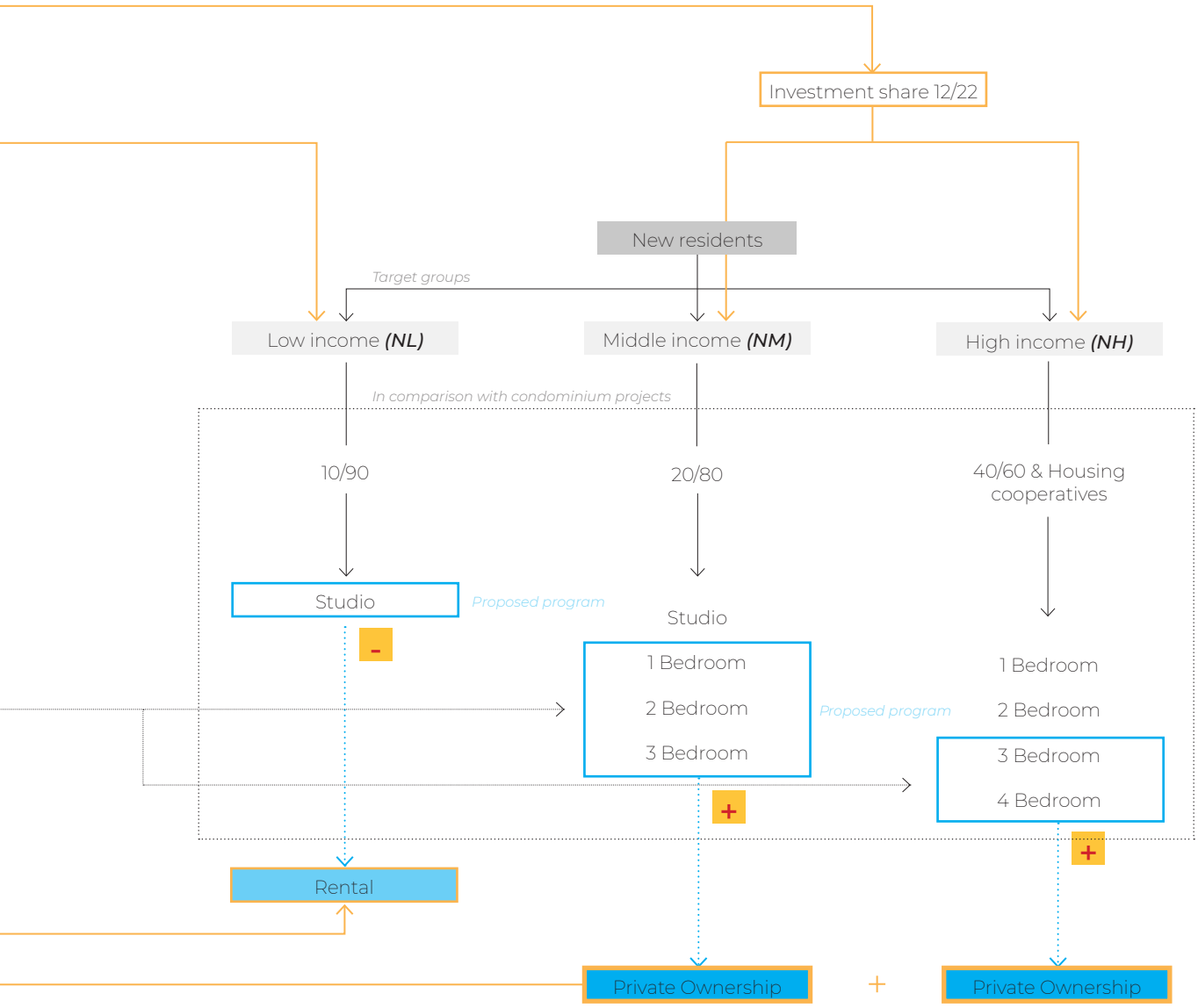
In the case of "six to one" plot...





22 Floors in total

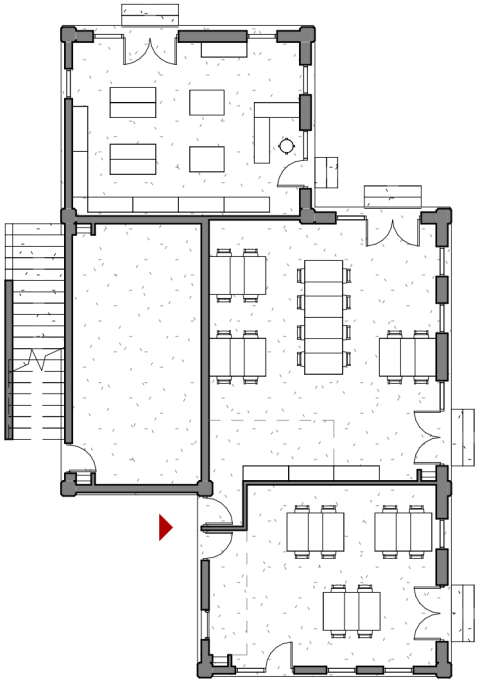




UNITS

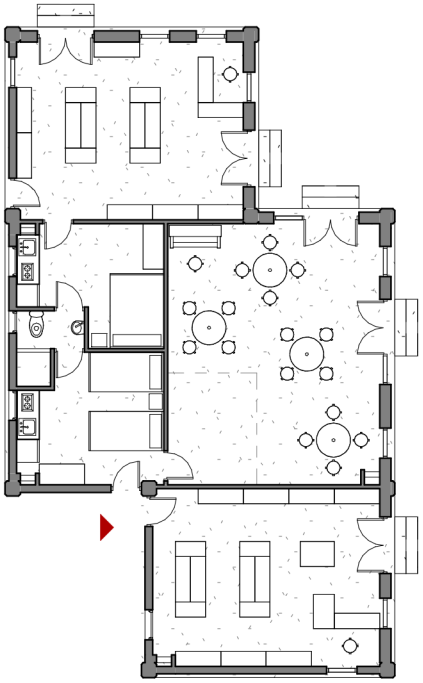
_ Ground Floor Space: For Public / Commercial / Residential Use

Periphery



Rain Water Collection
+ Commerce

Commercial use: 108m²

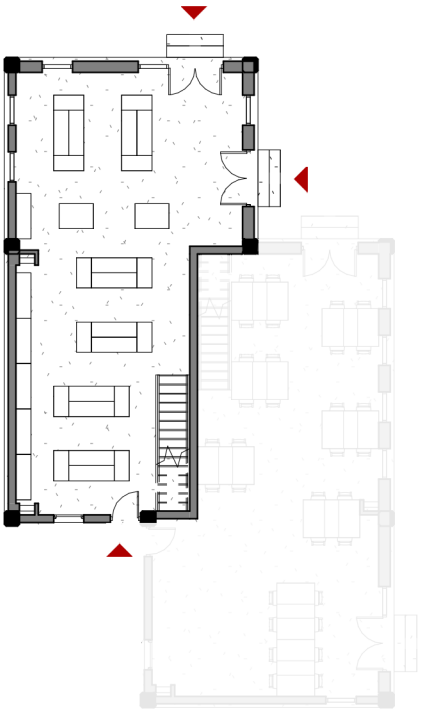


Commerce + Residence
(Single floor)

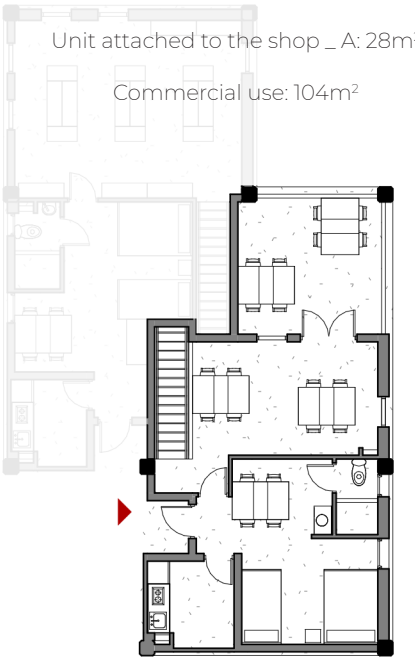
Unit attached to the shop _ C: 14m²

Commercial use: 103m²

Commerce + Residence (Duplex A)



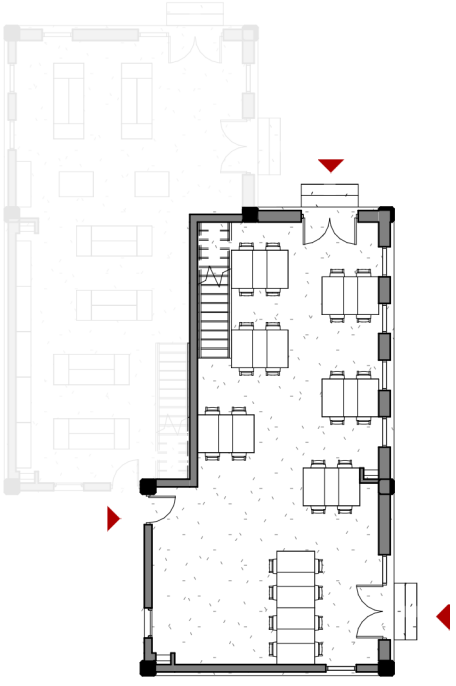
Ground Floor +

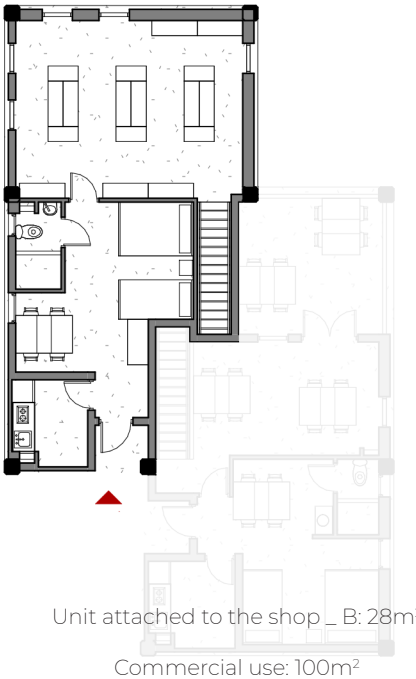


Unit attached to the shop _ A: 28m²

Commercial use: 104m²

+ 1st Floor





Unit attached to the shop _ B: 28m²

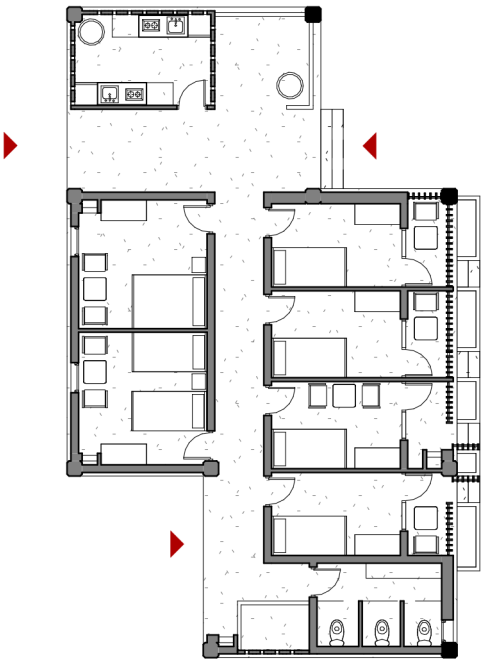
Commercial use: 100m²

Commerce + Residence (Duplex B)

Scale 1:200

0 2m 6m 10m 20m

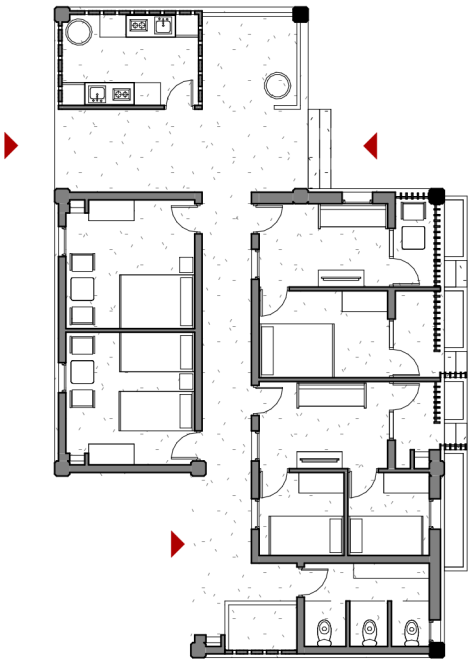
Inside A Neighbourhood



Basic Rental Units
(Small)

R1: 12m² / Each Unit
(9m² indoor & 3m² loggia)

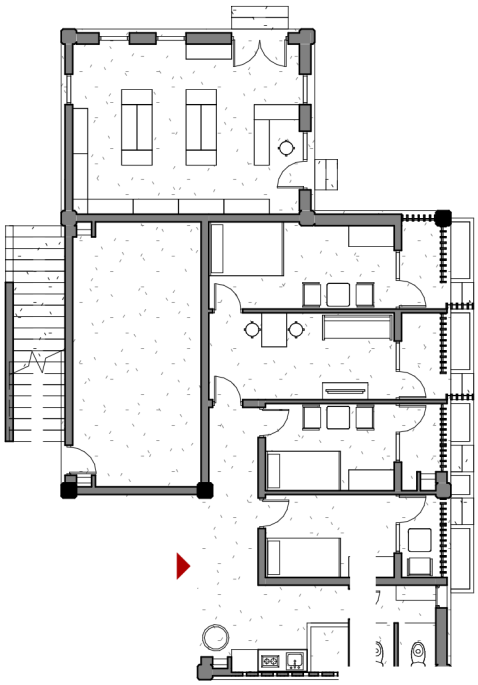
R2: 13m² / Each Unit



Basic Rental Units
(Large)

R1 Combined: 24m² / Each Unit
(18m² indoor & 6m² loggia)

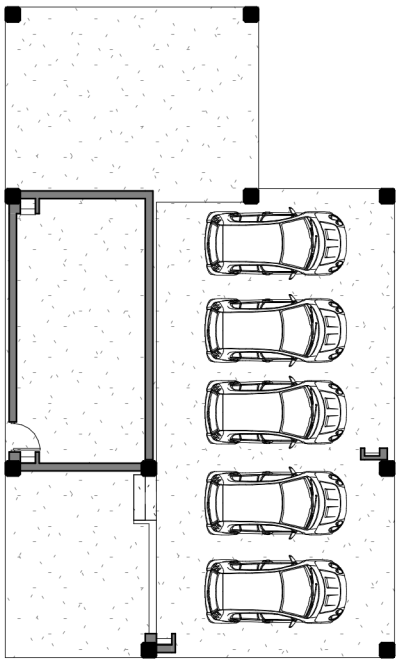
R2: 13m² / Each Unit



Rain Water Collection
+ Basic Units + Commerce

R1: 12m² / Each Unit
(9m² indoor & 3m² loggia)

Commercial use: 30m²



Rain Water Collection
+ Parking + Empty

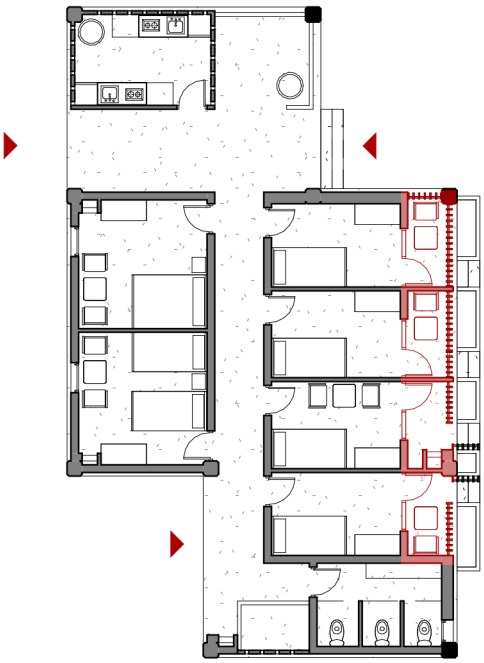
Parking: 78 m²

Area left empty: 30m²

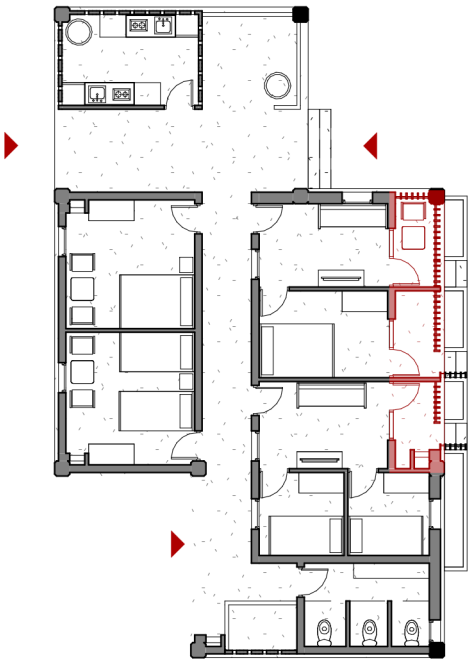
Scale 1:200

0 2m 6m 10m 20m

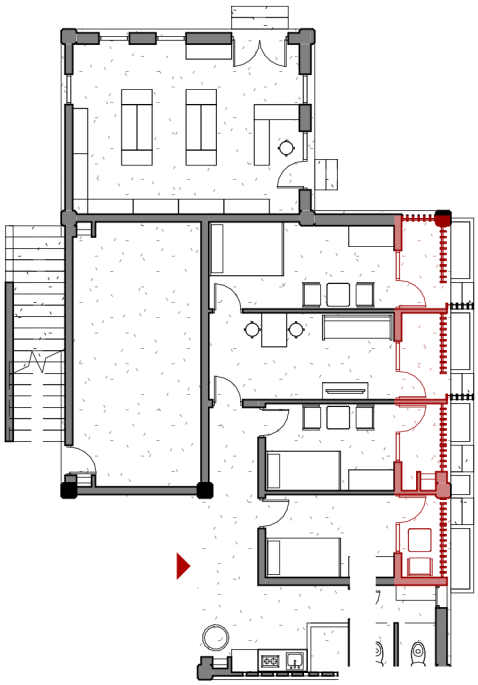
Appropriation



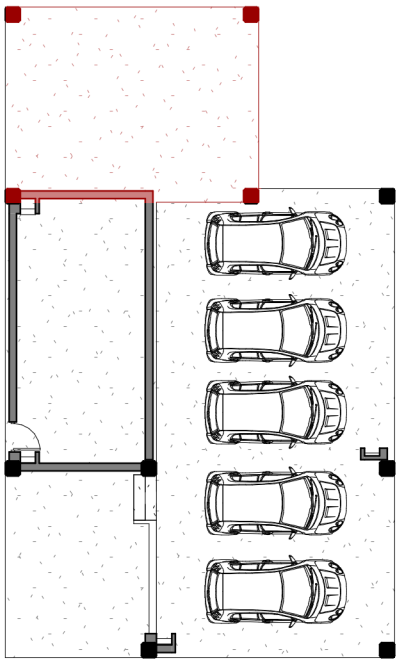
3m² from the loggia



3m² from the loggia



3m² from the loggia



30m² reserved for future use

_New Dwellers

Different unit types are offered to the new dwellers, with floor area varying from 47m² to 80 m² (including the balconies).

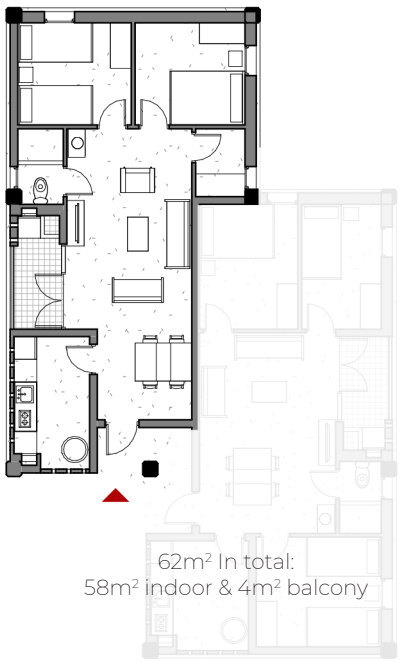
The options are listed below:

Studio: 47m²

2 Bedroom Unit: 55m² / 65m²

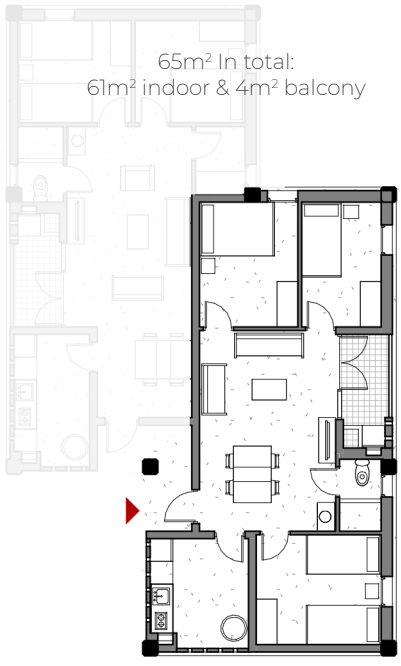
3 Bedroom Unit: 65m²/ 72m²

4 Bedroom Unit: 80m²



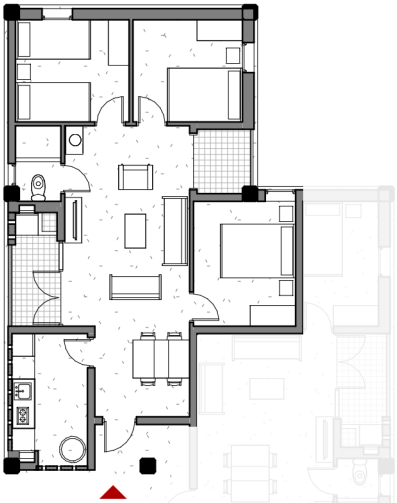
62m² In total:
58m² indoor & 4m² balcony

+

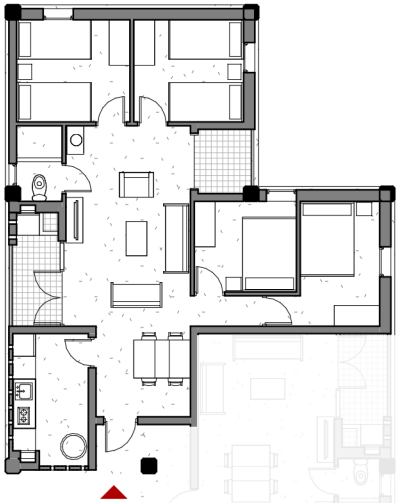


65m² In total:
61m² indoor & 4m² balcony

2BR Unit + 3BR Unit
A



72m² In total:
65m² indoor & 7m² balcony

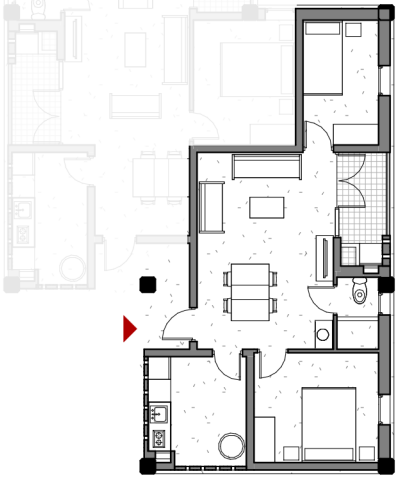


80m² In total:
73m² indoor & 7m² balcony

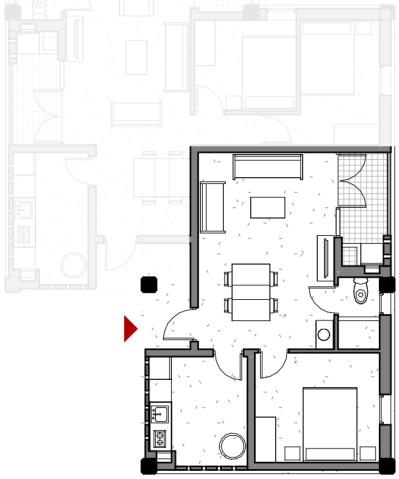
+

+

55m² In total:
51m² indoor & 4m² balcony



47m² In total:
43m² indoor & 4m² balcony



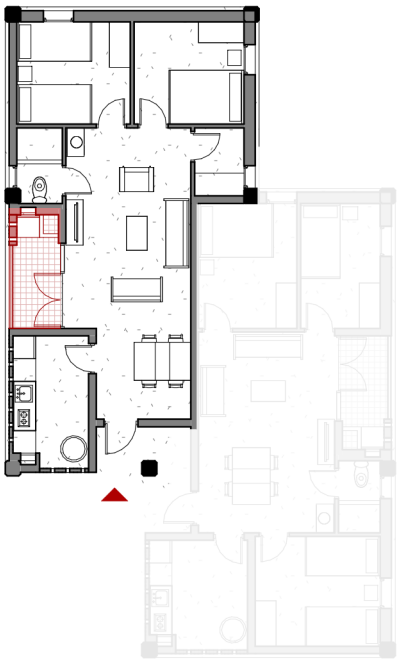
2BR Unit + 3BR Unit
B

Studio + 4BR Unit

Scale 1:200

0 2m 6m 10m 20m

4m² from the balcony



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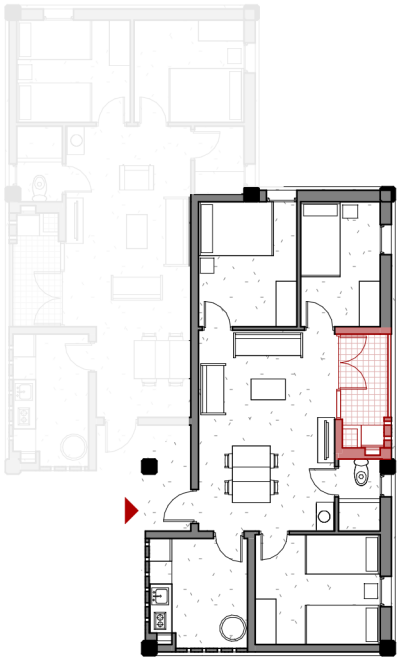
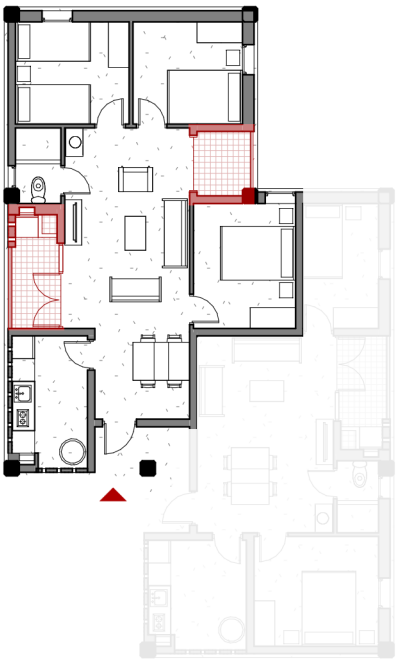
Appropriation



4m² from the balcony

7m² from the balconies



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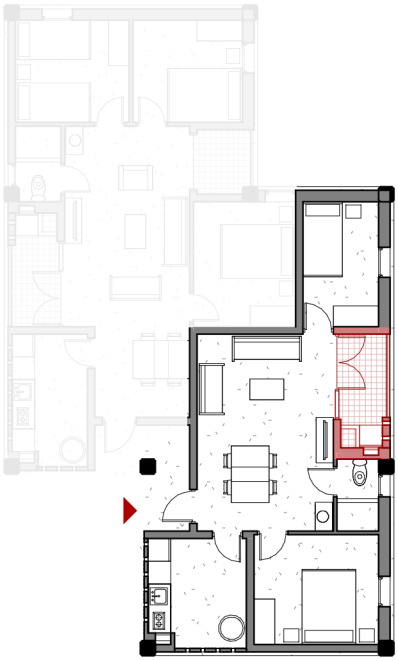
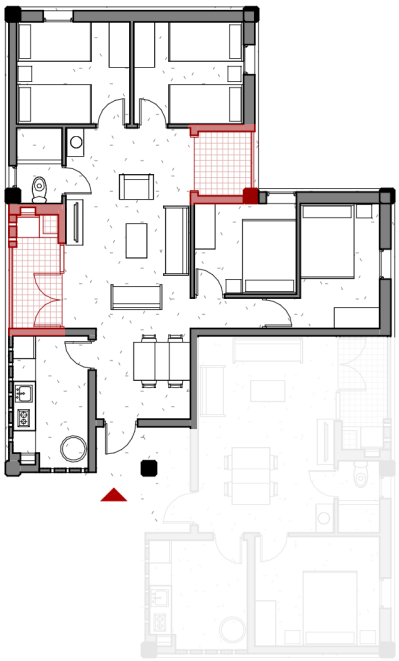


4m² from the balcony

7m² from the balconies



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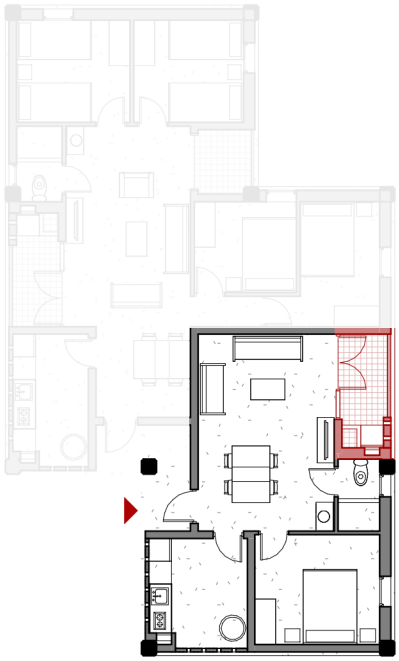
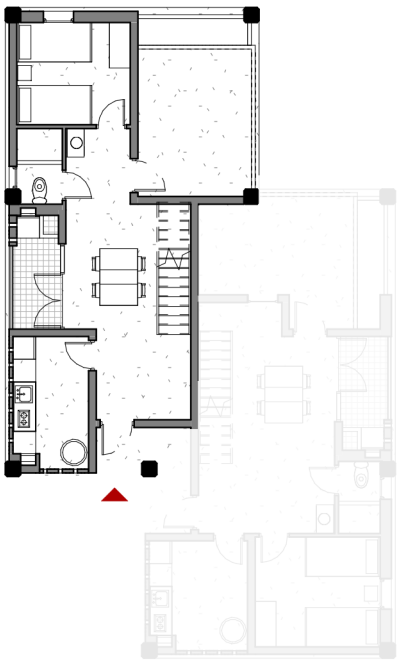


