



NEGOTIATING THE PERI-URBAN

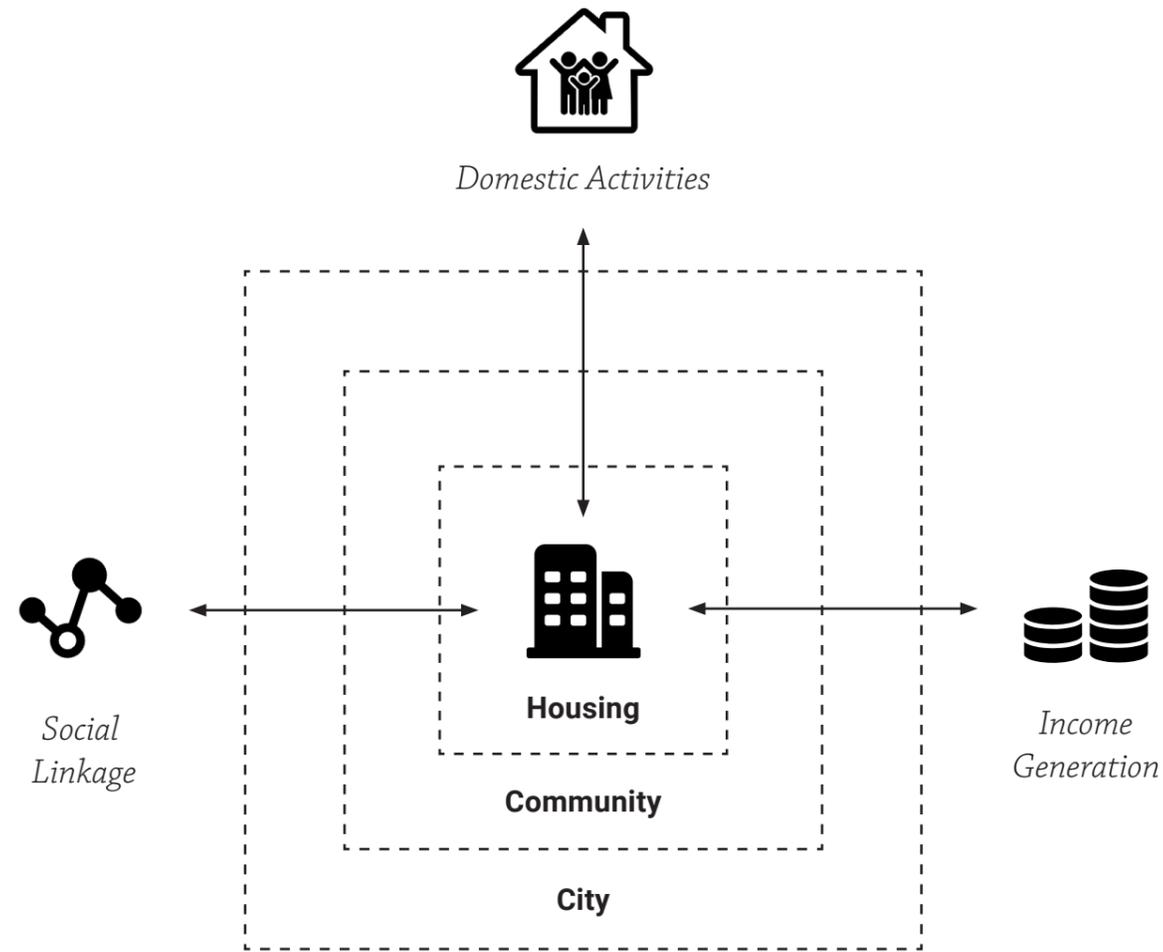
*Exploring Housing Serves as a Mediator between Local Inhabitants
and Migrant Quarry Workers in Navi Mumbai*

P5 Research & Design Booklet

I. BACKGROUND

This chapter provides an insight to the background of this master project, especially the rural - urban migration issue in India.

INTRODUCTION VIDEO



In general, the dynamic socio-spatial spaces in the peri-urban area are full of multidimensional conflicts between villagers, migrants, and government officials. Fortunately, housing is a combination of domestic activities, income generation, and social linkage in the Global South. It is significant for urban development and facilitates social integration. It led me to pursue and challenge an inclusive way to mediate the conflict and complex spaces in peri-urban areas.

Research Question

How can housing serve as a mediator between local inhabitants and migrant quarry workers in order to negotiate the peri-urban area in Navi Mumbai and build an inclusive Indian city?

Problem Statement

Approach & Ambition

Background

II. DESIGN RESEARCH

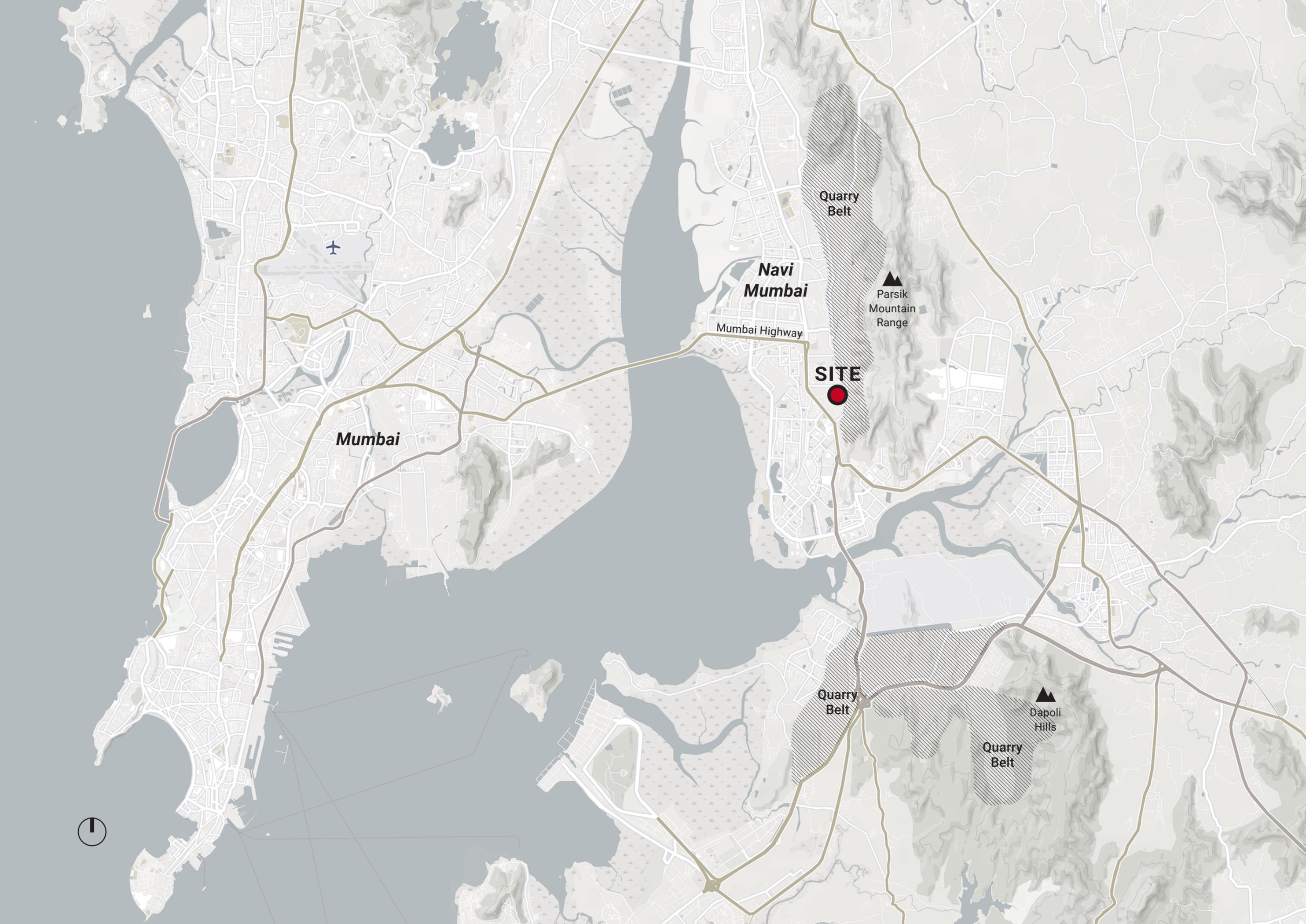
This chapter elaborates on how I worked with the design research, which is focused on three fields: stone quarries, quarry settlements, and housing in India.

Stone Quarry

Navi Mumbai's quarry belts are located in two main areas. One is located between the Parsik Mountain Range and the Mumbai highway, and the other is located in the Dapoli Range to the south of the city.

The rock formation in the region is derived mainly from Deccan basalt and also from granites, gneiss and laterite.¹ The conversion of this granite and Deccan basalt into smaller pieces is the main usage of the material due to its poor natural quality.

¹ Lux, Valerie Saavedra, and Paul Watson. "Navi Mumbai Stone Quarry Settlements: 10 Community Spaces." edited by Bo Tang: London Metropolitan University; Association of Rural People for Health and Educational Needs, 2008, 10.



**Navi
Mumbai**

Mumbai Highway

Quarry
Belt

▲
Parsik
Mountain
Range

SITE



Mumbai

Quarry
Belt

▲
Dapoli
Hills

Quarry
Belt



II. DESIGN RESEARCH

Stone Quarry

With ongoing resistance from local residents and environmentalists, the authority was under pressure to close the quarries in Navi Mumbai in 2016 temporarily. Despite a decision to reopen the stone quarries in 2021, it is foreseeable that the quarries will eventually close in the future. The planning of this area, therefore, requires a long-term perspective.

11 killed in stone quarry blast in India

4 August 2018 10:36

Share in:   



NEW DELHI. KAZINFORM - At least 11 labourers were killed and four others wounded in a dynamite blast inside a stone quarry in southern Indian state of Andhra Pradesh, officials said Saturday, [Xinhua](#) reports.

Source:
https://www.kazinform.kz/en/11-killed-in-stone-quarry-blast-in-india_a3343136
<https://india.mongabay.com/2020/11/quarrying-in-kerala-needs-more-monitoring-indicates-environmental-panel/>
<https://www.telegraphindia.com/west-bengal/illegal-stone-quarries-in-two-blocks-of-purulia-district-cause-pollution/cid/1748342>
<https://www.mumbailive.com/en/environment/state-government-decision-to-reopen-102-stone-quarries-in-navi-mumbai-66086>

Quarrying in Kerala needs more monitoring, indicates environmental panel

by K.A. Shaji on 30 November 2020



Maharashtra Government Decides To Reopen 102 Quarries In Navi Mumbai

After acquiring land for Navi Mumbai, CIDCO had allotted stone quarries to Bhumiputras as a means of livelihood.

BY [MUMBAI LIVE TEAM](#) • 12 MONTHS AGO • ENVIRONMENT • MUMBAI



SHARES 19 The [Maharashtra](#) government h
quarries in [Navi Mumbai](#).

Illegal stone quarries in two blocks of Purulia district cause pollution

Leaders & mafia in collusion: villagers



One of the illegal stone quarries near the Jharkhand border.
(Biswanath Roy)

[Abhijeet Chatterjee](#) | Purulia | Published 24.02.20, 07:17 PM

Several unauthorised stone quarries are operating in two blocks of Purulia district close to Jharkhand border, triggering dust and sound pollution and damage to homes.



Quarry Settlement

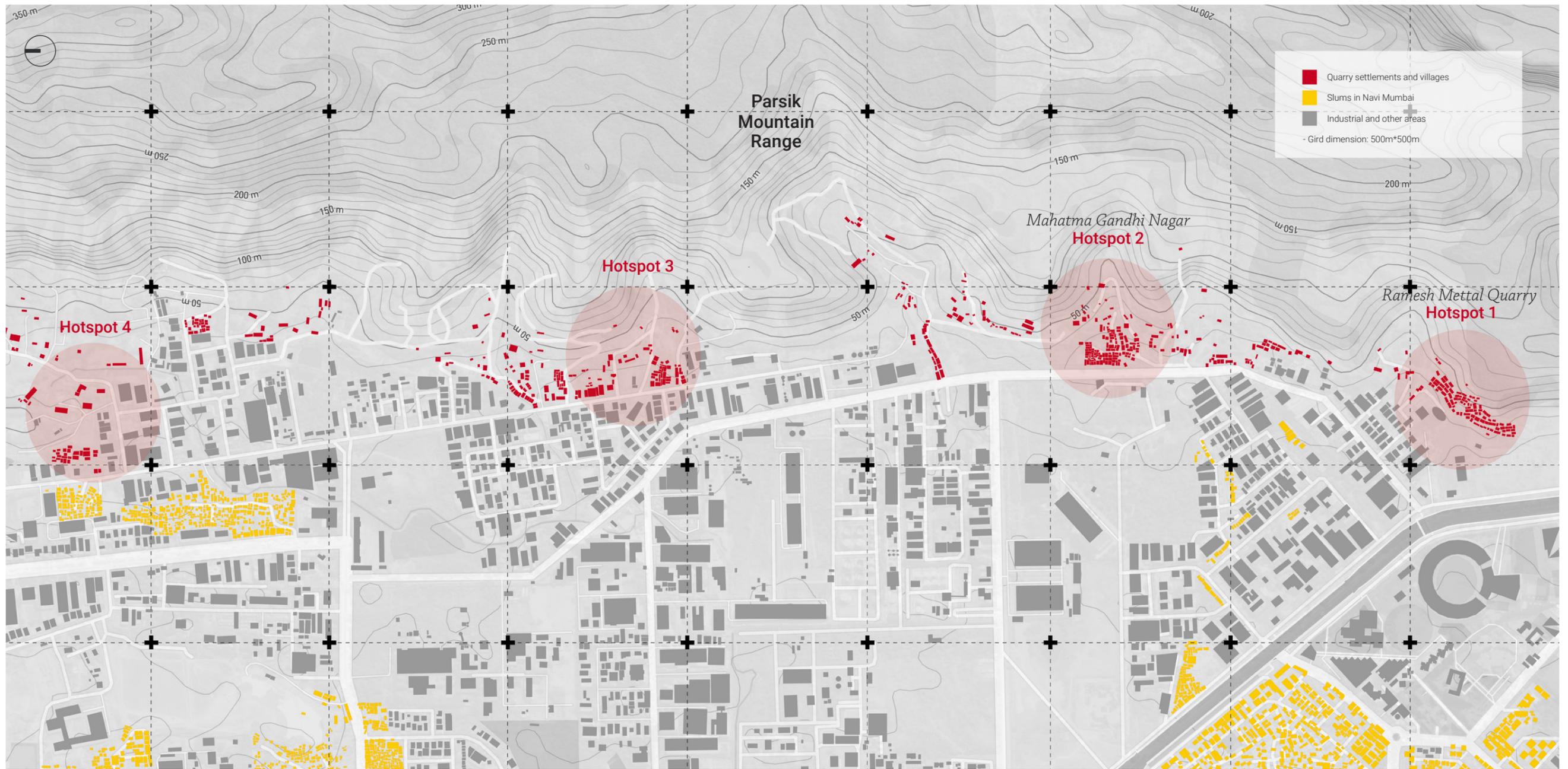
Since they could not afford formal housing in the city, most quarry workers lived in collective accommodation provided by quarry owners near the quarries. However, due to the poor living conditions there, some workers chose to leave the accommodation and build their informal houses instead.

These houses are exposed to high levels of risk, including pollution, dynamite blasting and heavy industrial road traffic. During the monsoons, floods can also endanger residential areas.

II. DESIGN RESEARCH

Quarry Settlements

The quarry workers' settlements are close to their quarries. Most of them are extensions of the remained urban villages, gathering in small clusters and each one has a high density. There is an urgency to resettle them into a safer place and upgrade the neighbourhood.



Map of quarry settlements allocation in Navi Mumbai.

II. DESIGN RESEARCH

Quarry Settlements



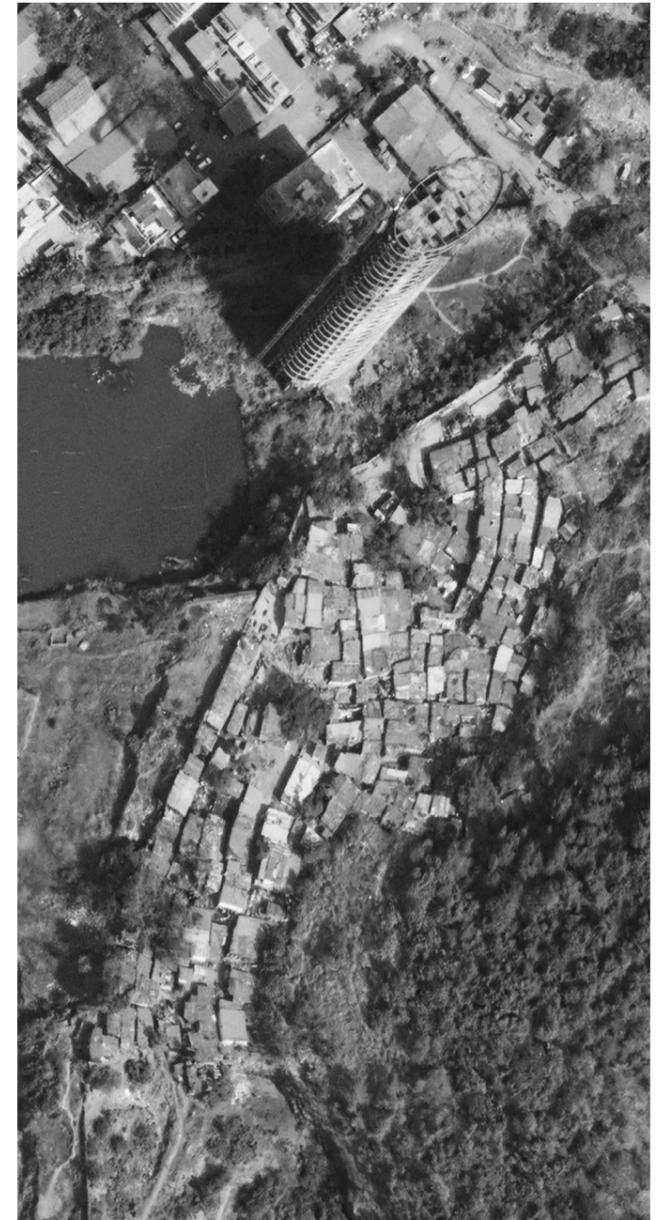
2003



2009



2015



2022

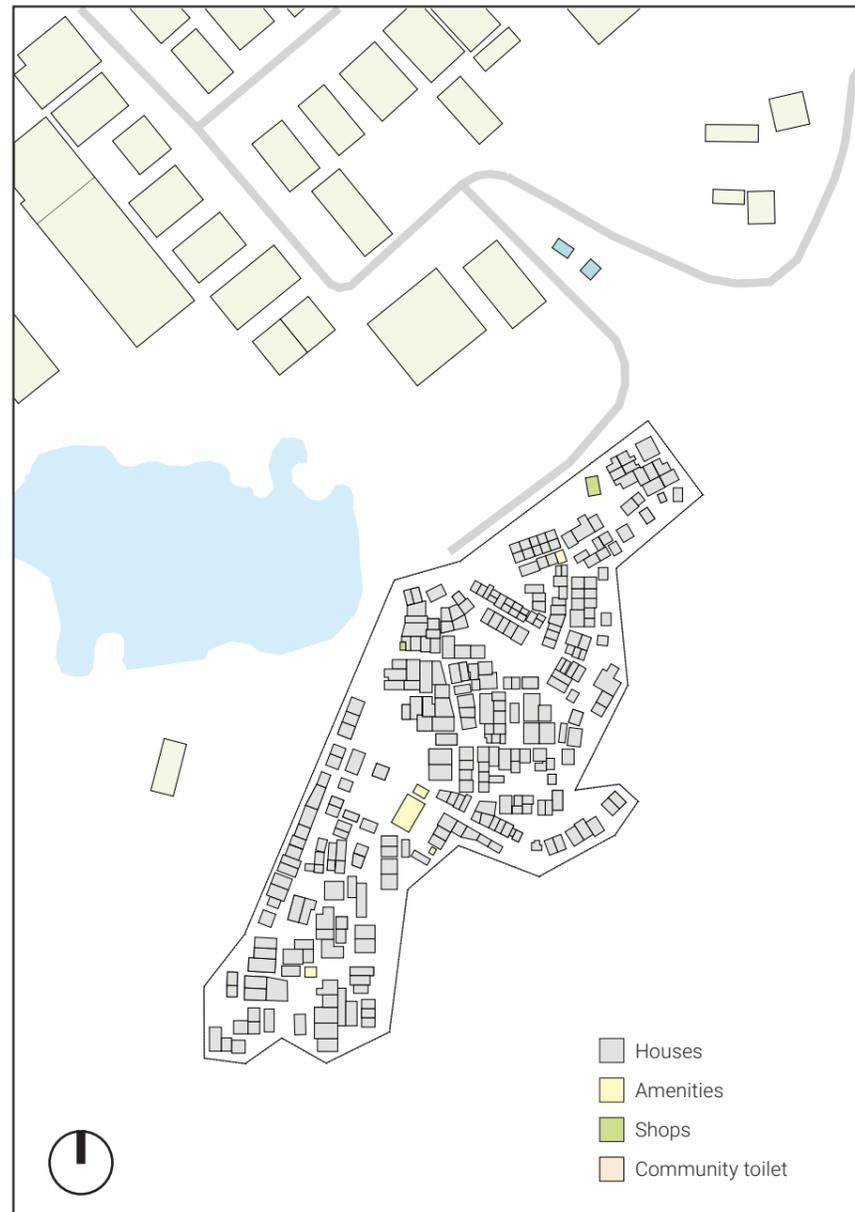
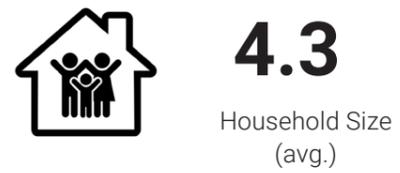
Data Source:
<https://app.shelter-associates.org/dashboard/city:Navi%20Mumbai>
Image Source: <https://www.sutori.com/en/story/ramesh-metal-quarry-nerul-navi-mumbai--oHFsZ9BFTUpkAi9ALsLvnZ5x>

II. DESIGN RESEARCH

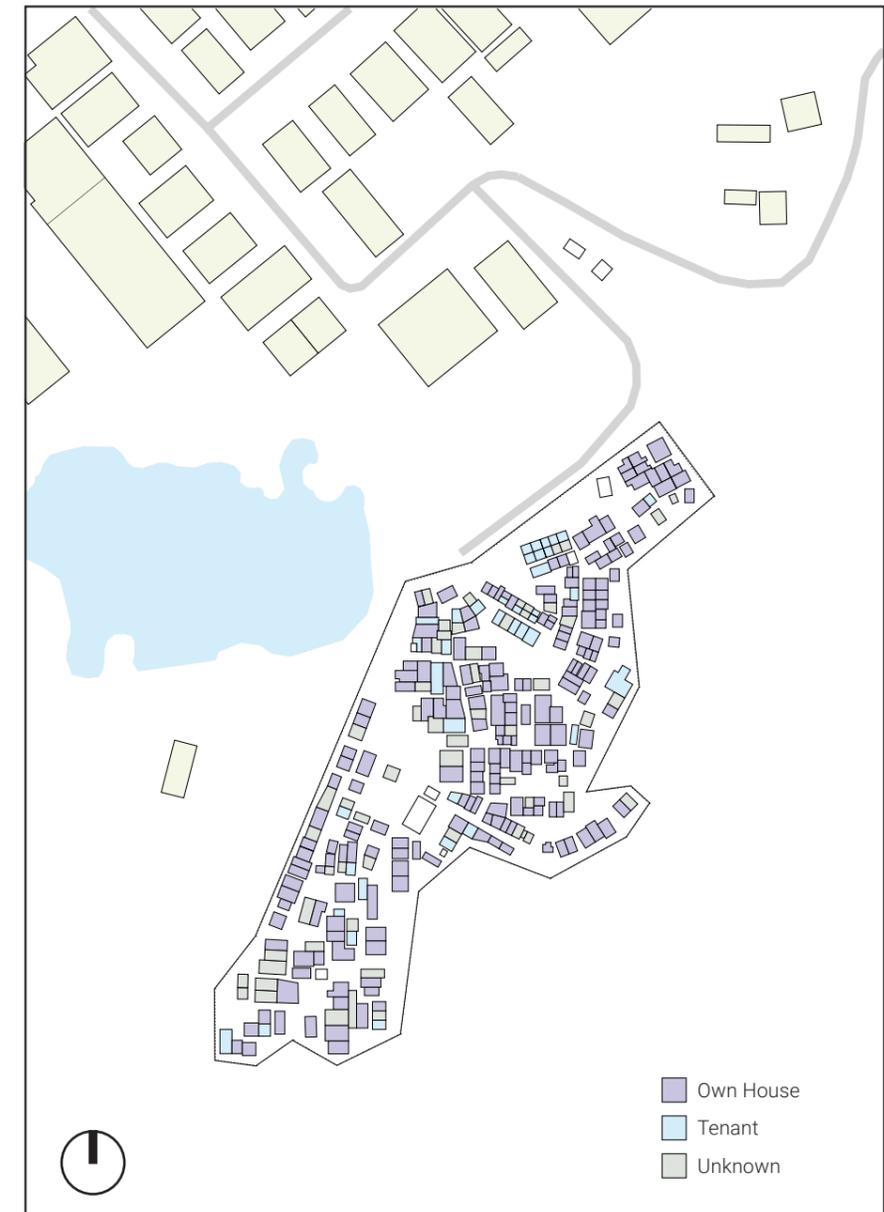
Quarry Settlements

Hotspot 1 Ramesh Mettal Quarry

Dwellers: 1,550
Dwellings: 310



Programme



Ownership

II. DESIGN RESEARCH

Quarry Settlements



2003



2009



2015



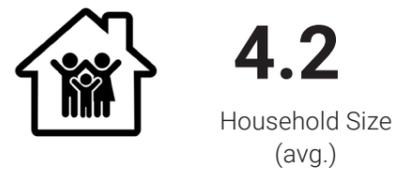
2022

II. DESIGN RESEARCH

Quarry Settlements

Hotspot 2 Mahatma Gandhi Nagar

Dwellers: 2,750
Dwellings: 550



Programme



Ownership

II. DESIGN RESEARCH

Living Pattern



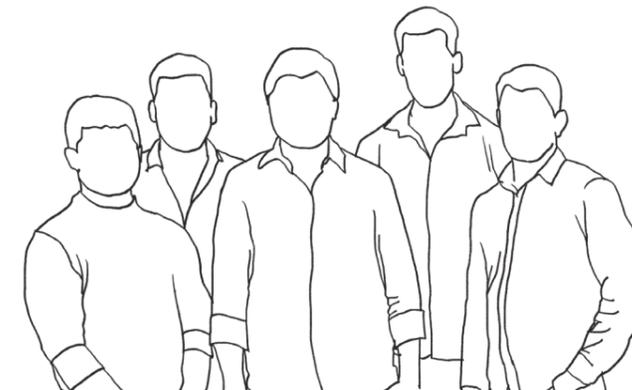
Source: GloocalResearch. "The Dark Sites of Granite: Modern Slavery, Child Labour and Unsafe Work in Indian Granite Quarries - What Should Companies Do?". Utreche, The Netherlands: India Committee of the Netherlands, 2017.