4m² from the balcony

Duplex A

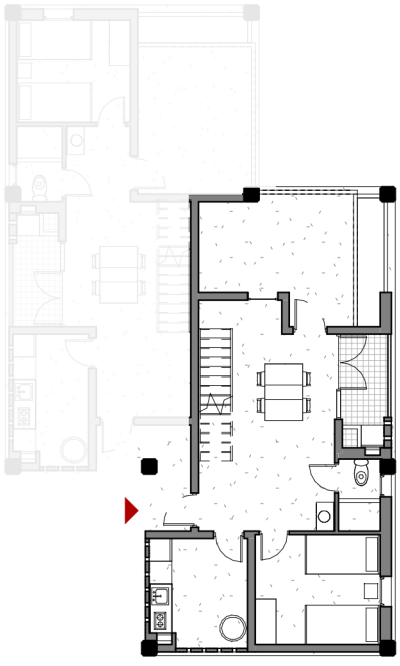
127m² In total:
89m² indoor & 38m² outdoor



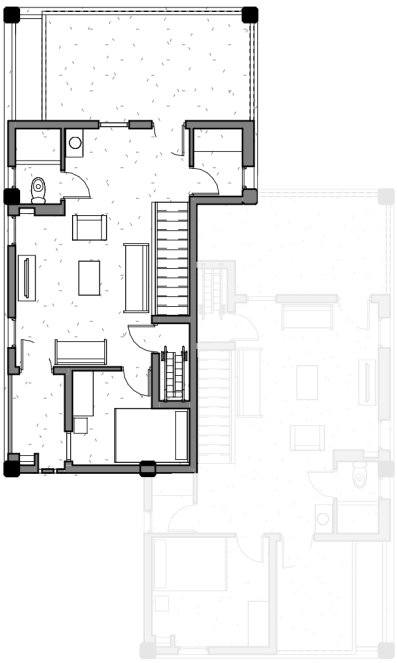
+

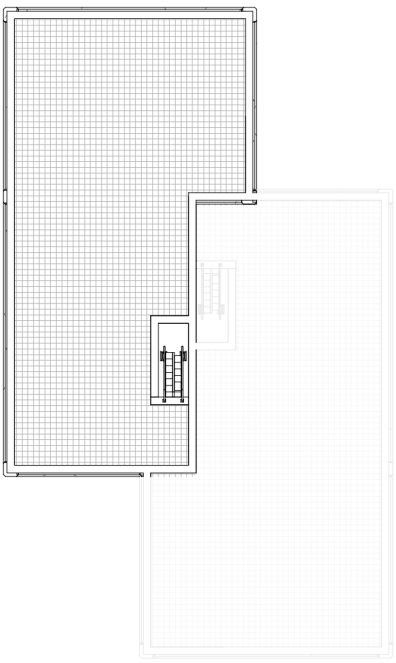
Duplex B

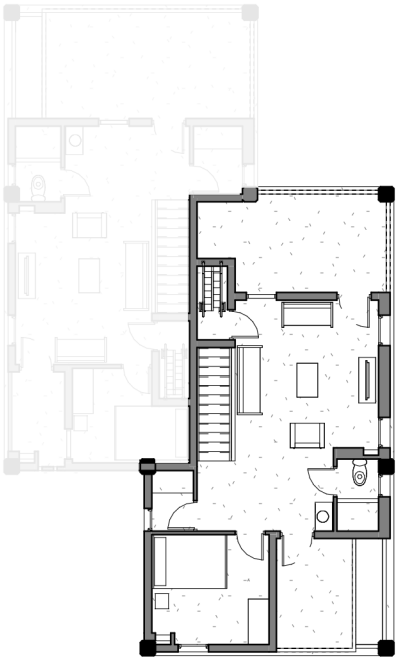
131m² In total:
89m² indoor & 42m² outdoor

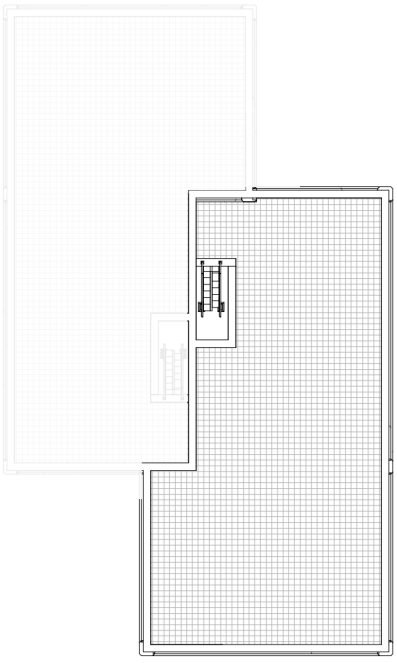


Lower Level









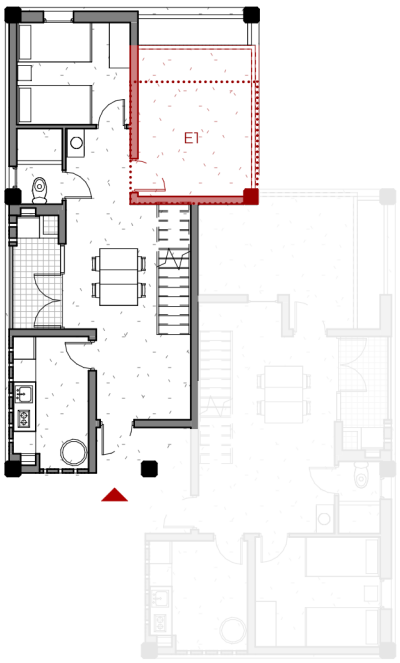
Upper Level

Private Roof Terrace

Scale 1:200

0 2m 6m 10m 20m

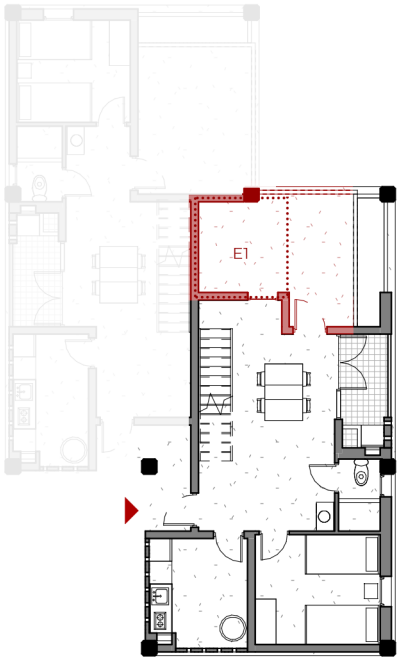
Possibilities of having 3 extra bedroom (38m²).

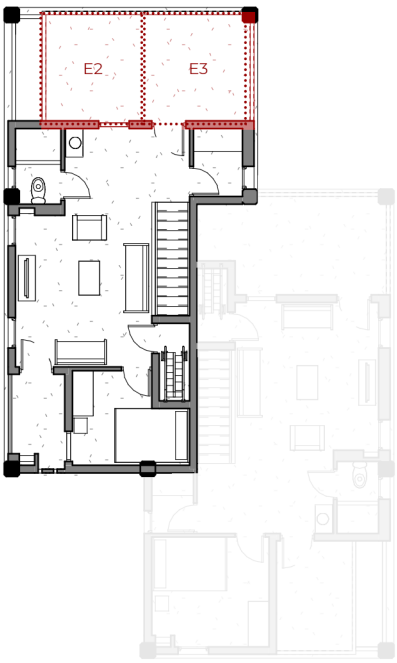


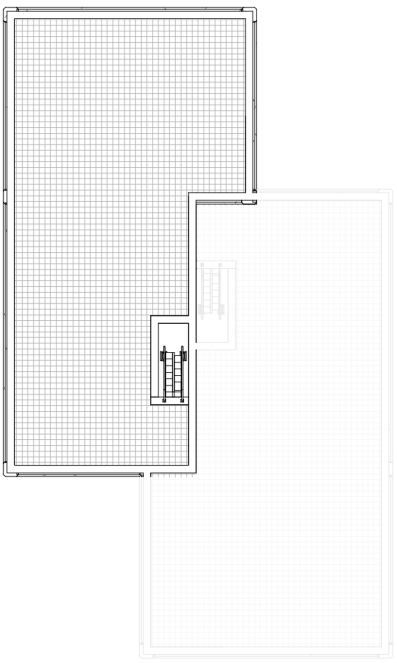
+

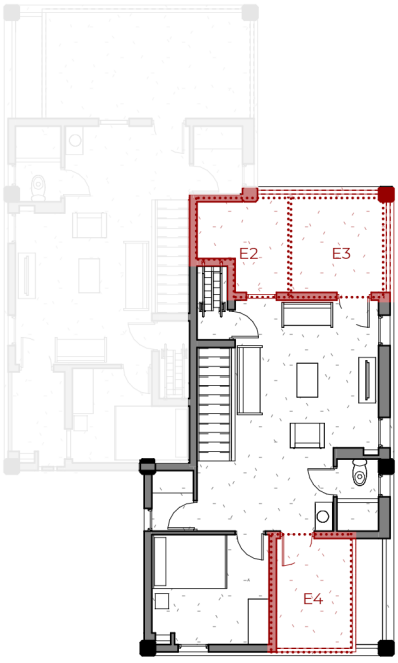
Appropriation

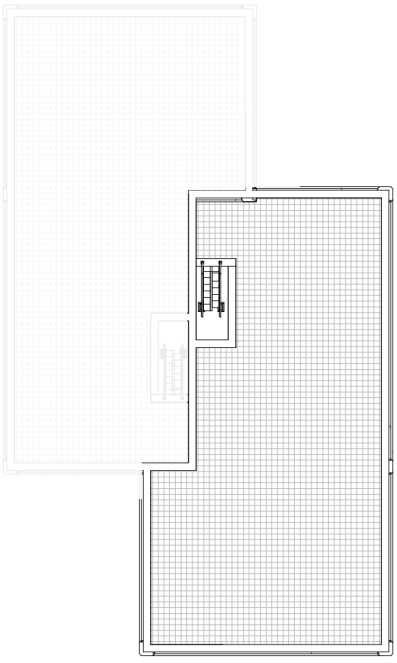
Possibilities of having 4 extra bedroom (42m²).

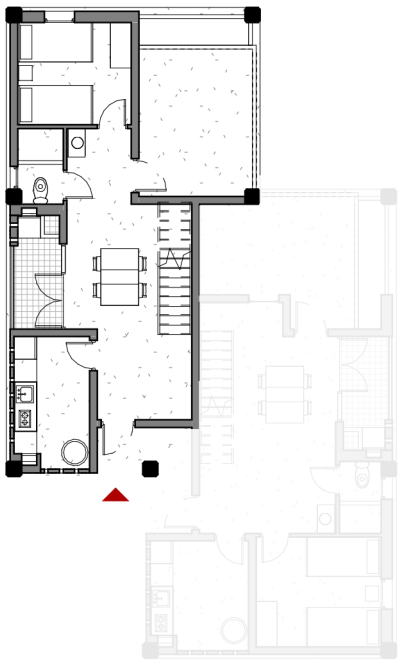



E2
E3




E2
E3
E4





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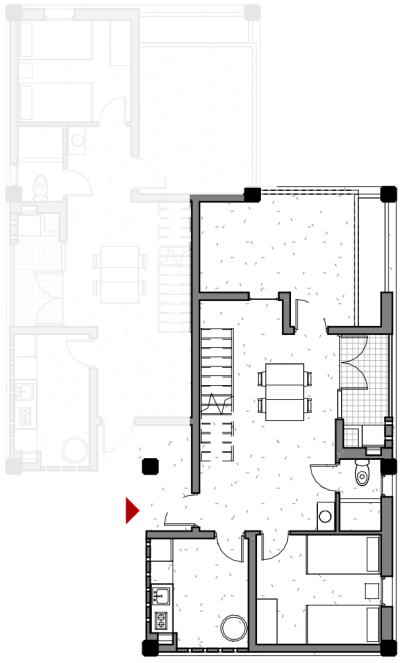
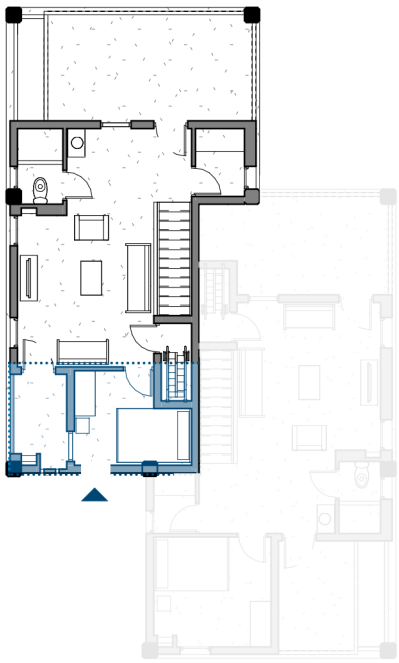
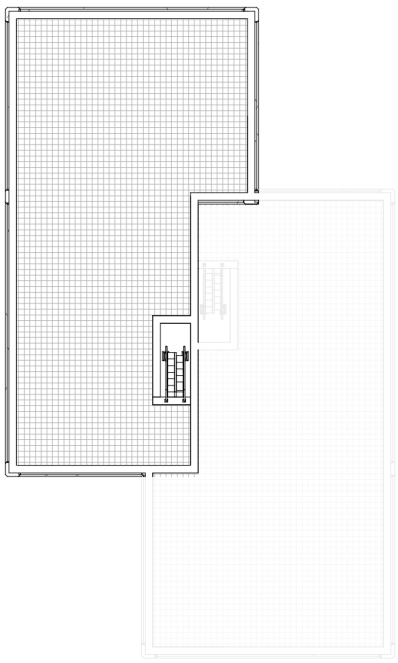
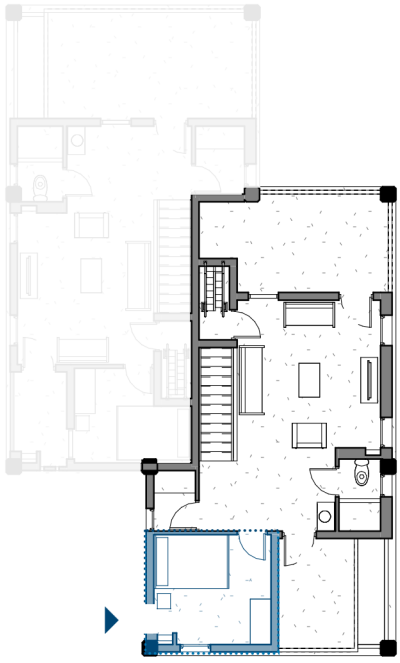
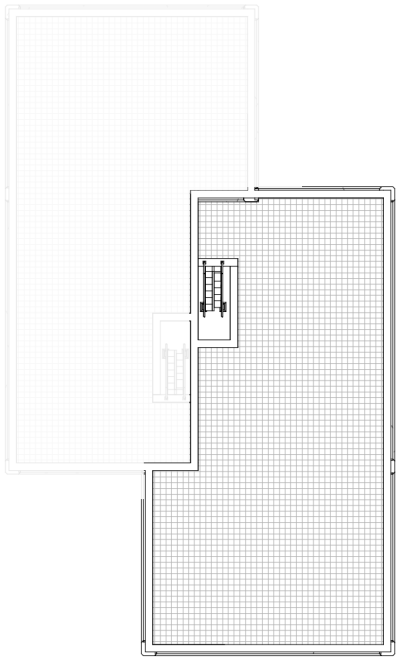
Possibility of Subletting



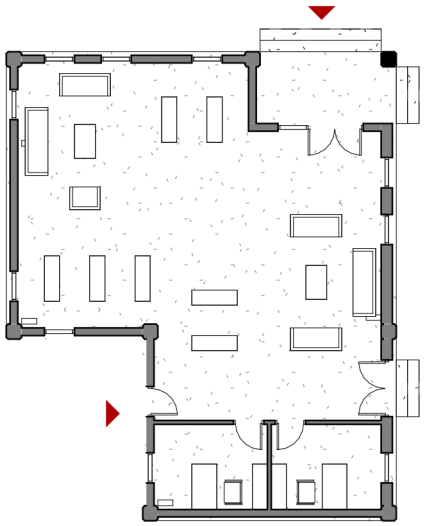








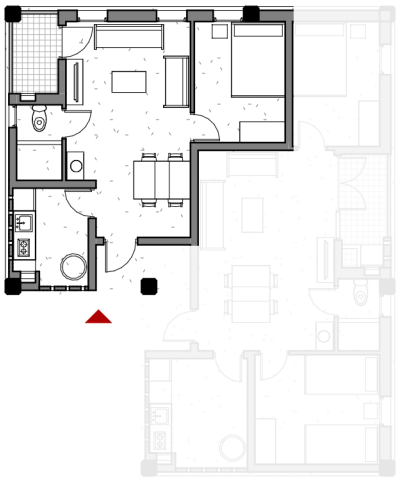
_The Corner Type

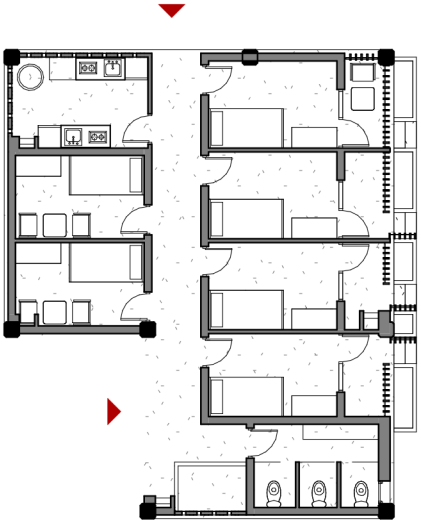


Public Use

102m²

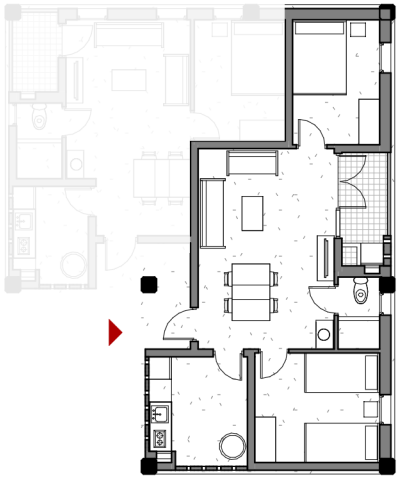
40m² In total:
37m² indoor & 3m² balcony





+

56m² In total:
52m² indoor & 4m² balcony



12m² / Each Uni t
(9m² indoor & 3m² loggia)

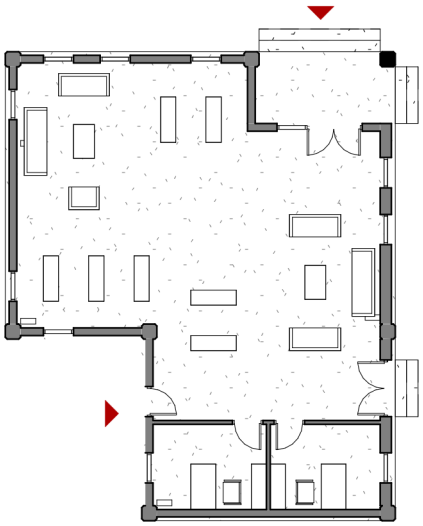
Ground Floor with Basic Rental Units

Studio + 2BR Units

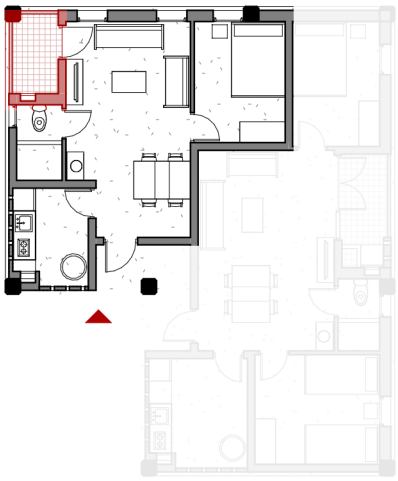
Scale 1:200

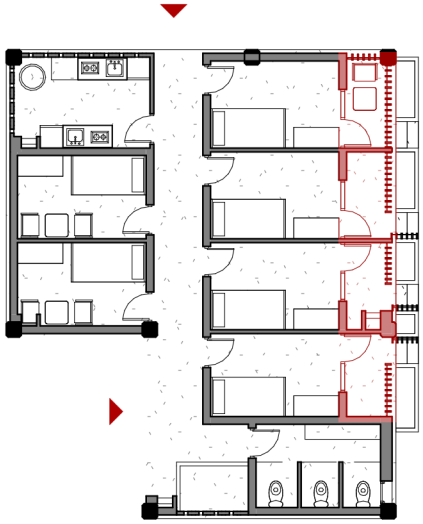
0 2m 6m 10m 20m

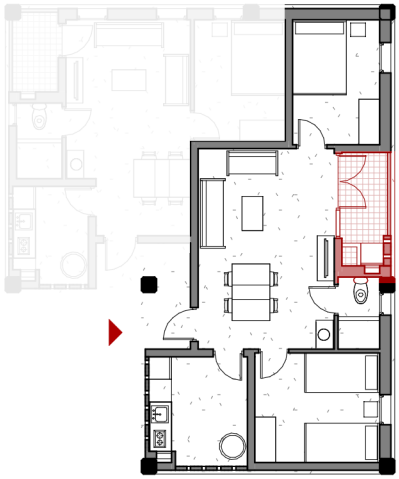
Appropriation



3m² from the balcony

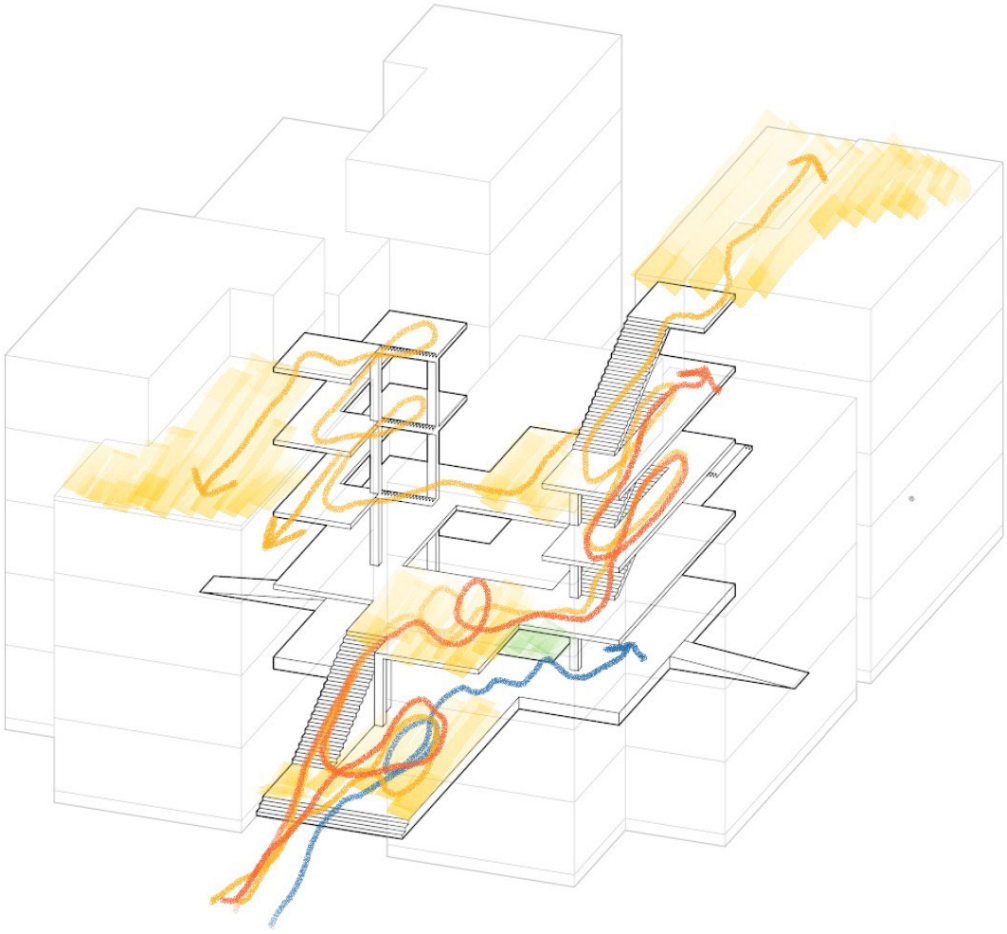






3m² from the loggia

4m² from the balcony



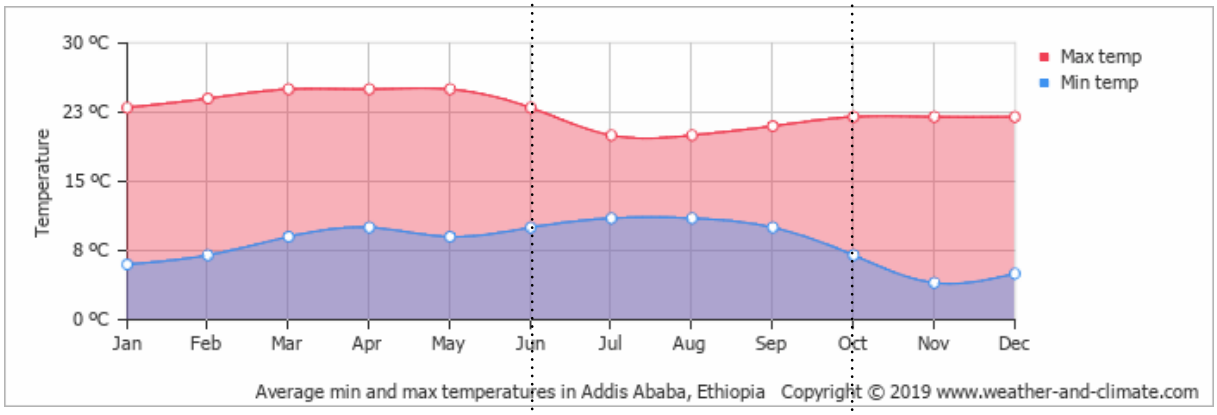
Social Interaction

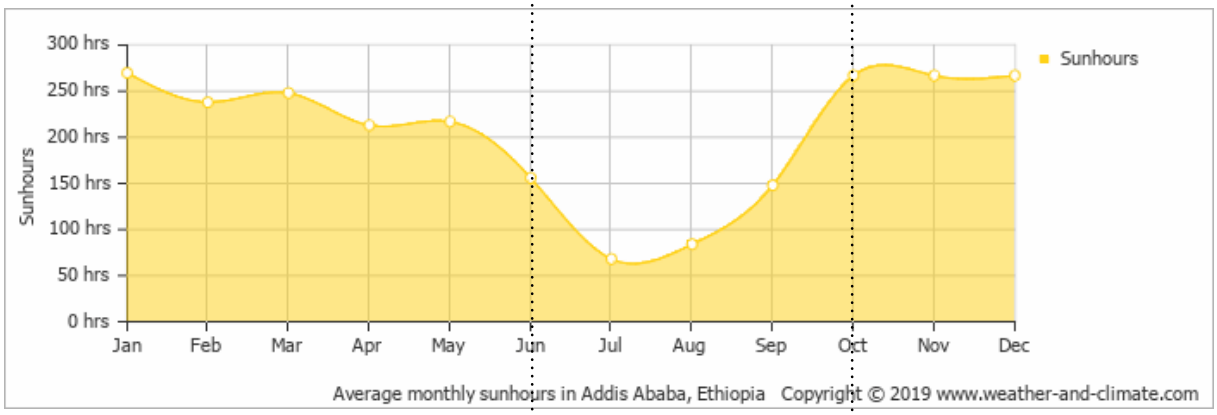

Courtyard
Platform as the second ground level.
Space on front of the apartment entrance.
Spacious unit with private terrace.
Staircase with two ends.
Shared roof terrace.
Ground Floor
First Floor
Third Floor