" In Andhra Pradesh 80% of the migrant accommodation consists of a semipucca houseix, roofed with tin or asbestos sheets with one lamp and one fan, where **12 to 15 persons are accommodated**. The ventilation of the rooms is so poor that one can barely see without light during daytime."

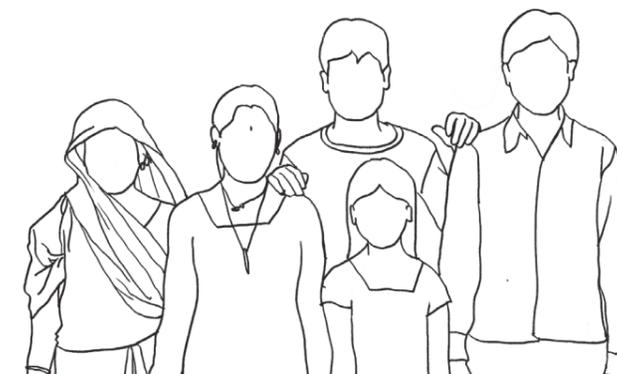
-- <The Dark Sites of Granite>



Quarry Worker
Single



Quarry Worker
Group



Quarry Worker
Family
Avg. Size 4.5 person

II. DESIGN RESEARCH

Living Pattern

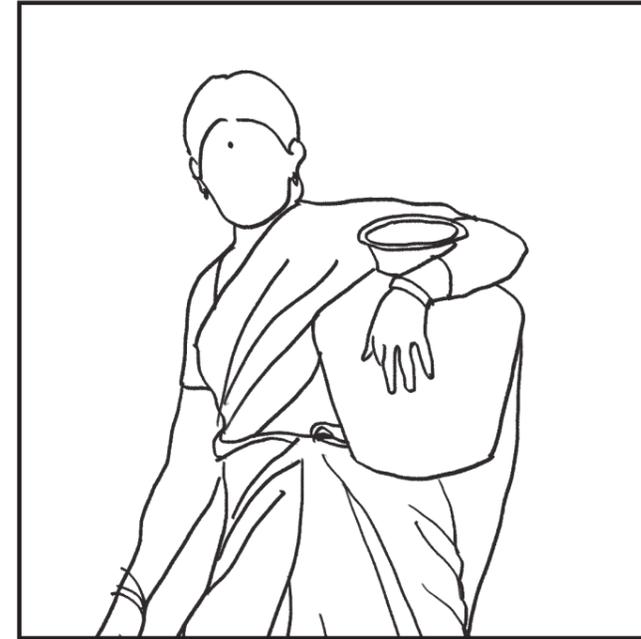
6:00



12:00



18:00



at quarry site

at home

Source:
Lahiri-Dutt, Kuntala. Gendered Livelihoods in Small Mines and Quarries in India: Living on the edge, 25.
Raj, Sanjay. Budhpura Ground Zero Standstone quarrying in India, 20.
The Dark Sites of Granite, Utrecht, India Committee of the Netherlands, 2017.

II. DESIGN RESEARCH

Living Pattern

Creche 'House Mother'



Source: Lux, Valerie Saavedra, and Paul Watson. "Navi Mumbai Stone Quarry Settlements: 10 Community Spaces." edited by Bo Tang: London Metropolitan University; Association of Rural People for Health and Educational Needs, 2008.

II. DESIGN RESEARCH

Living Pattern

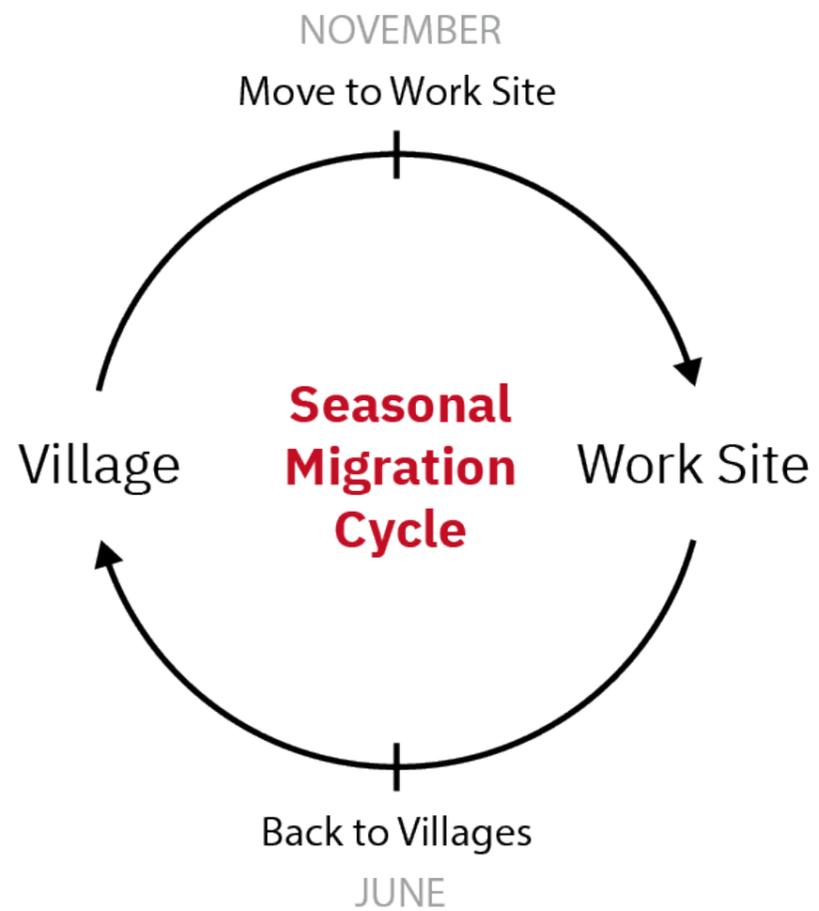
MAY 2022

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1 <i>International Worker's Day</i>	2	3 <i>Ramzan Id/ Eid-ul-Fitar</i>	4	5	6	7
8	9	10	11	12	13	14
15	16 <i>Buddha Purnima/ Vesak</i>	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				
		April 2022 Su M Tu W Th F Sa 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	June 2022 Su M Tu W Th F Sa 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30		Calendars by Vertex42.com © 2018 Vertex42 LLC. Free to print.	

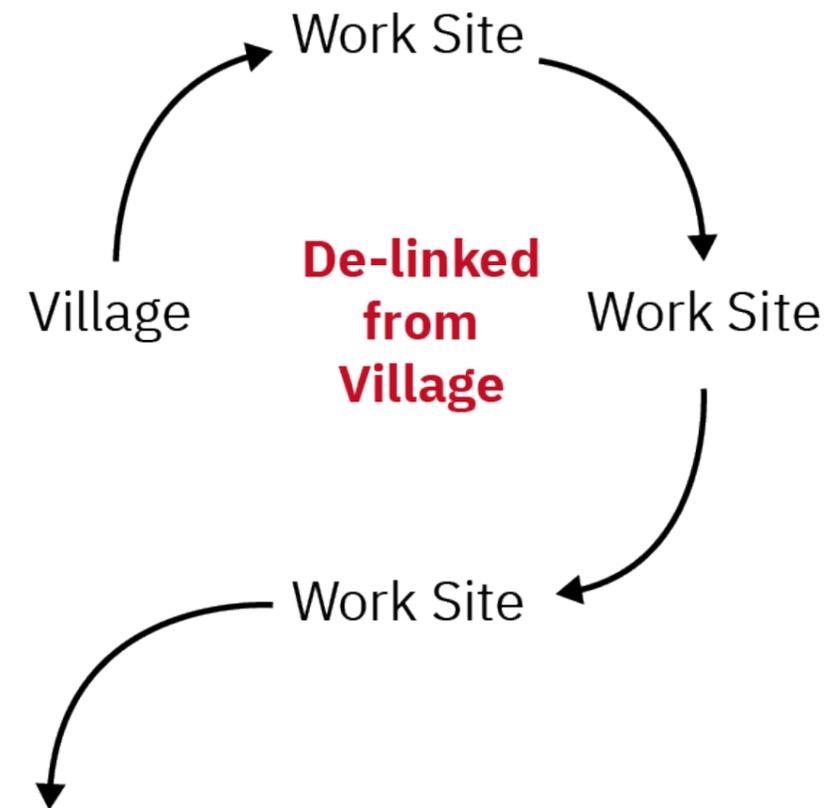
II. DESIGN RESEARCH

Living Pattern

*Migration Pattern Transition
of Quarry Workers in India*



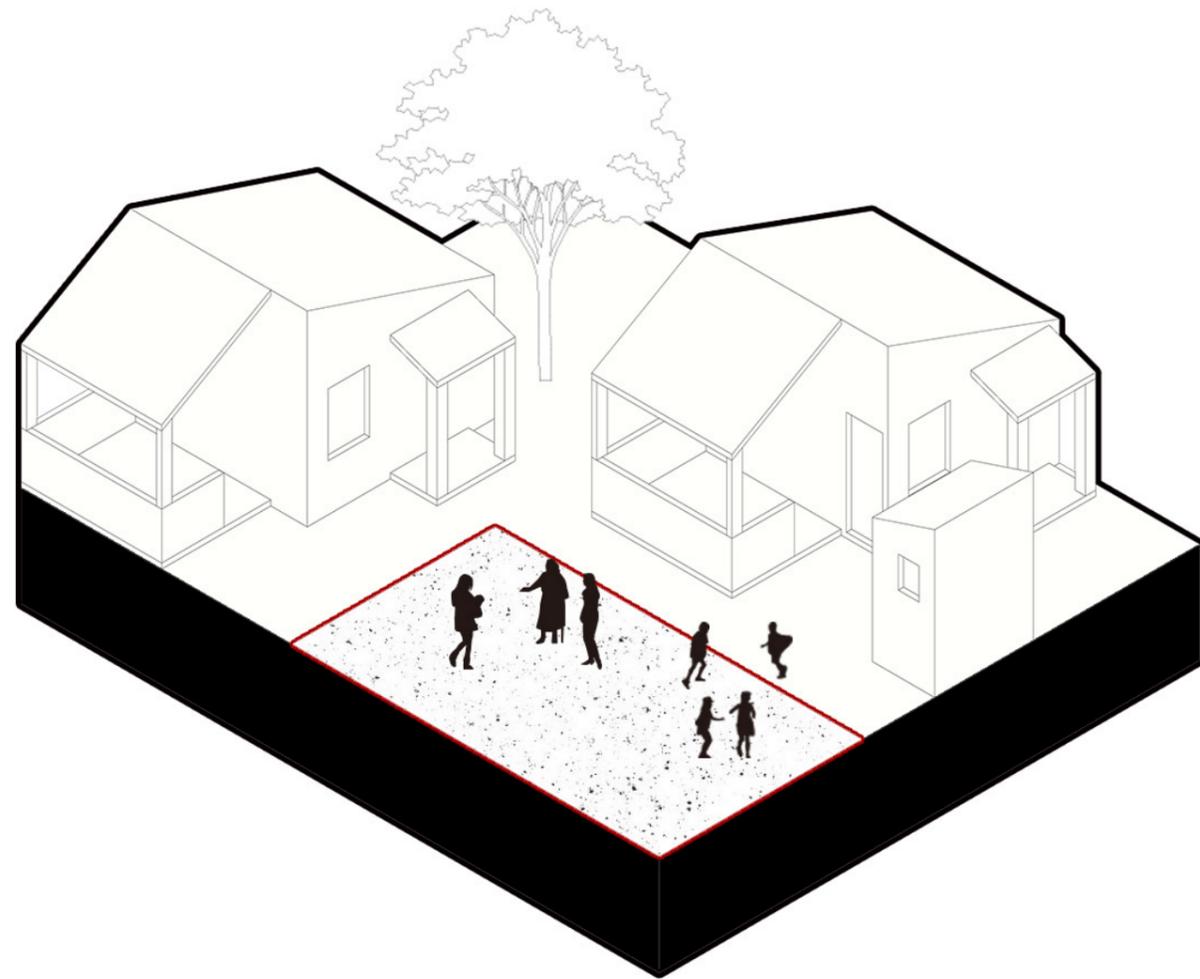
*traditional
migration pattern*



*changing
migration pattern*

II. DESIGN RESEARCH

Social Linkage



Courtyard as a Gossip Corner



Courtyard as a Reception Room

II. DESIGN RESEARCH

Housing in India



From top to down:
The central open space (courtyard) for community gatherings.
Residents celebrate the religious festival in the central open space.

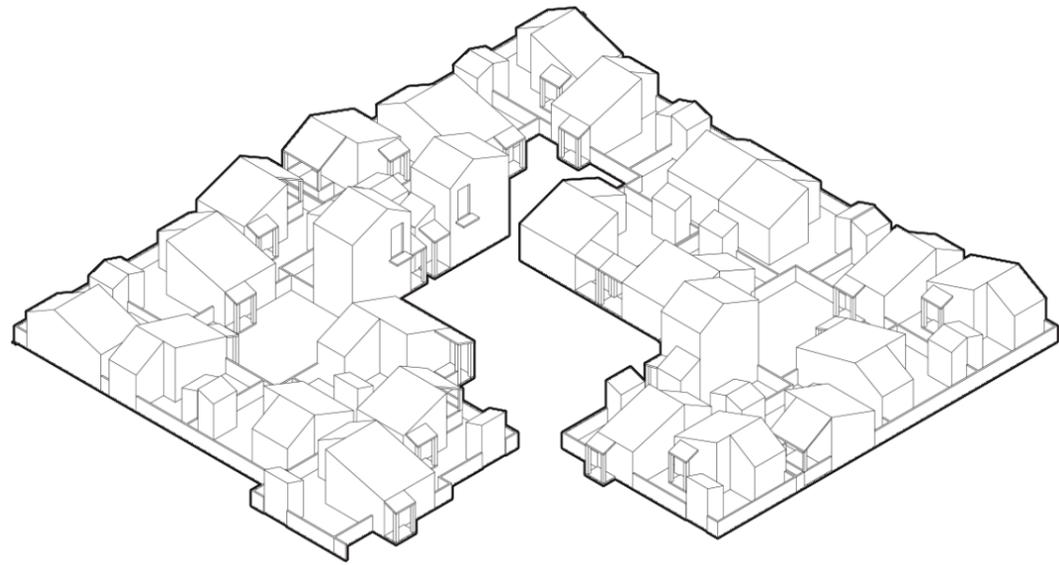


Versova Aga Khan Baug affordable housing in Mumbai.

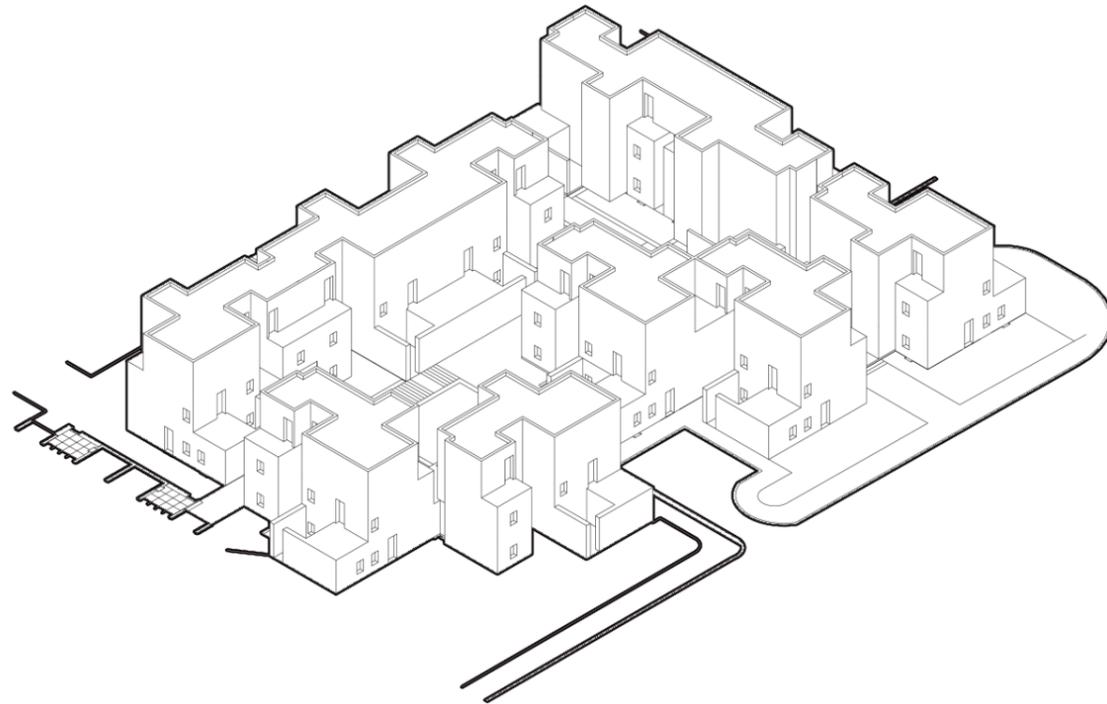
II. DESIGN RESEARCH

Housing in India

Low-rise Housing



Cluster layout of Artist Village.



Cluster layout of Raj Rewal CIDCO Housing.



Open-to-sky Space



Incrementality



Pluralism and Equity



Social Linkage

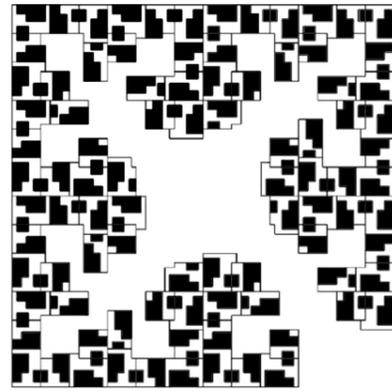


Materiality and
Climate Respond

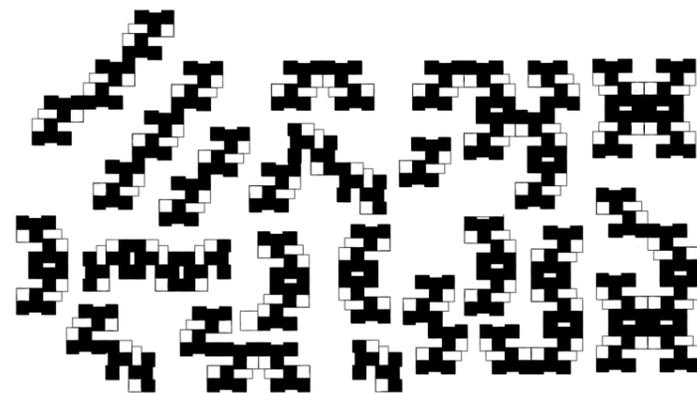
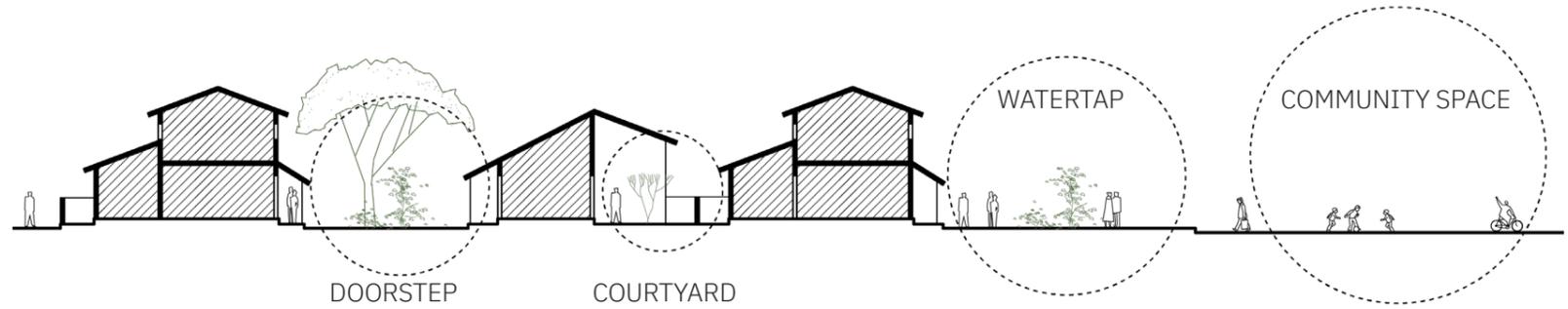
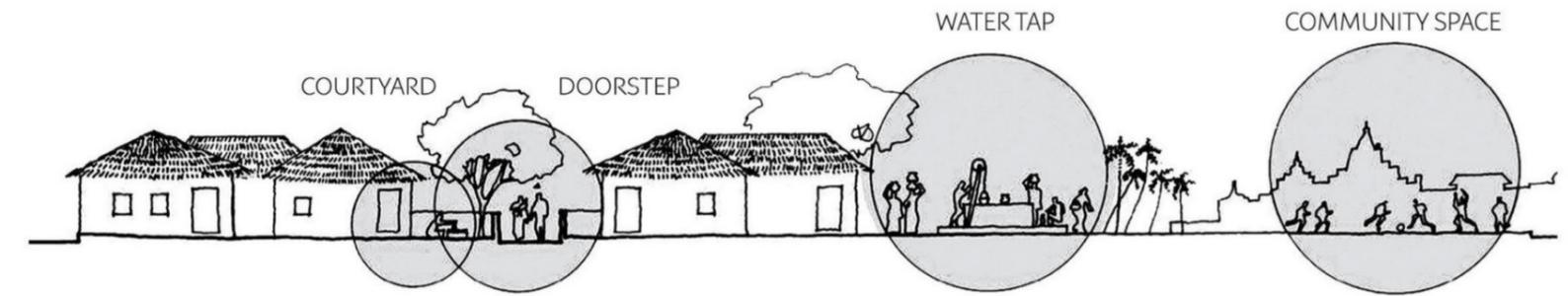
II. DESIGN RESEARCH

Housing in India

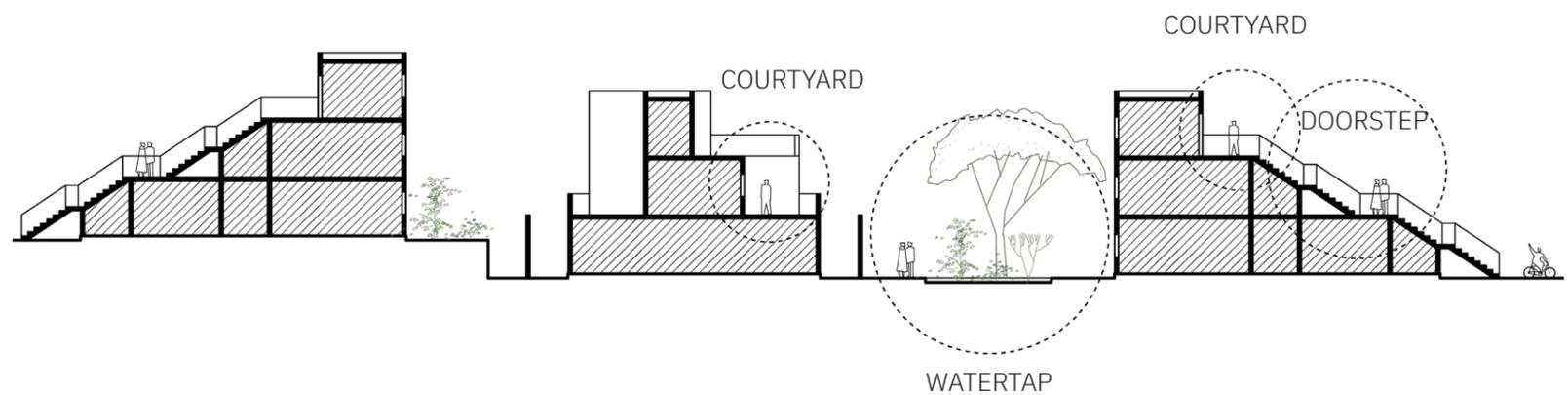
Low-rise Housing



Cluster layout of Artist Village



Cluster layout of Raj Rewal CIDCO Housing



Comparison of Charles Correa's spatial hierarchy section with Artist Village and Raj Rewal CIDCO Housing.

II. DESIGN RESEARCH

Housing in India



CIDCO
WE MAKE CITIES

Navi Mumbai Marches Ahead
With 'HOUSING FOR ALL'
89,771 HOUSES AT SEVERAL NODES
OF THE CITY BASED ON TRANSIT ORIENTED DEVELOPMENT

Ground Breaking Ceremony of
CIDCO'S MASS HOUSING SCHEME-2018
by
NARENDRA MODI
Prime Minister

ON TUESDAY, 18TH DECEMBER, 2018 AT 01:30 PM
AT: VASUDEV BALWANT PHADKE GROUND, LAL CHOWKI, ADHARWADI ROAD, KALYAN (W)- 421 301.

PROJECT HIGHLIGHTS

89,771 Houses 53,483 for Economically Weaker Section (EWS) and 36,288 for Lower Income Group (LIG) categories.	Houses in vicinity of Bus Depots, Truck Terminals and Railway Stations enabling Transit Oriented Development.
Bus Depots and Truck Terminals covered: Vashi, Kharghar, Kalambooli and New Panvel in addition to a Project at Talaja Node	Railway Stations Forecourt Areas covered: Sargpada, Junagar, Kharghar, Ramandongri, KharKopar, Mansarovar and Khandeshwar

Eligibility for Subsidy
for EWS under PMAY- Rs. 2.5 Lakh
for LIG under CLSS- upto Rs. 2.67 Lakh

DEVENDRA PADNAVS
Chief Minister, Maharashtra

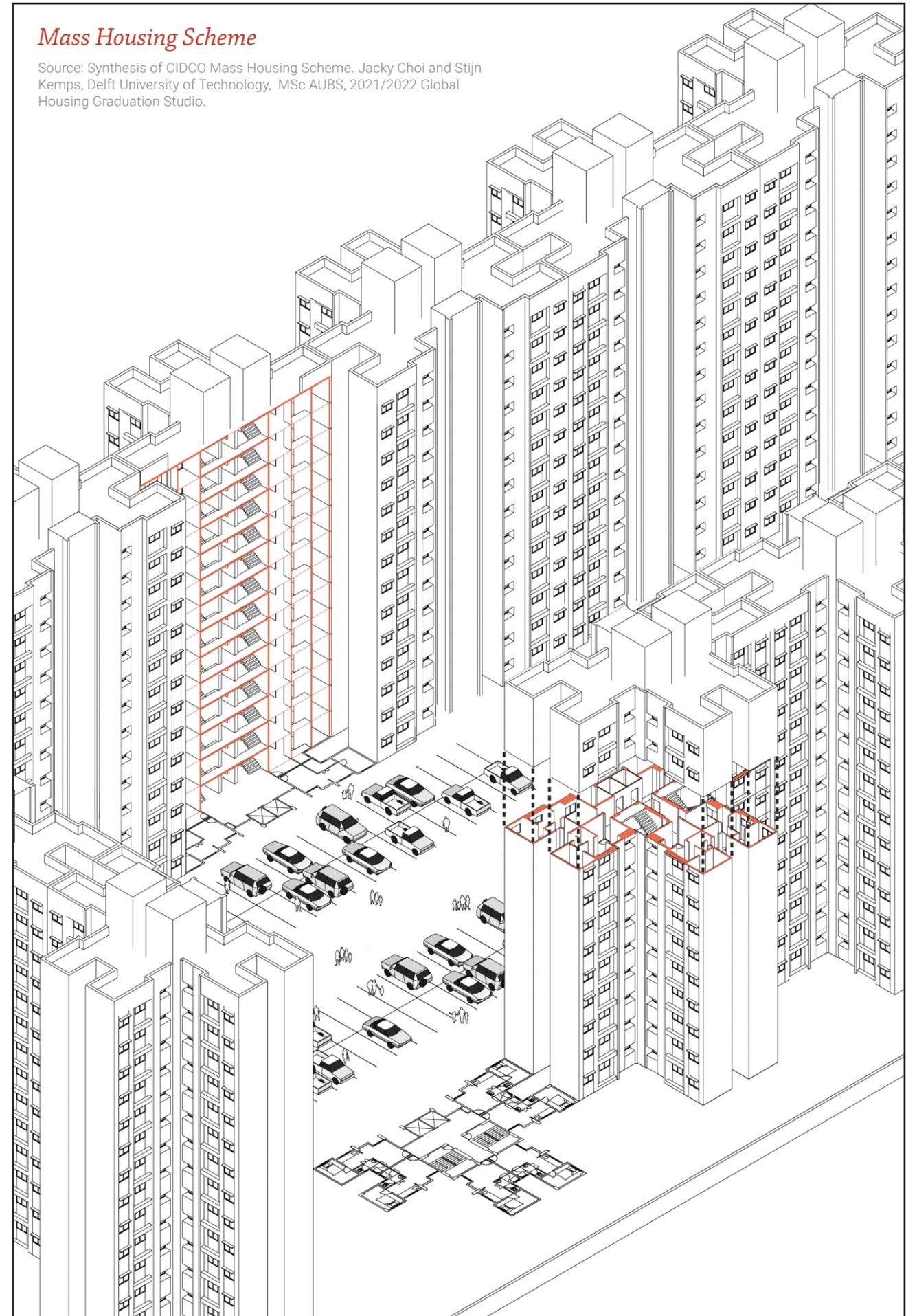
CITY AND INDUSTRIAL DEVELOPMENT CORPORATION OF MAHARASHTRA LIMITED.

REGD. OFFICE: Nirmal, 2nd Floor, Nariman Point, Mumbai- 400 021 | Phone: +91-22-4650-0900 | Fax: +91-22-2202-2509
HEAD OFFICE: CIDCO Bhavan, CBD Belapur, Navi Mumbai- 400 614 | Phone: +91-22-6791-8100 | Fax: +91-22-6791-8166
www.cidco.maharashtra.gov.in | CIN - U99999 MH 1970 SGC-014574 | CIDCO/PM/2018/18-19

Source: CIDCO Mass Housing Advertisement. Admin, W. (2020, 22 juli), Sarkari Yojana Latest News, <https://pml.in/maharashtra-govt-scheme/cidco-mass-housing-scheme/>.

Mass Housing Scheme

Source: Synthesis of CIDCO Mass Housing Scheme. Jacky Choi and Stijn Kemps, Delft University of Technology, MSc AUBS, 2021/2022 Global Housing Graduation Studio.



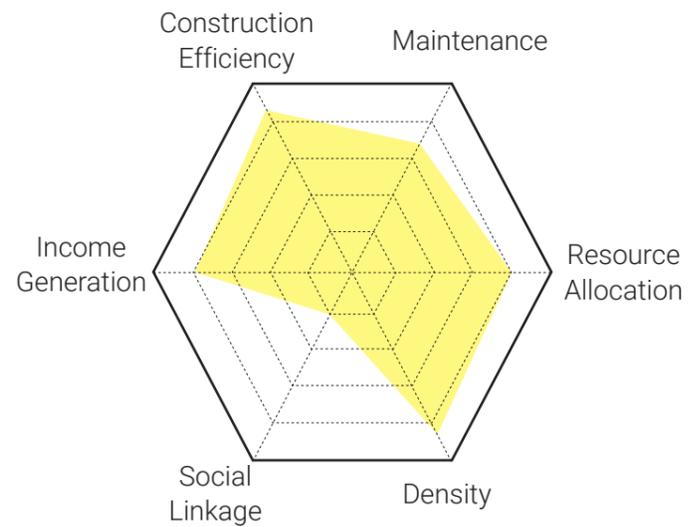
II. DESIGN RESEARCH

Housing in India

URBAN



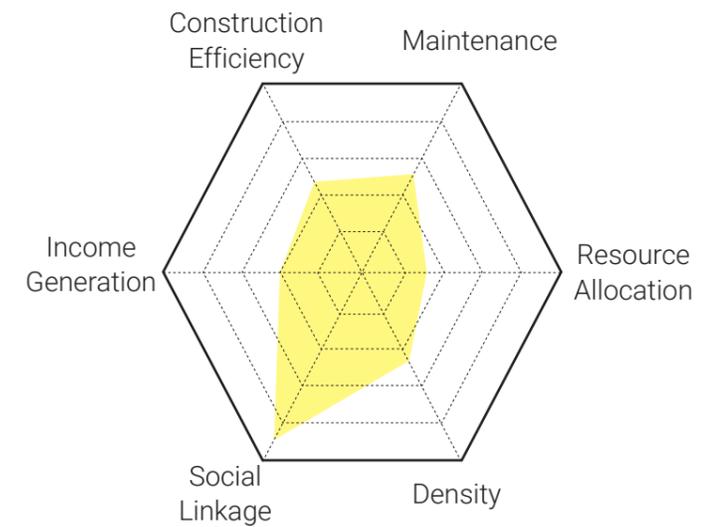
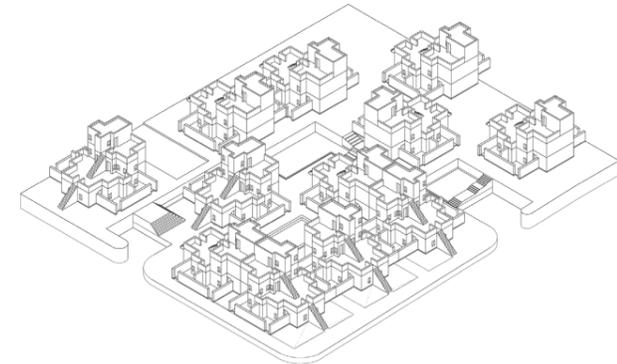
Source: Jacky Choi and Stijn Kemps, Delft University of Technology, MSc AUBS, 2021/2022 Global Housing Graduation Studio.



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Negotiating Peri-Urban

RURAL



III. URBAN STRATEGY

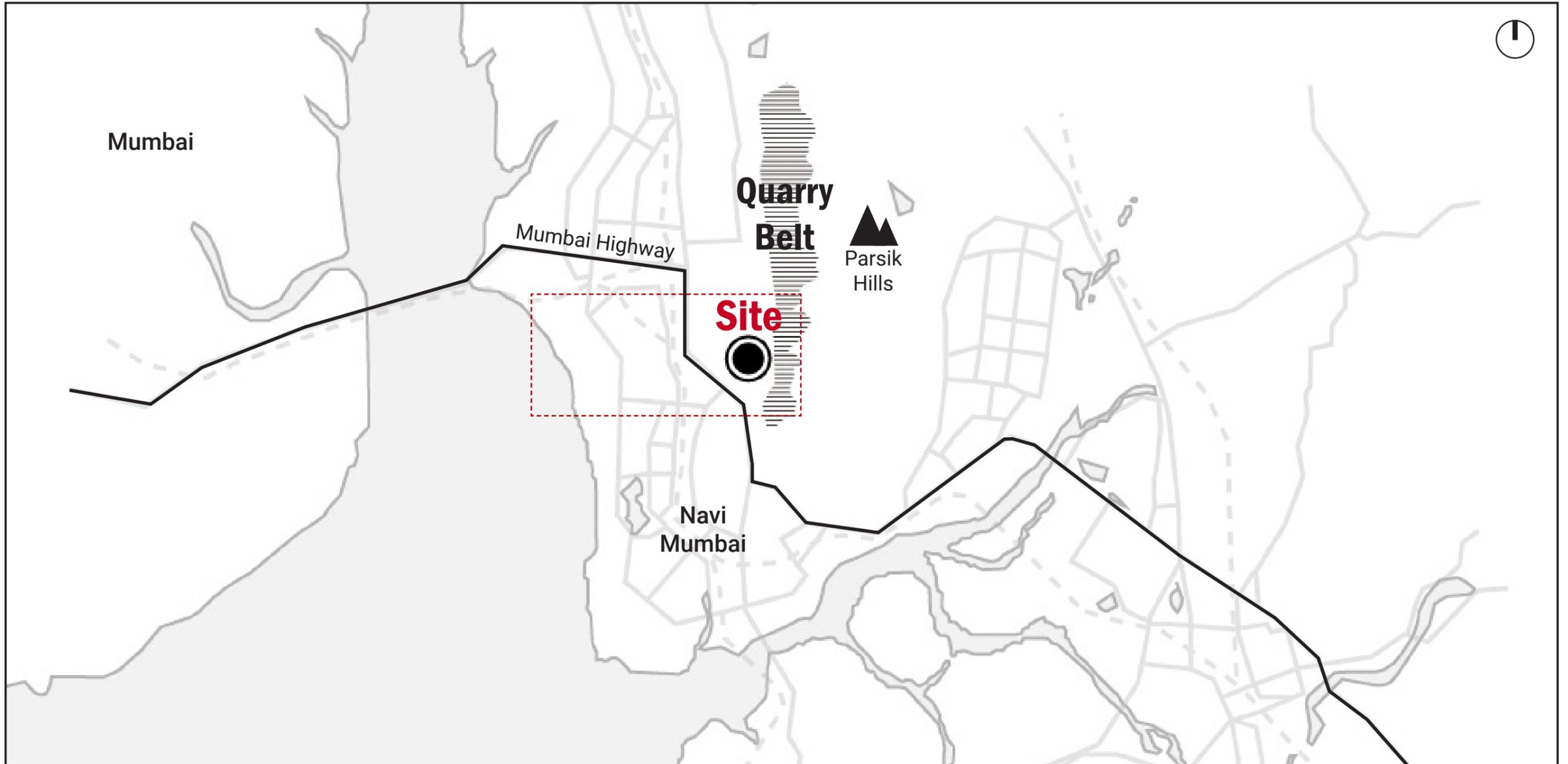
Based on the previous research, this chapter presents the design hypothesis for the research question from an urban perspective.



**socio-ecological
urban resilience**

III. URBAN STRATEGY

Selected Site Location

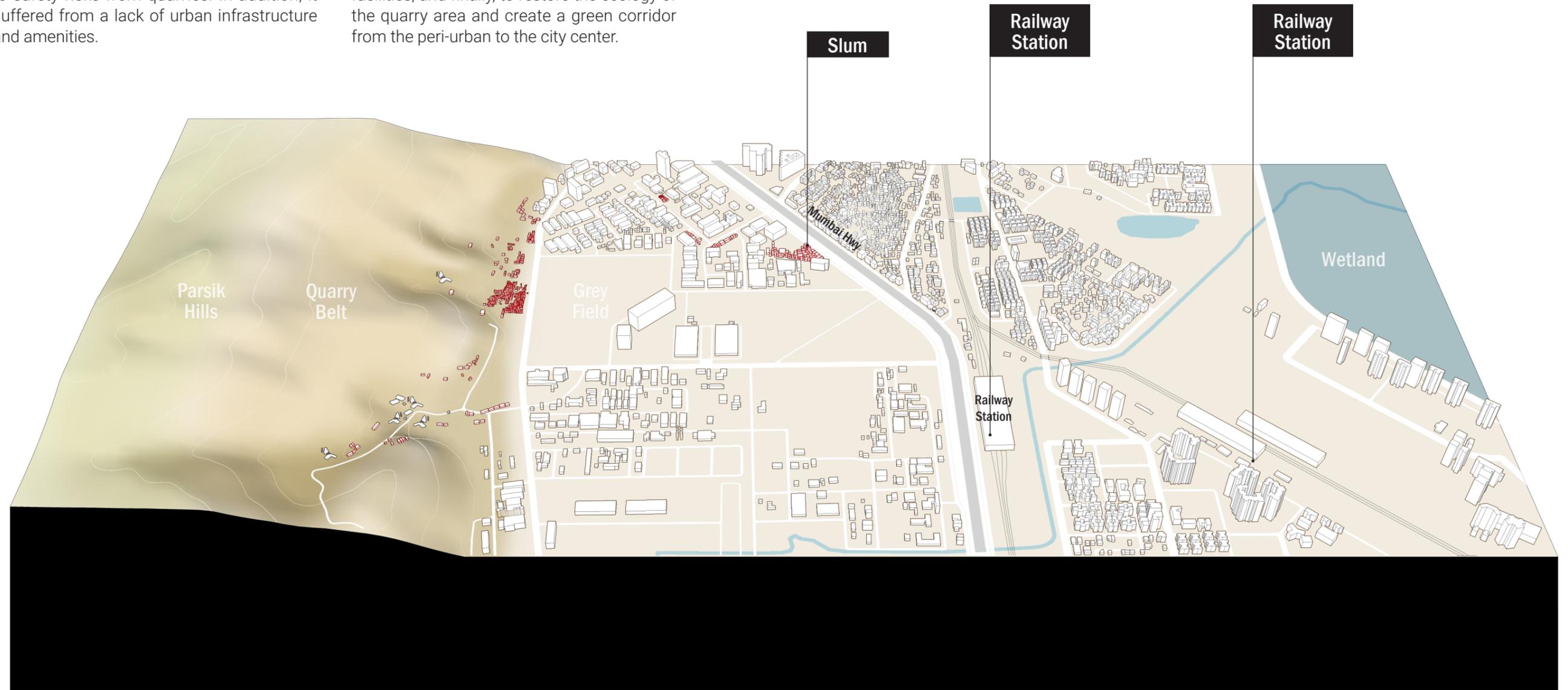


III. URBAN STRATEGY

Current Situation

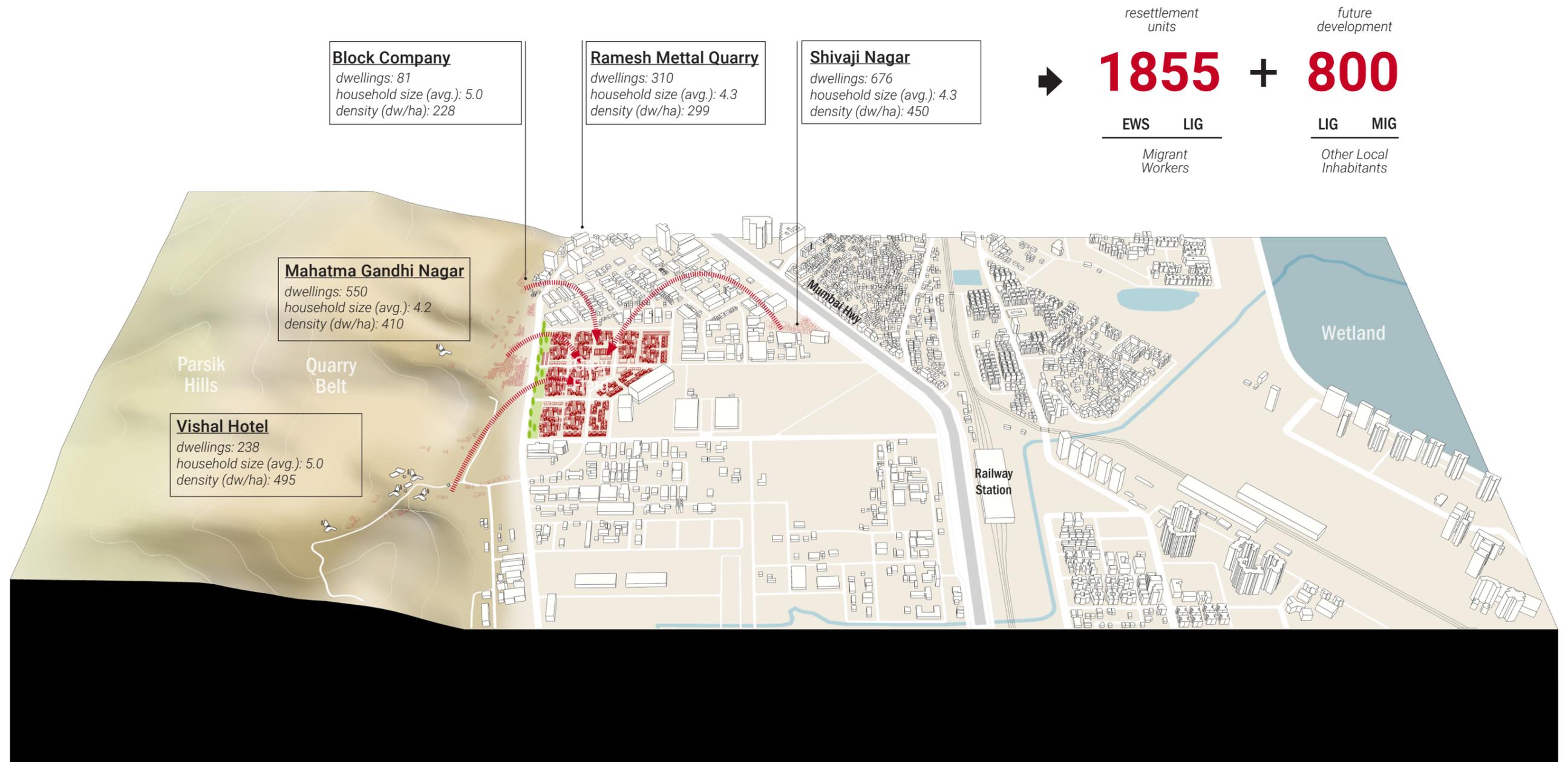
The original situation of the selected peri-urban area which is located between the Parsik Hills and Mumbai highway, is exposed to safety risks from quarries. In addition, it suffered from a lack of urban infrastructure and amenities.

The upgrading will be divided into three phases: firstly, to resettle workers to a safer place to live; secondly, to upgrade urban facilities; and finally, to restore the ecology of the quarry area and create a green corridor from the peri-urban to the city center.



III. URBAN STRATEGY

Phase 1: Resettlement



Data Source: <https://app.shelter-associates.org/city::Navi%20Mumbai>.