FEASIBILITY

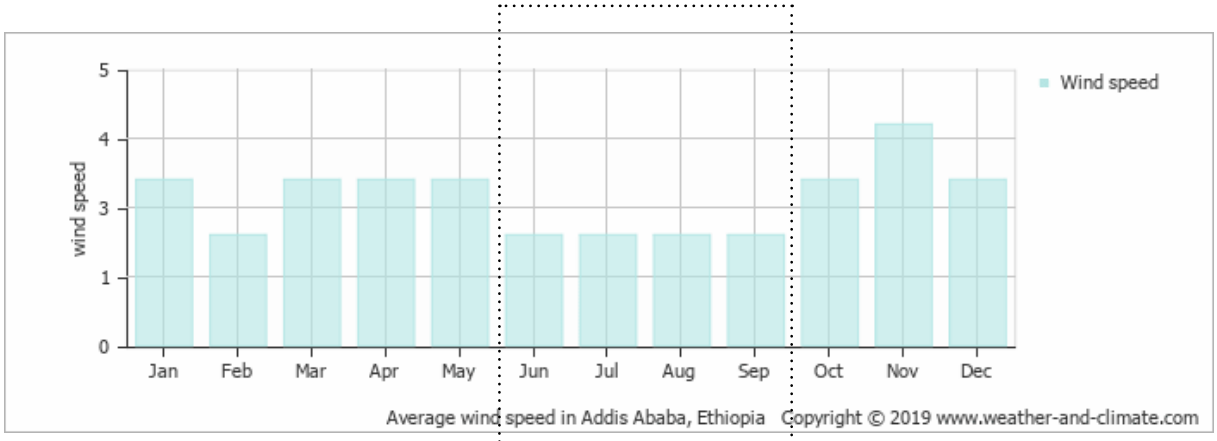
CLIMATE

_General

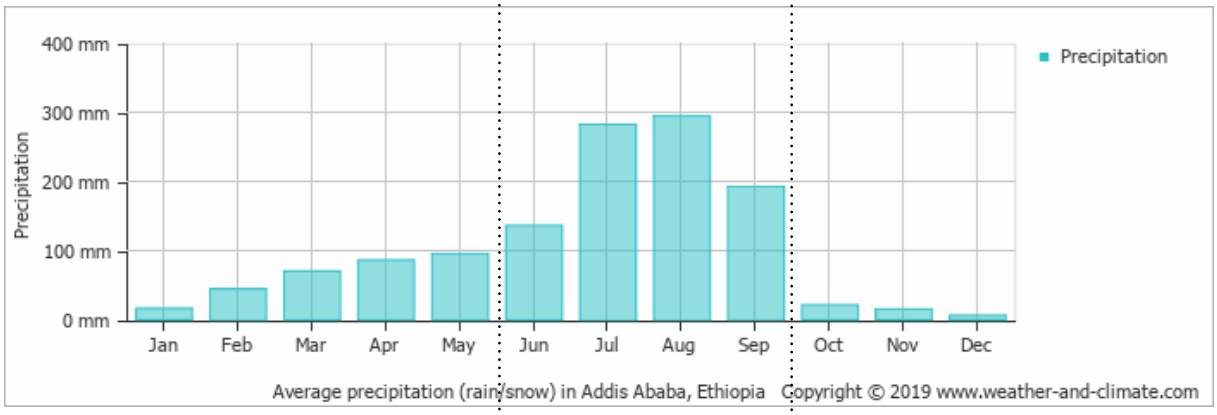


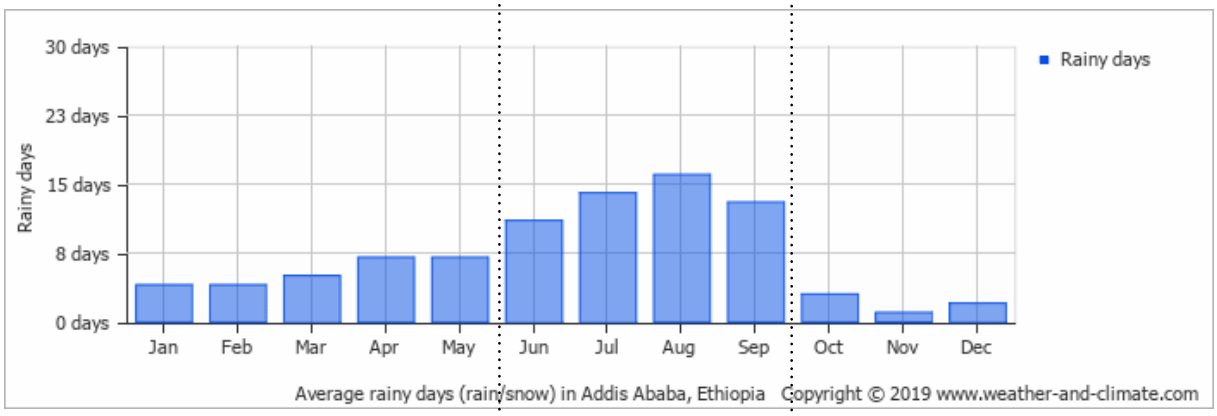


Rainy Season

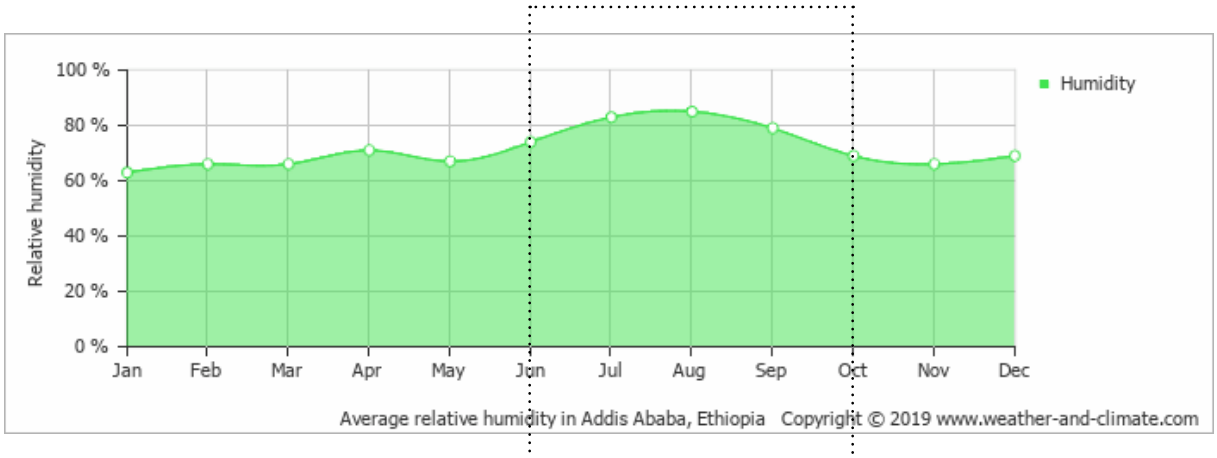


Rainy Season





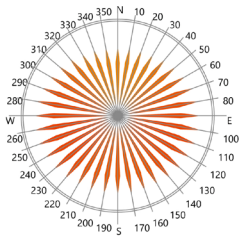
Rainy Season

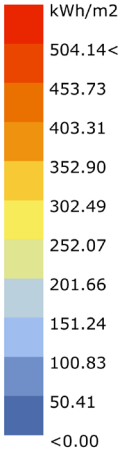


Rainy Season

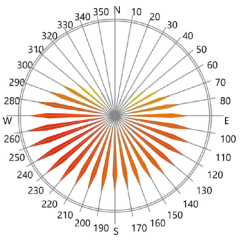
Source: weather-and-climate.com

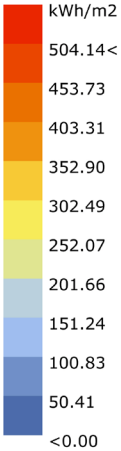
_Radiation





Diffuse Radiation(kWh/m2)
Addis_Ababa_Bole_Intl_Ap_AA_ETH_1984
1 JAN 1:00 - 31 DEC 24:00





Direct Radiation(kWh/m2)
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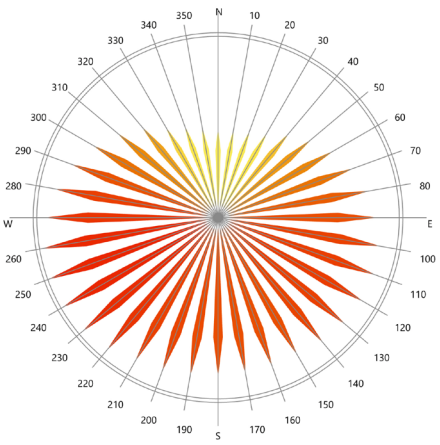

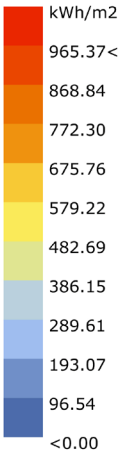

Total Radiation(kWh/m2)
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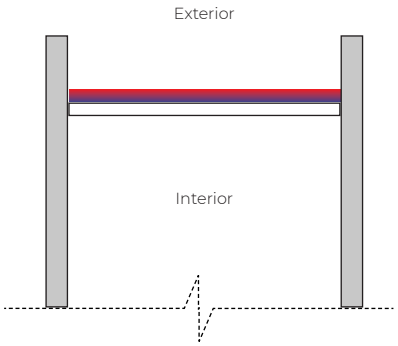
1 JAN 1:00 - 31 DEC 24:00

_Thermal Solution

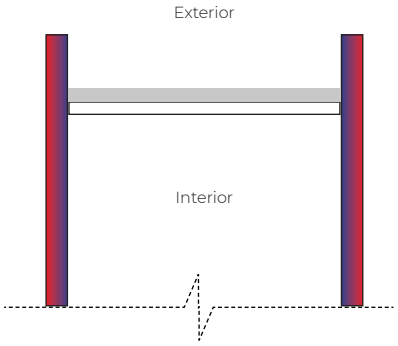
Roof Insulation

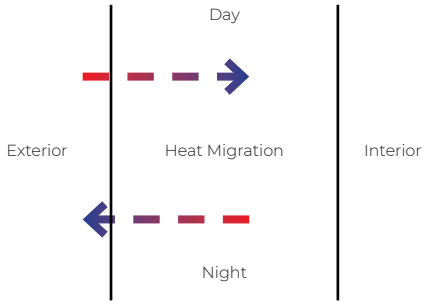


+

Roof is insuated to ensure the thermal comfort of the unit underneath.

Thermal Mass





Stabilised Compressed Earth Block Wall
* 300mm for eternal walls facing the street

Sun Shading

Open Staircase

+

Balcony

+

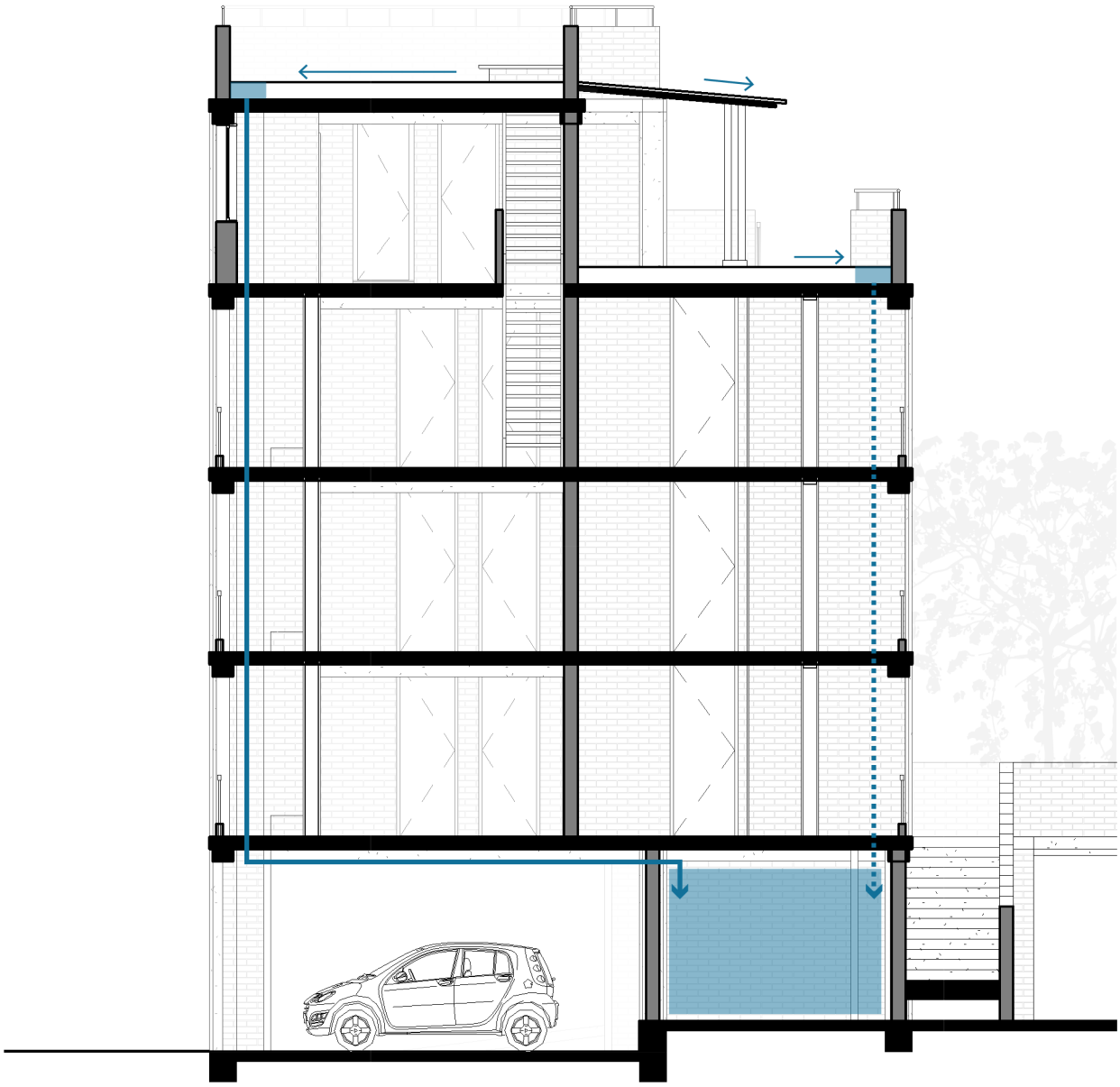
+

Window Shutter

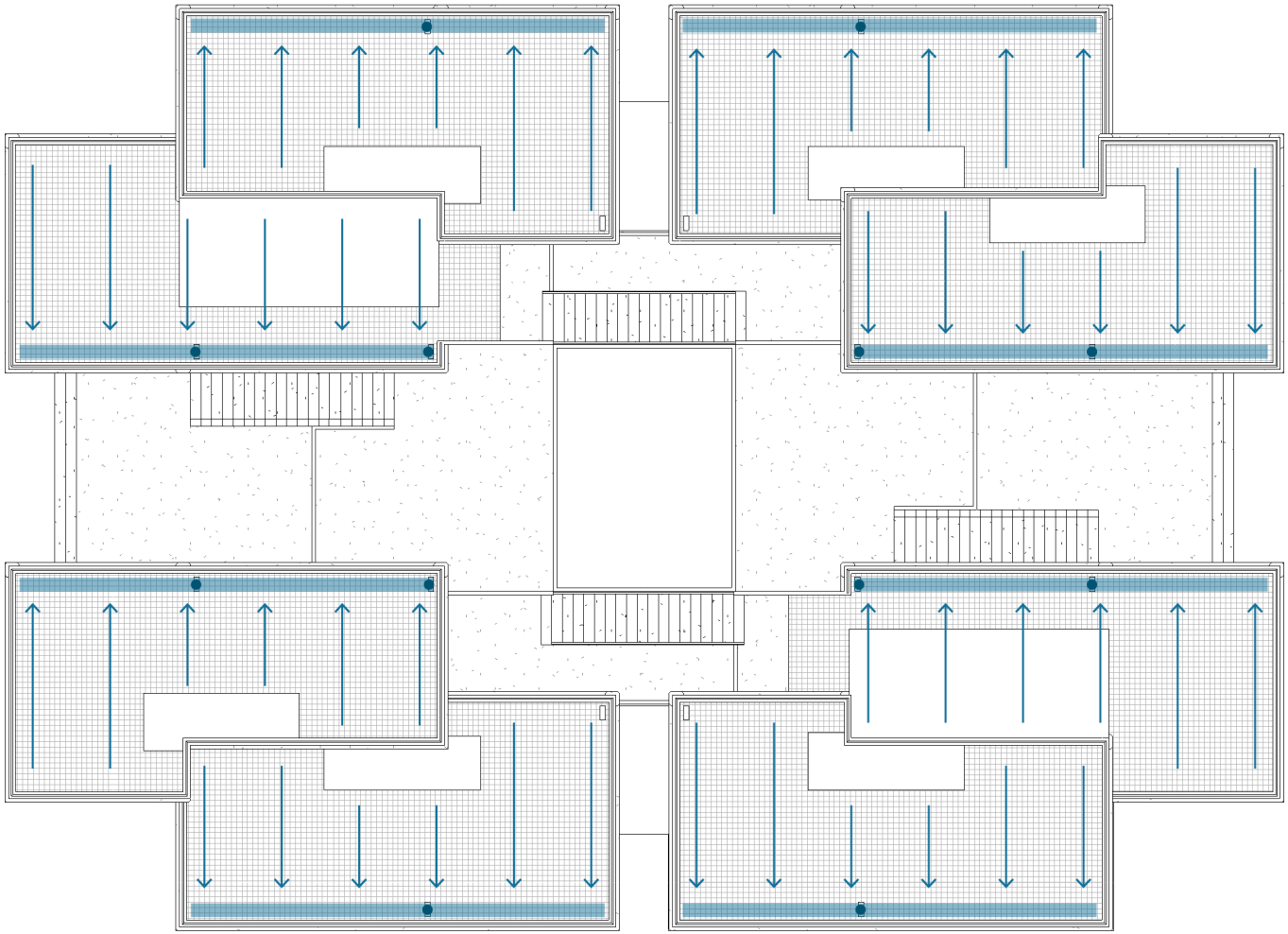
Cross Ventilation

Unit → Cluster → Neighbourhood → Site

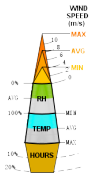
_ *Rainwater Collection*

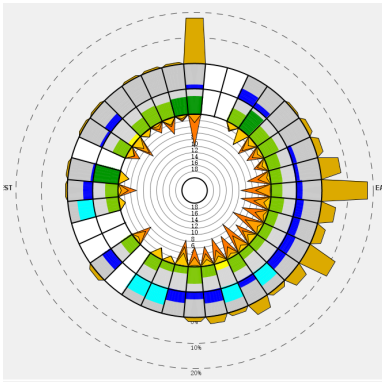


Rainwater Collection Scheme in Cluster Scale



_Wind





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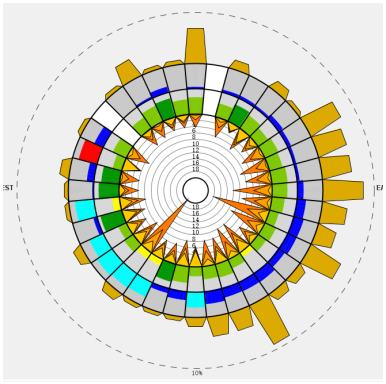

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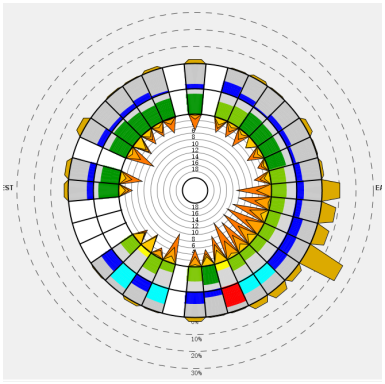

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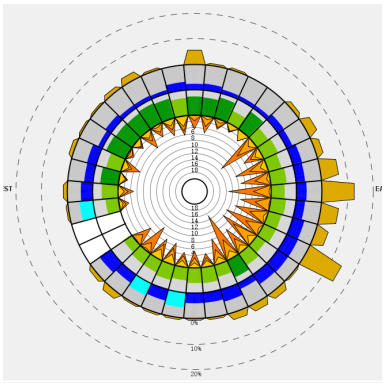

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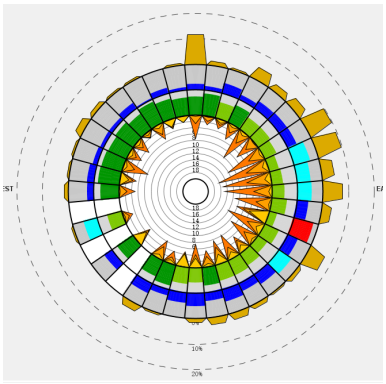

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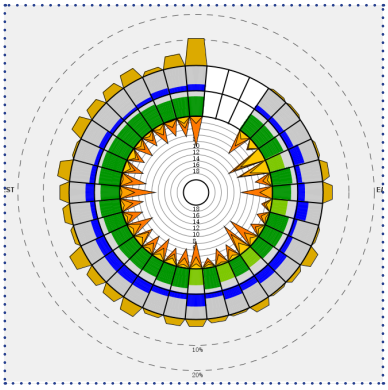

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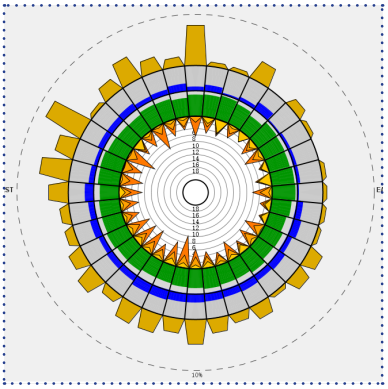

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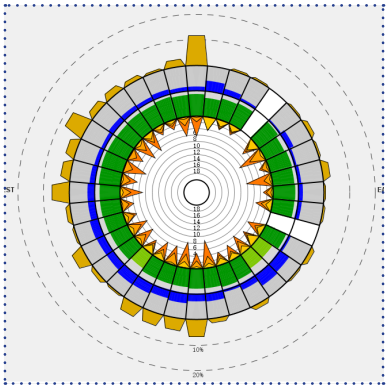

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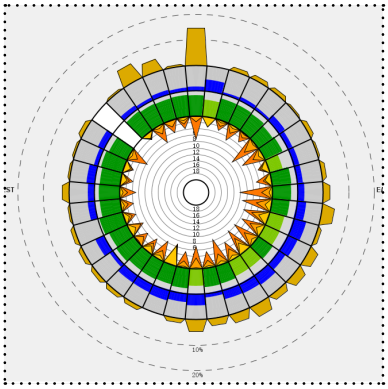

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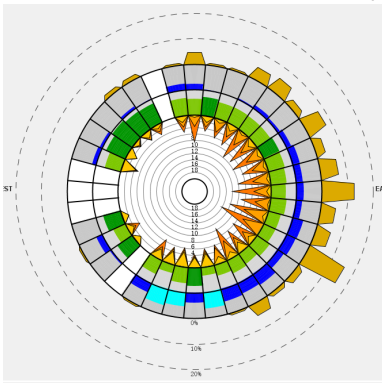

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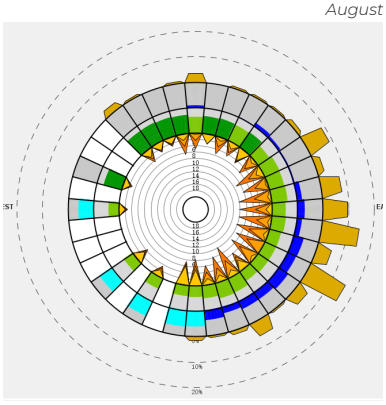

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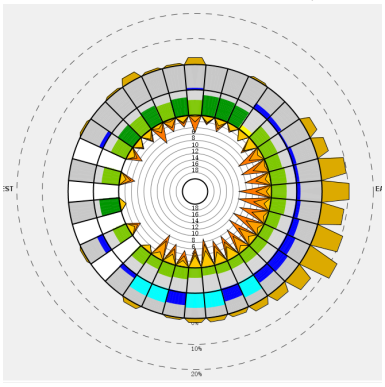

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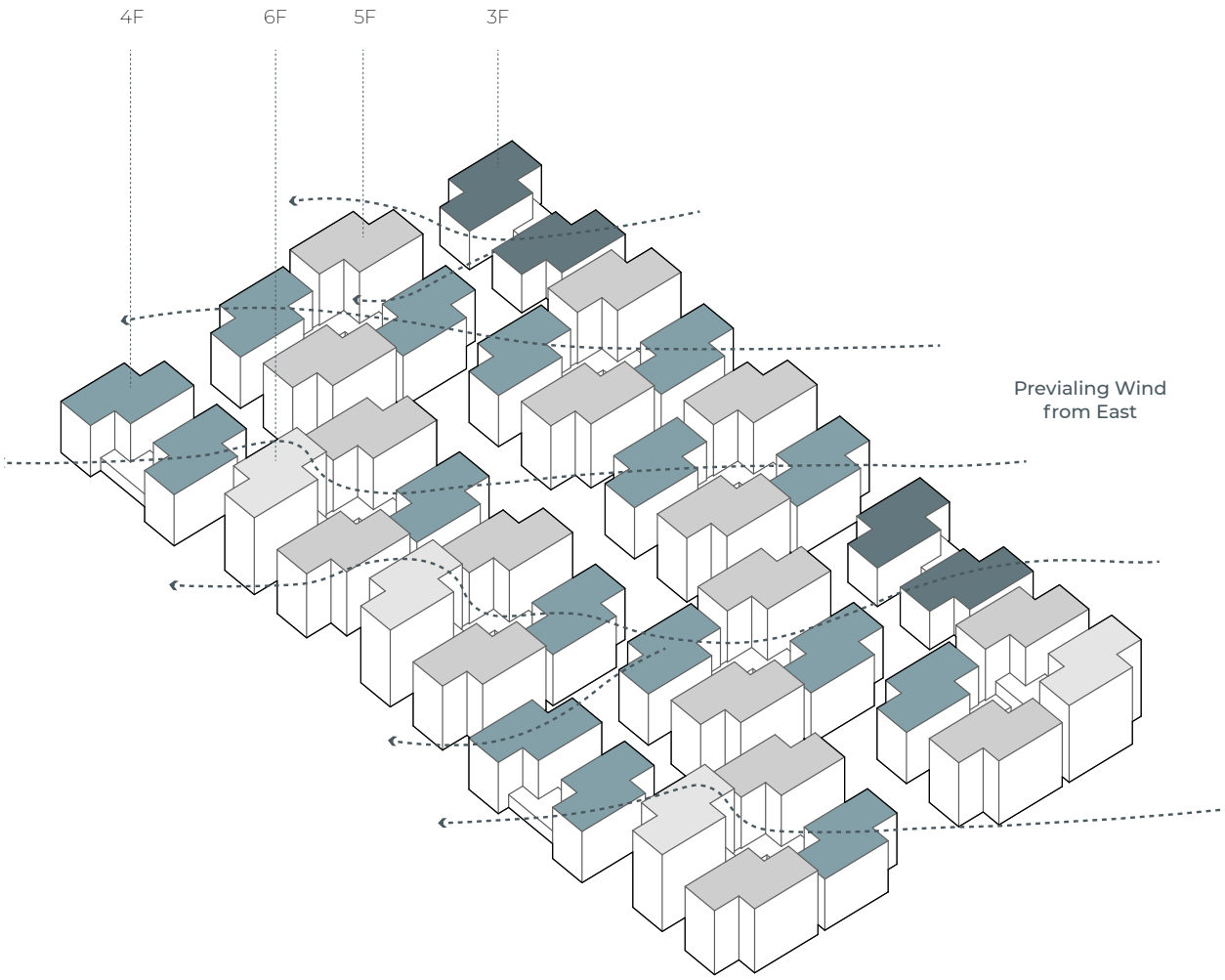
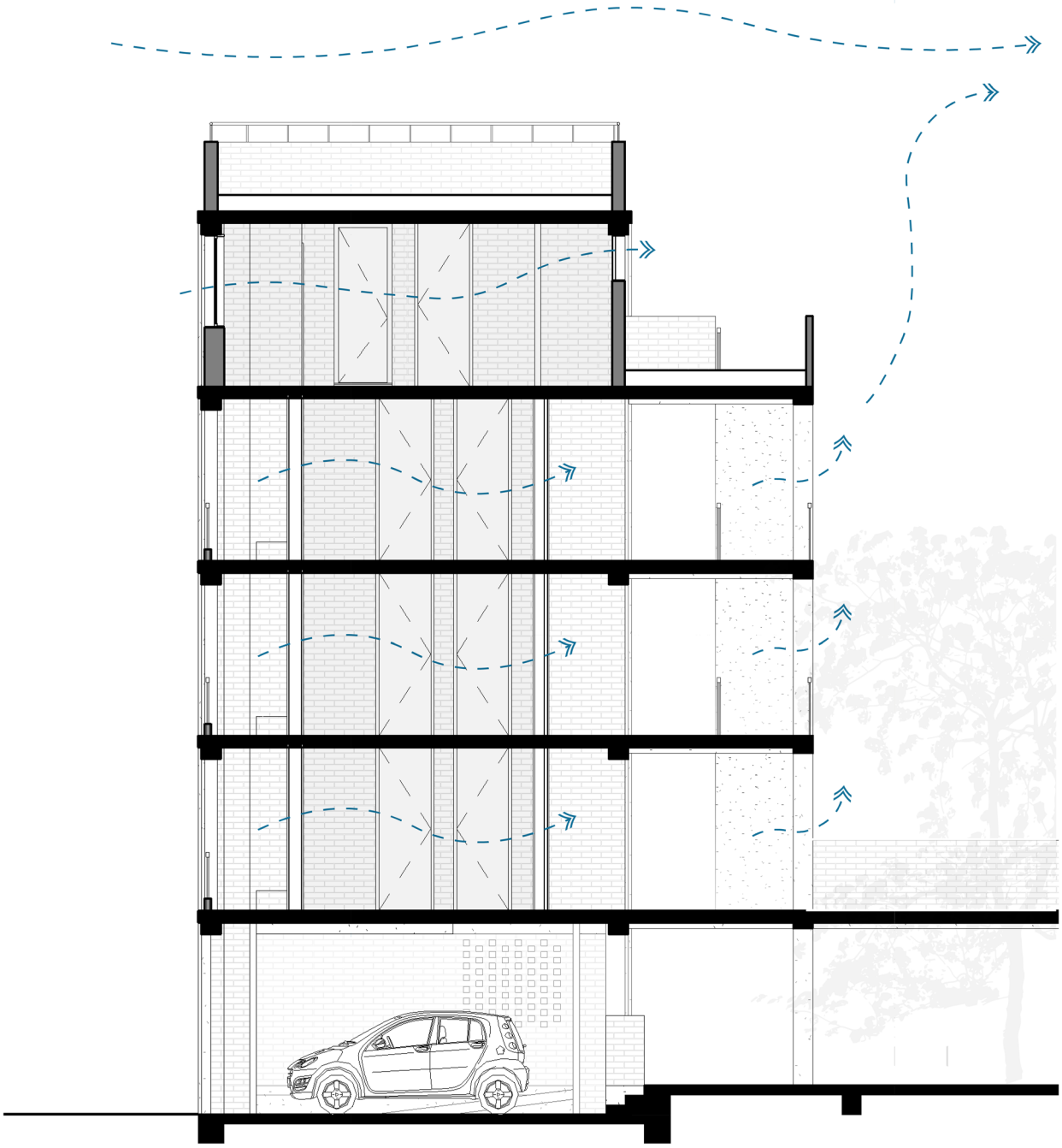
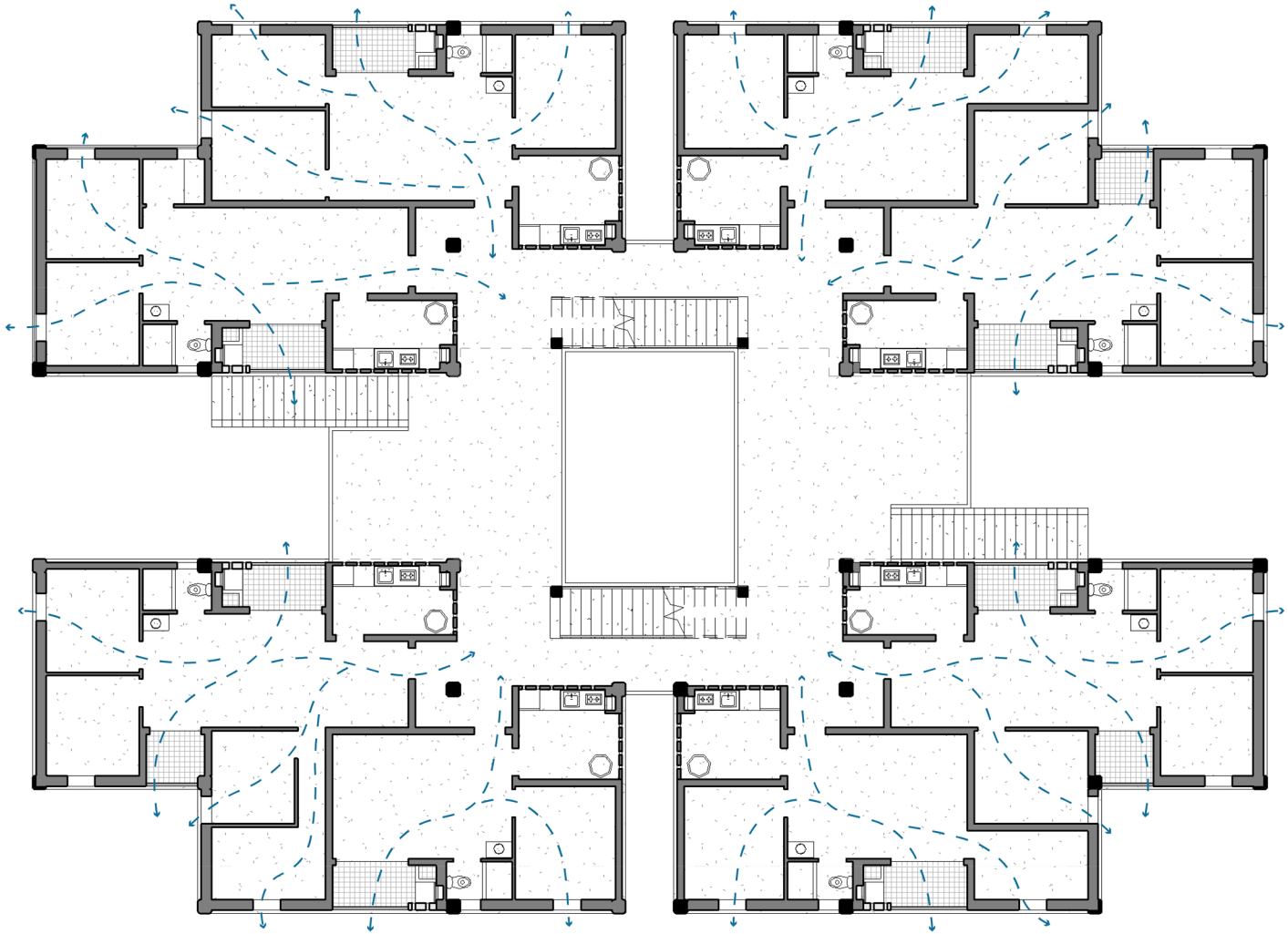