P1: resettlement

P2: urban upgrade

P3: ecological restoration

III. URBAN STRATEGY

Phase 2: Urban Upgrade



P1: resettlement

P2: urban upgrade

P3: ecological restoration

III. URBAN STRATEGY

Phase 3: Ecological Restoration



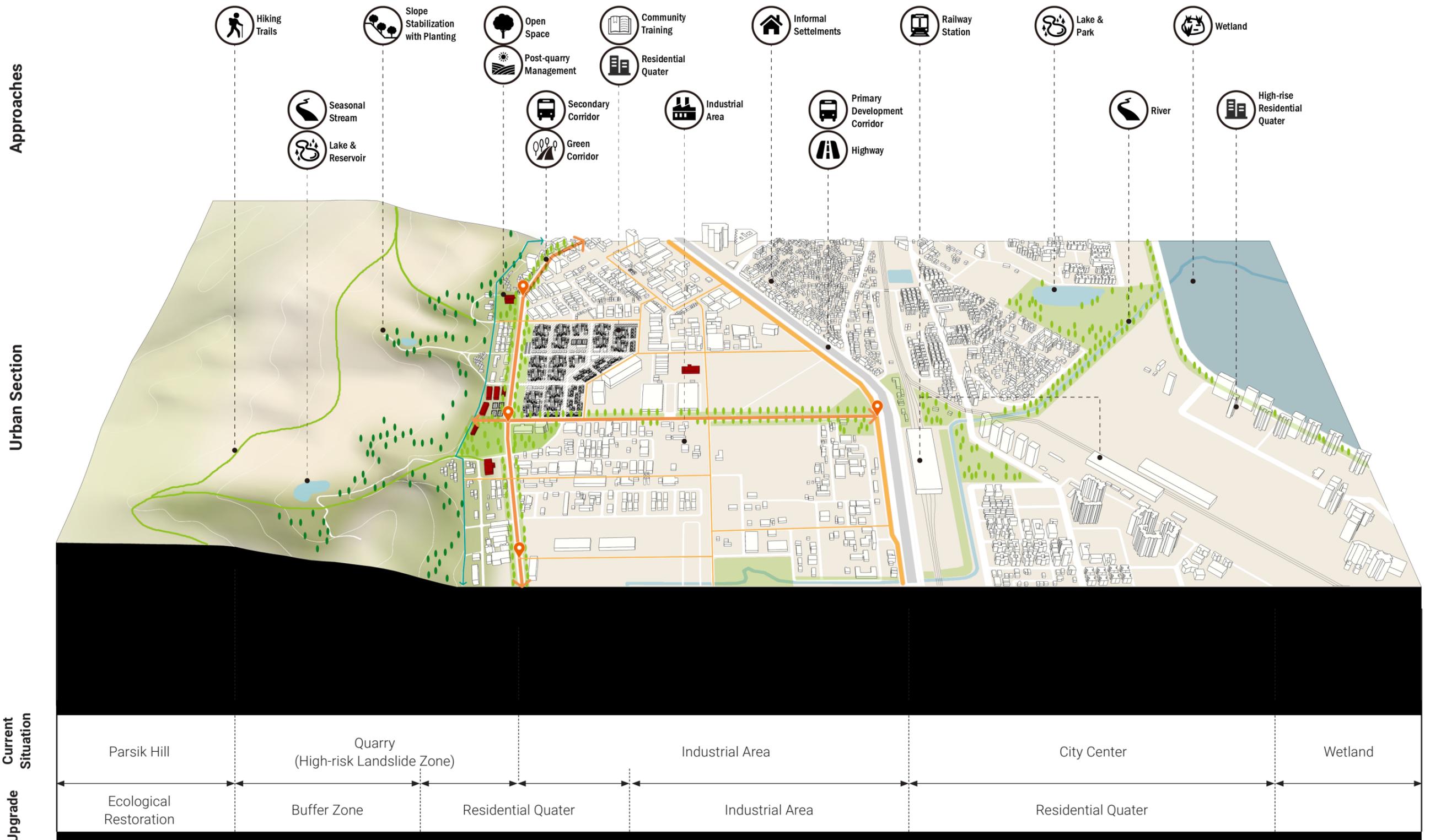
P1: resettlement

P2: urban upgrade

P3: ecological restoration

III. URBAN STRATEGY

Conclusion



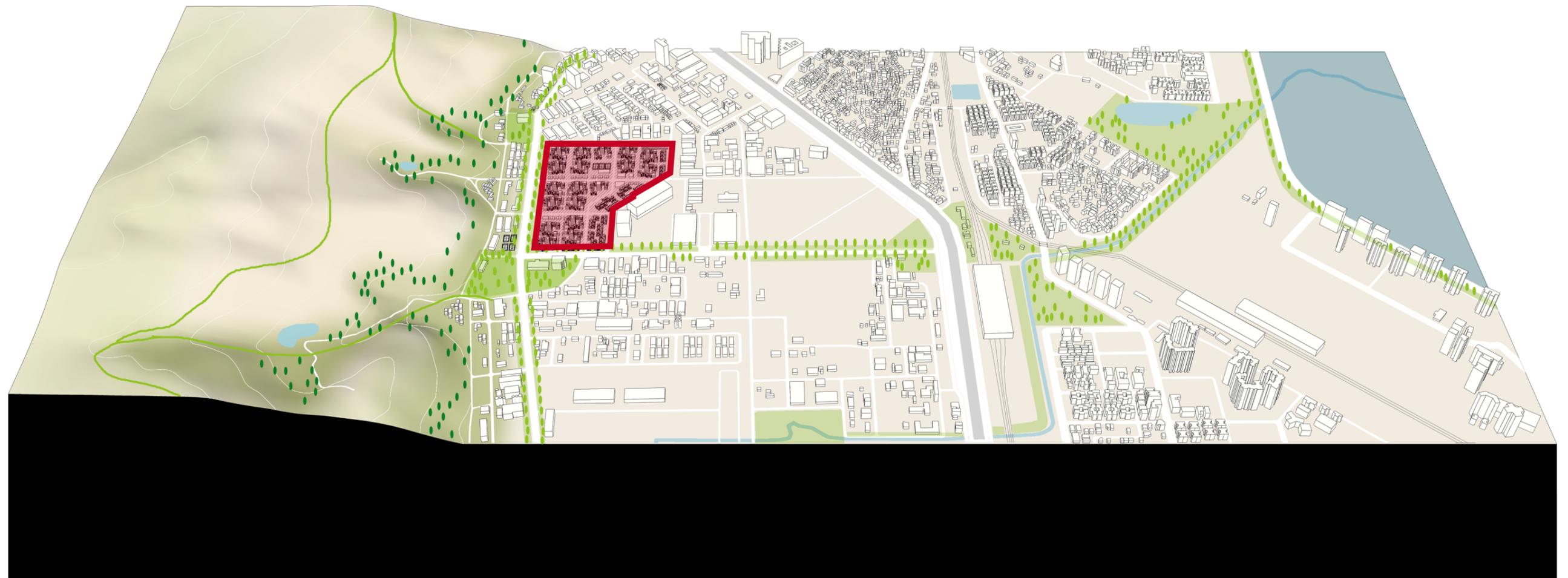
III. URBAN STRATEGY

Focus Area

P1: resettlement

P2: urban upgrade

P3: ecological restoration



IV. RESIDENTIAL DESIGN

This chapter focuses on residential design and further develops the project's urban strategies.

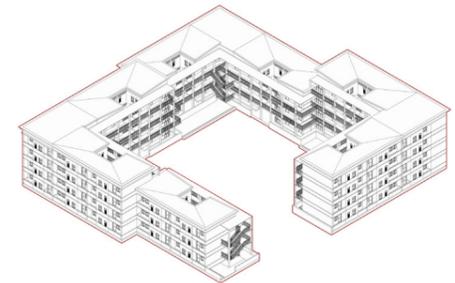
IV. RESIDENTIAL DESIGN

Concept

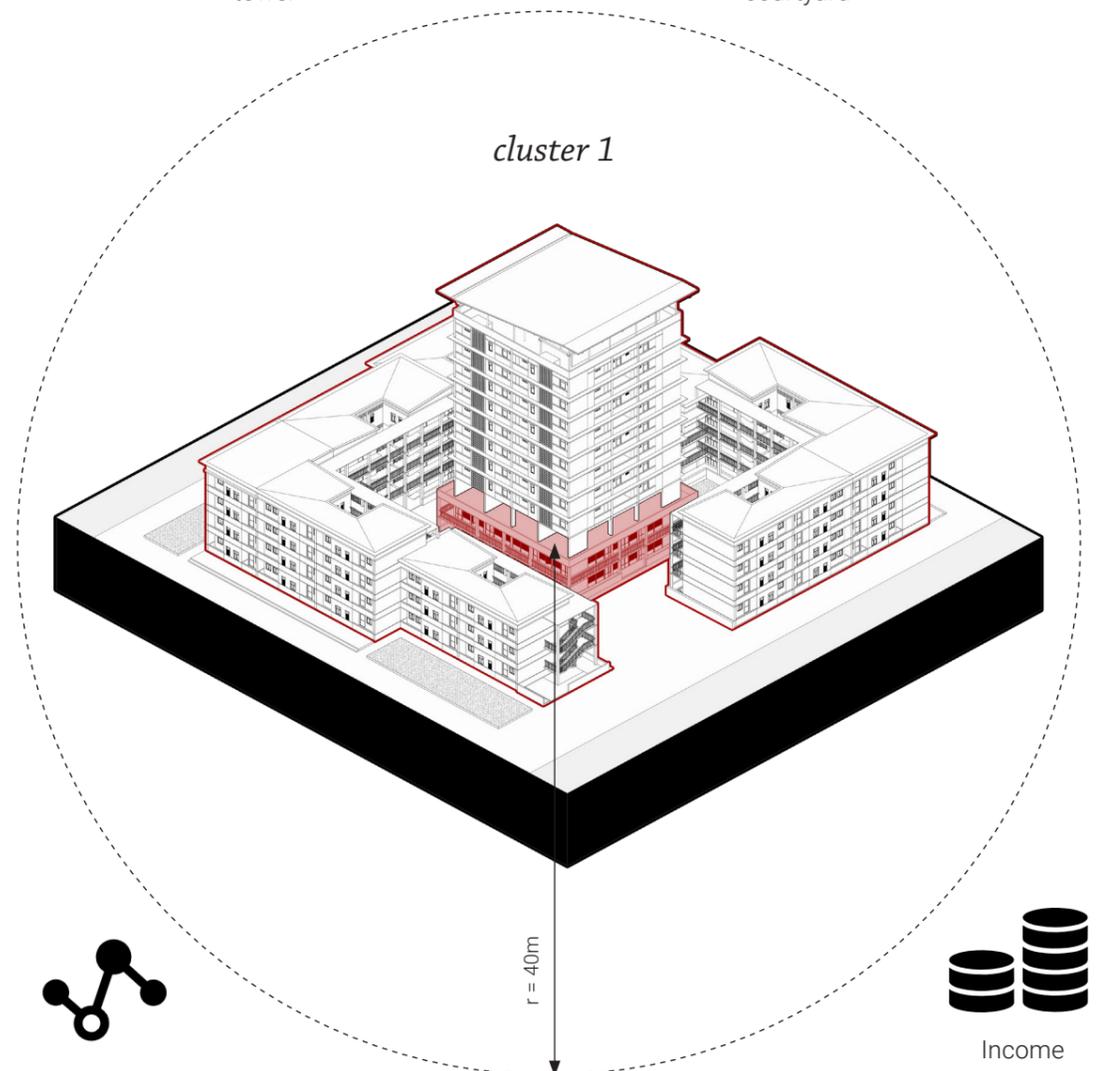


tower

+



courtyard



cluster 1

r = 40m



Social linkage



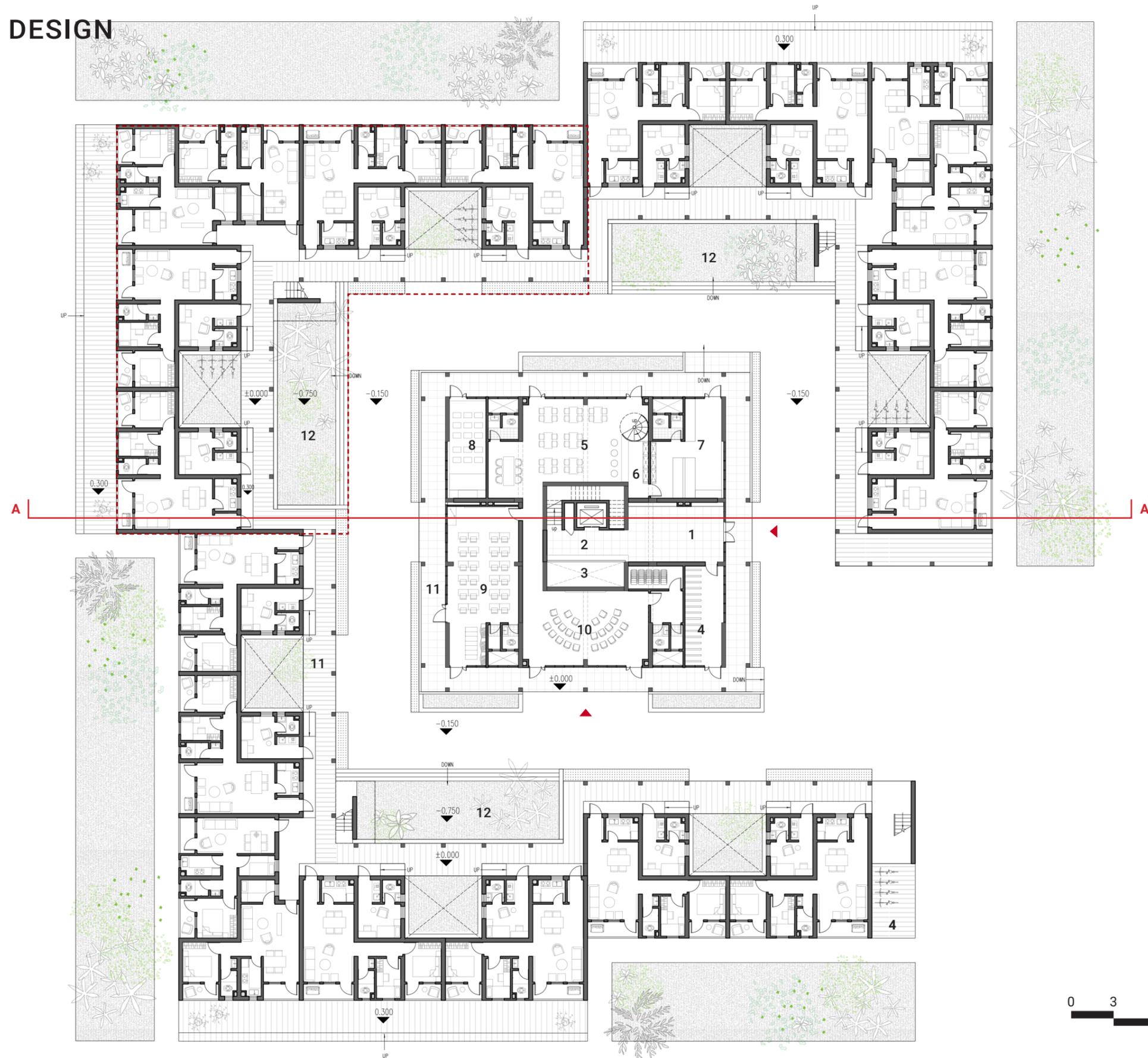
Income Generation



Domestic Activities

IV. RESIDENTIAL DESIGN

Cluster 1



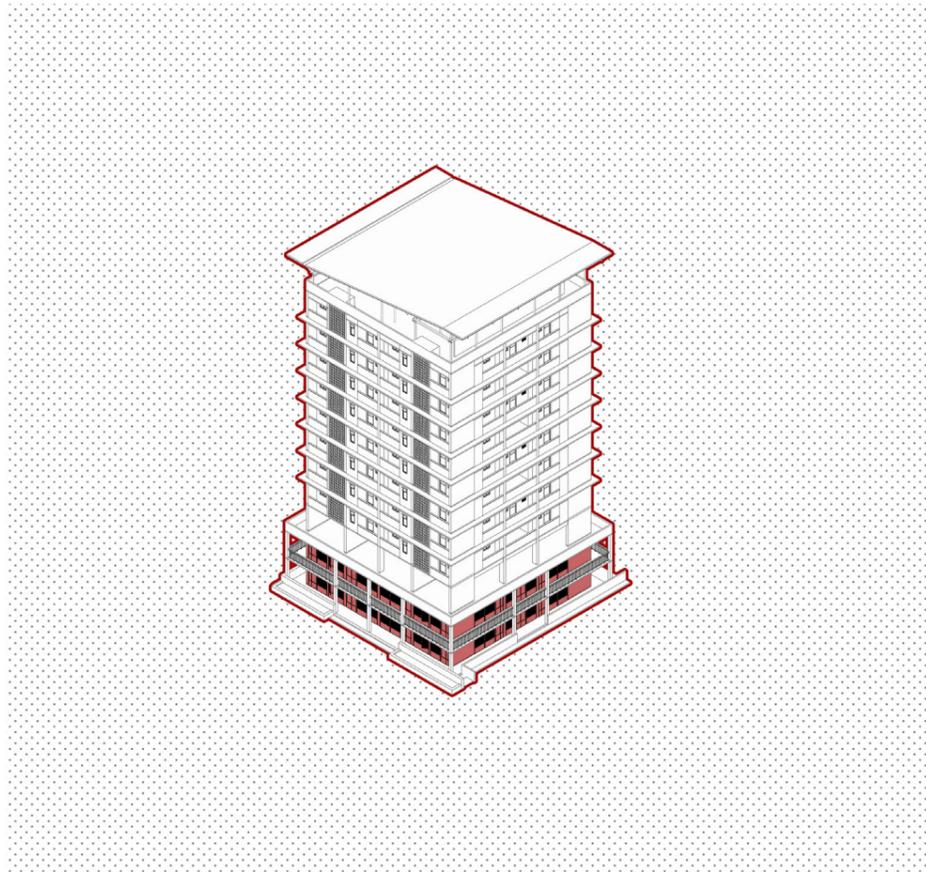
- 1 foyer (tower)
- 2 lobby
- 3 courtyard
- 4 bicycle parking
- 5 canteen
- 6 servery

- 7 kitchen
- 8 puja room
- 9 bridge school
- 10 community classroom
- 11 gallery
- 12 sunken courtyard

Ground Floor Plan

IV. RESIDENTIAL DESIGN

Building Typologies: Tower



With the ambition to improve the professional skills of migrant workers, the first two floors of the building will be used for communal space which includes income-generated programmes. These programmes will be supported by the NGOs.

The housing typologies provided by **Tower** are mainly collective accommodation which will be rent to workers. The design takes into account the temporality of the quarrying industry and proposes the possibility of converting the collective accommodation in the future after the closure of the quarry.



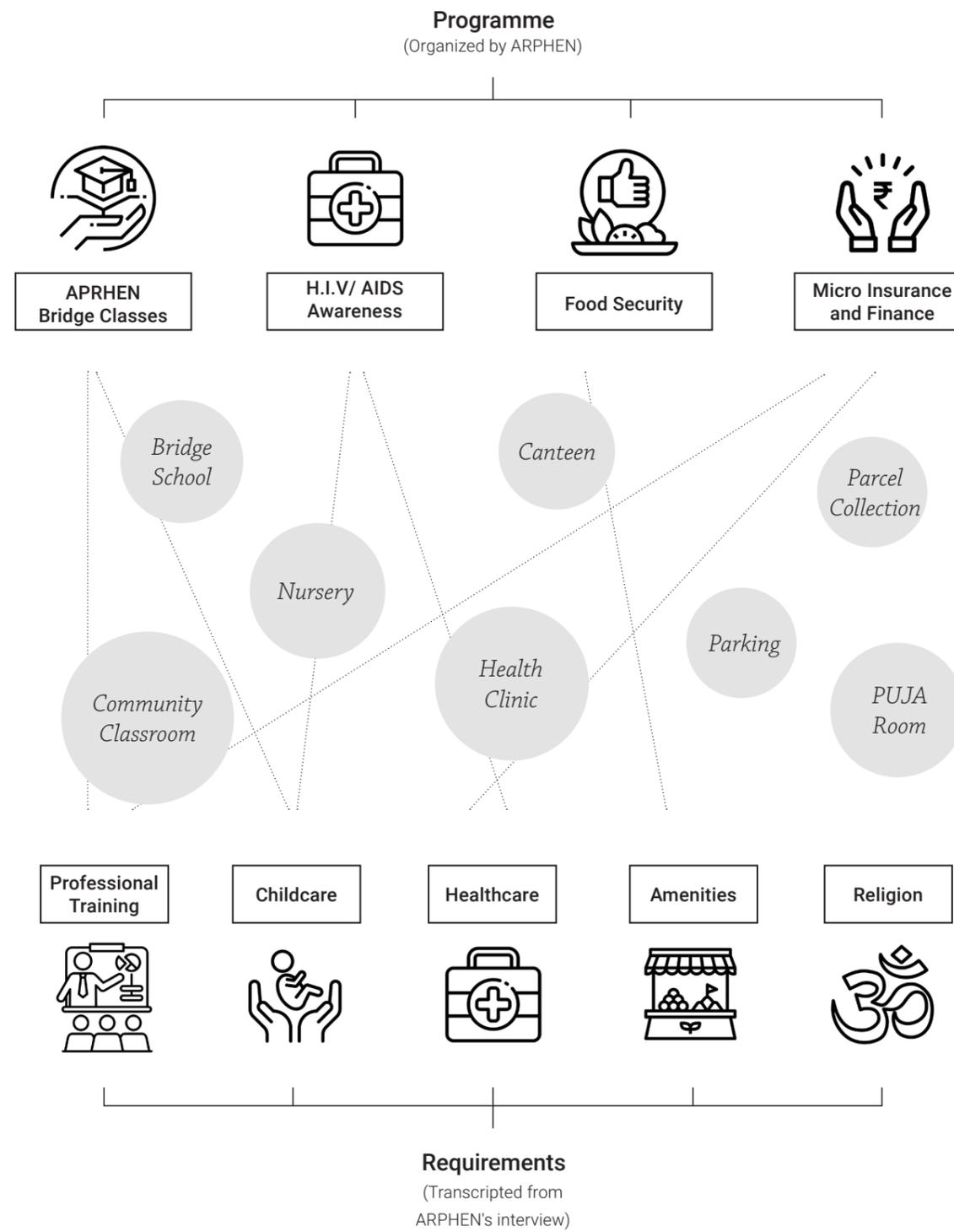
- | | |
|---------------------|------------------------|
| 1 mail room | 7 kitchen |
| 2 lobby (for tower) | 8 puja room |
| 3 courtyard | 9 bridge school |
| 4 bicycle parking | 10 community classroom |
| 5 canteen | 11 storage |
| 6 servery | 12 flower bed |

Ground Floor Plan 1:150



IV. RESIDENTIAL DESIGN

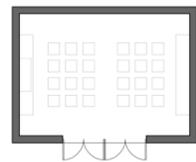
Building Typologies: Tower



Source: Lux, Valerie Saavedra, and Paul Watson. "Navi Mumbai Stone Quarry Settlements: 10 Community Spaces." edited by Bo Tang: London Metropolitan University; Association of Rural People for Health and Educational Needs, 2008.

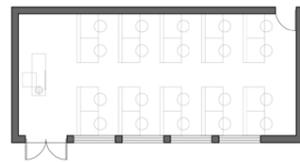
IV. RESIDENTIAL DESIGN

Building Typologies: Tower



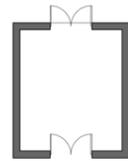
PUJA ROOM

a religious space for Hindu Rituals



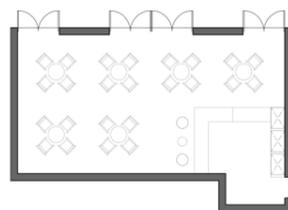
BRIDGE SCHOOL

an educational space for pre-school children



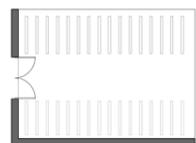
LOBBY (for tower)

a space for tower's entrance



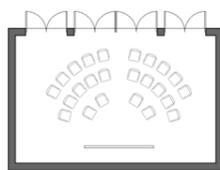
CANTEEN & KITCHEN

a dining space for busy migrant workers



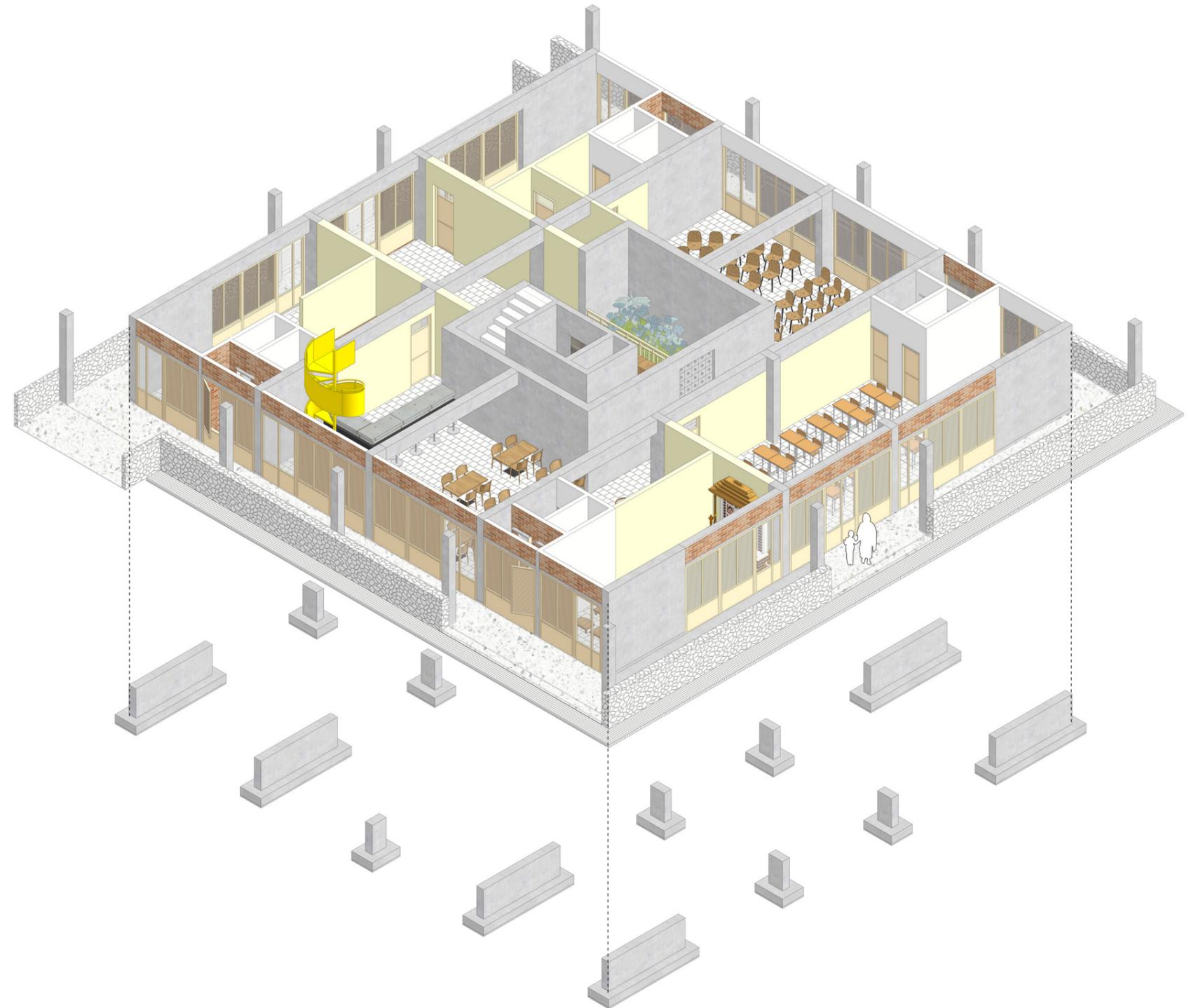
BICYCLE PARKING

amenities for bicycle and motorbike parking



COMMUNITY SCHOOL

an educational space for the unemployed



 partition walls

Ground Floor Axonometry

IV. RESIDENTIAL DESIGN

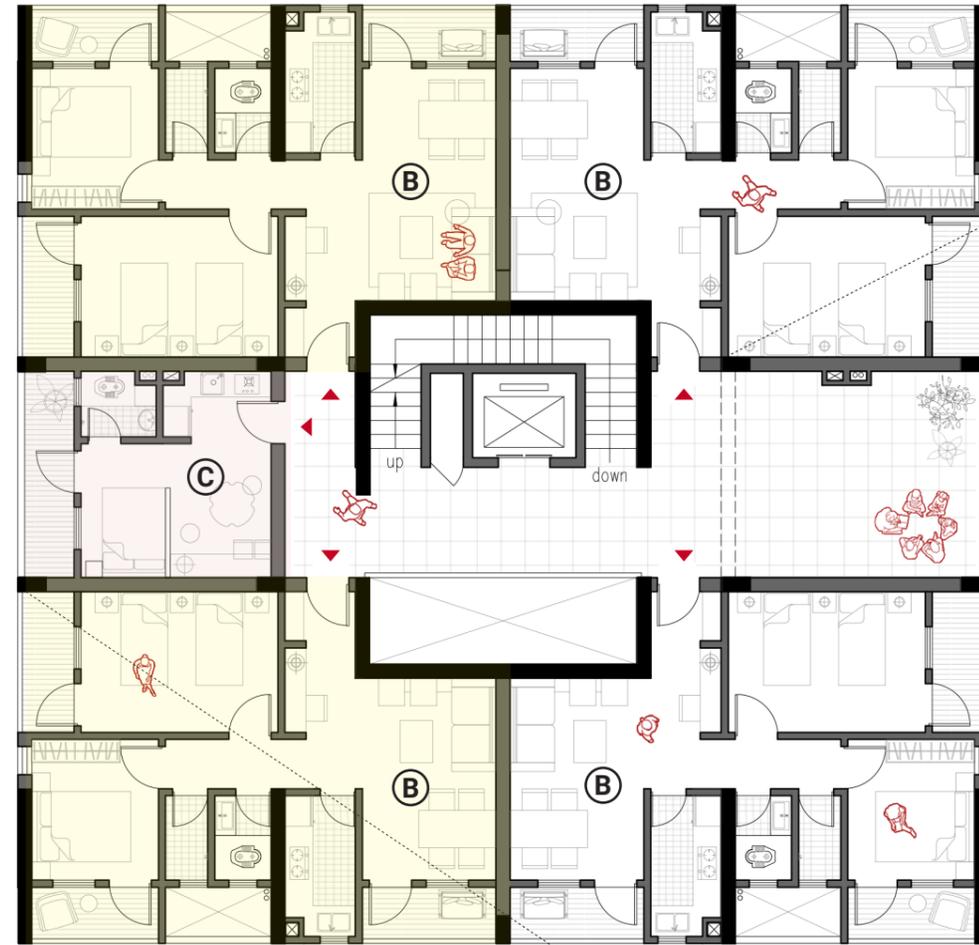
Building Typologies: Tower



Typical Residential Floor Plan
(Before)

Type A

collective accommodation
area: 160 sq.m.
group: quarry workers



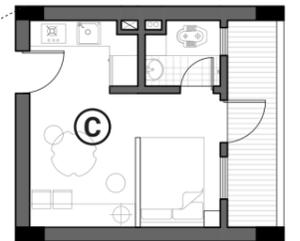
Typical Residential Floor Plan
(After)

Type B

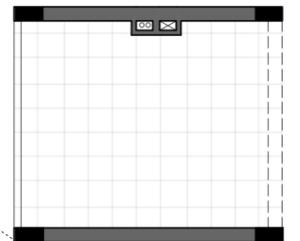
80%
2 BHK
area: 65 sq.m.
group: MIG

Type C

20%
1 BHK
area: 25 sq.m.
group: LIG



5/7/9 Floor

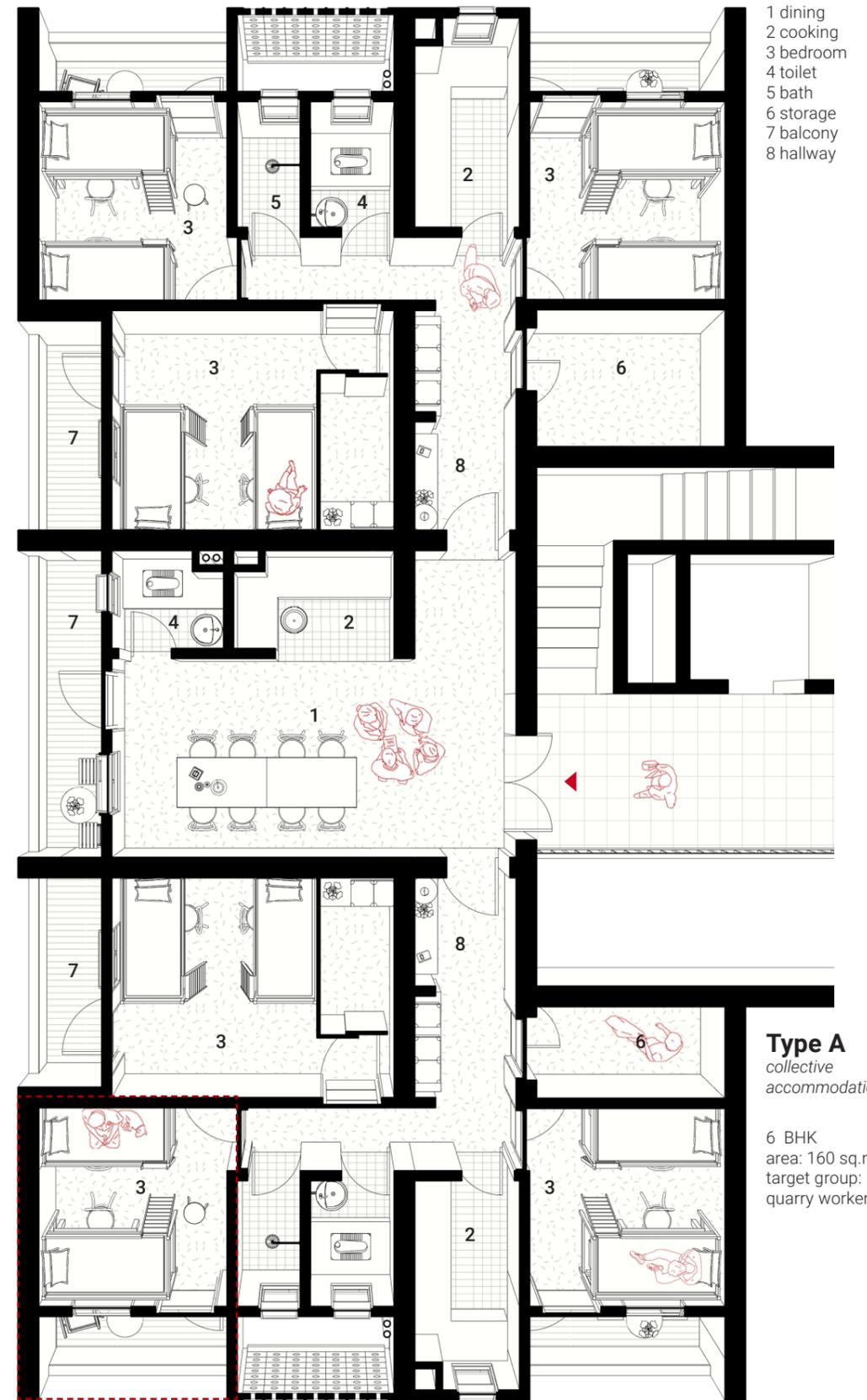
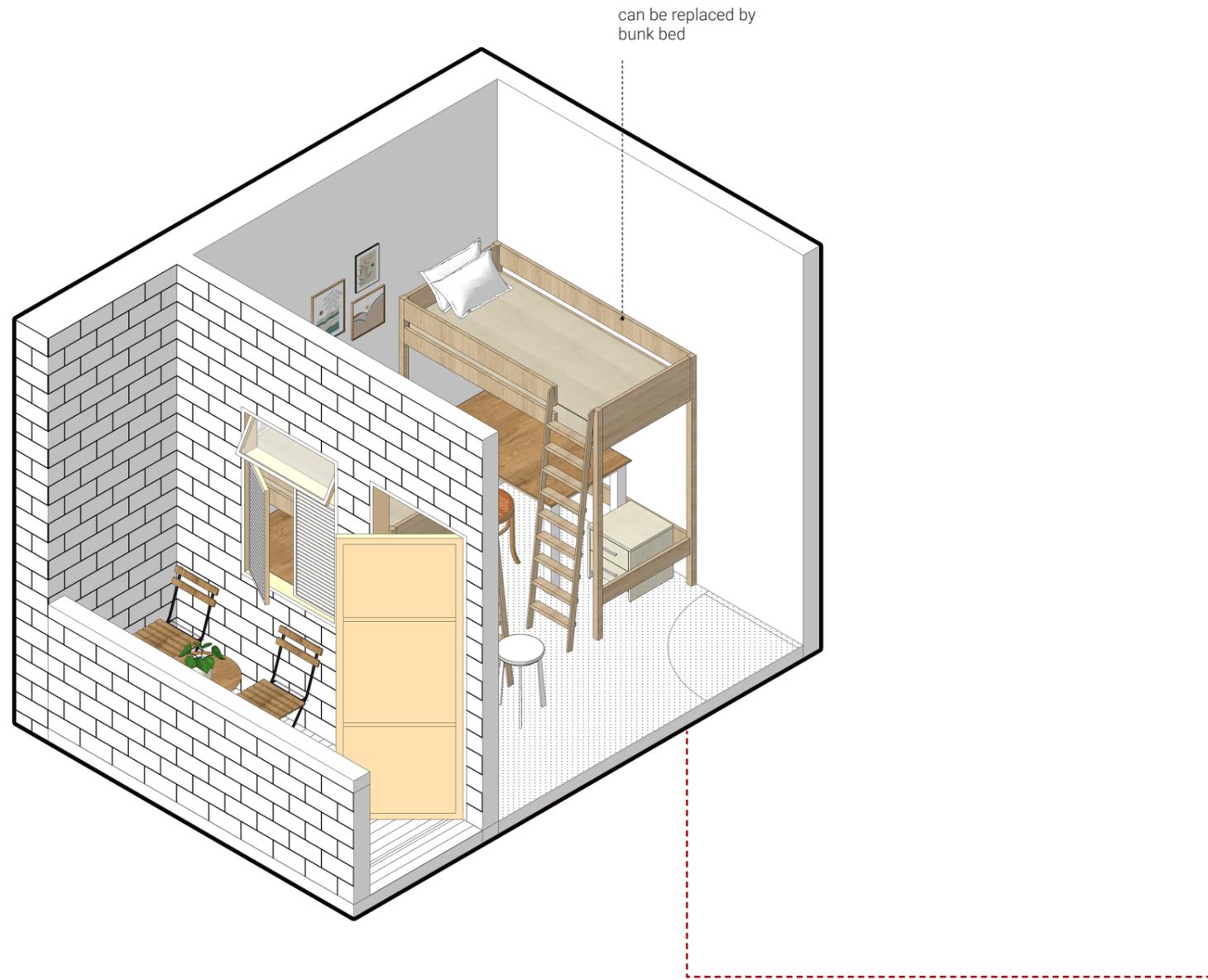


5/7/9 Floor



IV. RESIDENTIAL DESIGN

Building Typologies: Tower



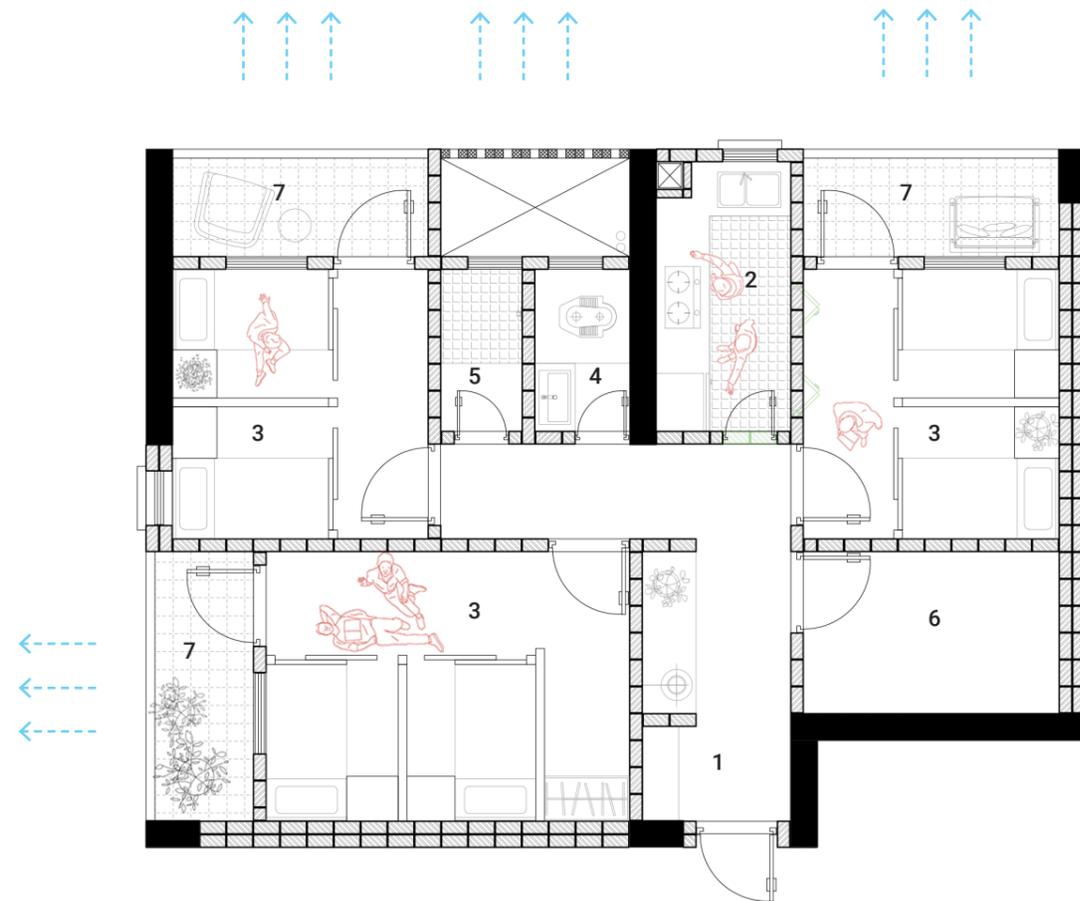
Type A
collective accommodation

6 BHK
area: 160 sq.m.
target group:
quarry worker

typical accommodation unit

IV. RESIDENTIAL DESIGN

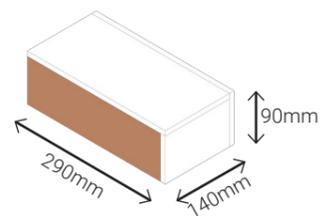
Building Typologies: Tower



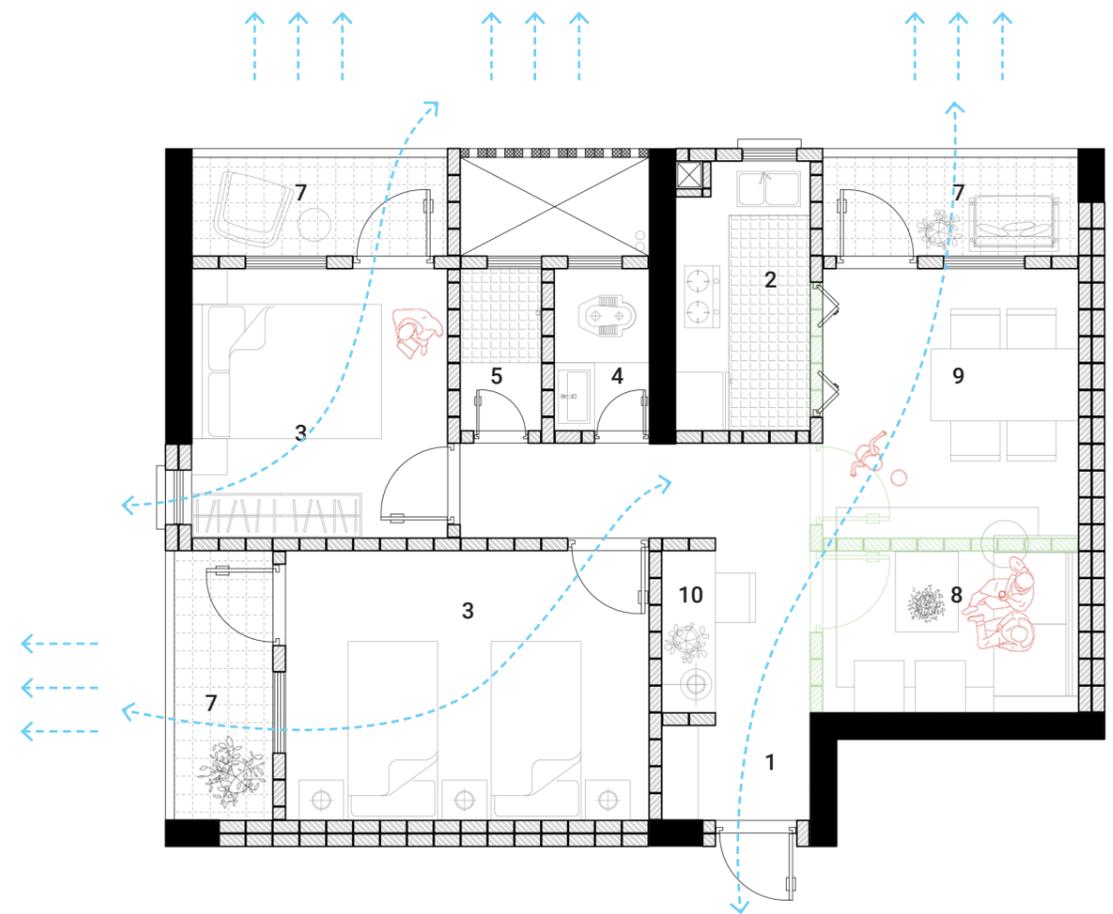
Type B (Before)

collective accommodation

The temporality of the quarry industry requires a long-term perspective. These collective accommodations will be converted into apartments for LIG & MIG in the future. The precast concrete skeleton and compressed earth block partition walls provide the flexibility to be refurbished.



(10mm mortar joint)



Type B (After)

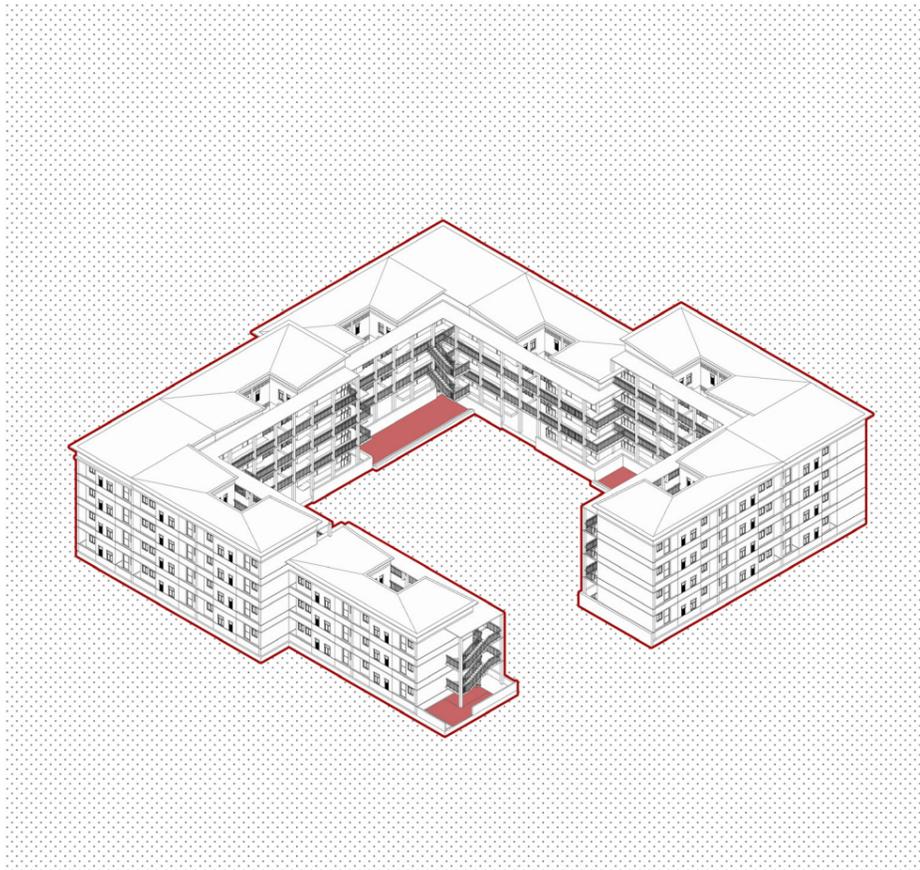
2 BHK
area: 65 sq.m.
group: MIG

- 1 hallway
- 2 cooking
- 3 bedroom
- 4 toilet
- 5 bath
- 6 storage
- 7 balcony
- 8 living room
- 9 dining room
- 10 study



IV. RESIDENTIAL DESIGN

Building Typologies: Apartment



Another building typology in the cluster is the low-rise apartment. It is designed for both individual workers and families with small housing units for sale. Therefore, building a social connection with the neighbourhood is important in this building typology.

An open gallery system with doorstep areas will link all the house units together. It is designed as a lively space where social connections can take place. In addition, the courtyard located between the low-rise building and the tower can be used for outdoor activities. It can also serve as a buffer area for flooding during the rainy season.