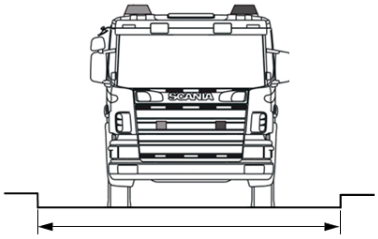
Ventilation Scheme in Neighbourhood Scale: The Formation of Wind Path



Ventilation Scheme in Cluster Scale

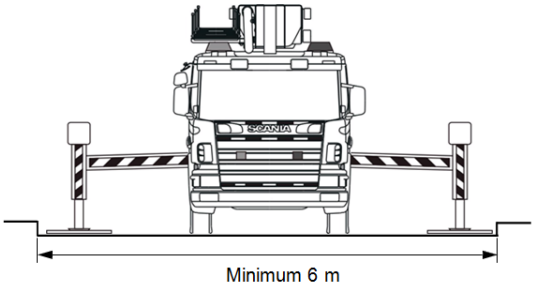


_ Route for Fire Truck & Ambulance



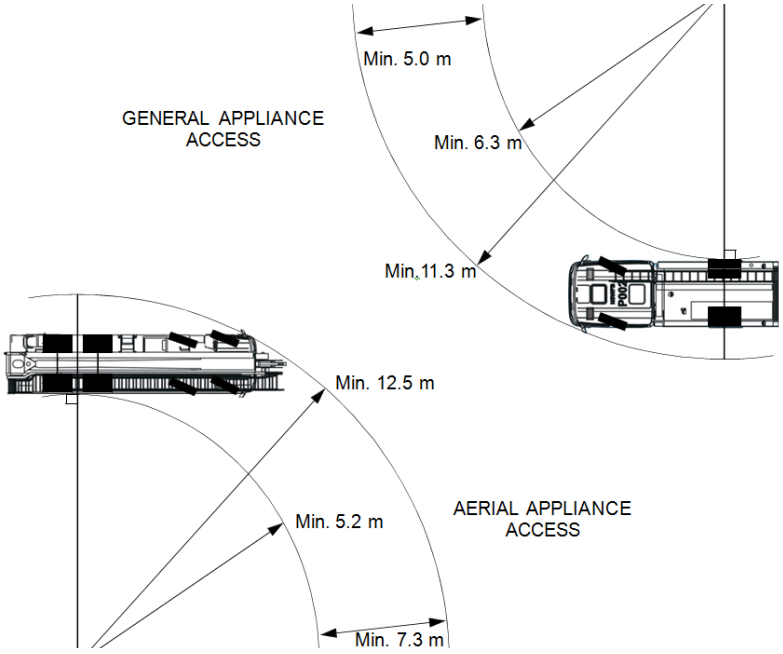
GENERAL APPLIANCE ACCESS

Minimum 4 m
(3.5 m at entrances)

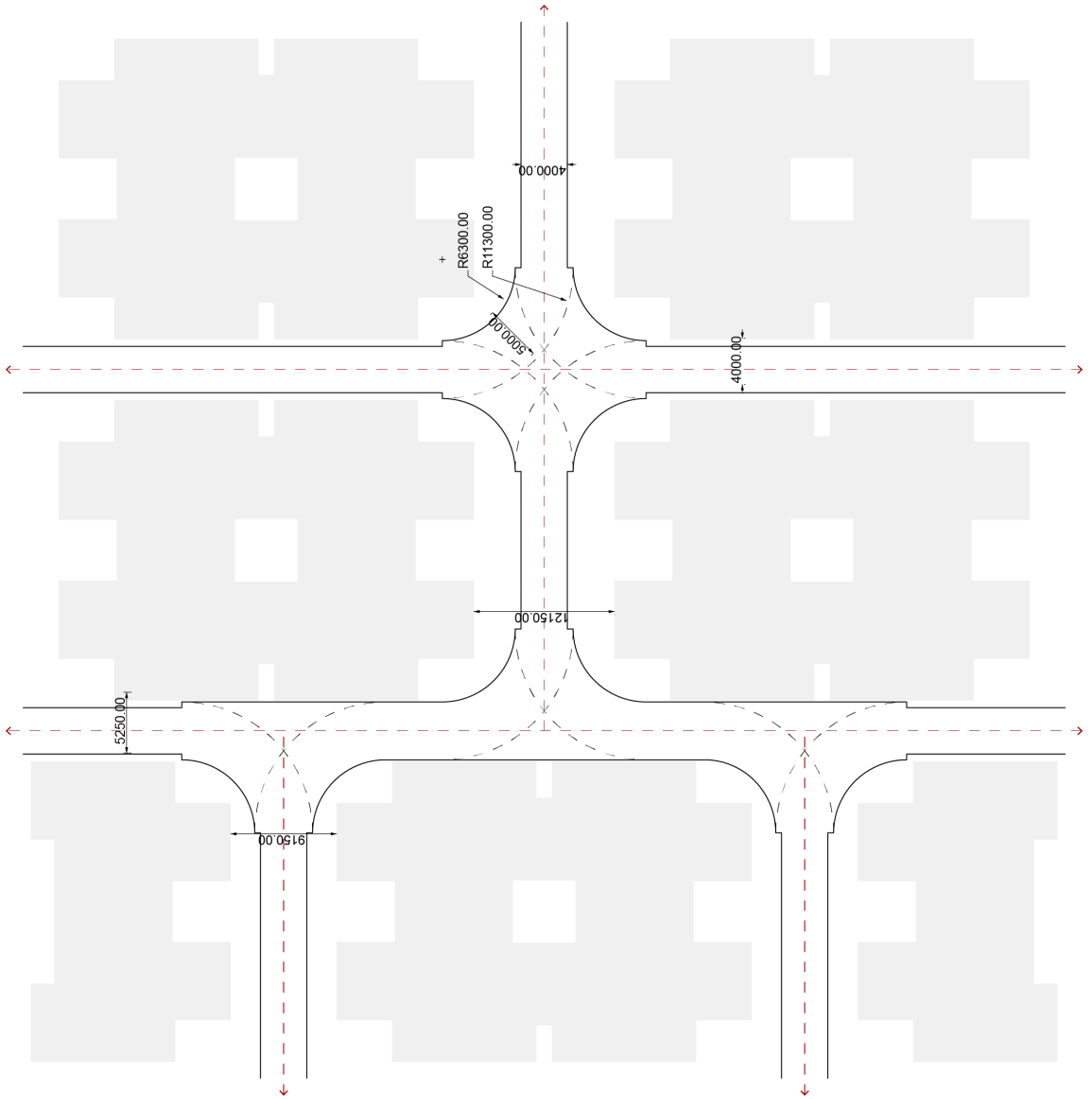


AERIAL APPLIANCE ACCESS

Minimum 6 m



Source: Emergency vehicle access guidelines New Zealand 2015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4000.00
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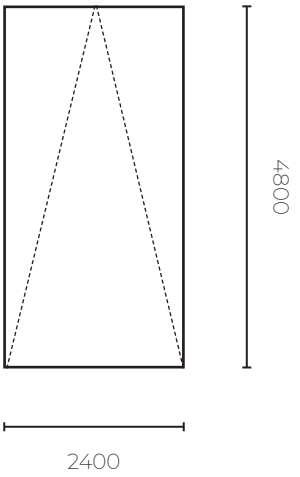
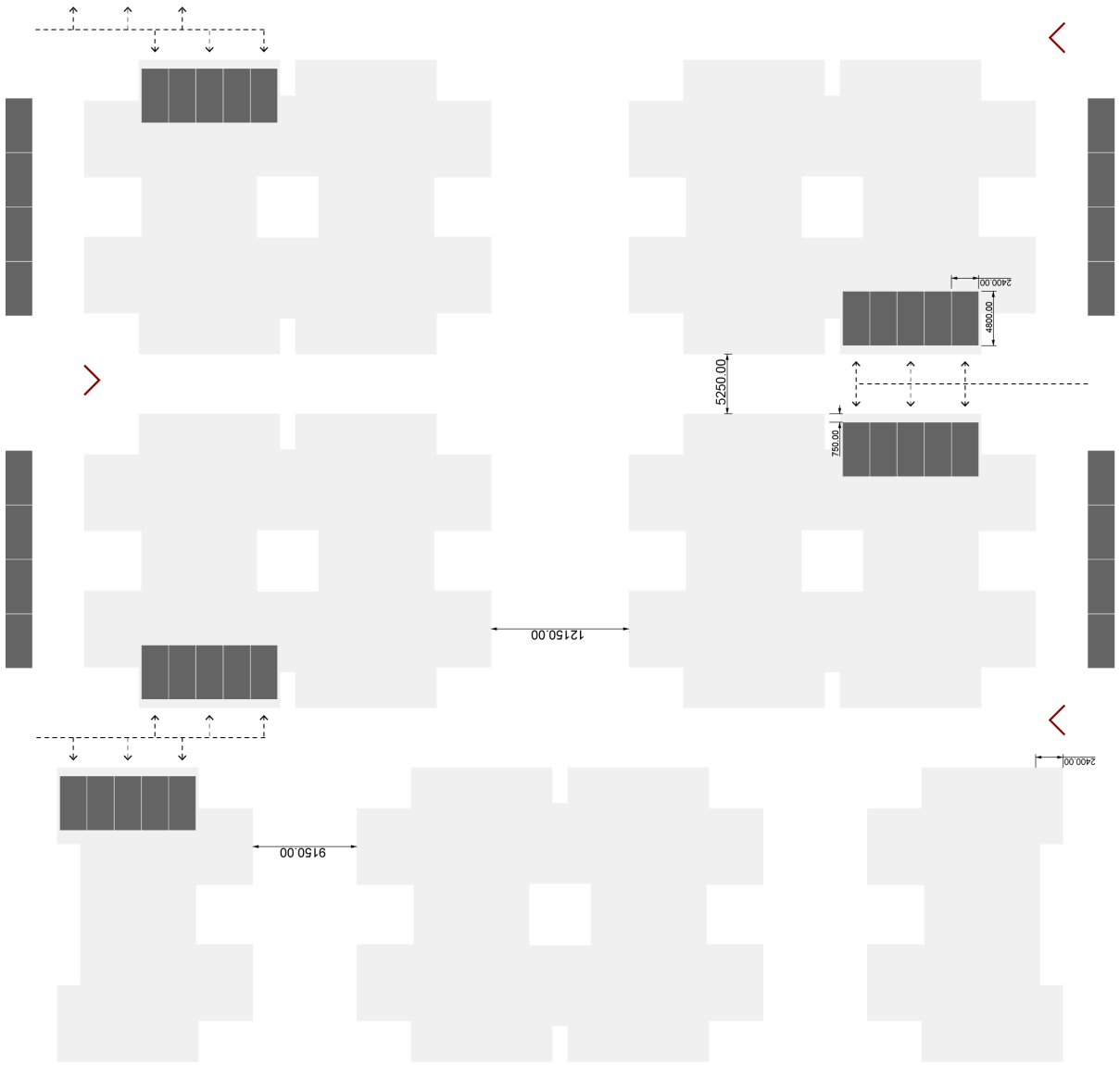
5250.00
9150.00

_ *Possible Parking Solution*



Indoor Parking + Road Side Parking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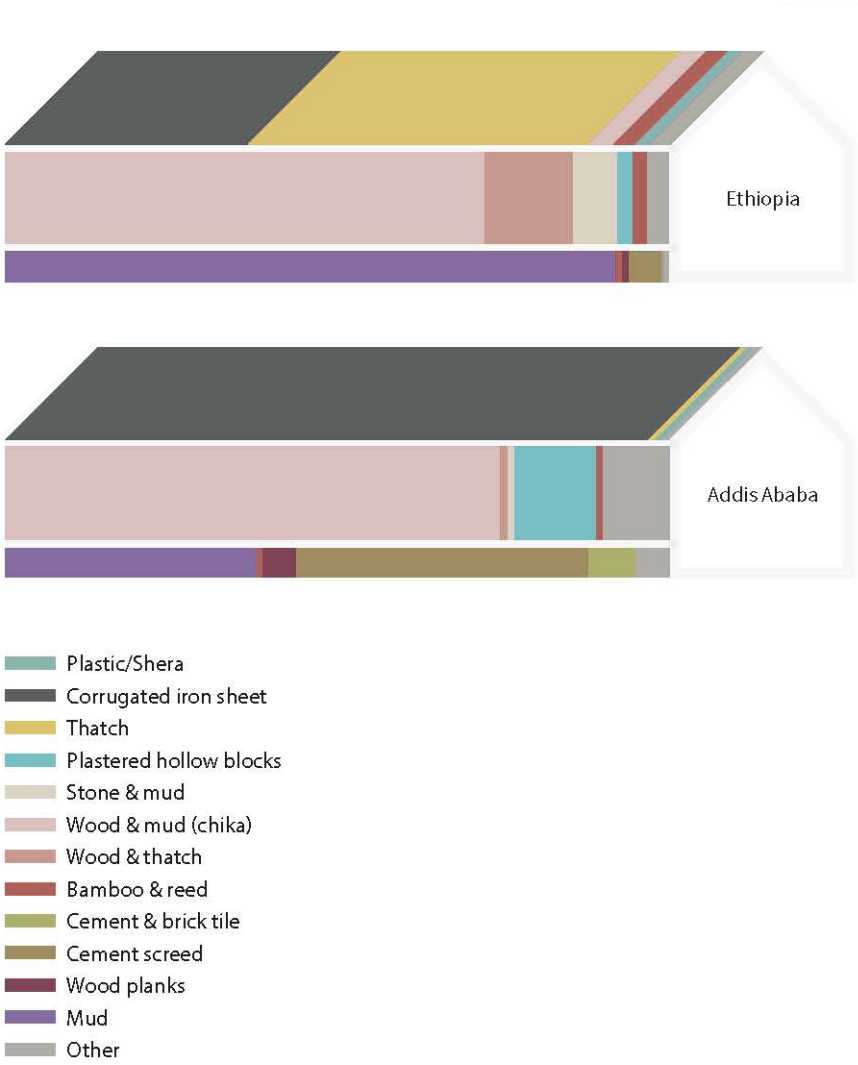
MATERIALITY

_ Current Situation



Share of Construction Material in Addis Ababa and Ethiopia

The prevalence of construction materials in each region are based primarily on the accessibility in the direct surrounding and the climate in which the building is constructed.

The primary roof construction material in Ethiopia, especially in rural area, are predominantly constructed in thatch. 37 % of all roofs in Ethiopia are constructed with corrugated iron sheets. Looking at Addis Ababa the share of corrugated iron sheets as roof spiked to around 98%. Other notable materials are plastic roofing (shera) used mostly in the Somali region; wood and mud roofing; and the combination of bamboo and reed. (Central Statistical Agency, 2007)

For wall constructions, the combination of eucalyptus wood and mud forming the traditional “chika” walls account for 73.6% of the building material of all the residential buildings in Ethiopia. Wood and mud wall construction is especially common in central- and western Ethiopian region like Amhara, Oromiya, Benishangul Gumuz, SNNP, Gambella, Harar, and Addis Ababa, where the houses of more than 65 percent of the total regional population have walls constructed with these materials. Wood and thatch for wall-building material are predominantly used in eastern regions like Somali and Afar. Another material used in large part of Addis Ababa is the plastered hollow block construction in the condominiums projects, accounting for 13% of the construction materials. Other building materials used less frequently are stone and cement, unplastered hollow block, brick, corrugated iron, and mud brick. Many areas use a combination of the materials mentioned for wall building material.

Mud is the most prevalent as a floor material throughout Ethiopia, with a share of 92% of the total floor construction. Addis Ababa is one of the few places where a significant amount of cement floors (almost 40%) are used.

Chika



Thatch Roof



Wood Frame
Covered with Plastic

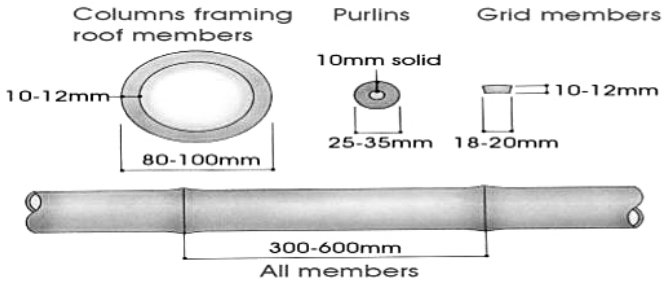


Source: Group research on Addis Ababa, Hard Data, Global Housing Studio 2019

Bamboo in Ethiopia

Bamboo as a resource is abundant in Ethiopia (about 67% of the continent and 7% of the world in total). However, it is not commonly used in building industry. But on the other hand, there are local faculties that are able to manufacture bamboo products.

Sizes

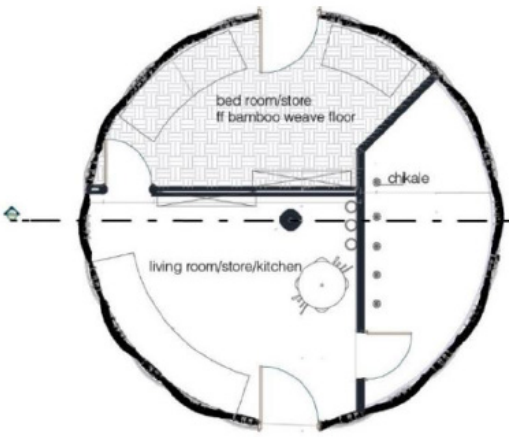


Laminated Bamboo



Application of Bamboo in Ethiopian Traditional Houses





_ *Corrugated Metal Sheet*



The using of corrugated metal sheet as the fencing between public and private territory has its most strong presence in Addis Ababa.



Another less obvious use would be the roof surface.



It is also commonly used in the case when people would built an extension in their courtyard. That would more often be a kitchen or bedroom.

_ *Concrete Hollow Blocks*



Concrete hollow block is a key material in the construction of condominium housings.



In the site of Gerji, it could also be found as fence materials.



And as well in Kolfe low-cost housing site.

_ *Earthy Materials*

Comparison of Earthy Materials

	Image	Pro & Con
Rammed earth		Pro: - Walls retain heat during the day and slowly release it at nigh - Easy to work with. Can be built with little to no experience. - Easy to acquire building materials that can be had locally. Con: - Space taking & Less modify possibility after construction - Labour Intense - Colder climates may require added insulation, like a foam wall with stucco on the outside. - Difficulty in designing the forms, circular shapes are usually out.
Prefabricated Rammed earth Panel		Pro: Similar as above. - Fast construction Con: - Space taking
Mud brick		Pro: - Less sound transmitting through walls. - Good flexibility in the construction and design - Could be easily cut for fitting Cons: - Life of mud bricks is limited, will not stand the test of time. - It generally has low resistance to stain as it has high porosity.
Clay brick		Pro: - A relatively low-maintenance building material, thanks to its durability and colour retention. - It won't rot or dent and doesn't need to be painted after installation. Cons: - Relatively expensive compared to the other materials.
(Stabilised) Compressed earth brick		Pro: - Depending in the quality of the soil, can be up to five times stronger than concrete blocks. - Ten times more thermally efficient then concrete blocks. - Produces less CO2 and consumes less energy than clay bricks. - Relatively easy to shape, round shapes are possible - inexpensive - Sound Proof And Resistant To Fire And Pests Cons: - The amount of people able to uses and build with this material is limited at the moment.

Keke primary school



Clay brick

El Haj Yousif experimental school



(Stabilised) Compressed earth brick

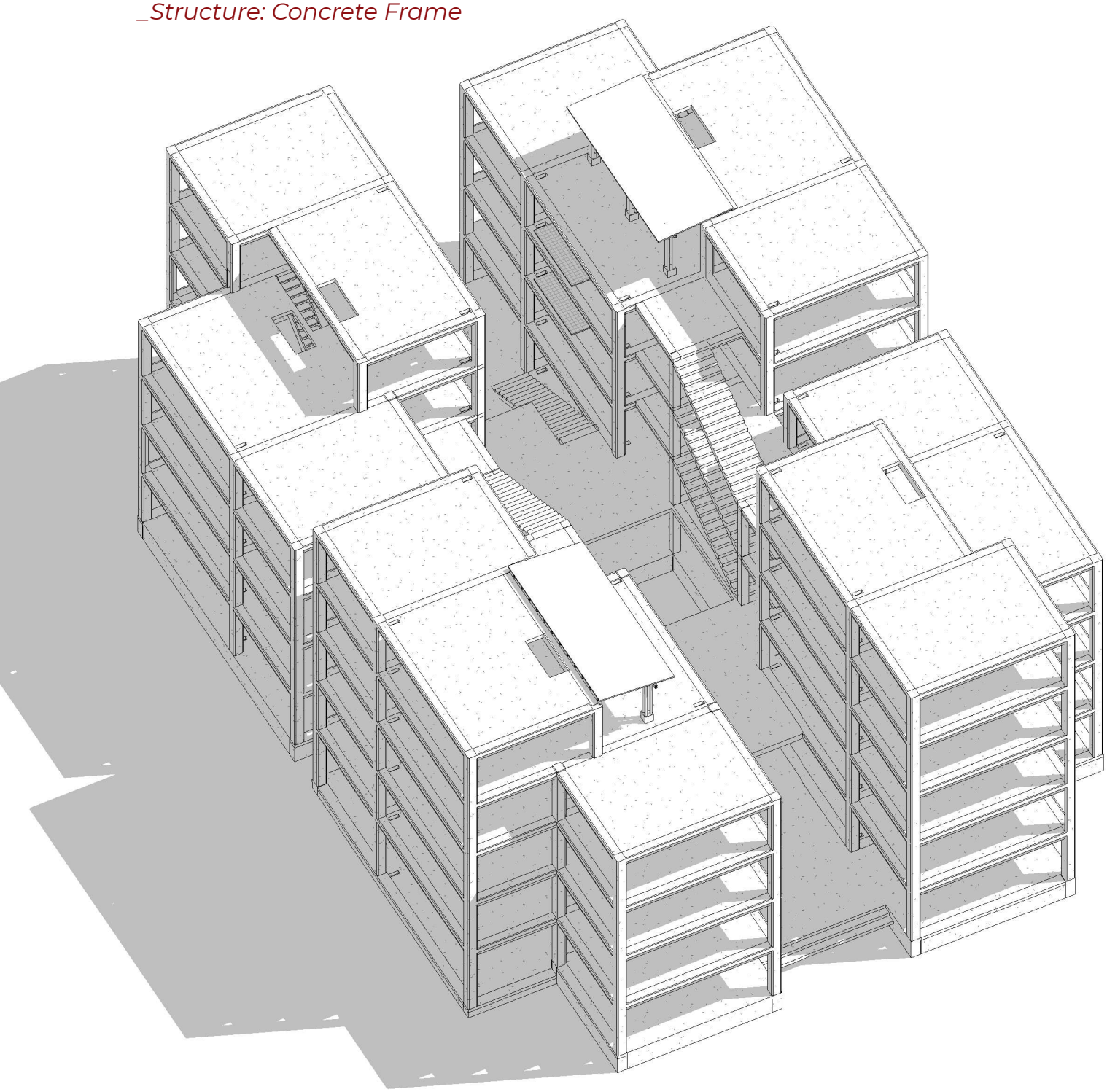
Primary School Tanouan Ibi





THE FORMAL CONSTRUCTION

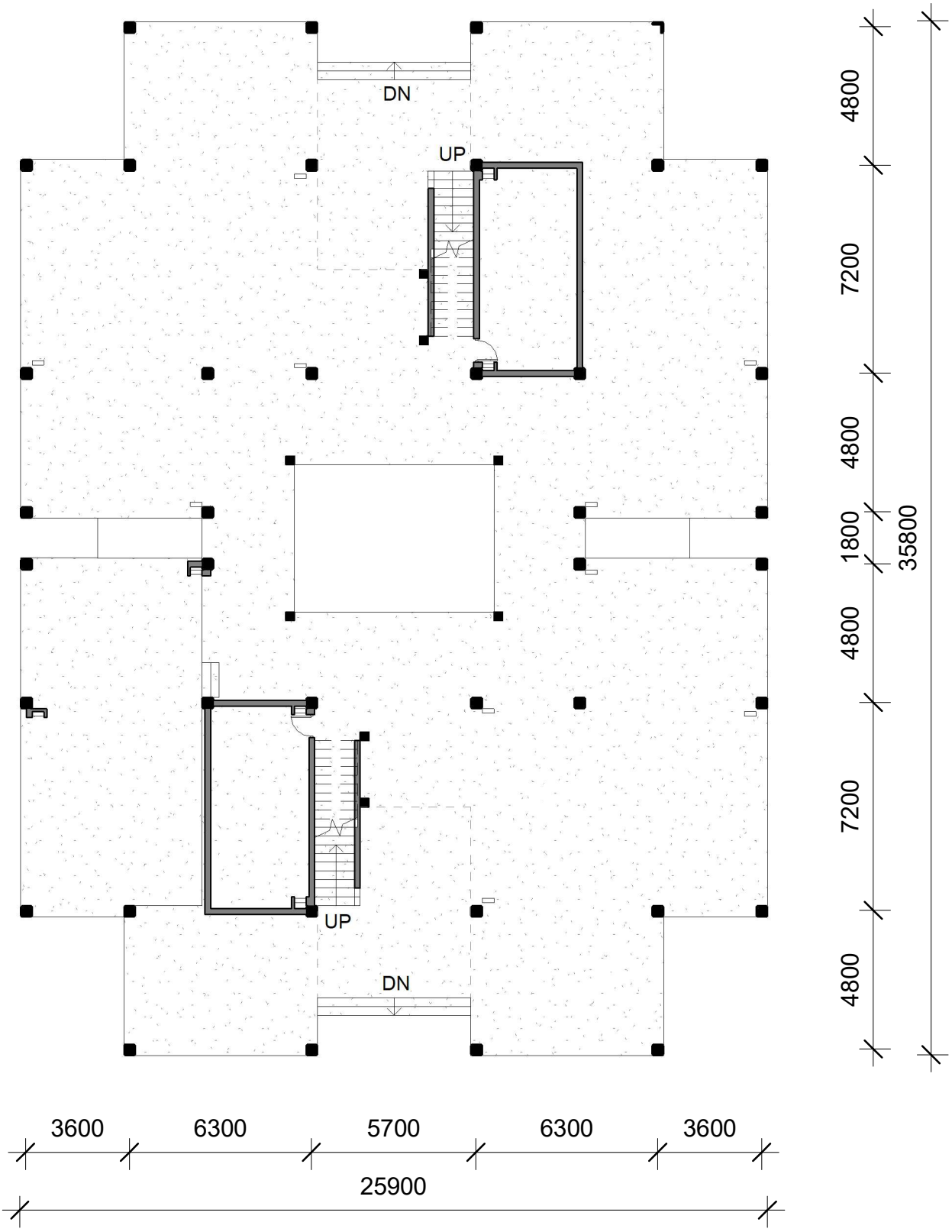
_Structure: Concrete Frame



Isometric Drawing of The Frame Structure _ 1:200

Scale 1:200

0 2m 6m 10m 20m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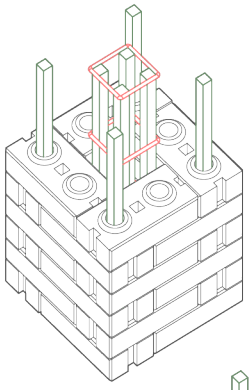
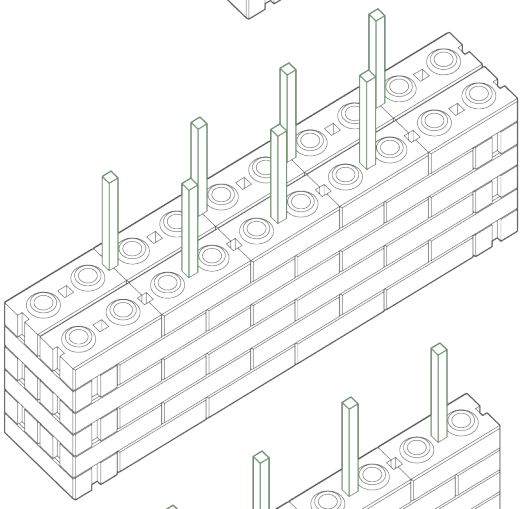
_ *The Formal Infill : Interlocking Compressed Earth Block and Its Applications*

Products available on market



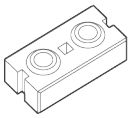
Column



External walls

Size: 150*300*90

Top



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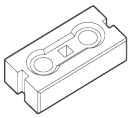
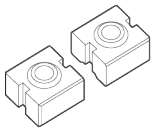
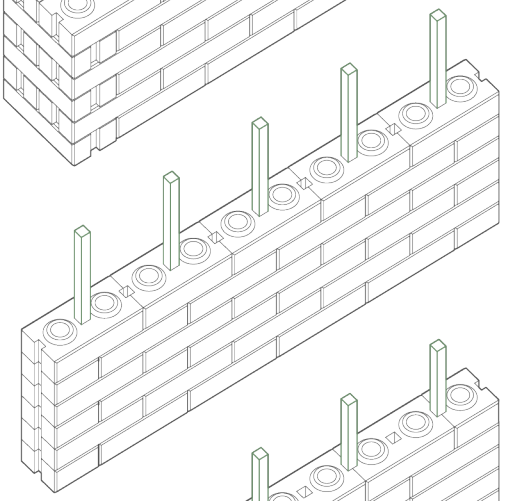
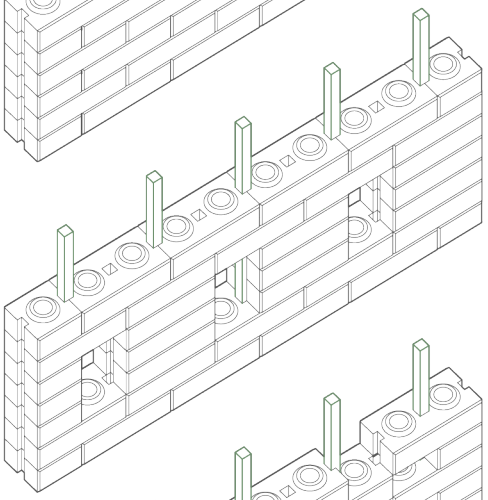