IV. RESIDENTIAL DESIGN

Building Typologies: Apartment



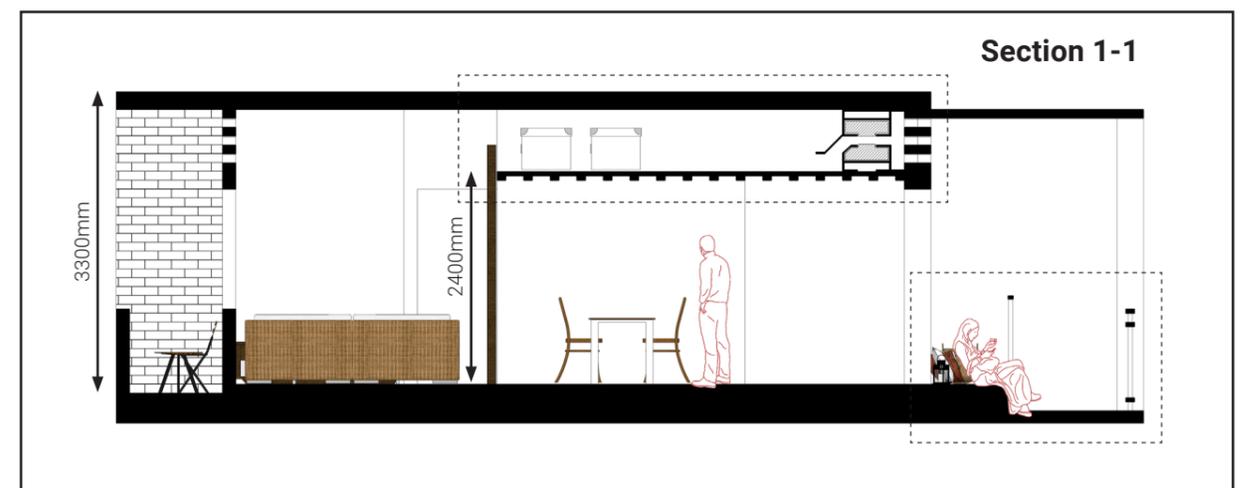
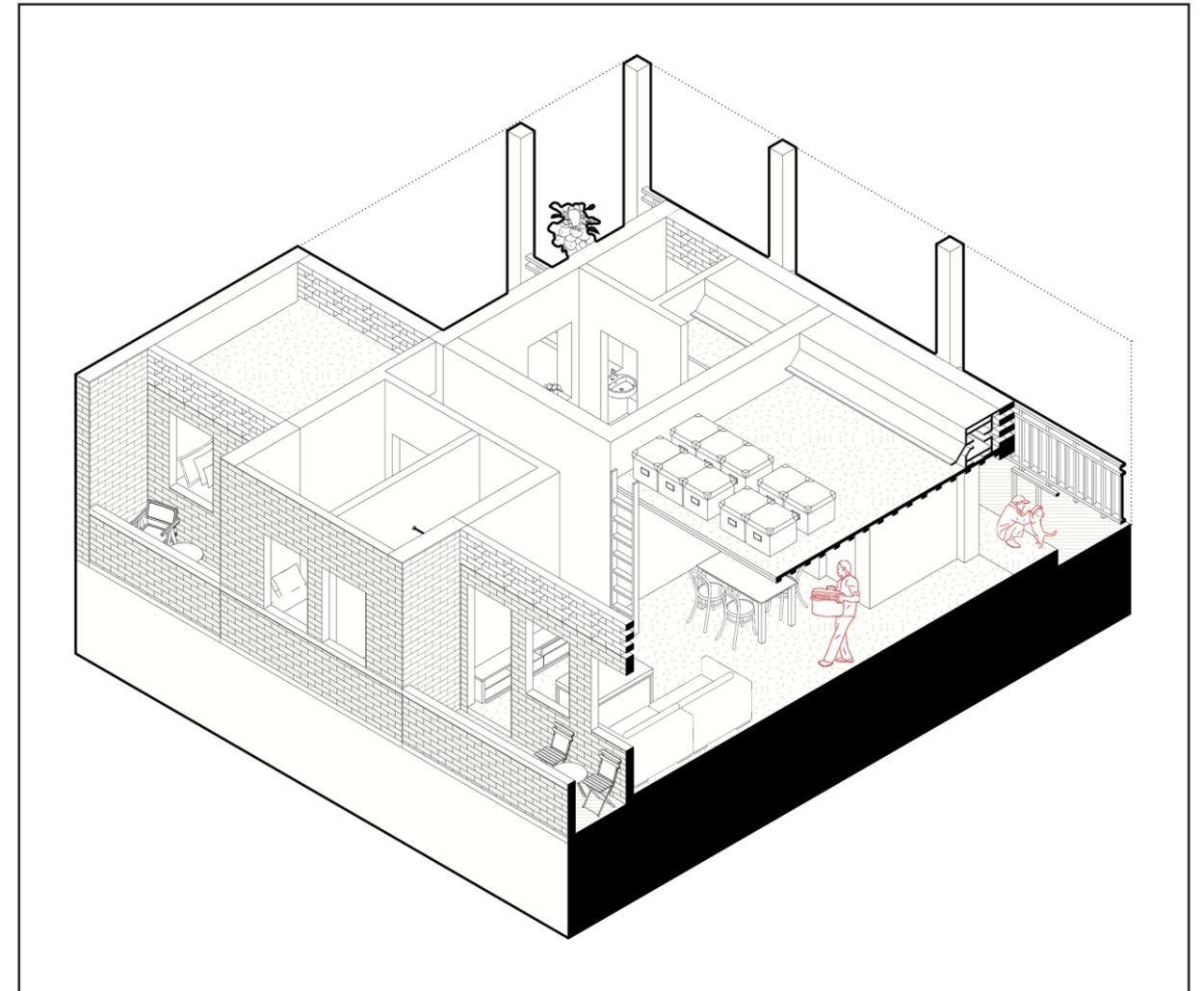
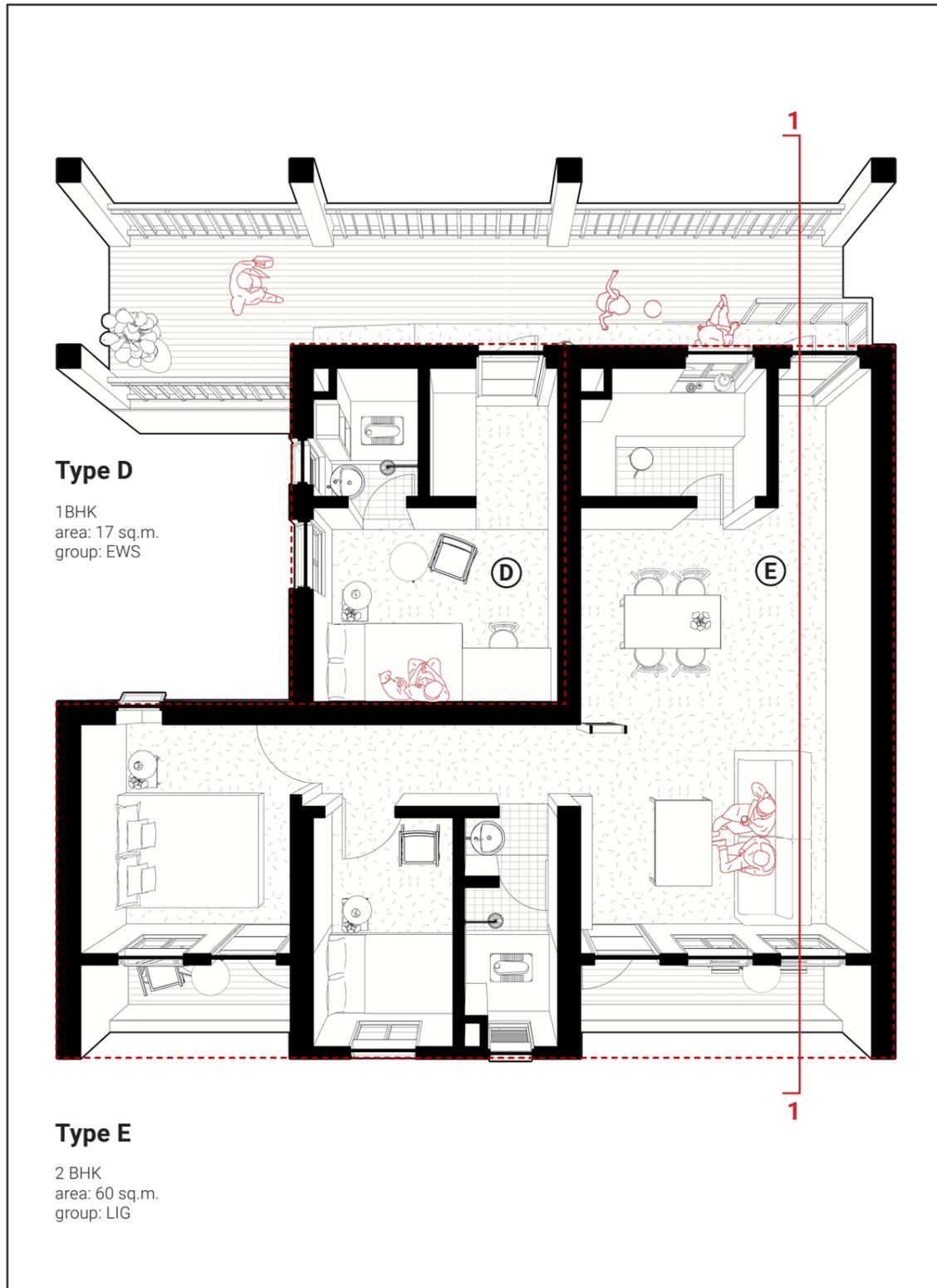
- 1 gallery
- 2 bicycle parking
- 3 doorstep area
- 4 drain
- 5 sunken courtyard
- 6 landscape steps
- 7 sound-buffer courtyard

Ground Floor Plan 1:150

41%	<p>Type D</p> <p>1BHK area: 17 sq.m. group: EWS</p>
41%	<p>Type E</p> <p>2 BHK area: 60 sq.m. group: LIG</p>
9%	<p>Type F1</p> <p>2 BHK area: 50 sq.m. group: LIG</p>
9%	<p>Type F2</p> <p>2 BHK area: 50 sq.m. group: LIG</p>

IV. RESIDENTIAL DESIGN

Building Typologies: Apartment

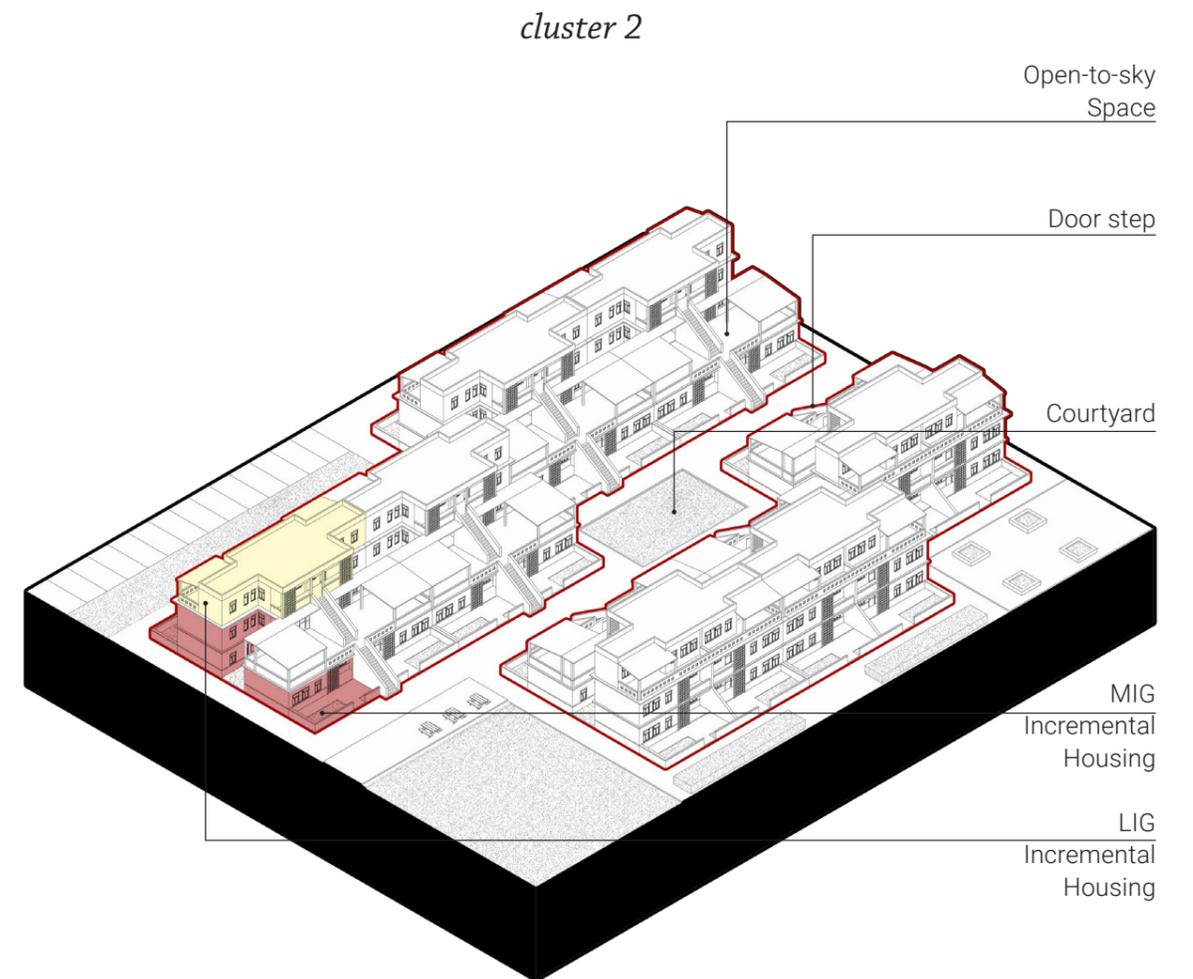




View of Courtyard

IV. RESIDENTIAL DESIGN

Concept

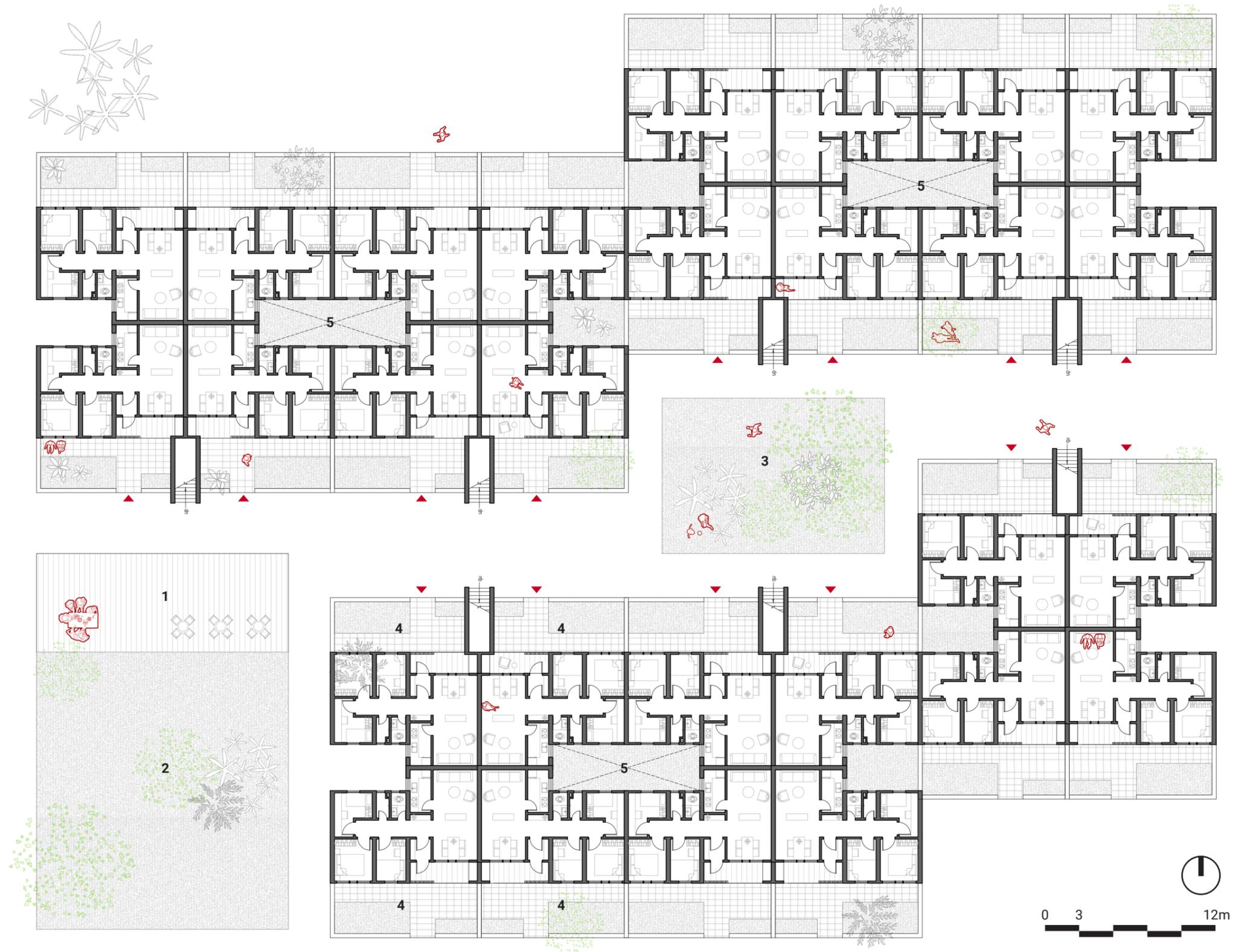


Another cluster with more connection with the ground will be provided to those who are willing to spend more budget on their houses, especially those local inhabitants. This cluster emphasizes

the social linkage with communities, with a lot of setback open-to-sky space to encourage residents' incremental development.

IV. RESIDENTIAL DESIGN

Cluster 2

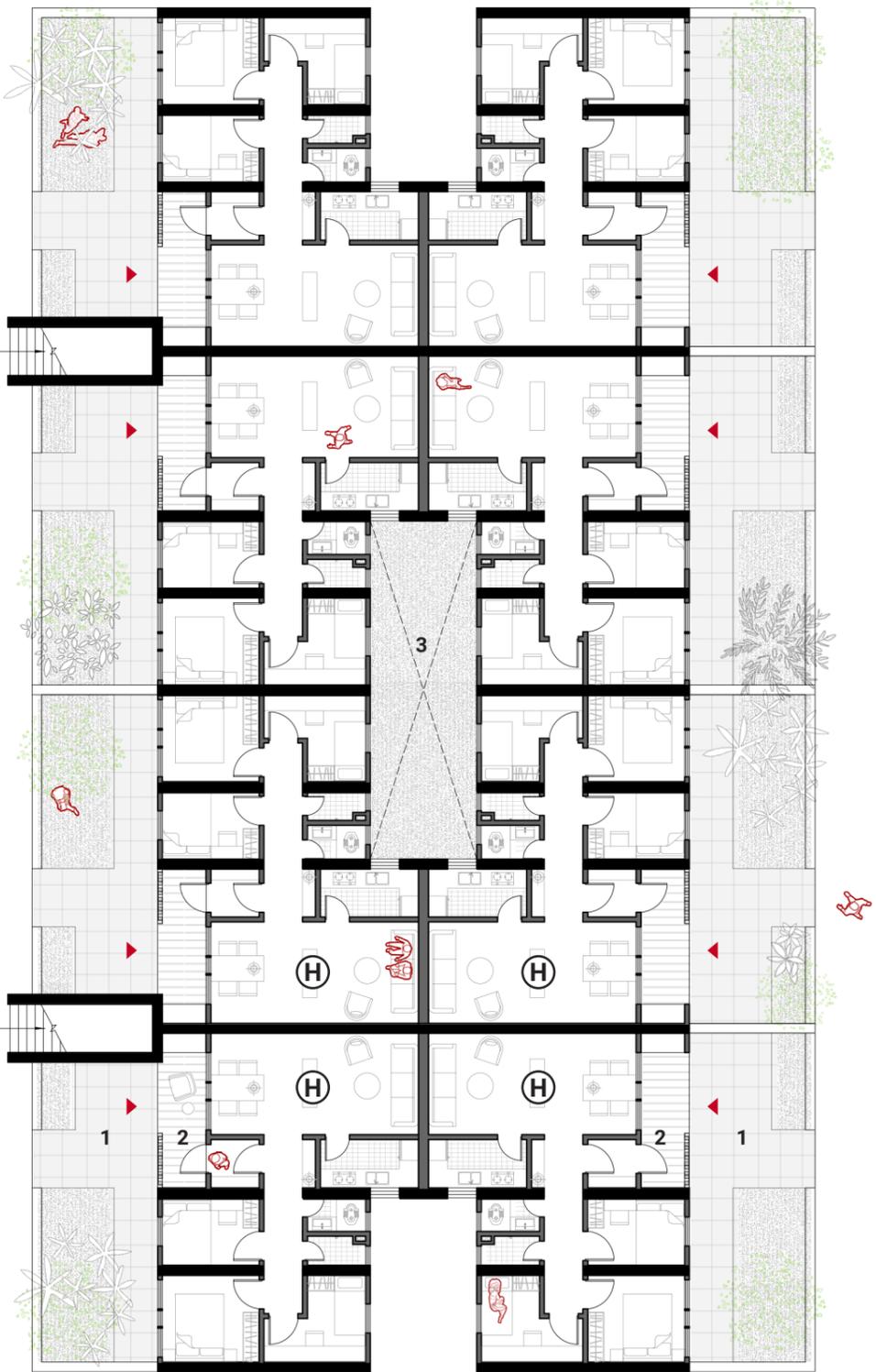
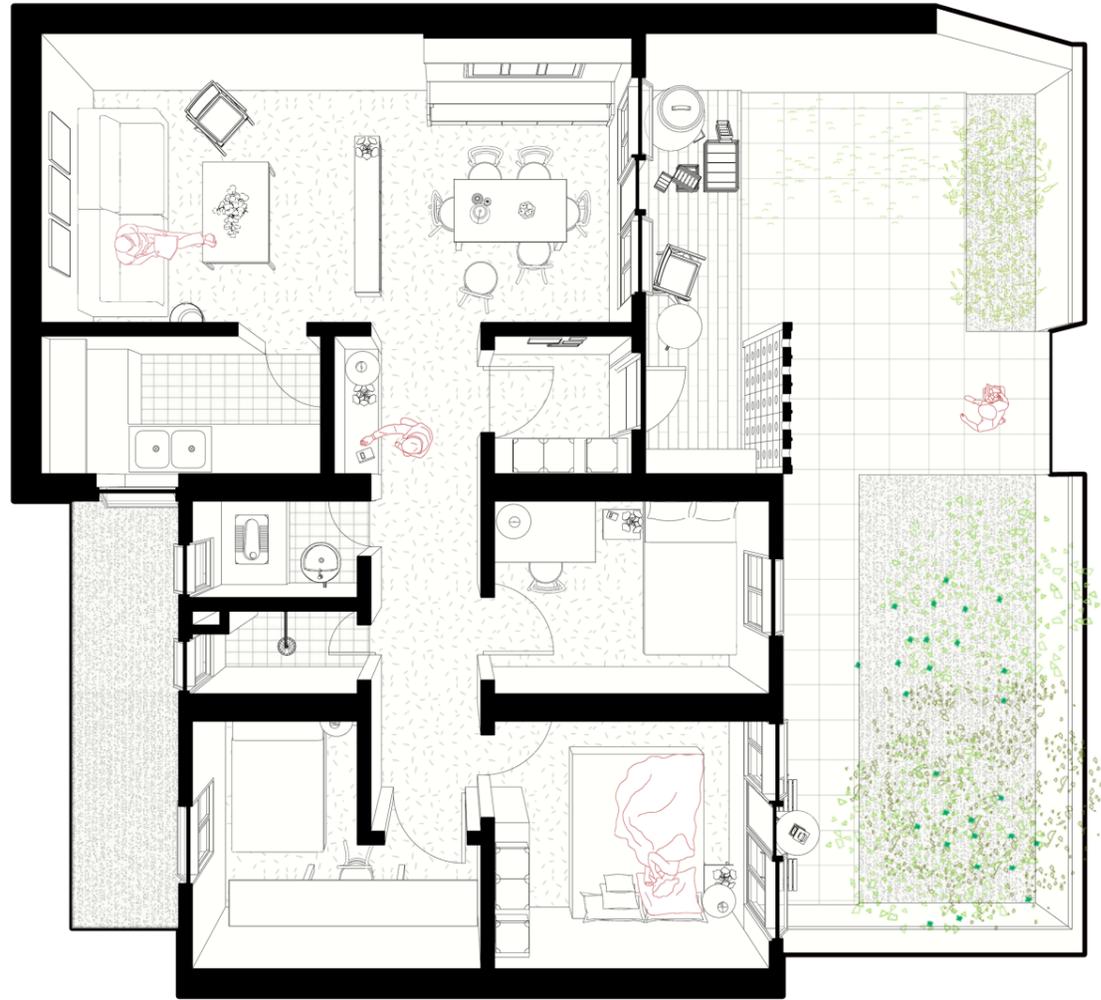


Ground Floor Plan

IV. RESIDENTIAL DESIGN

Building Typologies: Row House

Ground Floor Plan 1:200 



Type H (before)

3 BHK
area: 70 sq.m.
group: MIG

A typical unit is 70 sq.m. with 3 BHK. It is suitable for large Indian families of 4-5 people. The house is divided into two main areas for living and resting. Relatedly, the garden is also divided into two areas. One is connected to the entrance of the house with more pavement and is an outdoor activity area; the other is connected to the bedrooms and is a planting area that provides better sound buffer through vegetation.