Halved

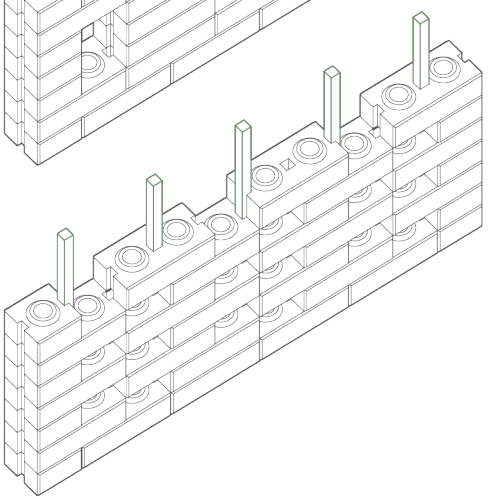




Internal walls



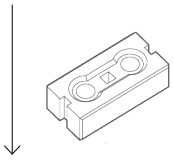
With small openings



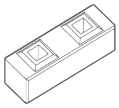
Parapet

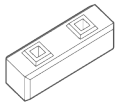
Modification

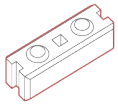
Size: 150*300*90



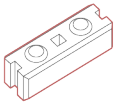
Size: 100*300*90



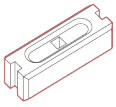




Selected Shape



Top



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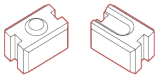
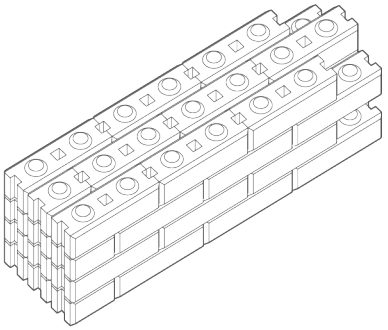
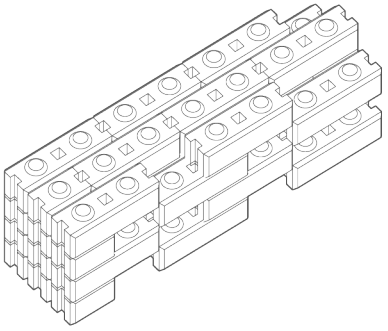


Halved

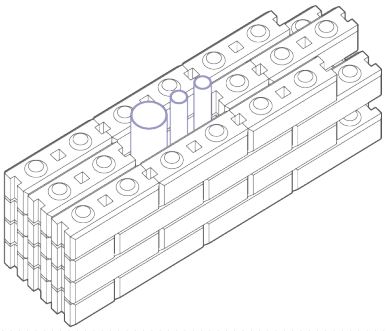
300mm



External walls_ East & West facade

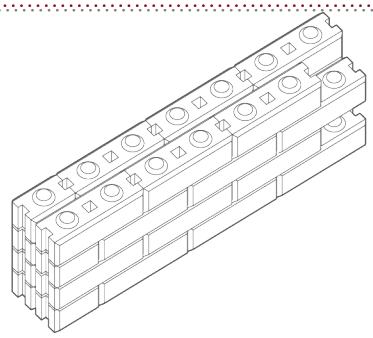


External wall _ East & West facade



Plumbing wall

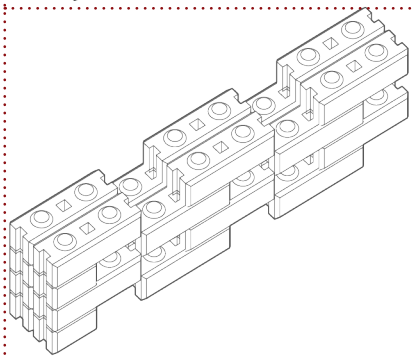
200mm



External wall

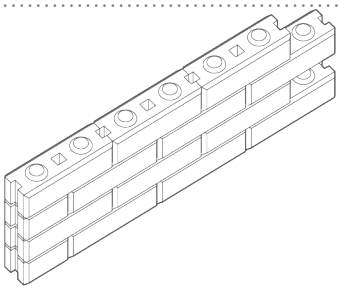
/

Partition wall between units



Perforated Wall

100mm



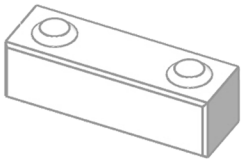
Indoor partition wall

External walls

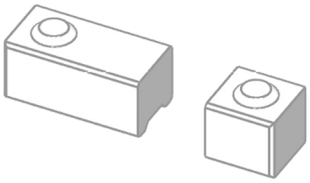
Internal walls

Selected Block Size

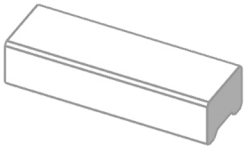
Common Block: 100*300*90



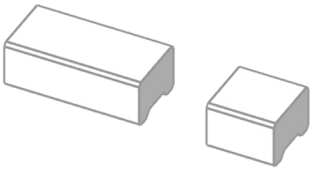
Cut: 200 / 100



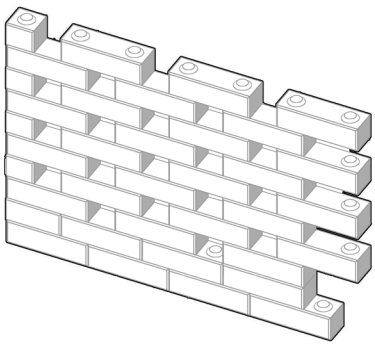
Cap Block: 100*300*70

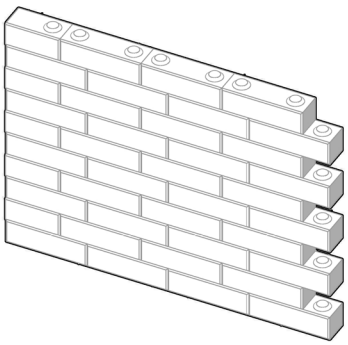


Cut: 200 / 100



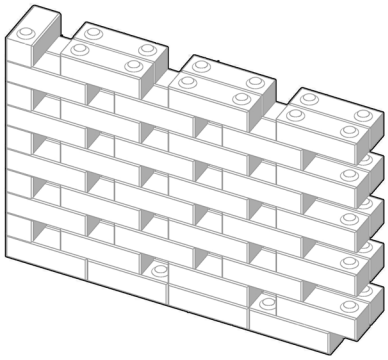
100mm

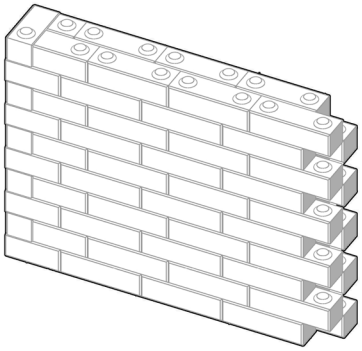




Indoor partition wall

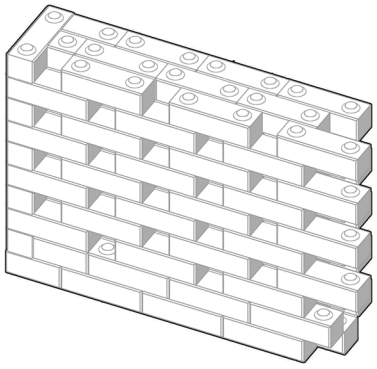
200mm

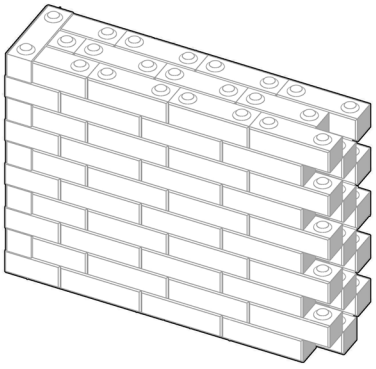




External wall /
Partition wall
between units

300mm

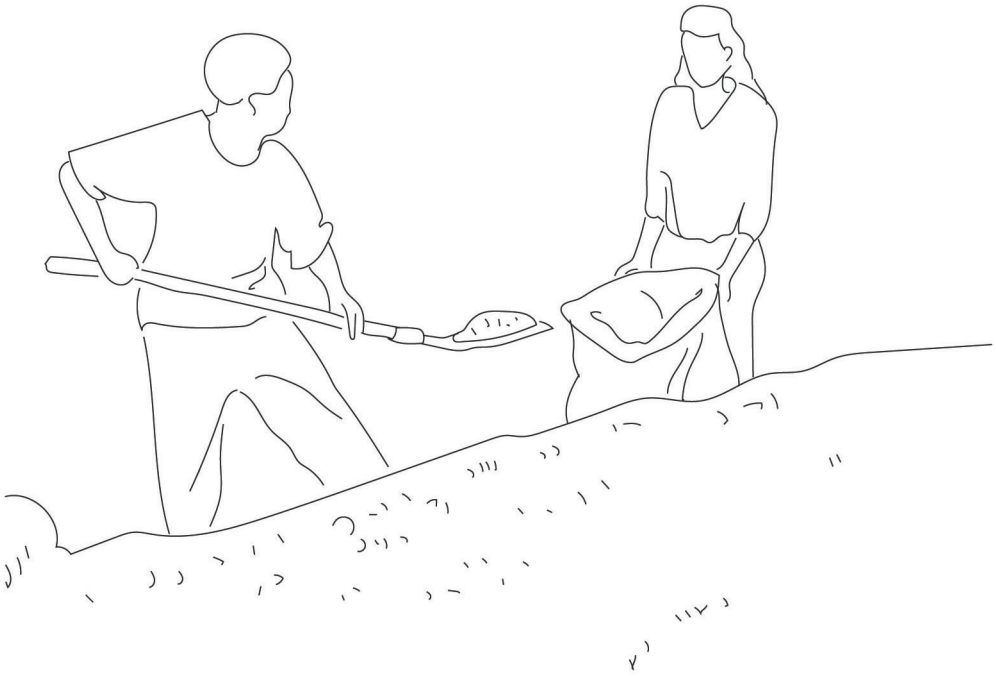




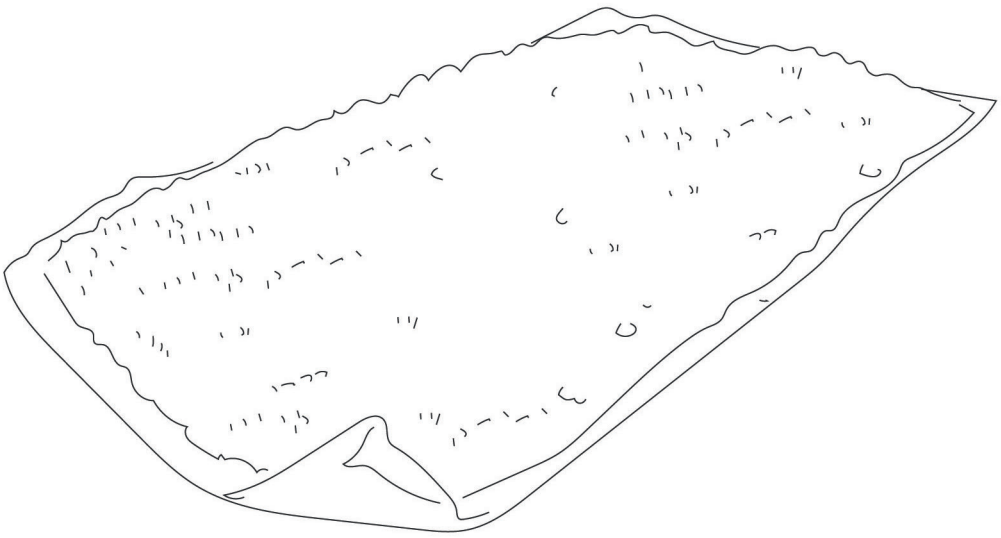
External wall on West
Facade

Perforated

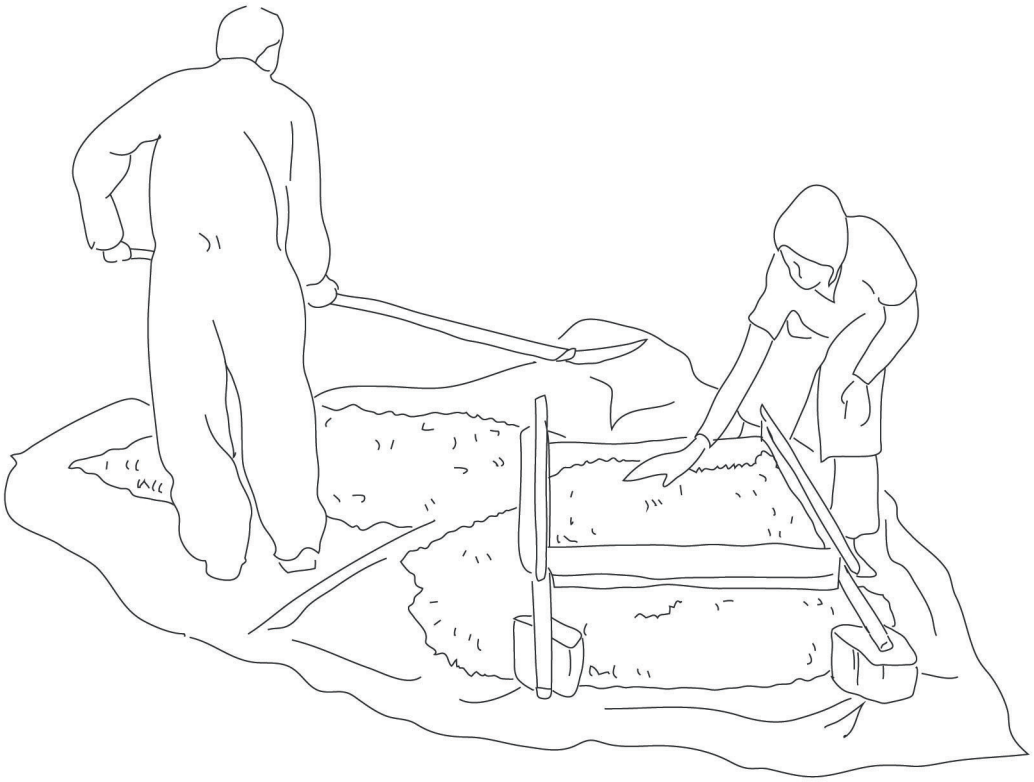
Solid



Collect soil in sacks.



Spread soil on a plastic sheet in the shade for drying.



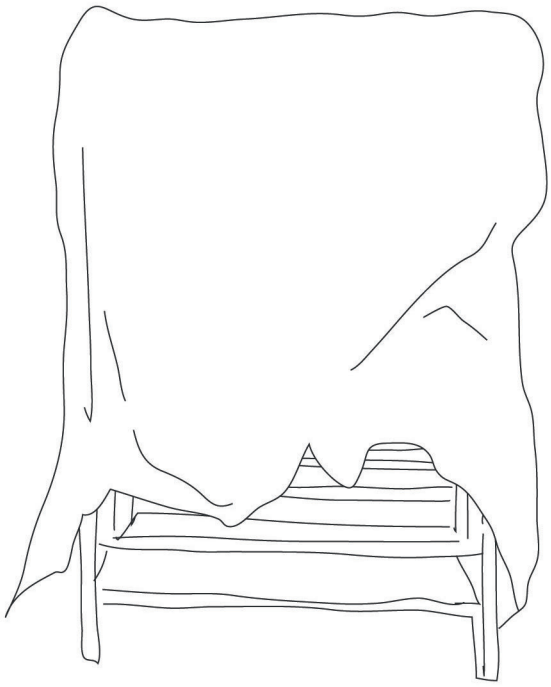
Screening.



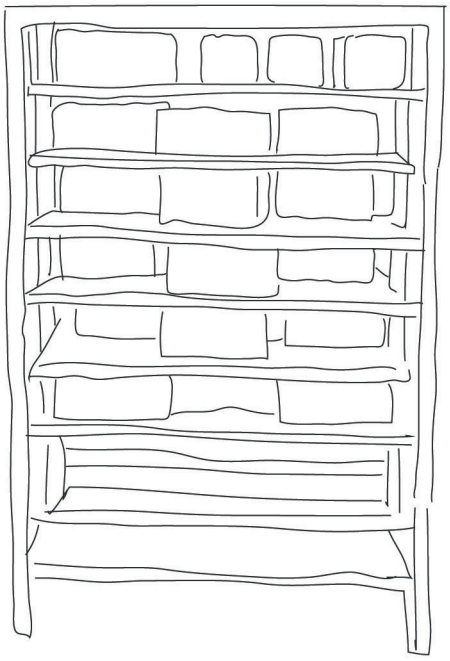
Dry mix soil with cement (5-10%), and later with water.



Manual production of SCEB.

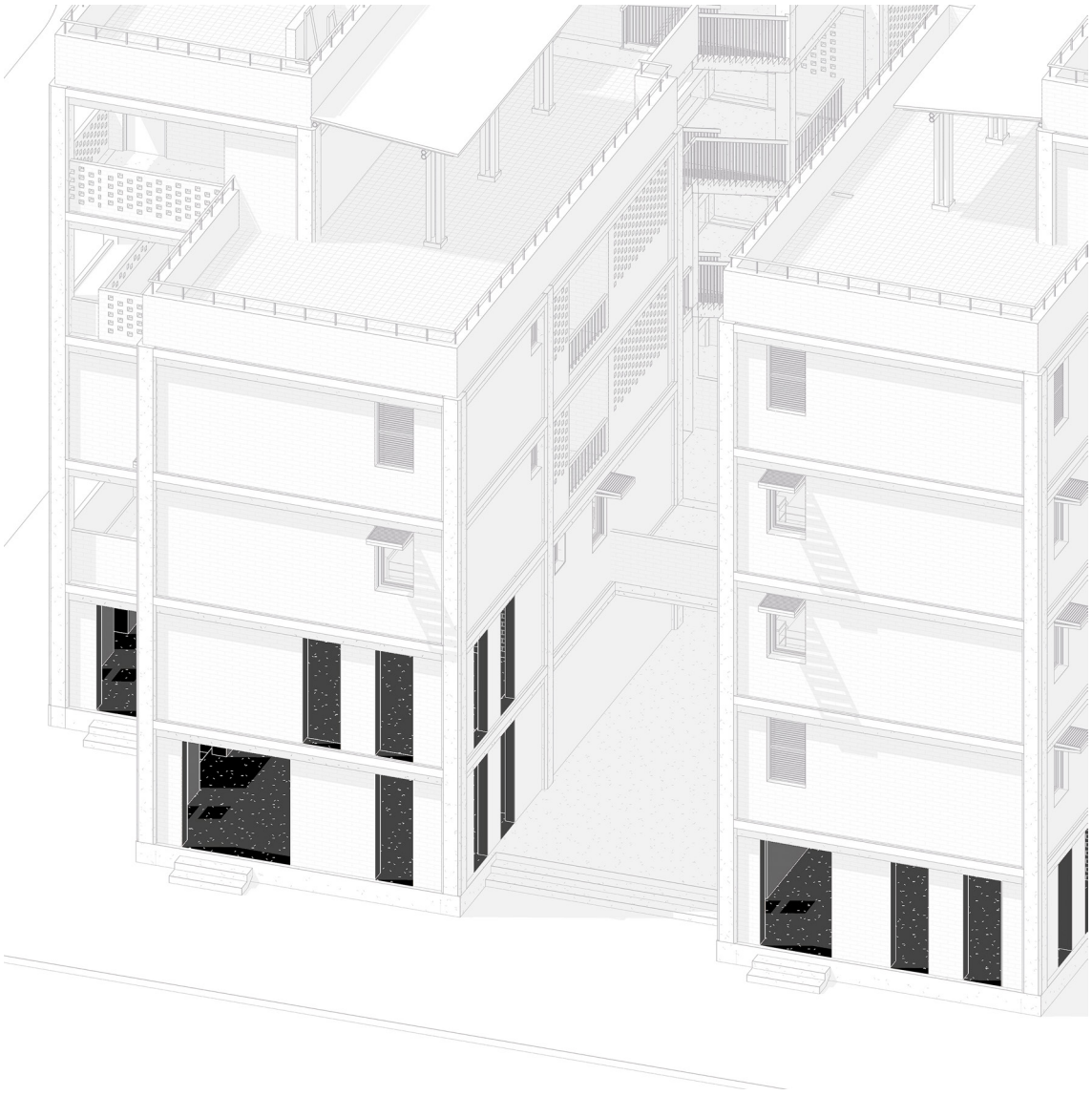


Store the pressed blocks on shelves, cover it with a plastic sheet and sprinkle water once per day during the wet-curing (7 days).

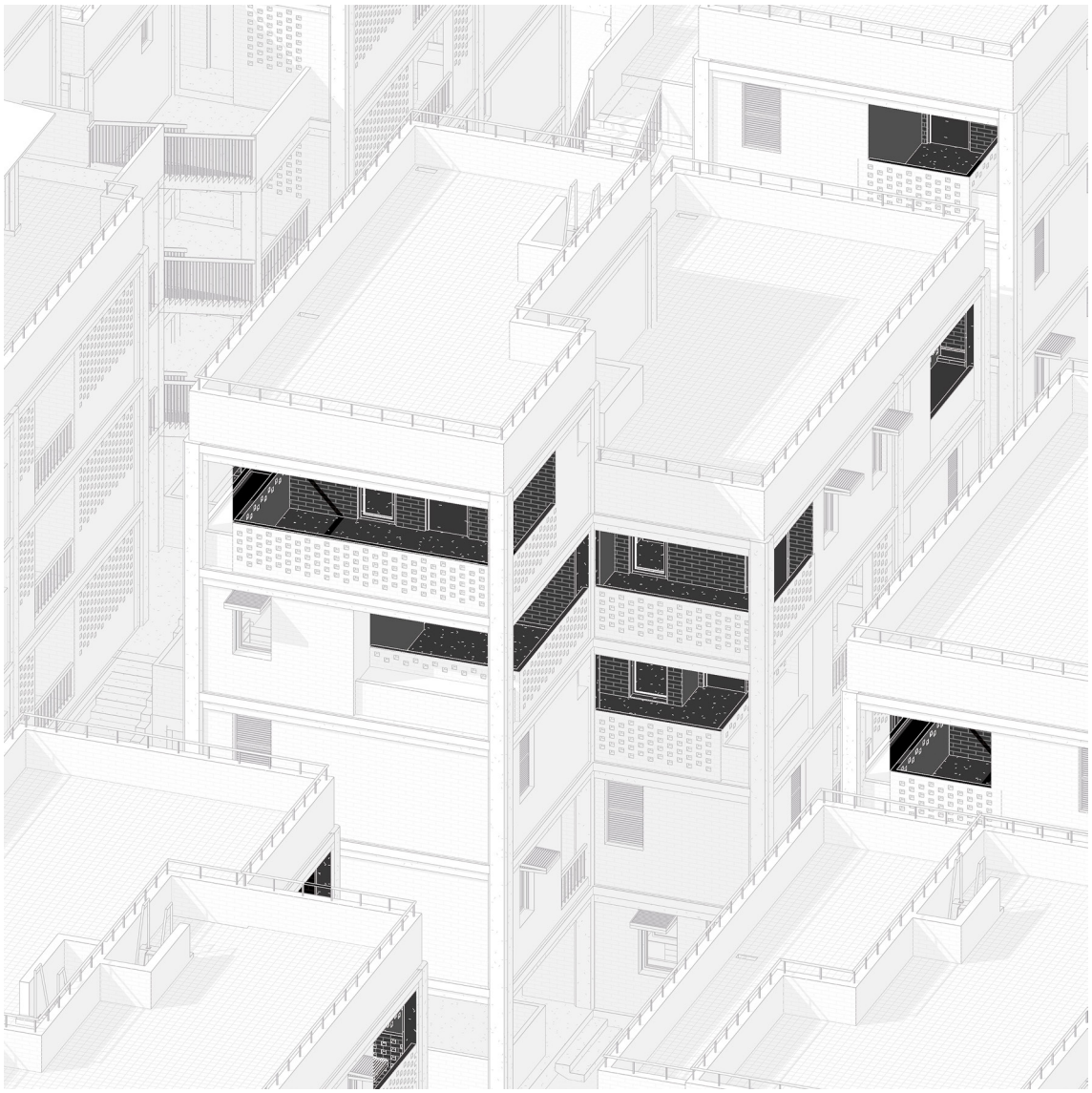


After 7 days, remove the plastic sheet and dry-cure the blocks.

THE INFORMAL CONSTRUCTION

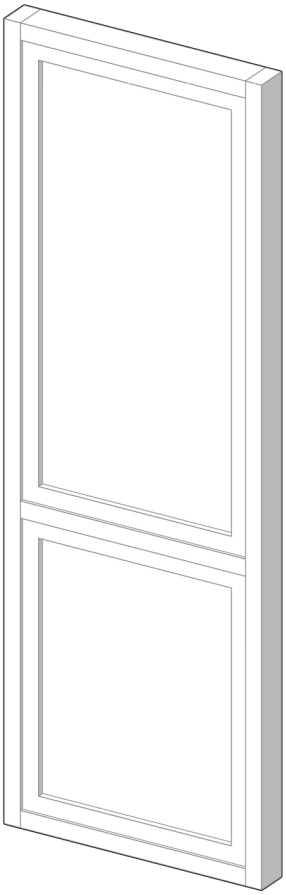


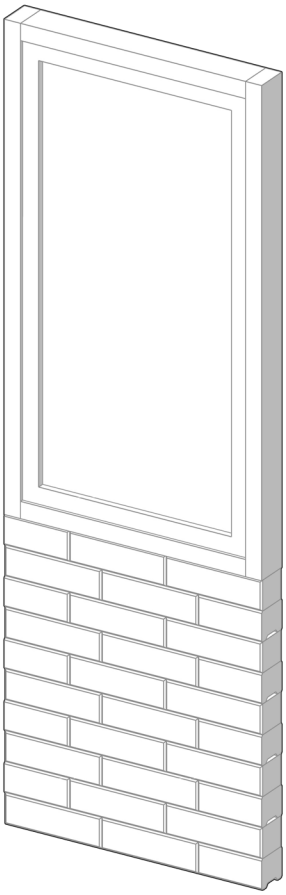
Ground Floor Openings _ Typically 800mm in width

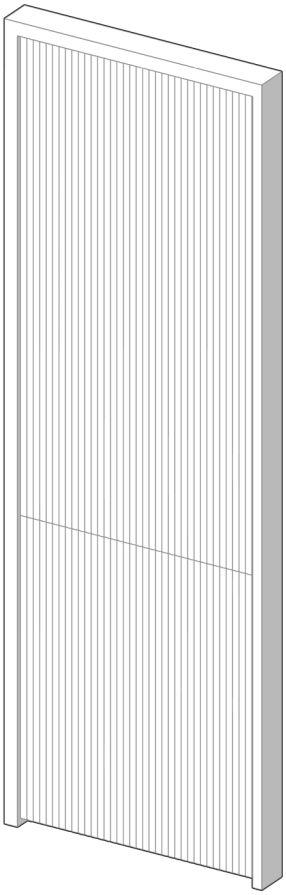


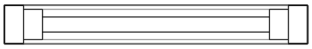
Self Constructed Walls _ Typically for original dwellers

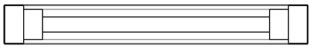
_ *Examples of (Light-weight) Infill on the Ground Floor*









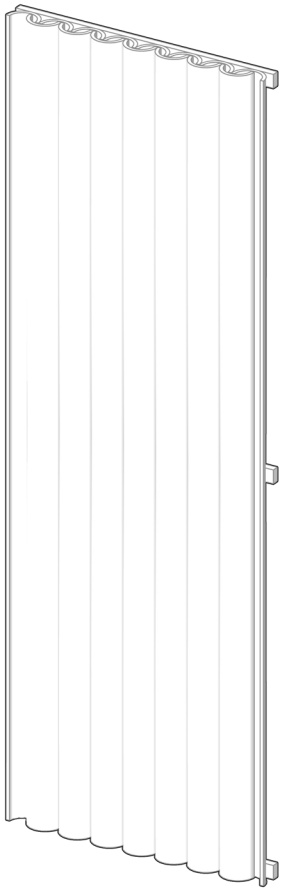


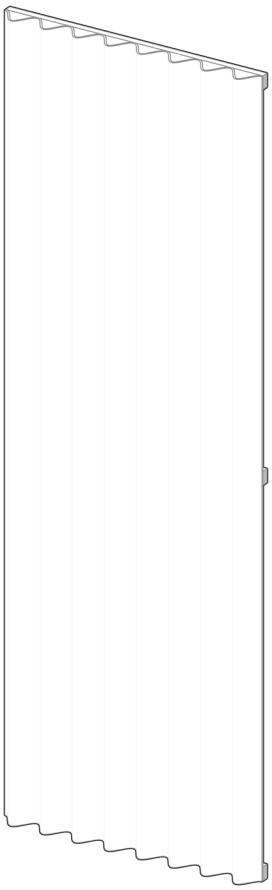


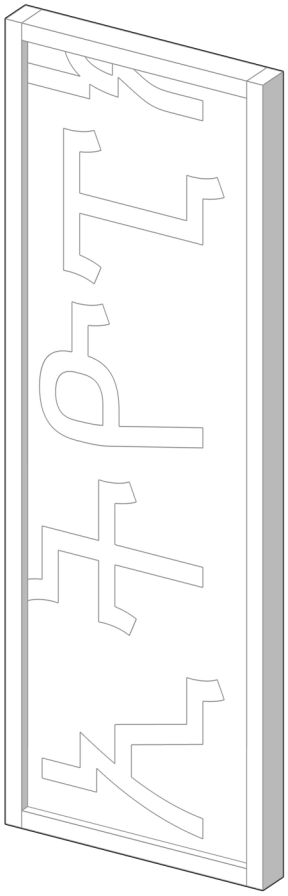
Full Window / Door

Window + SCEB

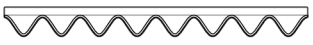
Bamboo Strip

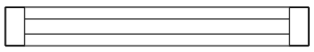












Halved Bamboo

Corrugated Metal Sheet

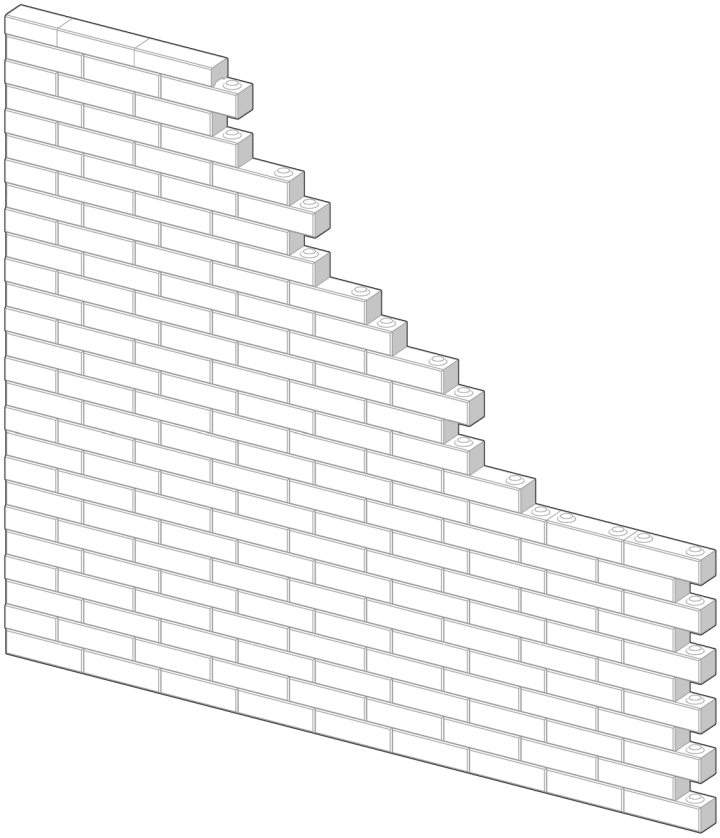
Advertising Signboard

Scale 1:20

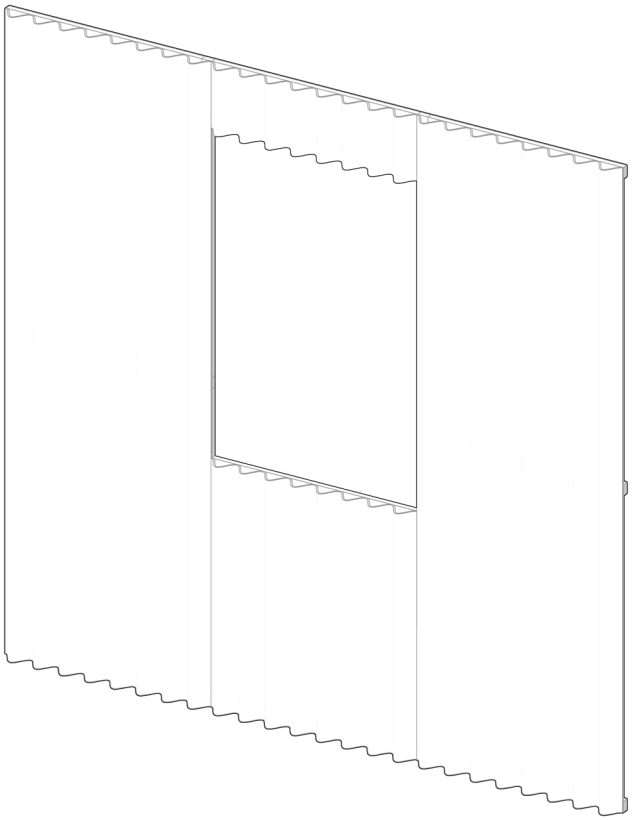
0 0.2m 0.6m 1m 2m

_ *Examples of Self-constructed Wall*

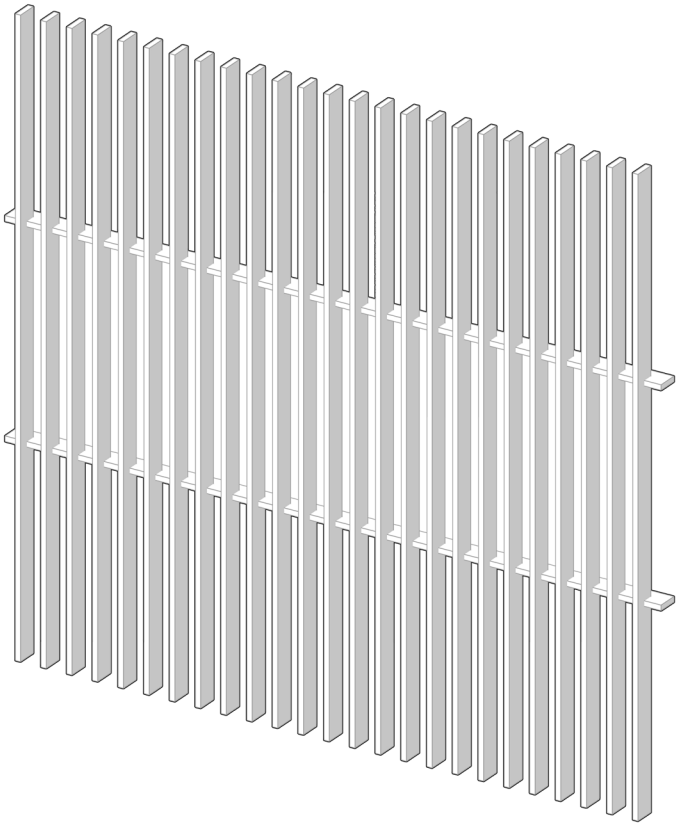
SCEB Wall



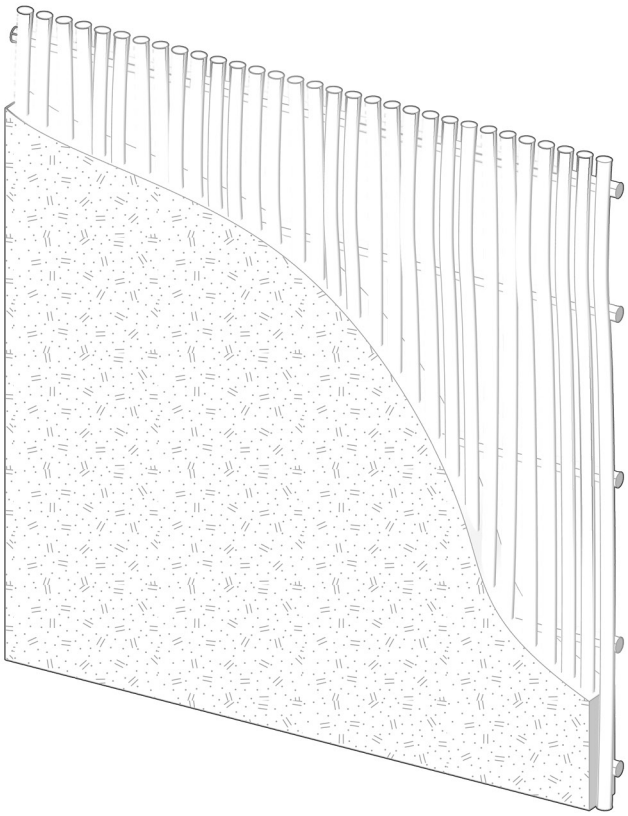
Corrugated Metal Sheet



Bamboo Shutter



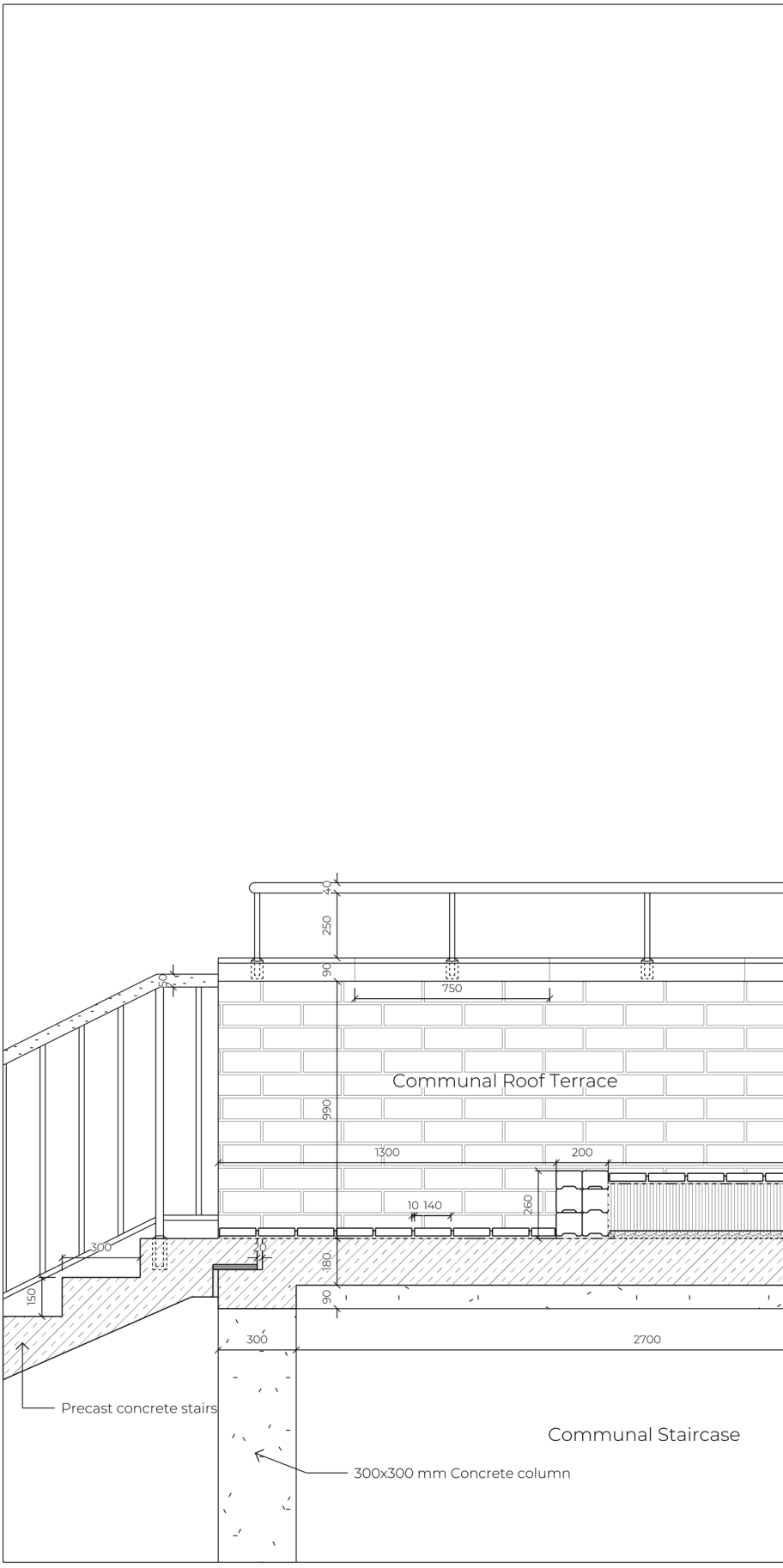
Chika



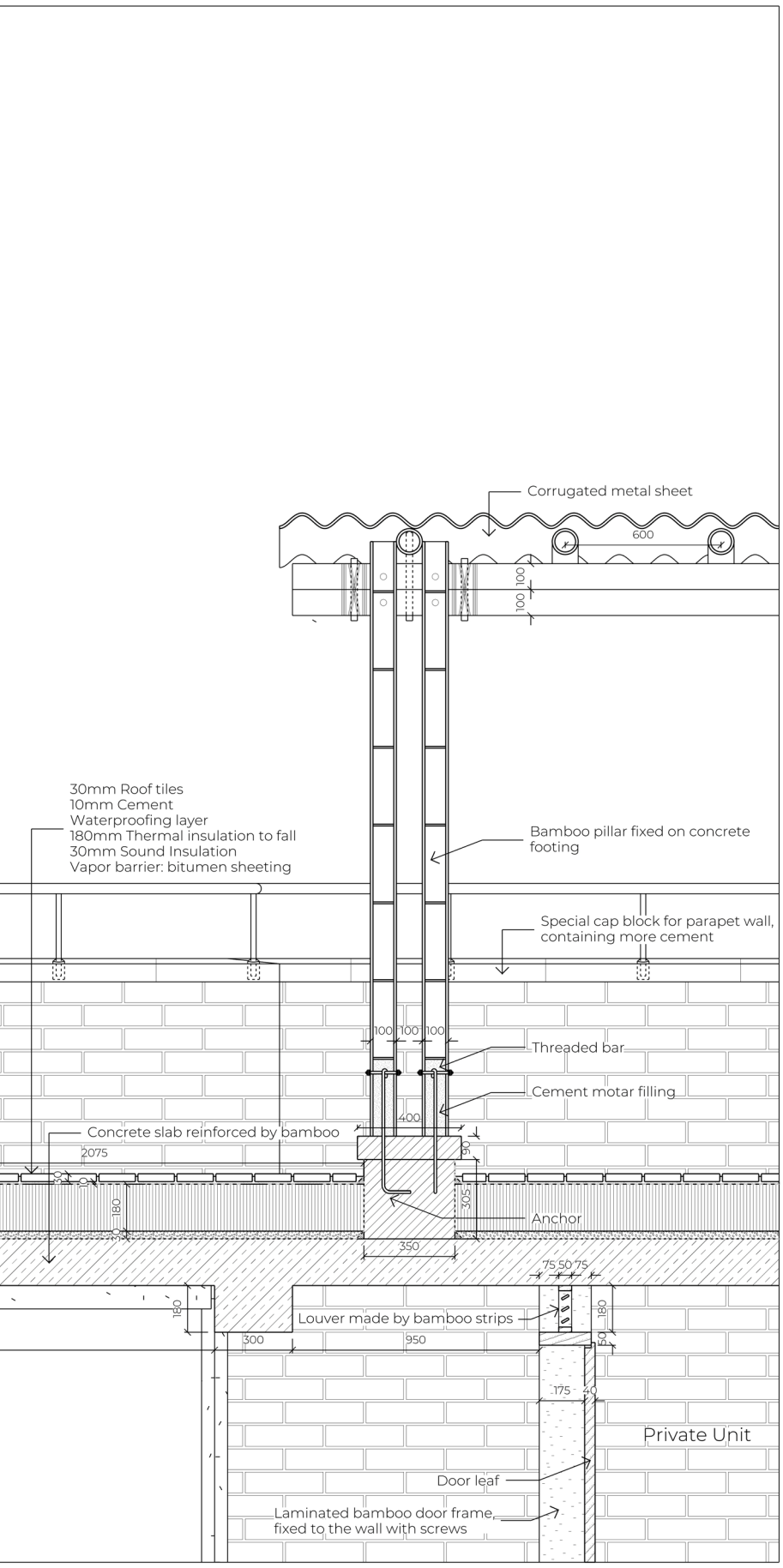
Scale 1:25

0 0.5m 1m 2m

DETAILS

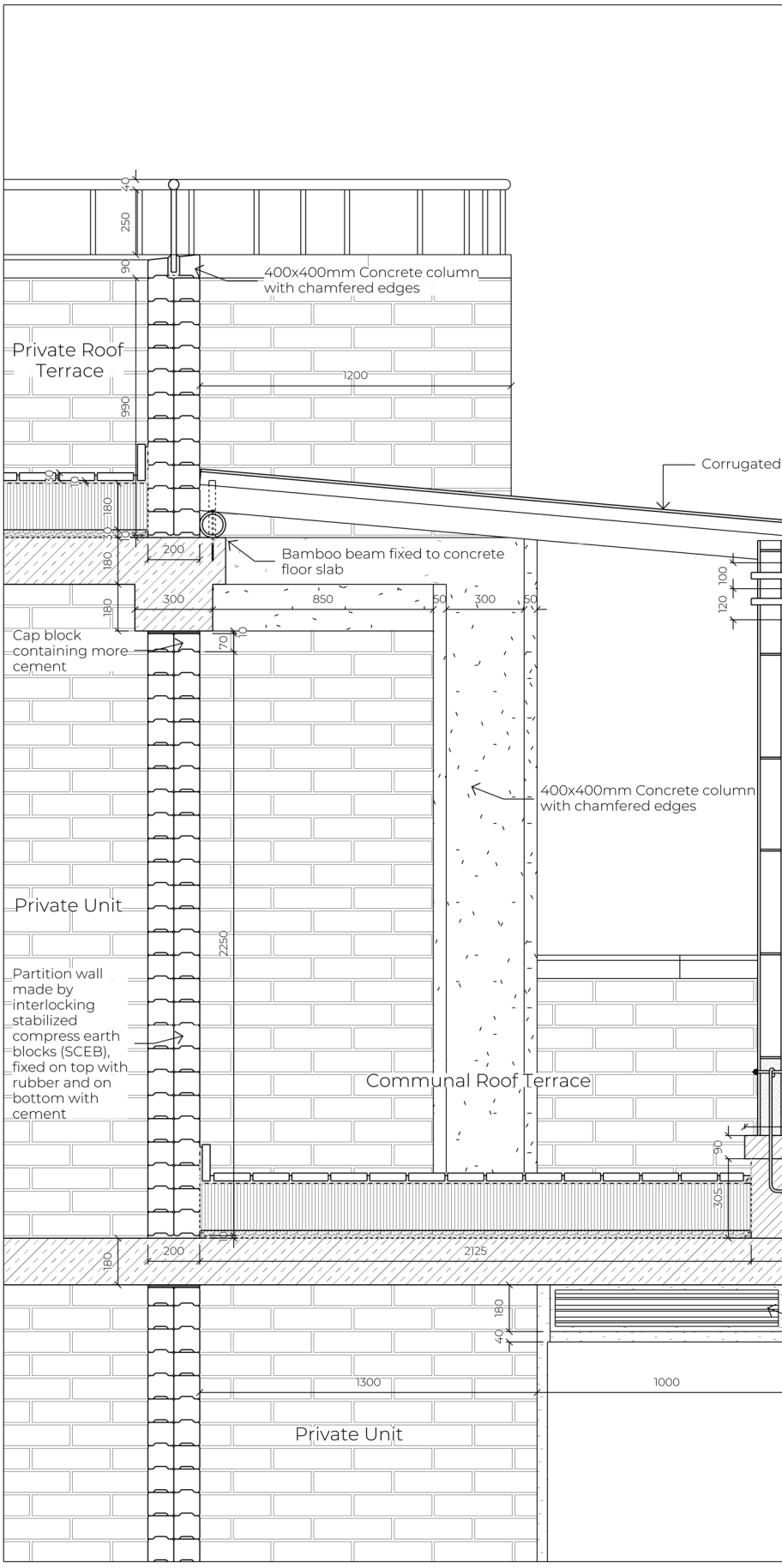


Detail 1 _ Connection of Staircase, Flat Roof and Bamboo Awning _ 1:25

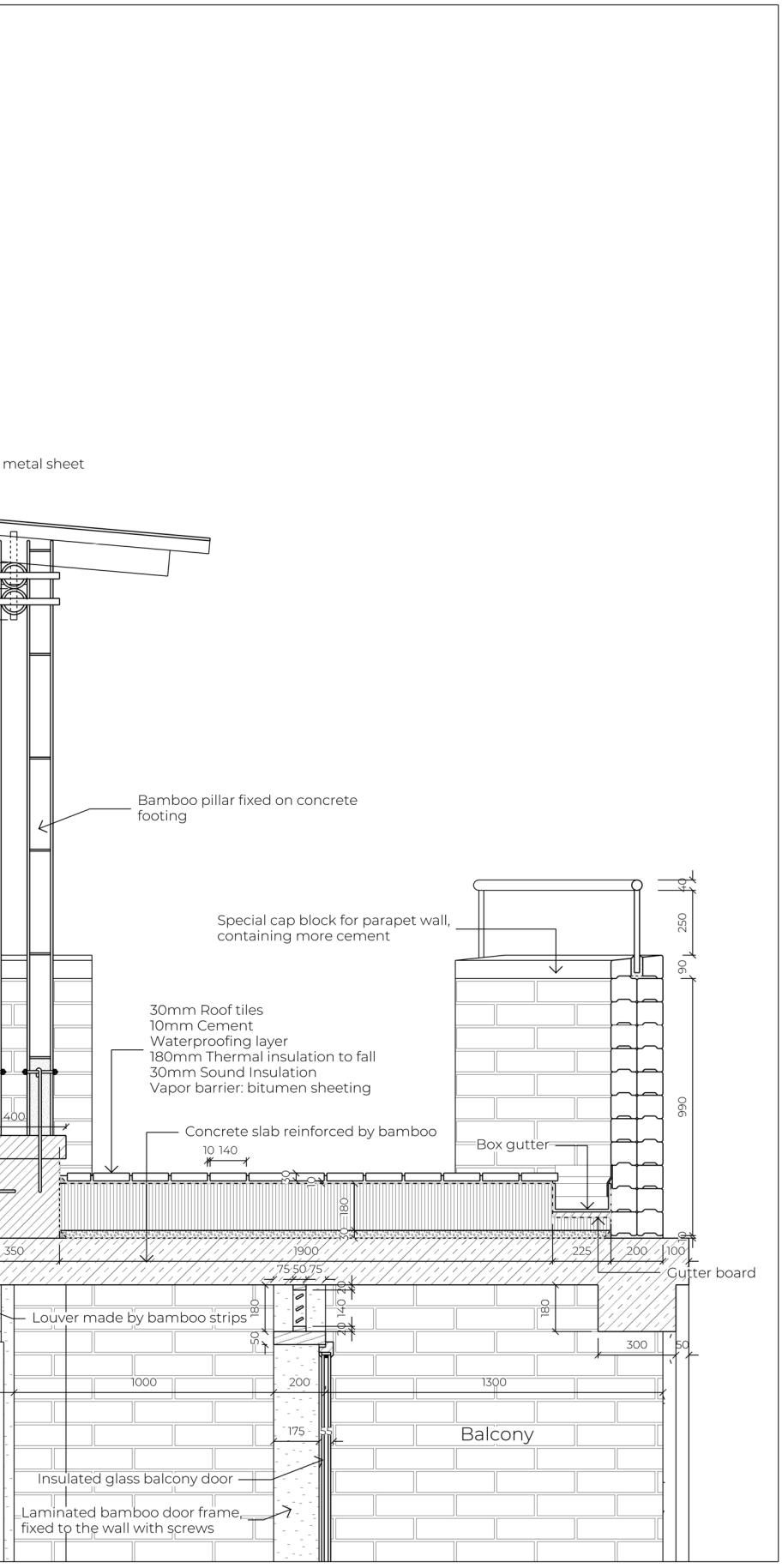


Scale 1:25

0 0.5m 1m 2m



Detail 2 _ Cross Section of Roof and Bamboo Awning _ 1:25



Scale 1:25

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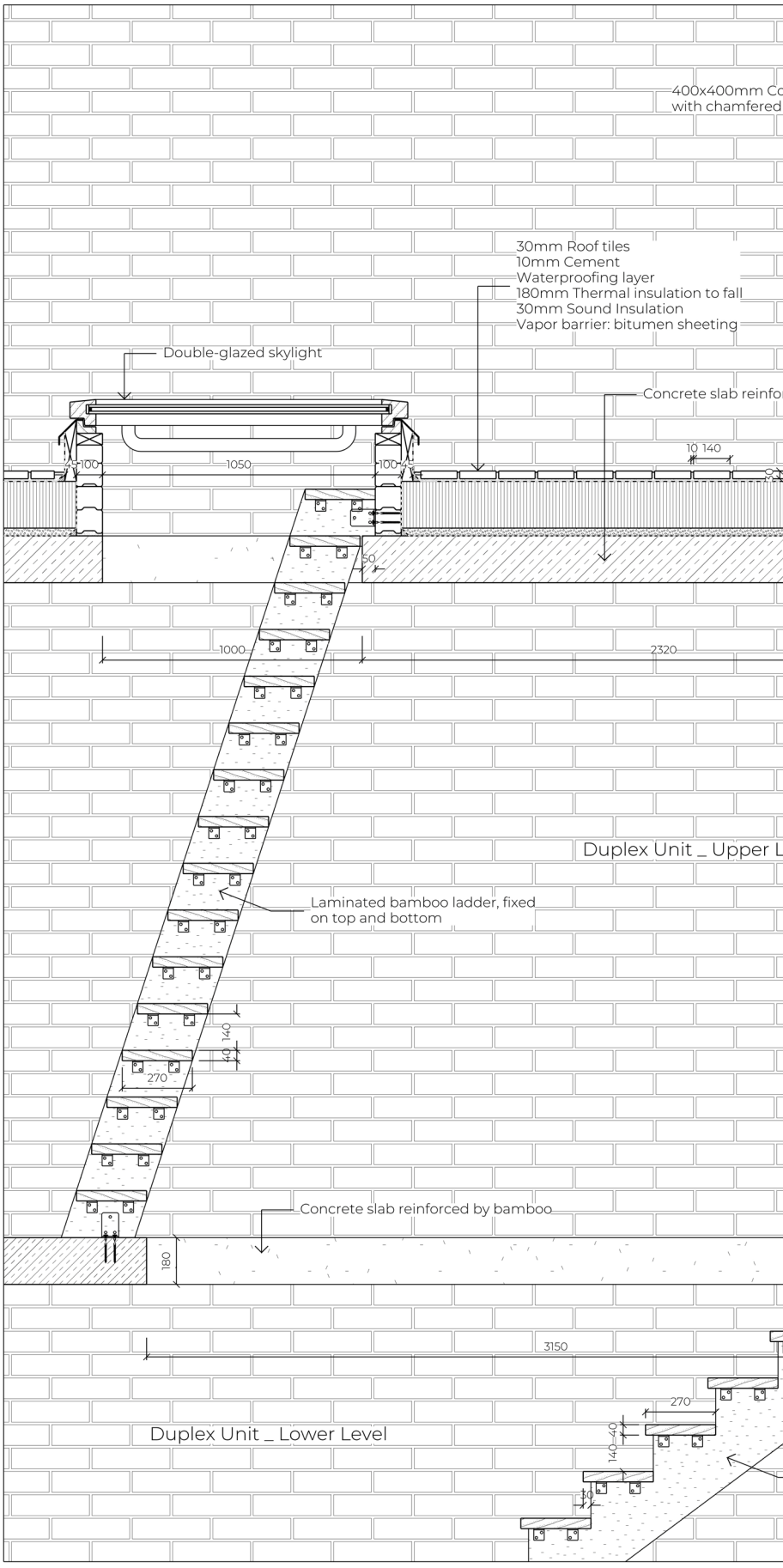
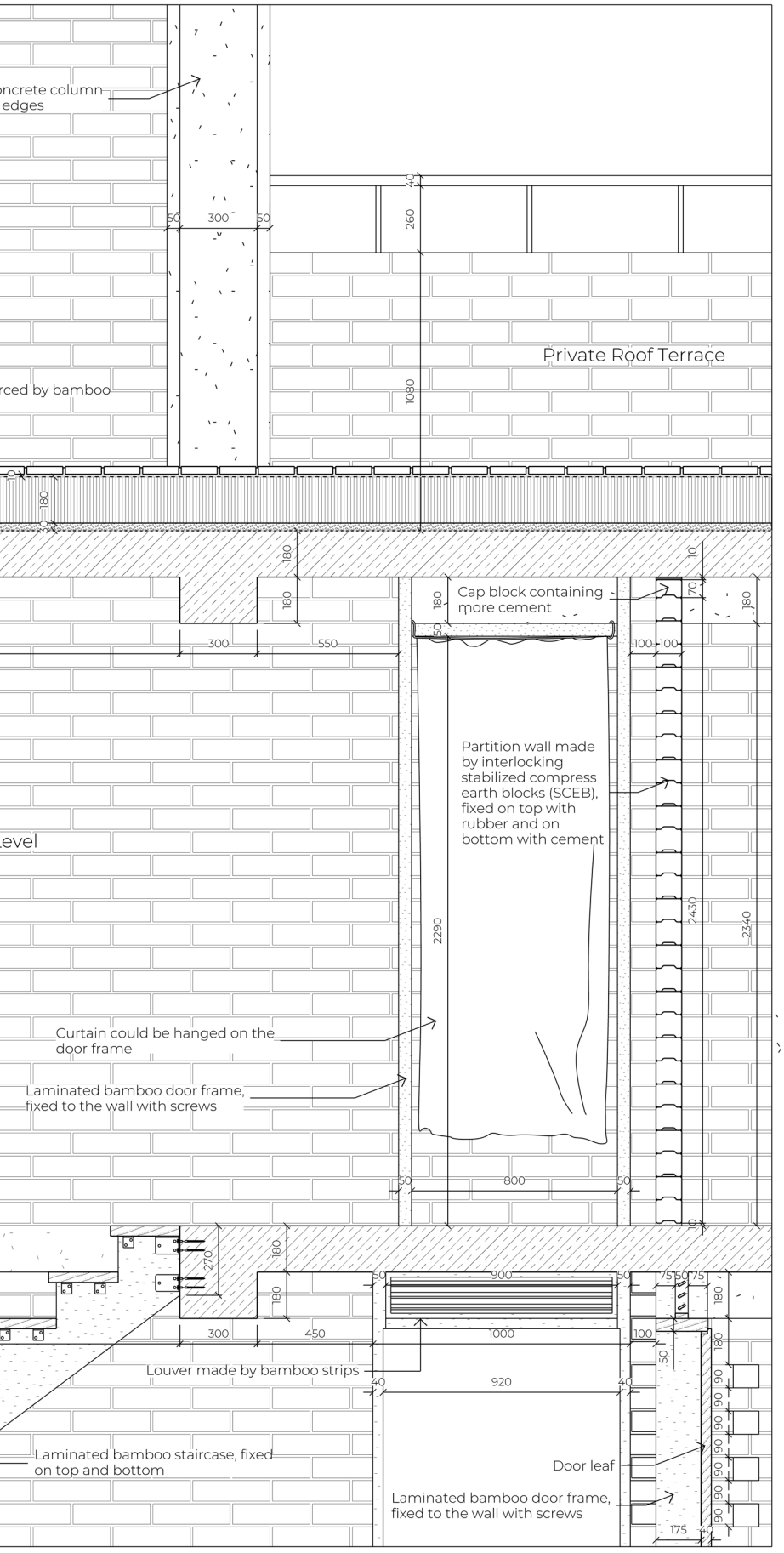