IV. RESIDENTIAL DESIGN

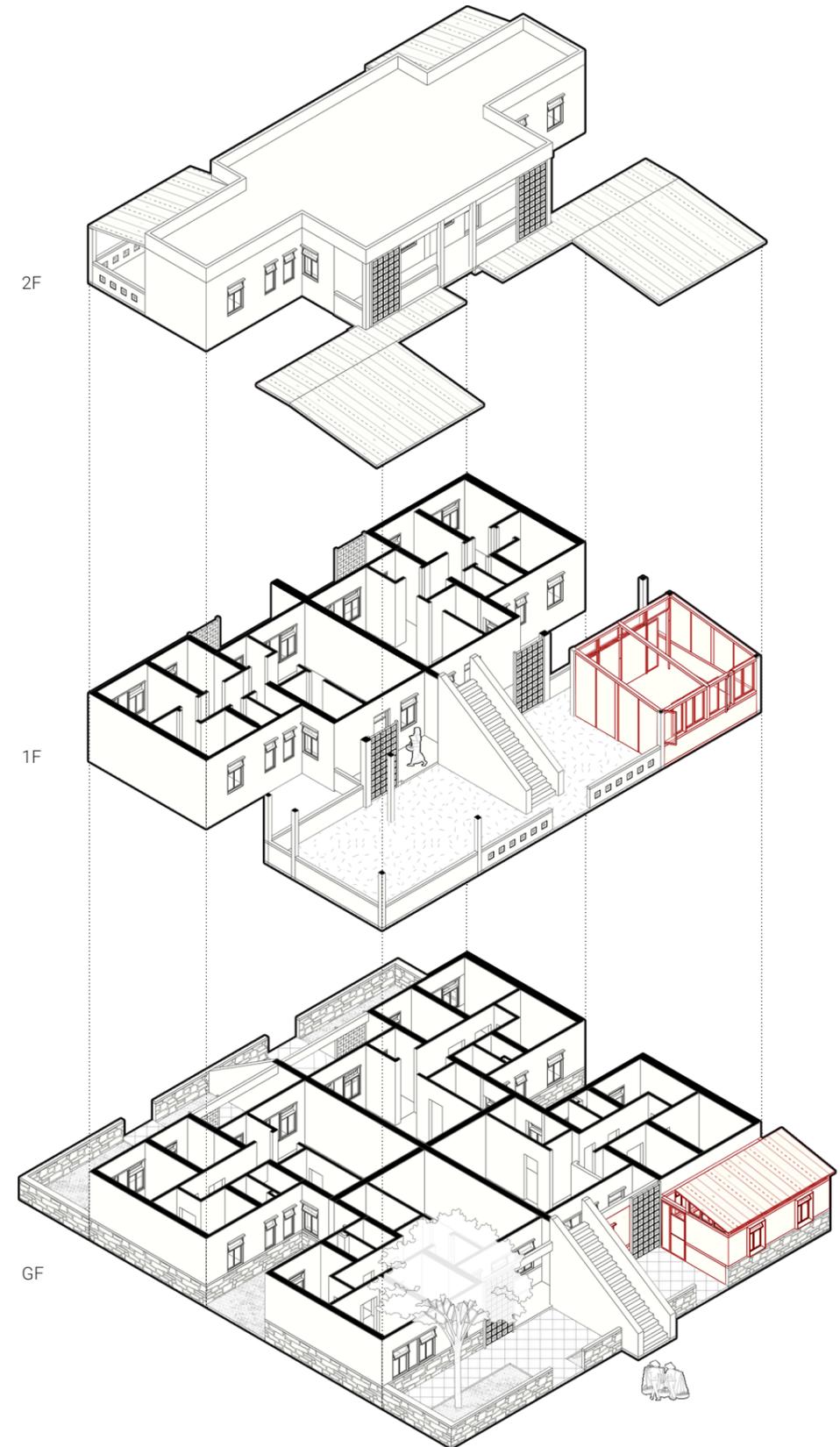
Building Typologies: Row House



Type H (after)

3+2 BHK
 area: 70+20 sq.m. (+22%)
 group: MIG

The garden can be used as an incremental area when the size of the family becomes larger. A possible incremental plan is shown in the diagram: the original doorway will be included as part of the living room, and parts of the garden will be used to build additional bedrooms.



incremental parts
Row House Axonometry



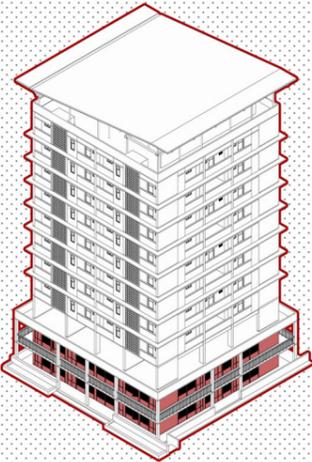
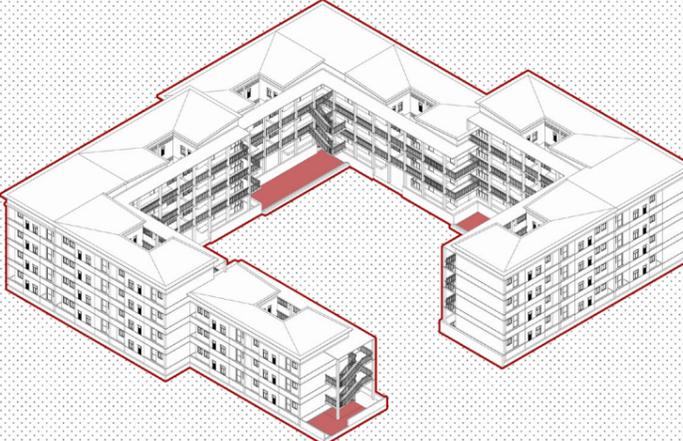
View of Rowhouses (before incremental phase)



View of Rowhouses (after incremental phase)

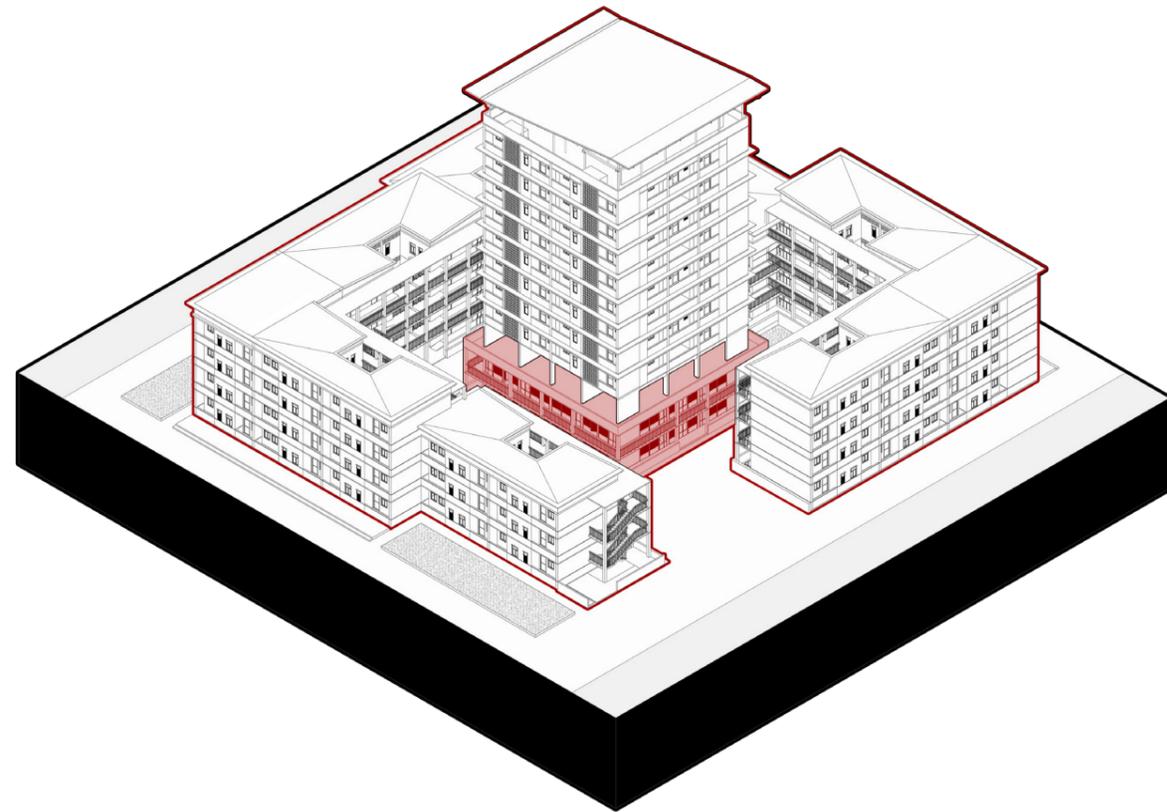
IV. RESIDENTIAL DESIGN

Typologies Conclusion

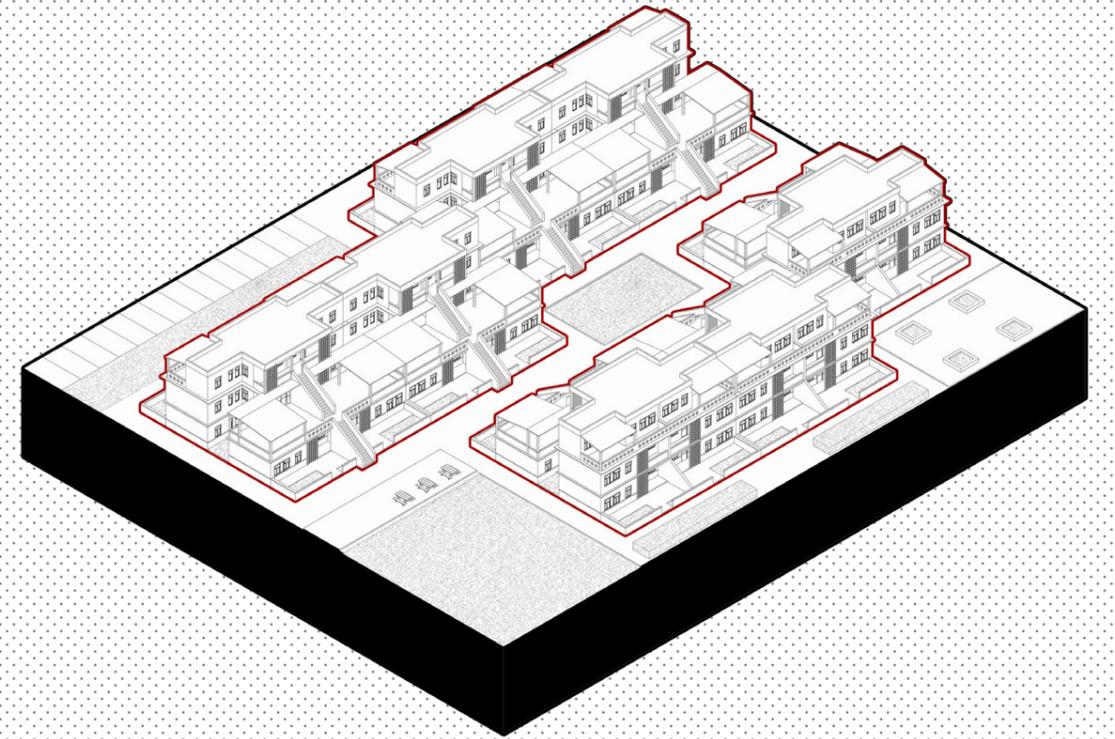
TOWER	APARTMENT	ROW HOUSE
 <p>Quarry Worker Group</p>	 <p>Quarry Worker Single Quarry Worker Family</p>	 <p>Quarry Worker Family</p>
		
<div style="border: 1px solid black; padding: 5px; display: inline-block;">160 m2</div> <i>Accommodation</i>	<div style="display: flex; gap: 10px;"> <div style="border: 1px solid black; padding: 5px; display: inline-block;">16 m2</div> <div style="border: 1px solid black; padding: 5px; display: inline-block;">60 m2</div> </div> <i>Apartment</i>	<div style="display: flex; gap: 10px;"> <div style="border: 1px solid black; padding: 5px; display: inline-block;">50 m2</div> <div style="border: 1px solid black; padding: 5px; display: inline-block;">70 m2</div> </div> <i>Duplex</i>
		

IV. RESIDENTIAL DESIGN

Typologies Conclusion



CLUSTER 1



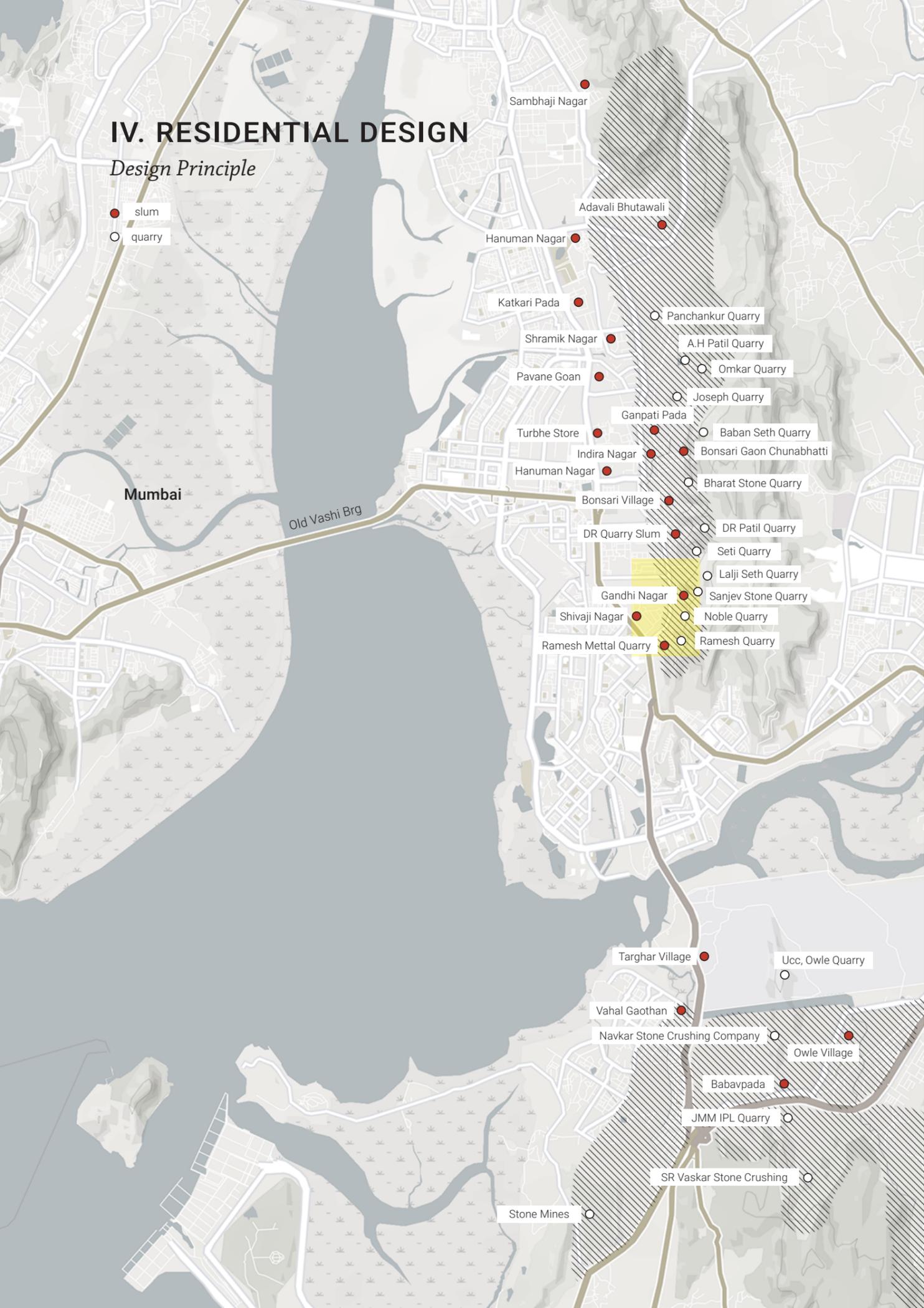
CLUSTER 2



IV. RESIDENTIAL DESIGN

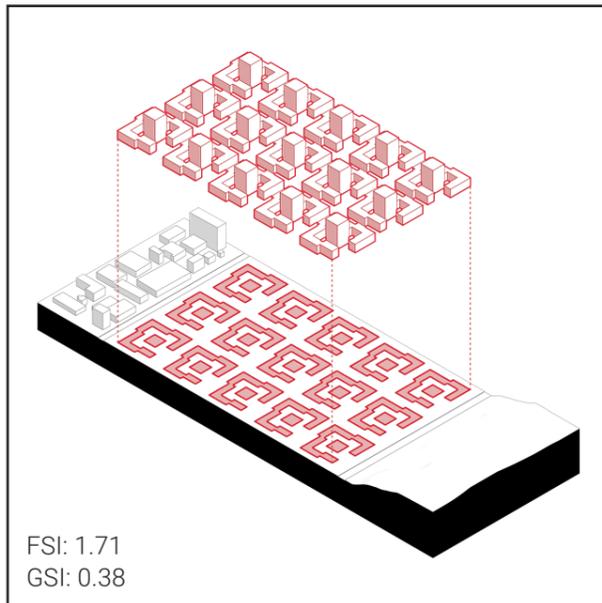
Design Principle

- slum
- quarry

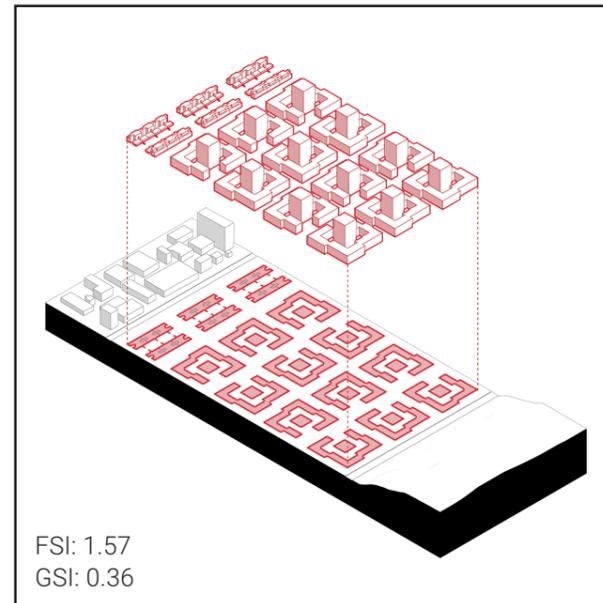


IV. RESIDENTIAL DESIGN

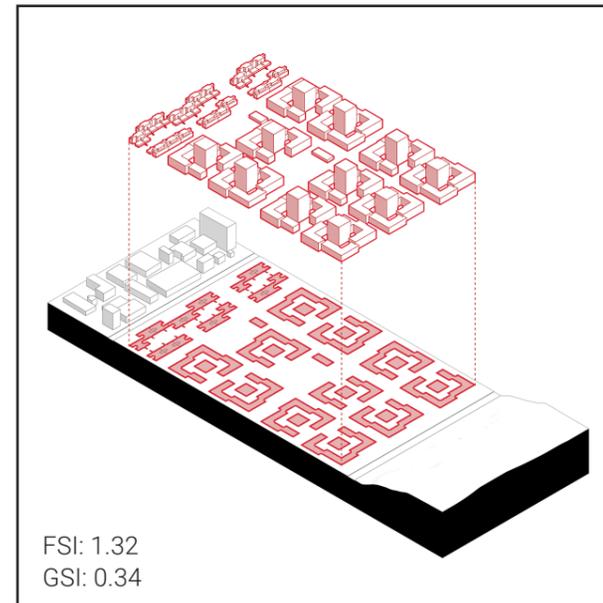
Design Principle



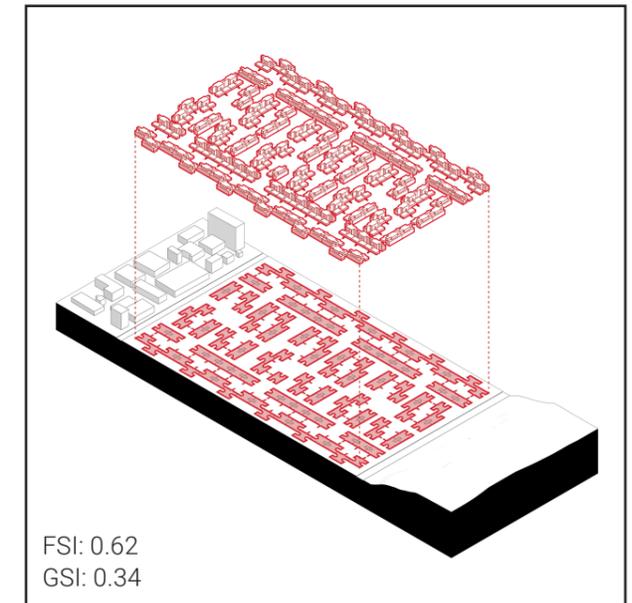
POSSIBILITY 1



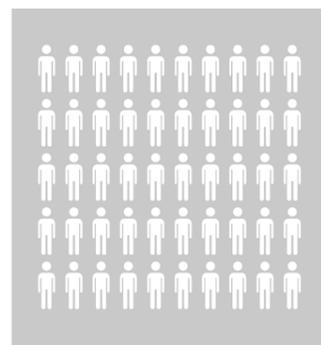
POSSIBILITY 2



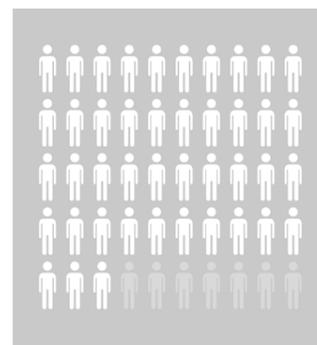
POSSIBILITY 3



POSSIBILITY 4



density:
261 dwellings/hectare
1000 dwellers/hectare



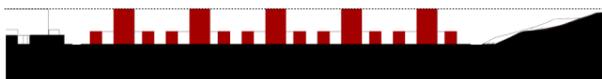
density:
223 dwellings/hectare
863 dwellers/hectare