Detail 3 _ A Cut through The Duplex Unit _ 1:25



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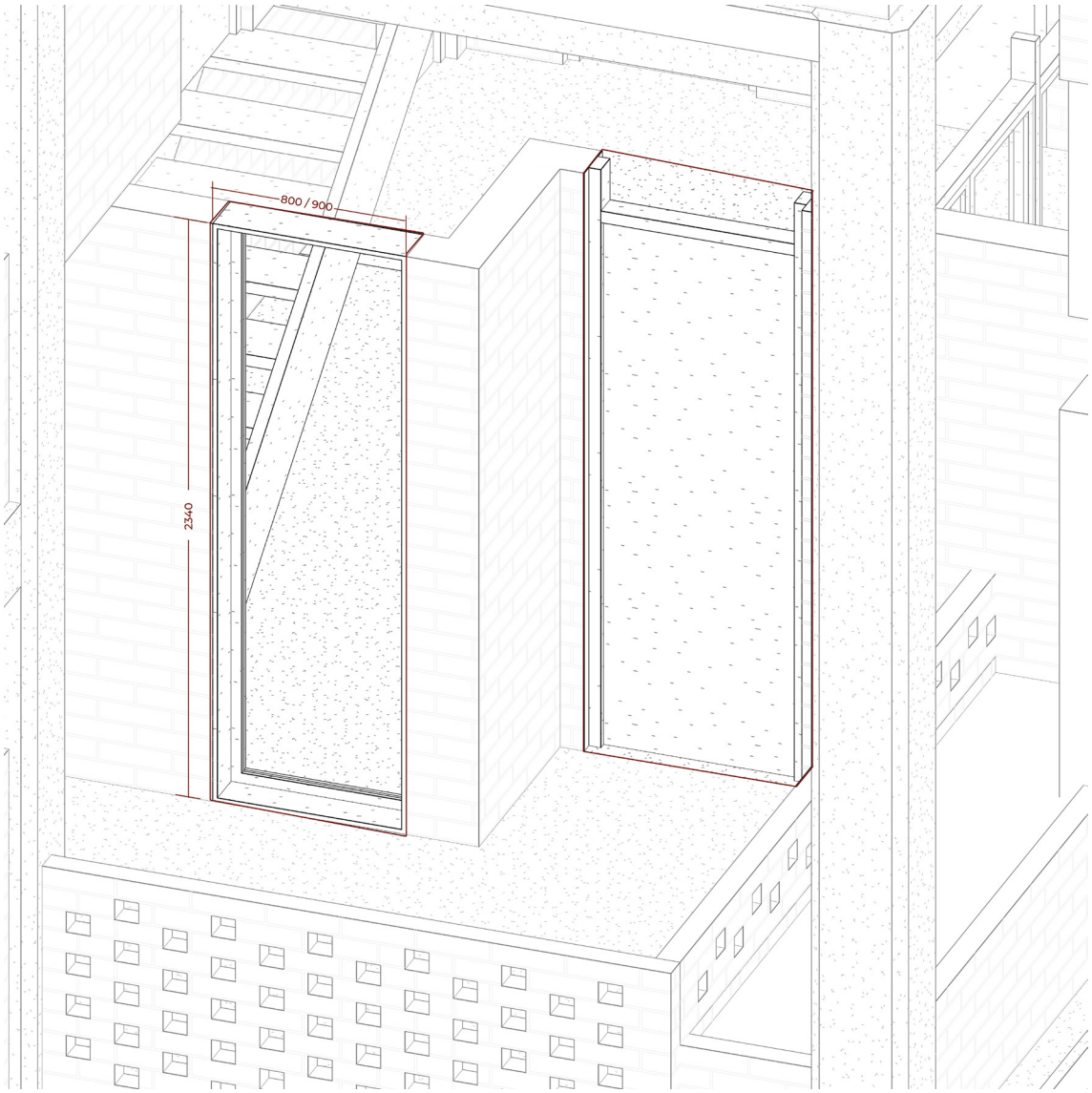
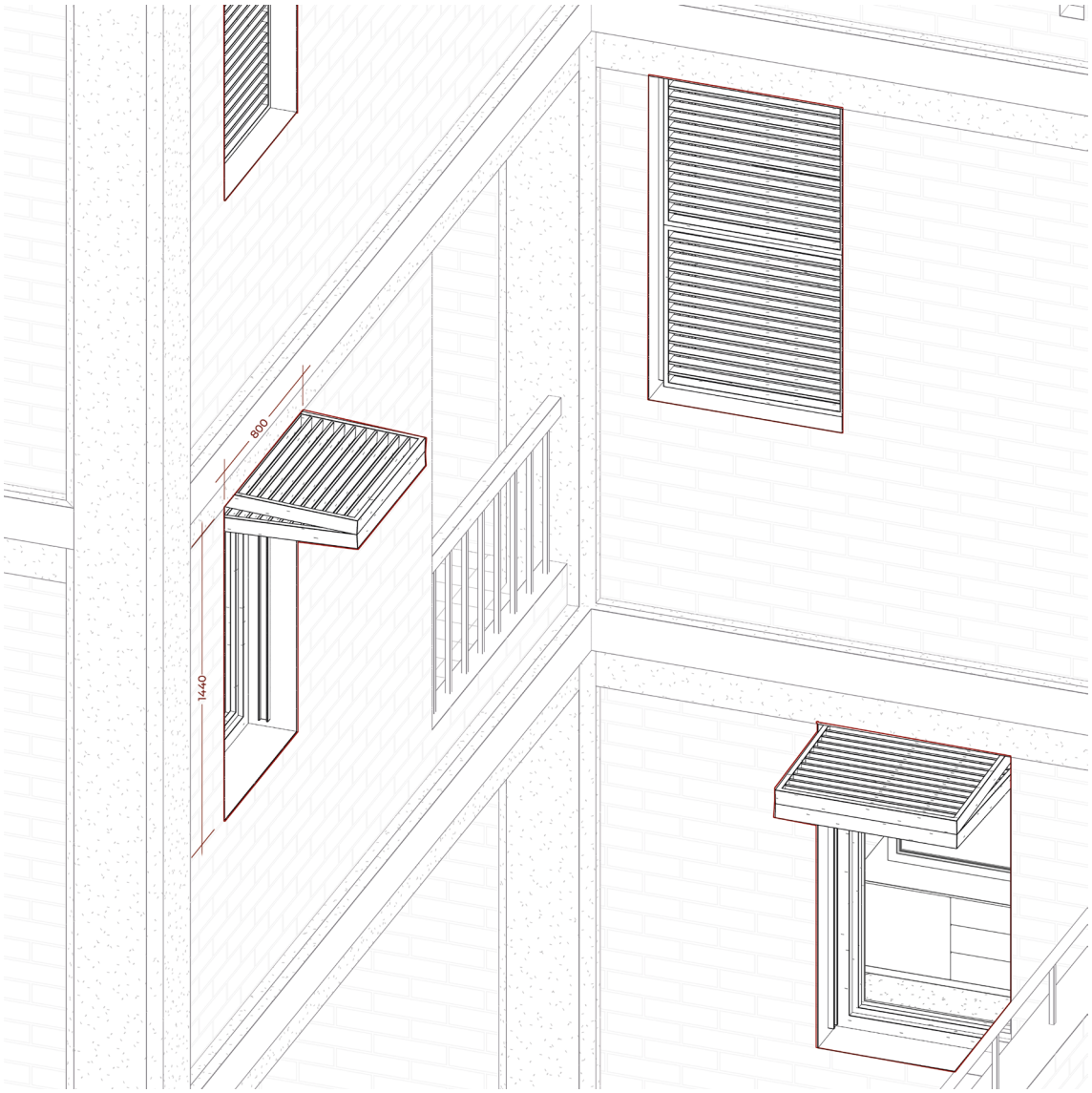
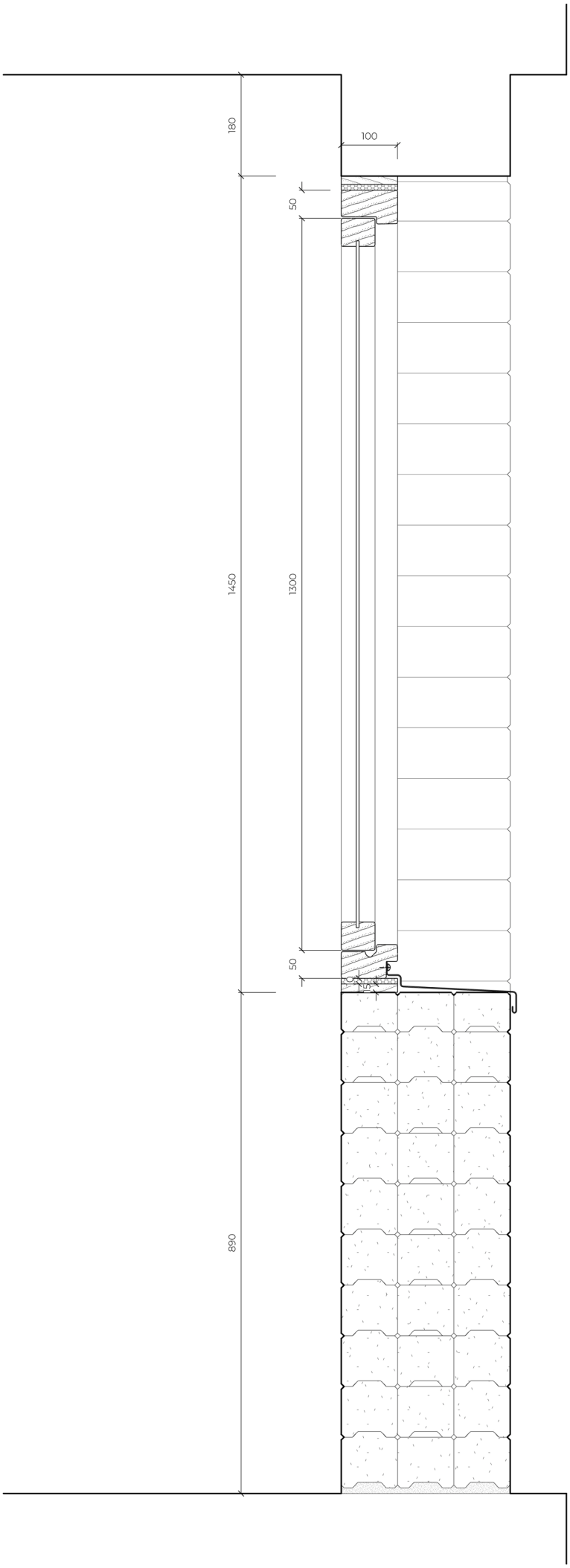
_ Standardized Door And Window



A Typical Door of 800mm*2340 mm



A Typical Window of 800mm*1440mm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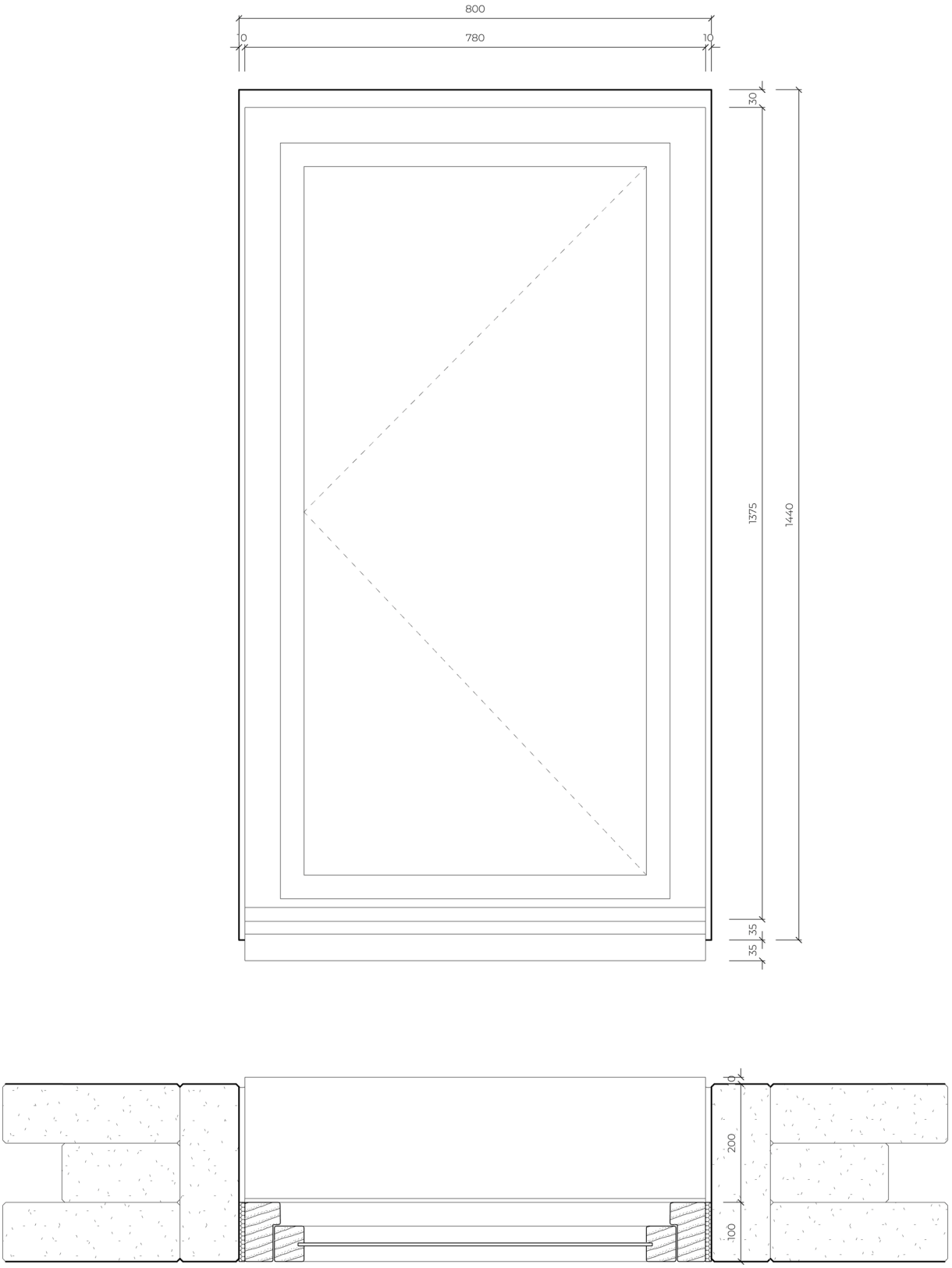
100
50
1450
1300
50
890



Details of A Typical Window _ Realistic Solution _ 1:10

Scale 1:10

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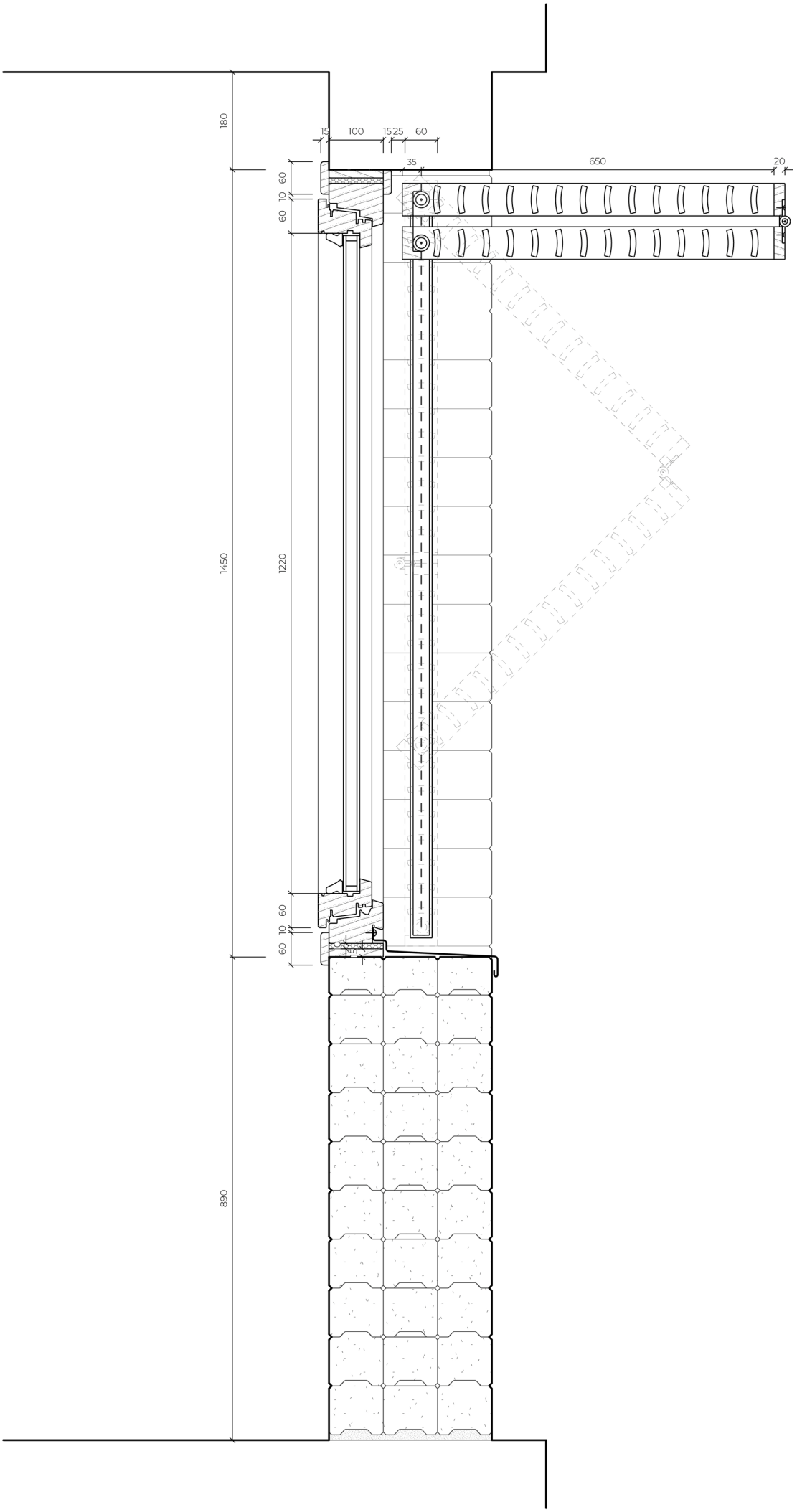
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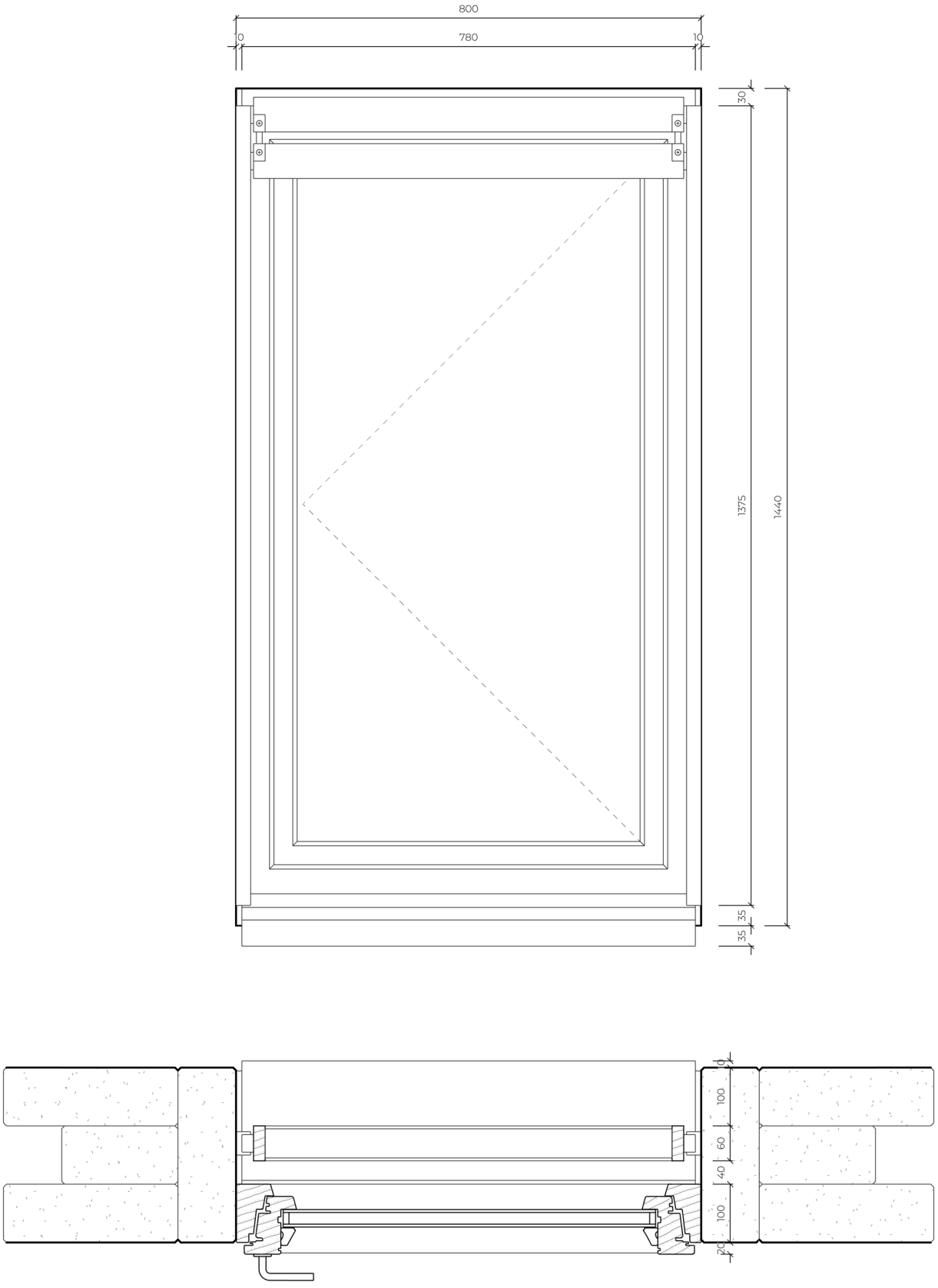

Details of A Typical Window _ Ideal Solution _ 1:10

Scale 1:10

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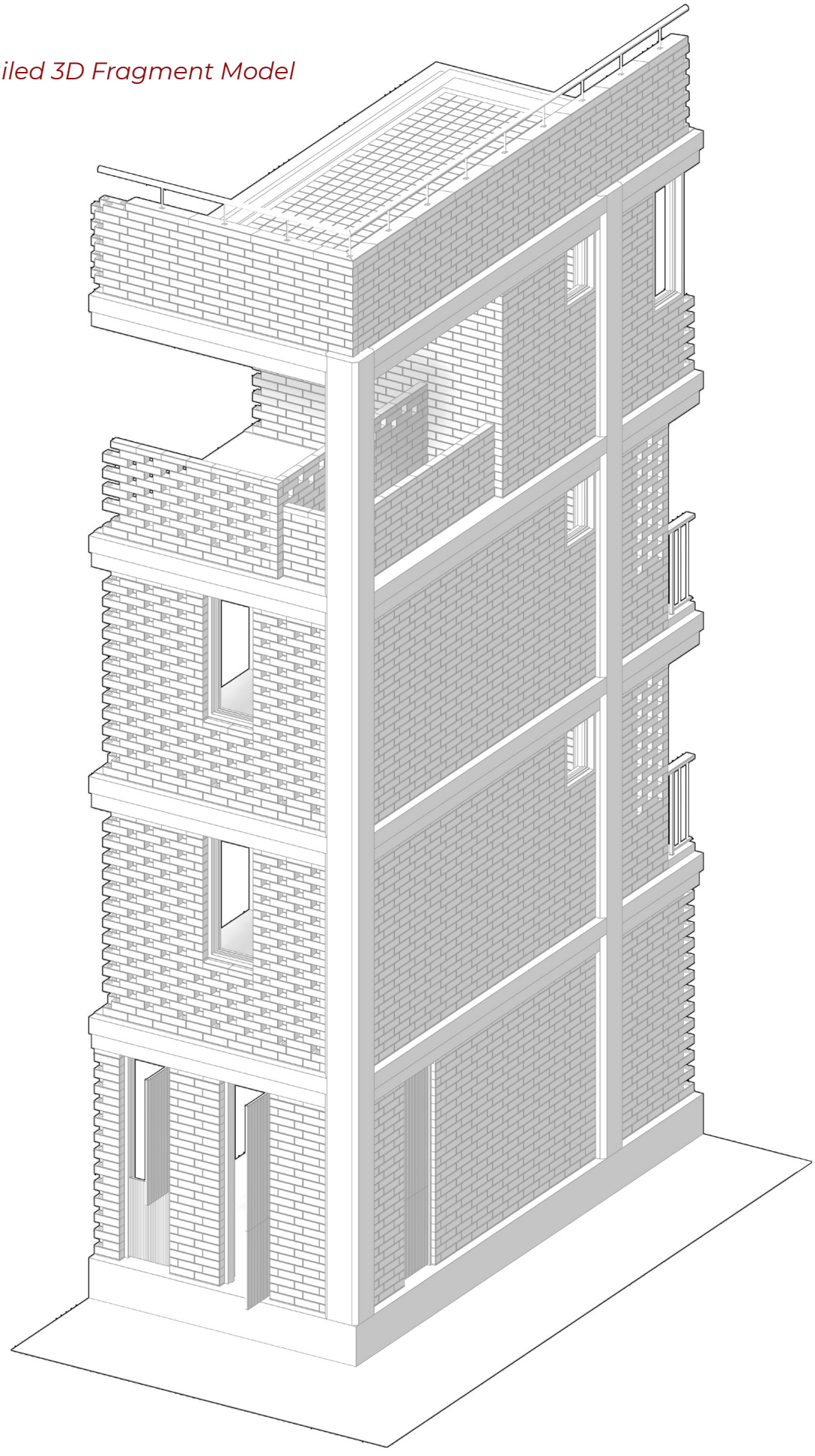
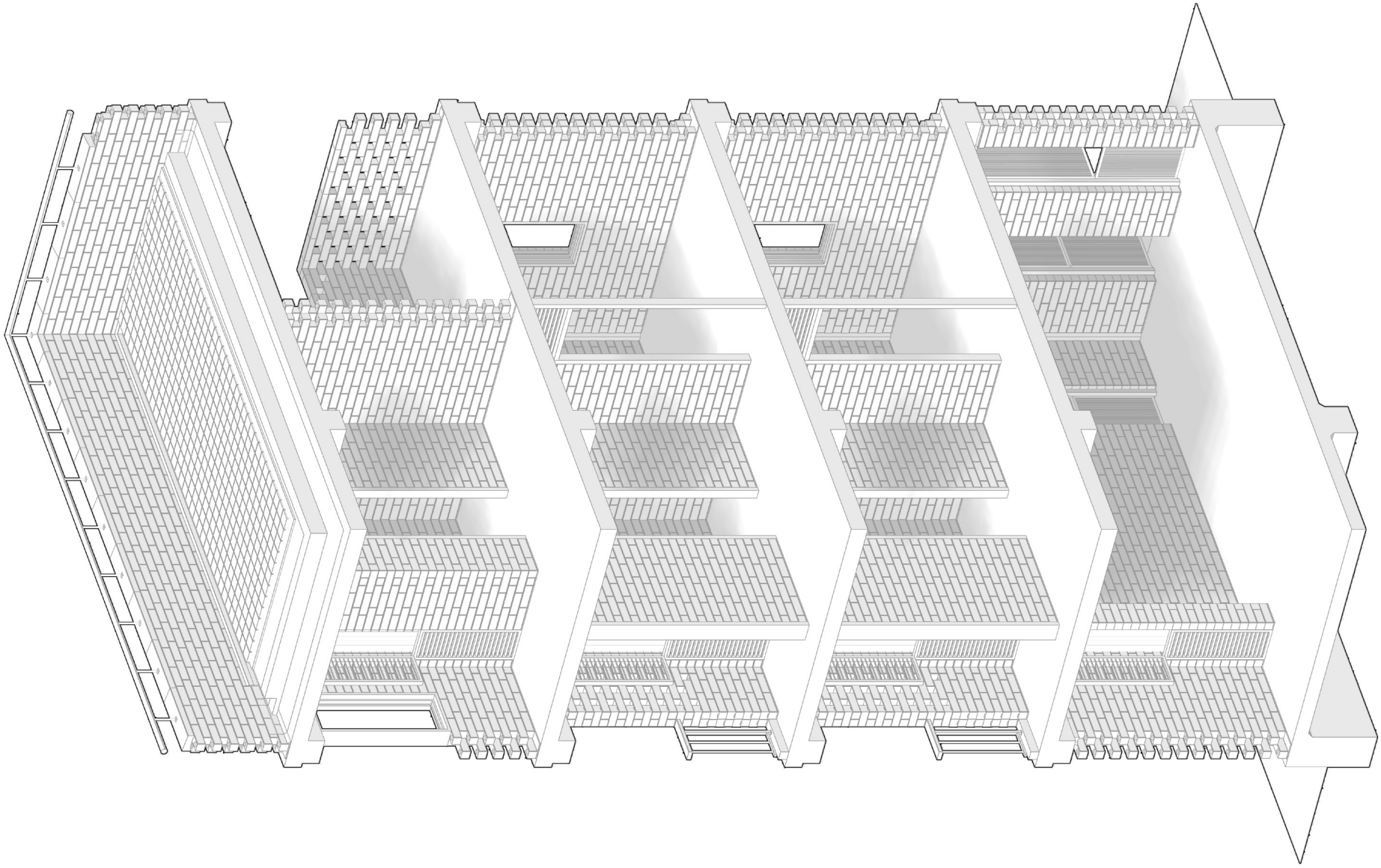
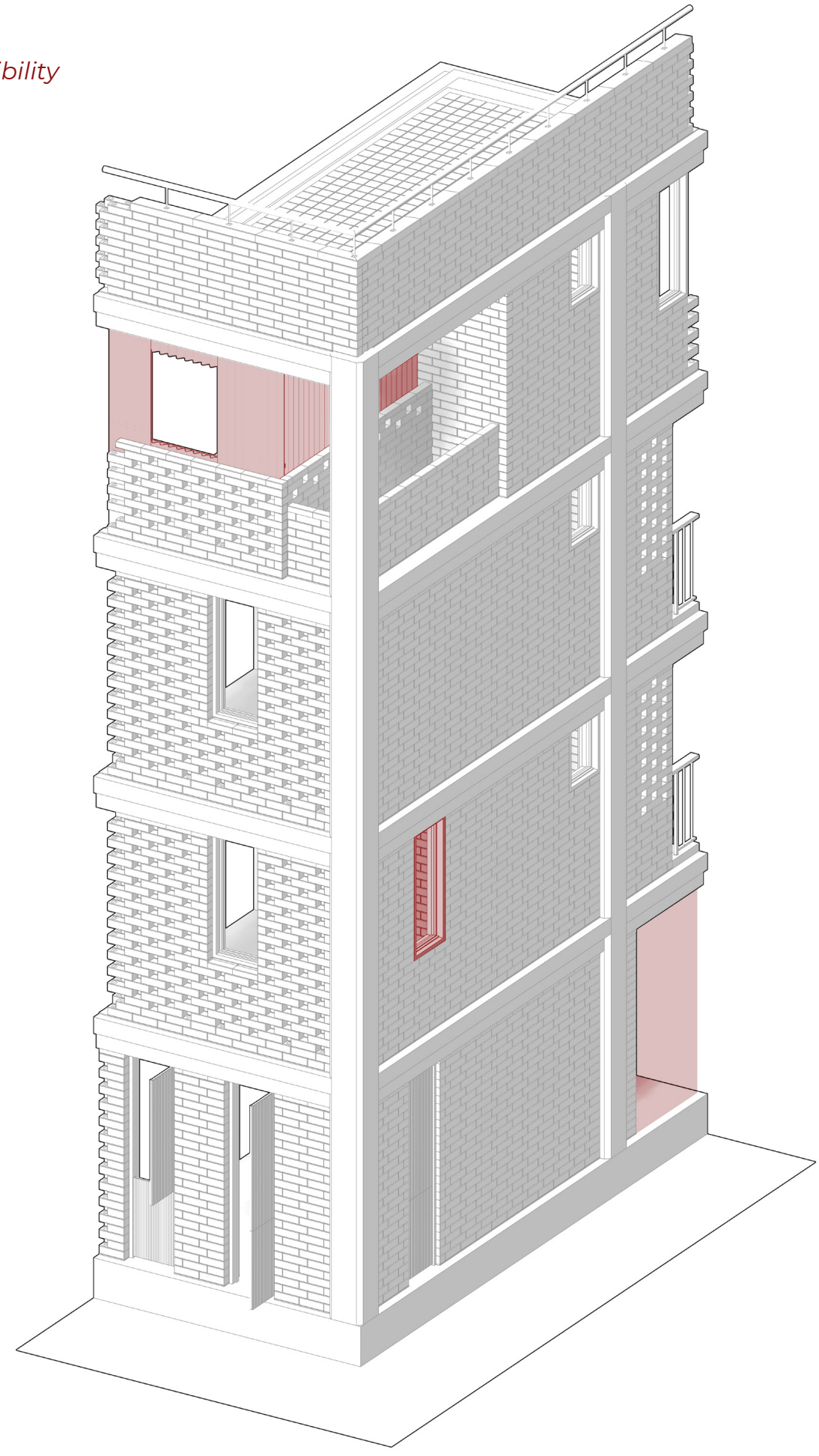
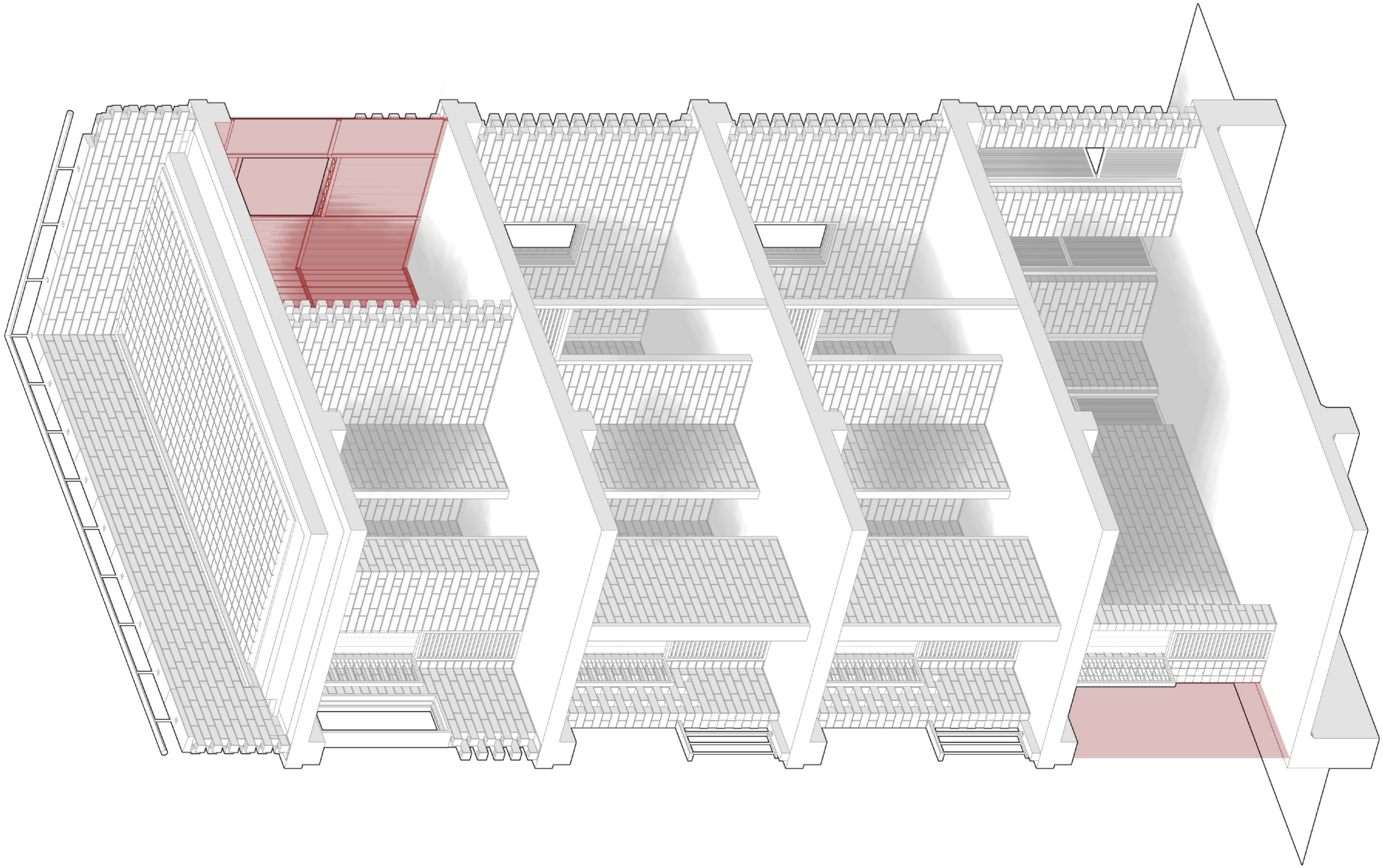
_Detailed 3D Fragment Model









CONCLUSION

REFLECTION

From Global to Gerji

The rapid urbanization and population growth in the developing world, implies an urgent need for housing globally. And under this theme, the topic of Global Housing Graduation Studio this year is in the capital of Ethiopia, Addis Ababa, about "Creating Resilient Dwelling Clusters for Urban Resettlement". I choose this topic as I believe housing to be the building type having the closest relationship with its users, and its background set in the ancient continent is attractive and challenging as well.

Giving my own background, the word "Resettlement" becomes my focal point in an almost inevitable way. My family moved from a smaller city to one of the typical megacities in China when I was little, from which I experience the impact of urbanization on an individual level while being sensitive to it. In my perspective, if we broaden the meaning of "Resettlement", it appears as the connotations of "native & outcomer", "nostalgia" and "sense of belonging". Those are the ground of my graduation topic for the redevelopment of Gerji: "Co-habitable densification", which is much about caring for the affected individuals under the overwhelming urbanization.

Position finding

A primary role of research in my graduation project is to help me find my position and further adjust it. Starting with the earlier group research about Addis on all aspects, including statistic (hard data), culture (soft data), building (housing) and urban context (spatial mapping), it draws an image of a young, underdeveloped African city with little resource, inhabited by people with various rich cultural background. There are great potentials, but the constraints are more obvious and should be taken into serious consideration. That's why the tone of my position was setting into solving realistic problems already back to the beginning.

But I have to admit that I didn't have a concept of Addis in reality until we went for the excursion. It was a trip facing directly with poverty out of the experience I had before. After I got that concept, I'm more certain that building housing projects in such a context, is not about the self-fulfillment of architects, but the very essential needs of the dwellers. That's where my decision of taking a humbler realistic approach comes from.

This position is quite different from the positions we took for my Msc1 and Msc2 Studios (Interiors, buildings, city and Public Building Budapest). In those two cases, it was more about a statement of the architect, to which sometimes other factors could give way. These position differences could be derived from the condition difference, as the previous ones are public buildings in wealthy western countries, but the graduation project is low-cost housing in the developing world. One is the icing on the cake, while the other is fuel in the snowing days.

Research as a design tool

Problem-solving, as the base of my position, contains two aspects of defining problems and seeking answers. The latter is where research plays its second role as a design tool.

Considering the lack of systematic research on the topic, the study of precedents is interspersing through the whole design process. I'm particularly searching for a low-tech vernacular approach. However, not many of them could suit my site precisely, giving its unusual condition. Therefore, I have to extend my search time-wisely and location-wisely. This resulted in looking into different kinds of traditional houses in Ethiopia, along with other housing projects globally. The precedents come from locations varying from South Asian (especially India), to South America (Mexico), and then back to Africa.

I wouldn't say I learned directly from any of those projects, but many of them have inspired me. Say the Gando primary school by Francis Kéré, it is a simple solution for a simple request, build with simple materials and techniques, but still achieving its aesthetic value. I think that's something I'm also looking for in my own project. The material choice of stabilized compressed earth block is influenced by an experimental school in Sudan, however, regarding techniques, I learned from some Indian company. The spatial configuration is evolved from the house I grew up with in the subtropical city of Guangzhou. It is common there to have open-air staircases, and often a platform on higher levels. Those childhood experiences have been engraved in my memory. With this in mind, the project is indeed "global" housing. I guess that's because, despite the differences, there are as well common needs and values behind them.

Another method works well for me is interdisciplinary study with my friends from my own lab, landscape, building management and civil engineering. Having almost a full year time for this graduation project, allows me to work on the depth I have never been to before, (although the time will never be enough to develop a project). This often posts to me as the limitation of my heretofore knowledge and experience, and talking with friends of different professional background allows me to push that limitation further and furthermore review my project from other perspectives.

From Gerji to Global

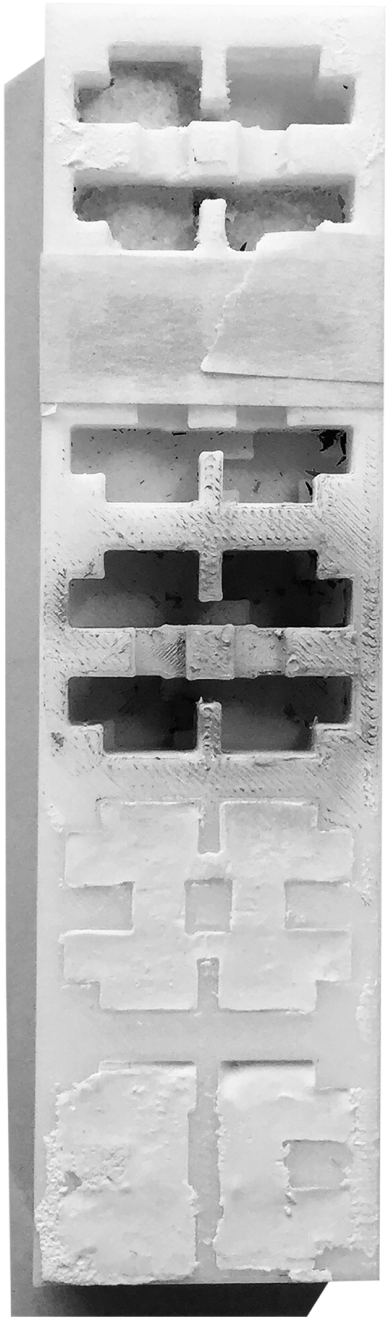
My proposal for Gerji starting with a single basic plot commonly applied in FHC sites. All other measures are generated from there step by step. This forms a systematic design that could be easily adapted to other FHC sites. But on a larger scale, I also see it as an example of a gentler densification alternative for other places with similar conditions.

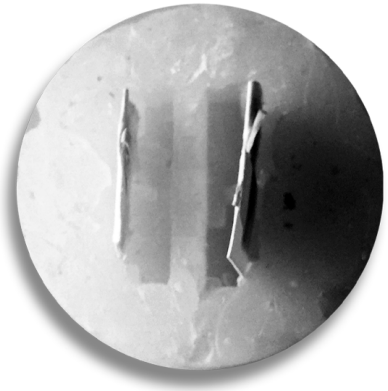
Depart from here

Apart from solving realistic problems, in this project, I also want to talk about "insignificant" individuals that are carried forward by the larger development picture and their belongingness. Translate that to architecture, it would be a series of questions like what kind of space should be considered as home? How would a housing project affect its dwellers? What will be their relations? And what role should architects take in this? I don't have a certain answer to any of these questions yet, but I believe this graduation project would be my answer of the time. And those small thinking could perhaps have a larger social and professional impact (at least for myself). After all, the large part of architecture is done without architects, or by unknown architects, and most probably I will be one of them.

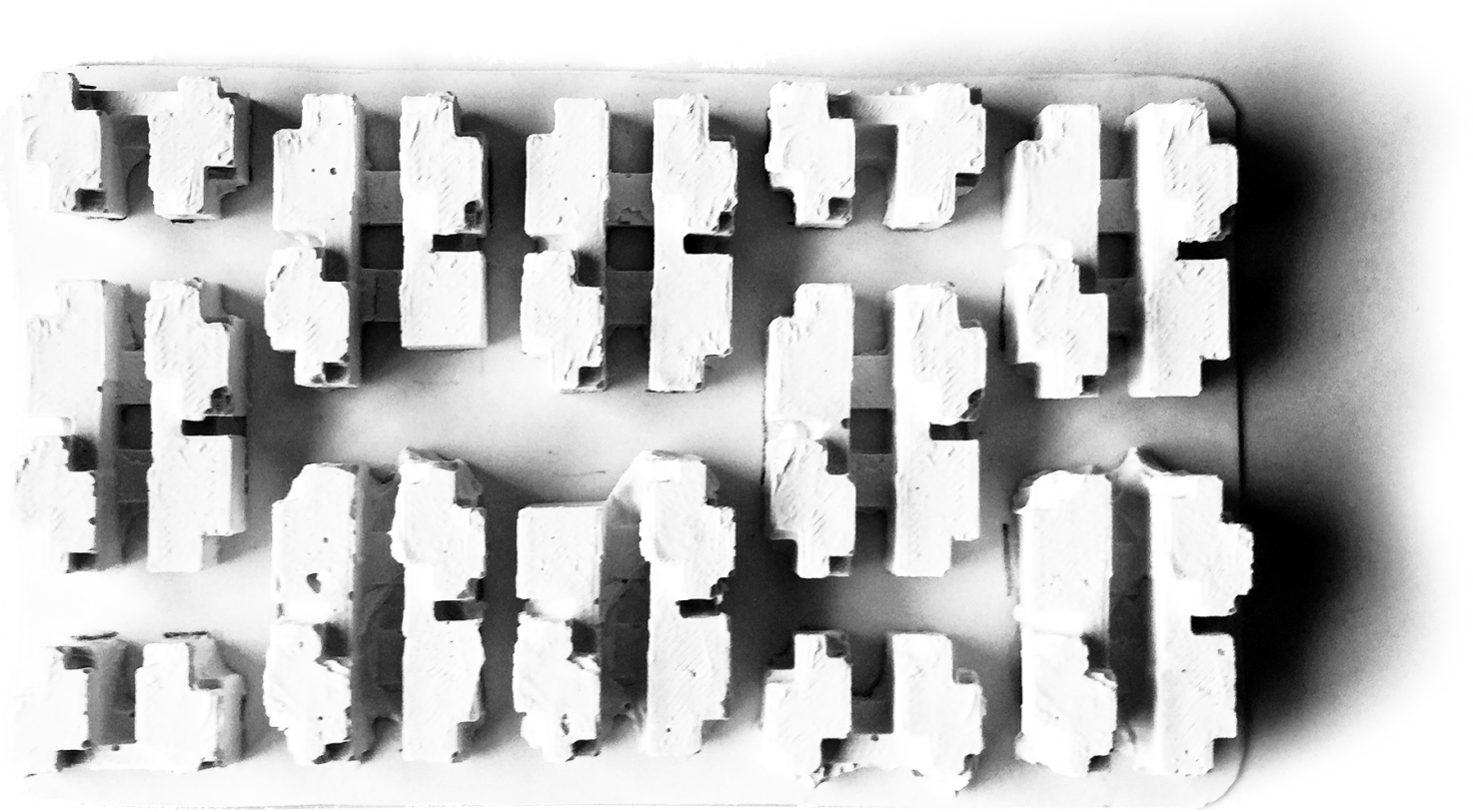
25/05/2020
Delft, The Netherlands

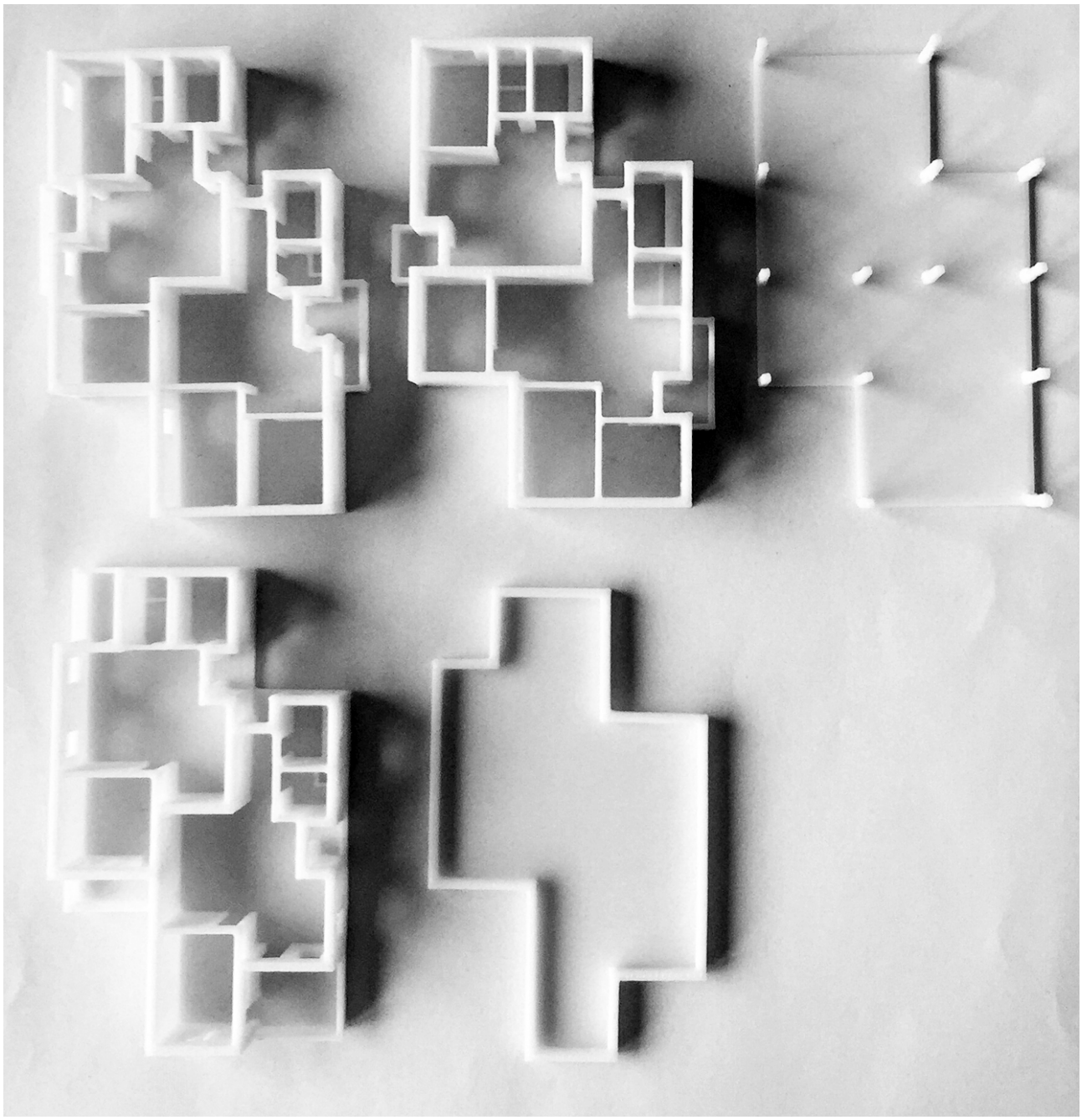
PROCESSES

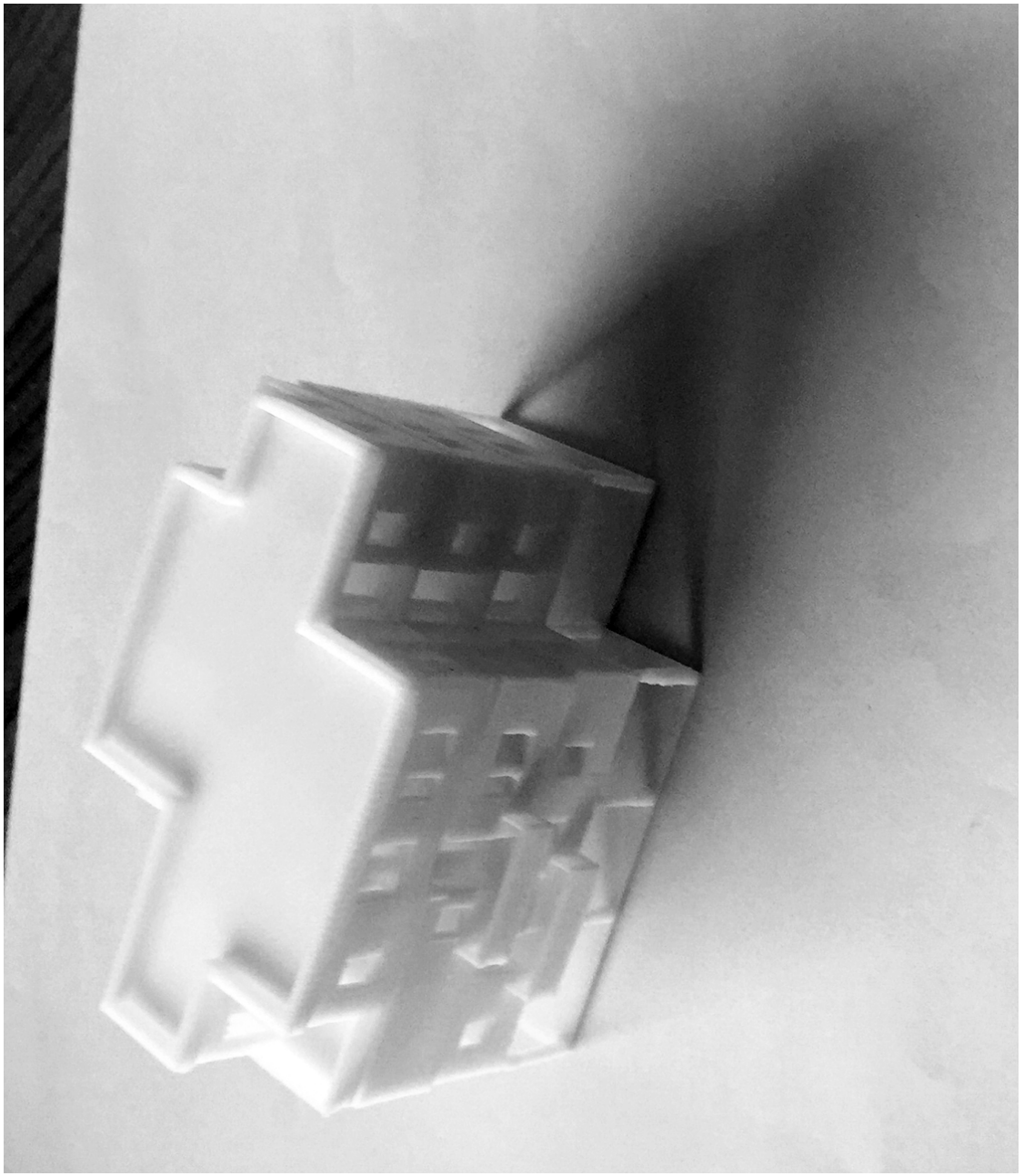












ANSWERING THE RESEARCH QUESTION

Research Question

The general research question is how to achieve collective welfare between the locals and new inhabitants, by creating a co-habitable community under the context of urban densification and sufficient infrastructure?

Sub questions:
1. What are the common and conflicting concerns of original and new dwellers?

The architectural ethnography study has shown that in Rotterdam and Addis, regardless of the differences in all aspects, when it comes to housing, people are all looking for something that is meeting the essential living needs, and further to feel safe with and get attach to. The gentrification happening in Oude Westen is excluding away its original inhabitants. In the case of Kolf Low-cost Housing site, the appropriations happen to the houses could be seen as the connections of people and the physical environment that they are living in.

But to achieve this goal, a conflict would emerge between the original and new residents of Gerji, as the land is taken away from the original residents to build the houses for the new residents. Meanwhile, they have different standard towards housing. The original residents have settled in Gerji since 1980s, they built and improved their life there overtime. This results their higher exception and standards for housing. More often, they tend not to leave their old houses.

In this project, the needs from both side should be meet and the tension between them should be eased.

2. To what extent the site should be densified?

The need of densification is urgent in the city scale. If we take a look at the current condominium solutions, 20/80 and 40/60 are giving out two different approaches. The 40/60 scheme is applied in larger scales, tend to be mid-rise but densely distributed. 20/80, However, is a high-rise scheme, leaving large ground floor area empty. A large amount of 20/80 buildings are left empty, lack of livelihood. It seems that it's not fitting into the context of Addis.

In the specific site of Gerji, seeing its role in the city that is in the new city centre, but in a broader sense, I tend not to go an extreme path. The main reasoning would be the restrictions posted from the city side. The frequency of electricity blackout wouldn't be ideal for the buildings with lift. That's why the site would be densified in a gentler way, mainly keeping up to pedestrian friendly 5 to 6 floors. As a compensation, the scheme is strongly adaptable to other areas of Addis (especially FHC sites).

To conclude, Gerji as a single site not necessarily need to reach its largest densification capacity, but it could be an example to densify the city gently as a whole.

3. What are the essential infrastructures that are needed for a good quality of life, and how to build them?

The infrastructures for the good quality of life could be the ones that assist with basic living activities, as for water, electricity supply, but moreover the ones that heading for a higher goal of improving the living experience in the neighbourhood. The former one could be solved technically, with the help of reusing some of the old infrastructures of Gerji. As for the later one, in the scheme of "Gerji Co-habitable Densification", the actions are taking in different scales, encouraging the social interaction and helping with the generation of a new community.

A STORY OF LIYA AND HER FAMILY

Liya is a lady who lives in Gerji site since the 1980s. She owns a small single-bedroom house with a big courtyard where she has planted many plants.

As the Gerji densification going, she left her house and moved into a duplex unit with an extra bedroom in the new constructed neighbourhood.

Soon, she lent the spare bedroom on the upper floor to a young visiting doctor of the Korean hospital.

Everyday coming back to home, she passes by the communal terraces on the ground and first floor, where she meet her old friends and meantime the new neighbours.

She get to know a girl who always dry her spices on the terrace, who is new to the city and rents an unit on the ground floor.

The girl became Liya's helper later. At a normal day, she would walk up to Liya's apartment and help with the housework, and by night returning to her own room.

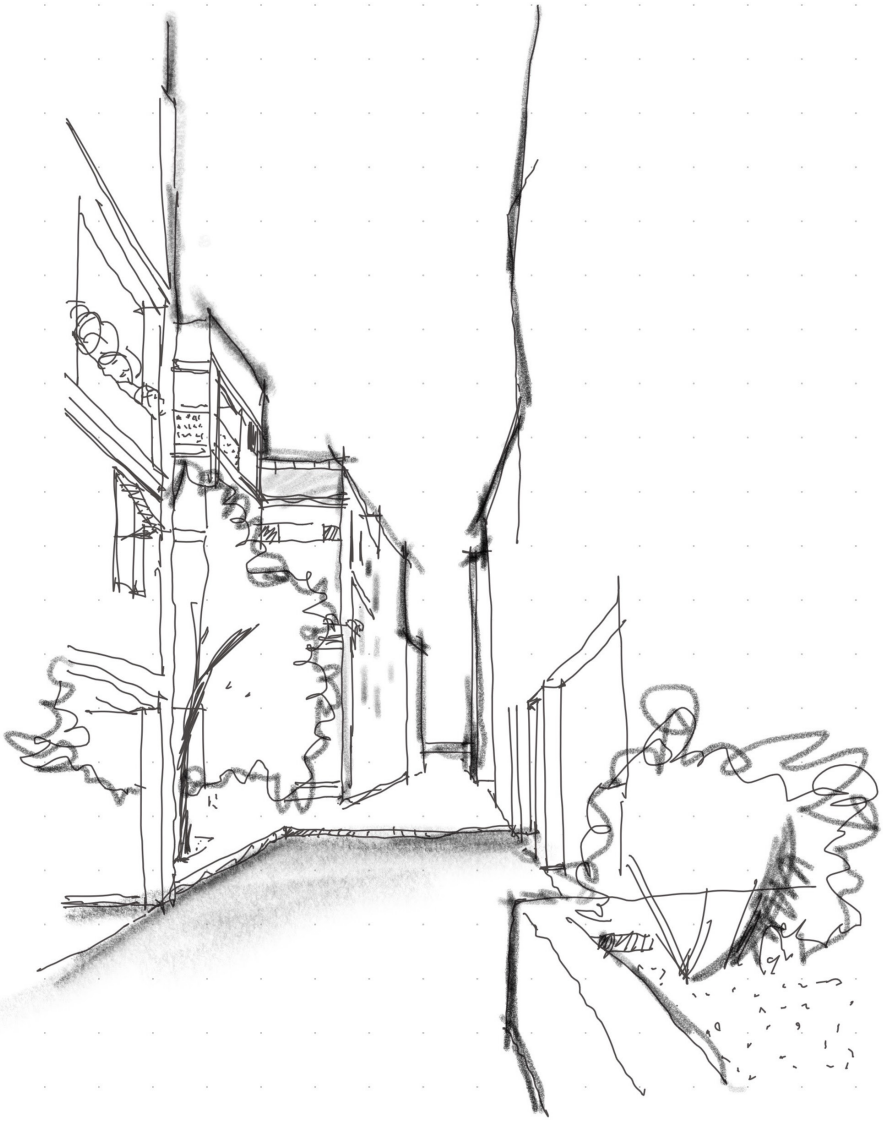
The grandson of Liya, Kofi, would start his year in the close-by high school, so he moved in with his grandma. Liya built an extension for the boy, right next to her own bedroom.

On the boy's way back from school, he would pass by the sequences of public space of the neighbourhood, where he sometimes would play with his school friends. When it's time for him to go back home for lunch, the smell of food that is filling the communal staircase would guide him home.

Later his parents also decide to move in. As the doctor has finished her program and left the country, They could move into the upper floor. The family always have their dinner together in the dinning room downstairs and later go up to the living room to watch TV series.

As they have their private roof terrace, Liya had turned it to a roof garden again, they don't often use the communal roof terrace. But one of the things Kofi likes to do most is to watch their neighbours on the terrace, and talk with them through air.

A few years later, Liya's helper brought her family to Addis. They bought a small 2 Bedroom apartment in the neighbourhood. And hopefully, everyone's life is heading to a better future.



A ROUTE



The pedestrian Pocket



Public space inbetween clusters





Center public space



On the ground floor looking at the staircase leading up to 1st floor communal terrace



1st floor communal terrace



On 1st floor communal terrace looking at the staircase



On the staircase landing looking at another dwelling block



On the staircase landing looking at the door of apartments



On communal roof terrace looking at the bamboo awning

Thanks.

谢谢。