density:
188 dwellings/hectare
716 dwellers/hectare

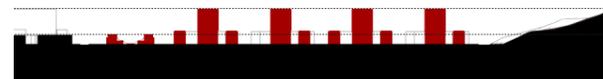


density:
98 dwellings/hectare
431 dwellers/hectare



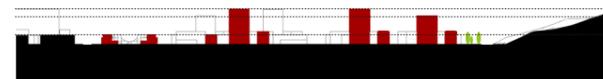
local labour

skilled labour



local labour

skilled labour



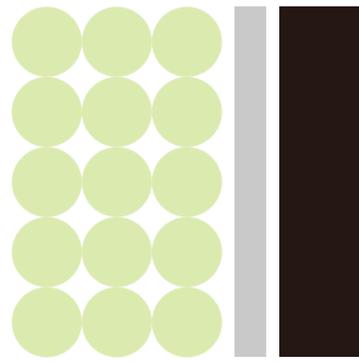
local labour

skilled labour

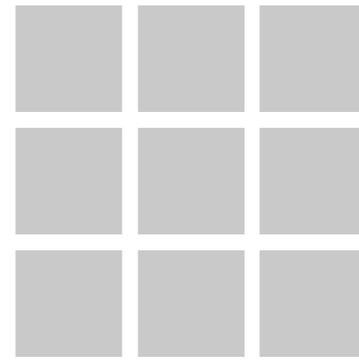


local labour

skilled labour



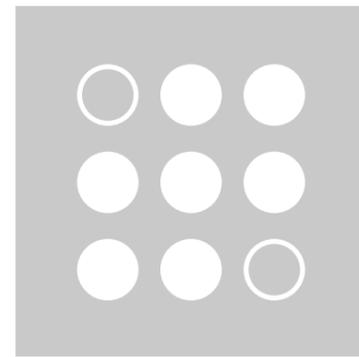
Principle 1
Green Buffer



Principle 2
Traffic Loop



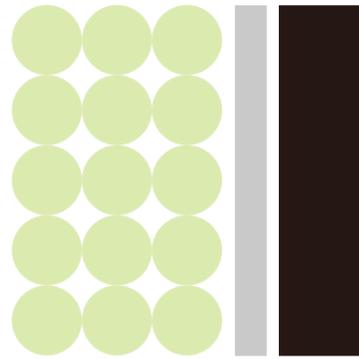
Principle 3
Vendor Street



Principle 4
Communal Space

IV. RESIDENTIAL DESIGN

Street Profile



Principle 1
Green Buffer



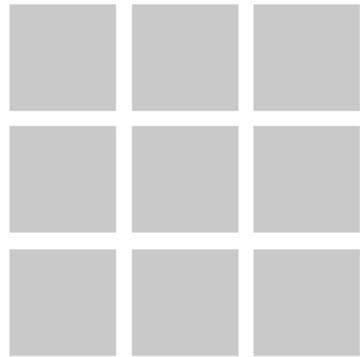
IV. RESIDENTIAL DESIGN

Street Profile



IV. RESIDENTIAL DESIGN

Street Profile



Principle 2
Traffic Loop



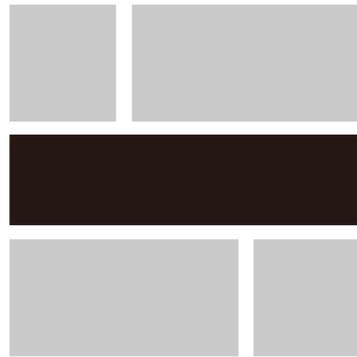
IV. RESIDENTIAL DESIGN

Street Profile

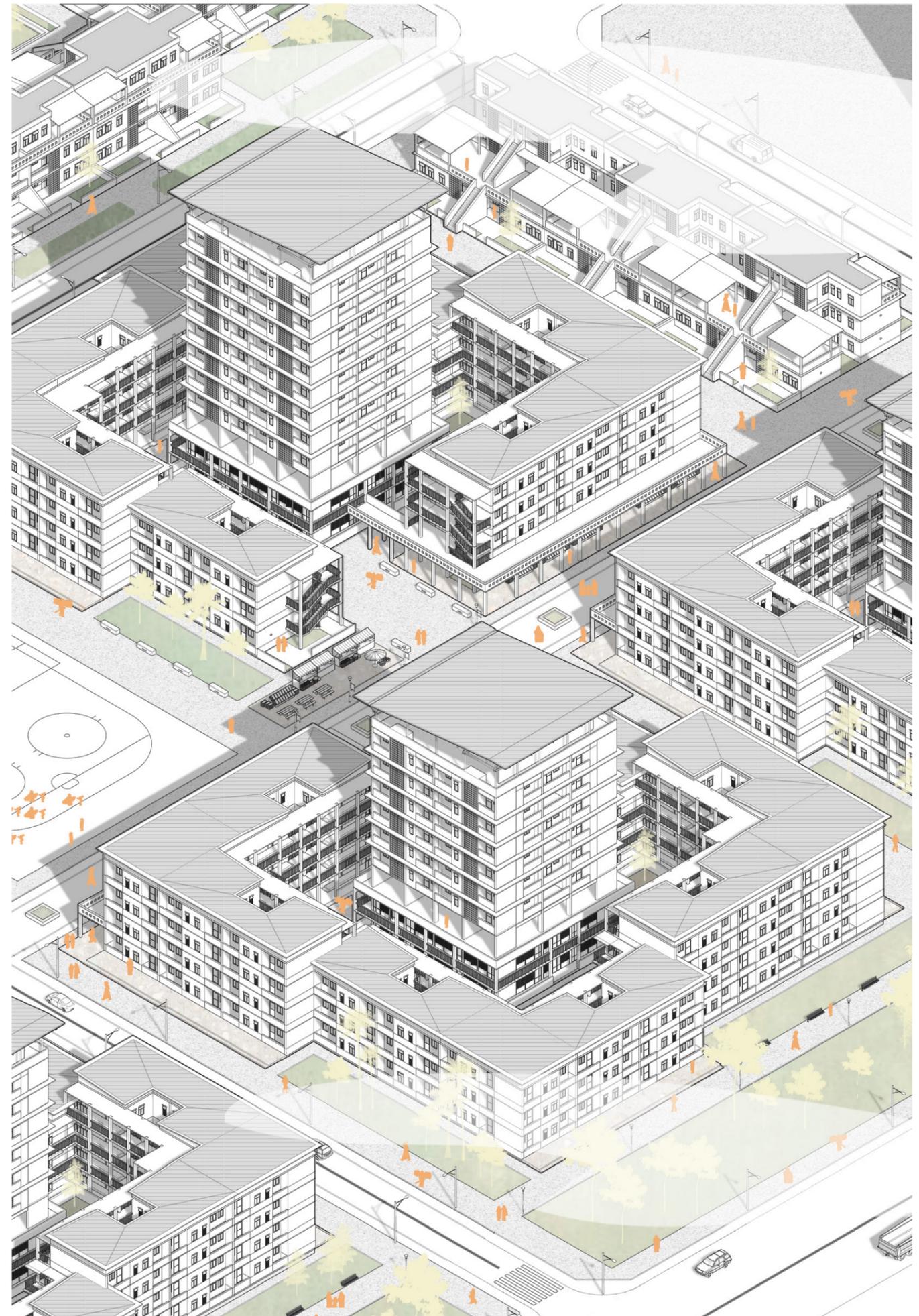


IV. RESIDENTIAL DESIGN

Street Profile



Principle 3
Vendor Street



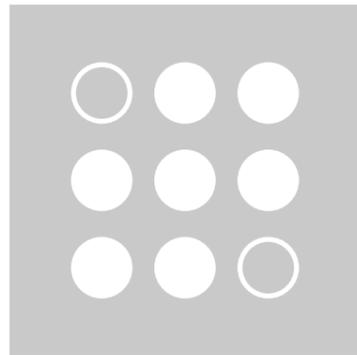
IV. RESIDENTIAL DESIGN

Street Profile

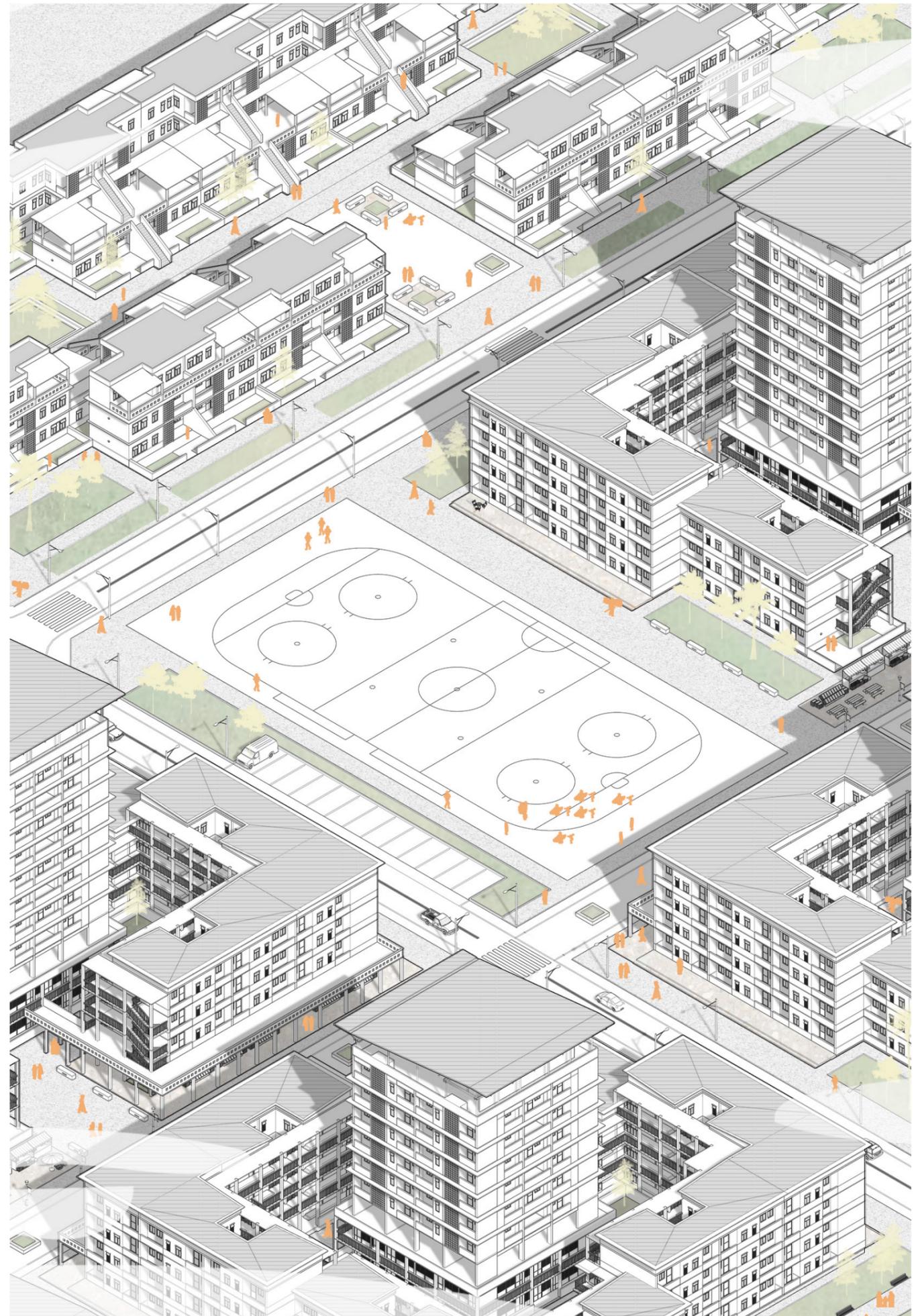


IV. RESIDENTIAL DESIGN

Street Profile



Principle 4
Communal Space



IV. RESIDENTIAL DESIGN

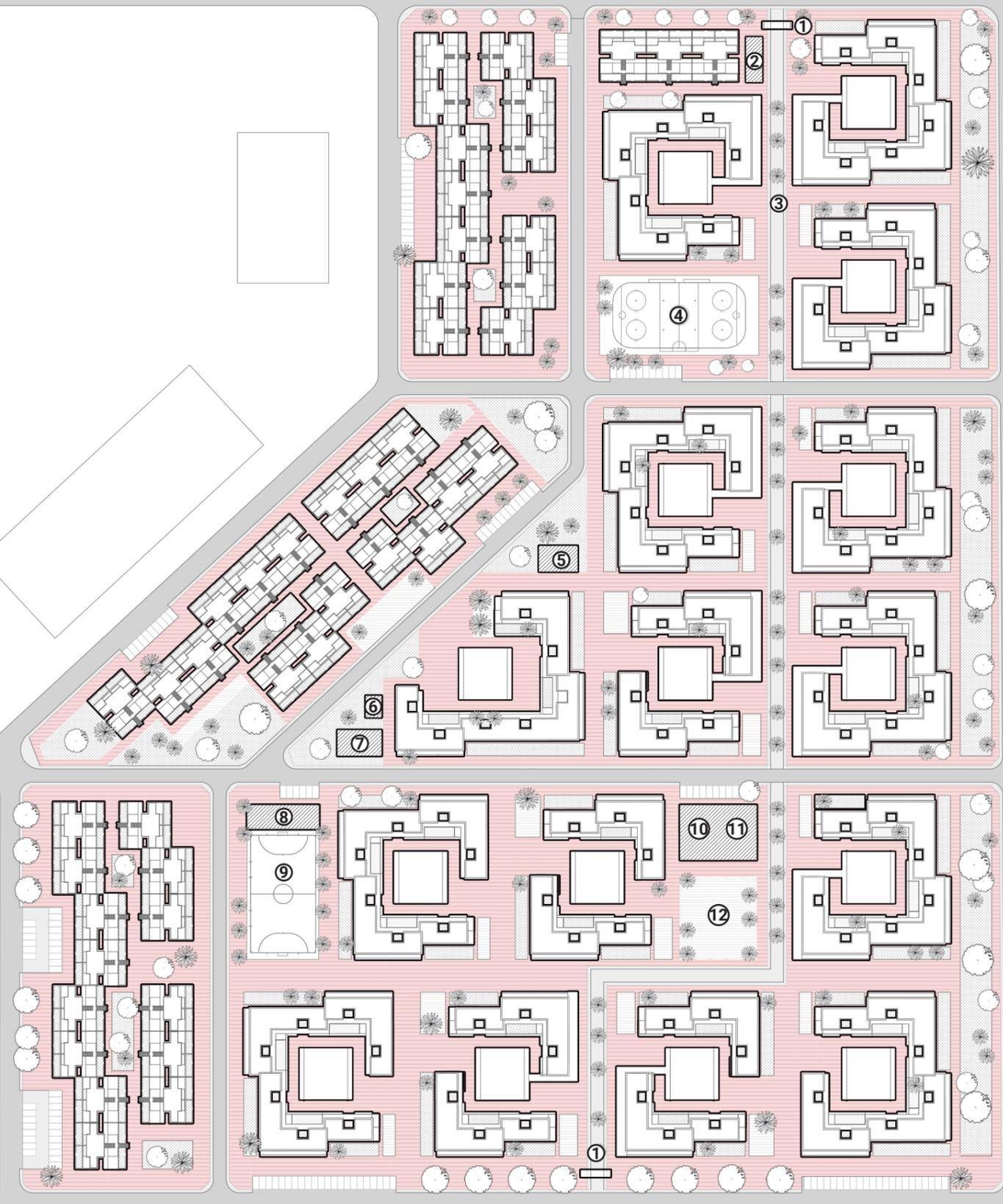
Street Profile



IV. RESIDENTIAL DESIGN

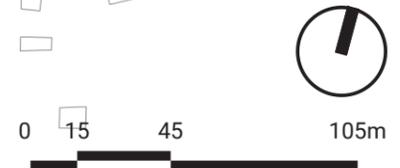
Master Plan

Units: 2718
FSI : 1.10
GSI: 0.34
Density: 153
Dwellings/ Ha



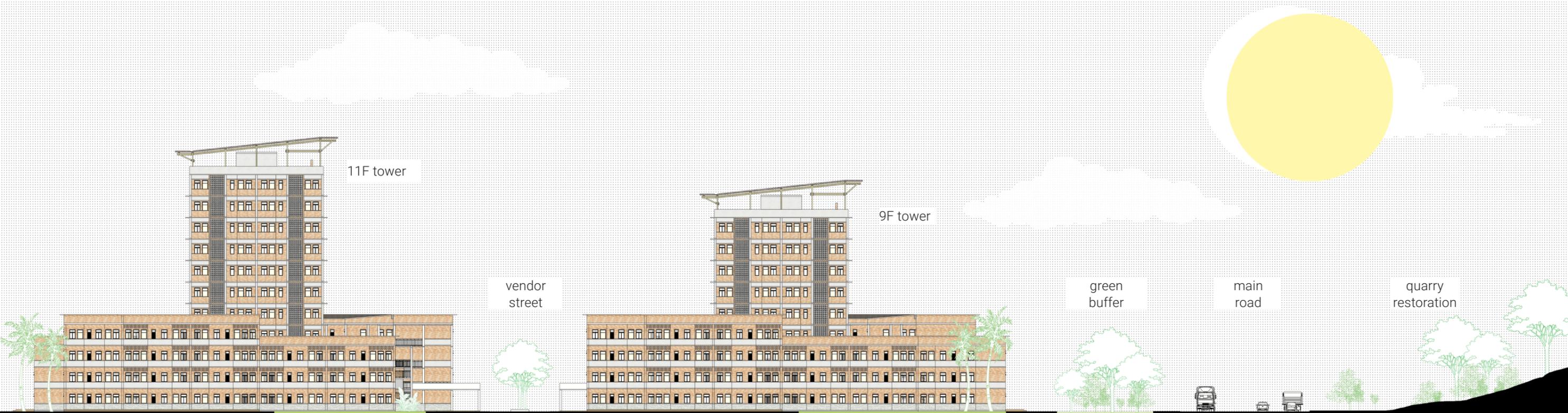
Mahatma Gandhi Nagar

- 1 entrance
- 2 vendor center
- 3 vendor street
- 4 hockey court
- 5 Mosque
- 6 religious service
- 7 Hindu Temple
- 8 communal service
- 9 football court
- 10 consultant center
- 11 career center
- 12 festival square



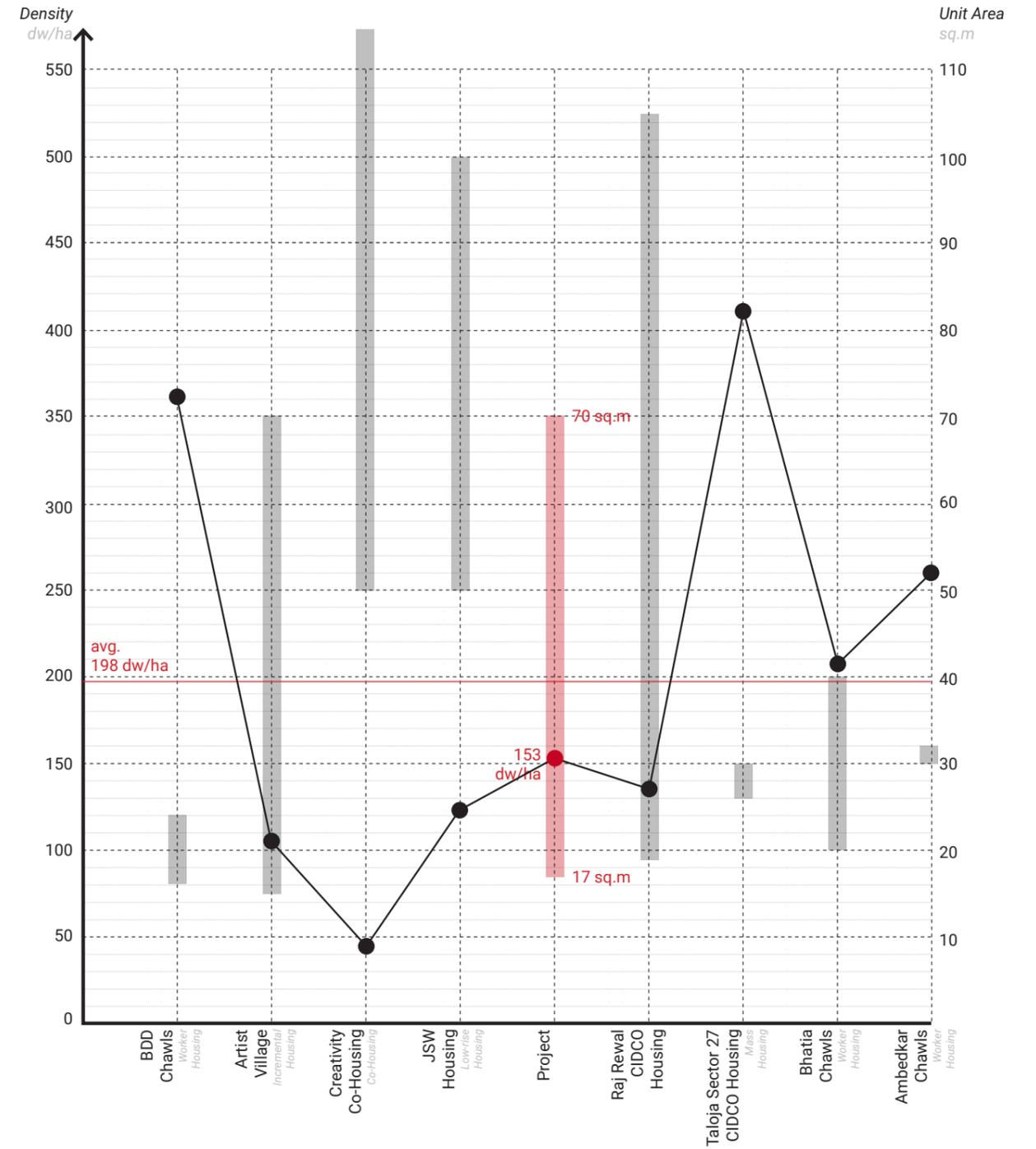
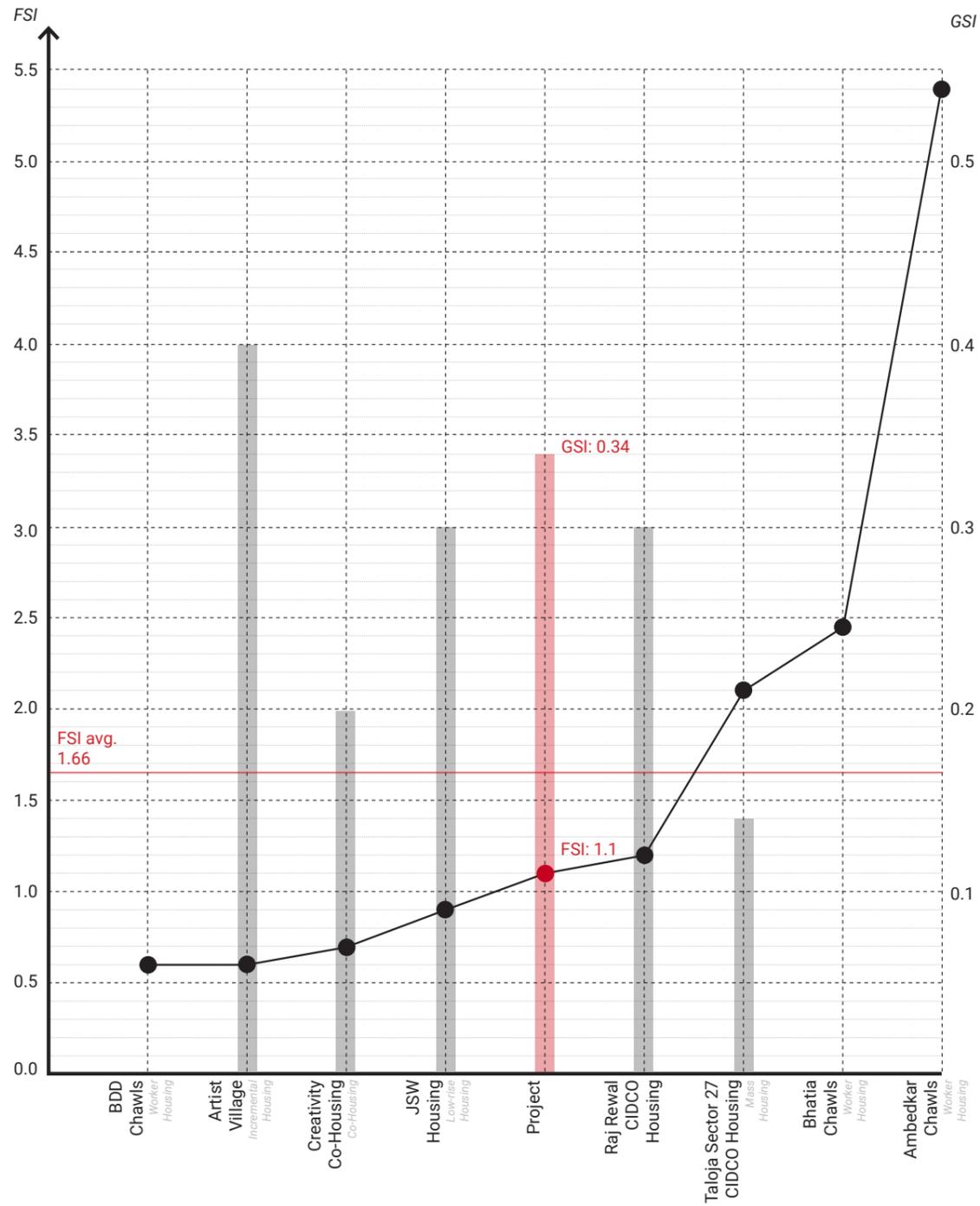
IV. RESIDENTIAL DESIGN

Urban Section



IV. RESIDENTIAL DESIGN

Comparative FSI & Density



Data Source: Padora, Sameep. How To Build An Indian House: The Mumbai Example. Reprint, Rotterdam: nai010 publishers, 2020.

IV. RESIDENTIAL DESIGN

Upscaling and Replicability

- slum
- quarry

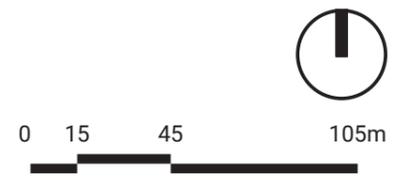


In Navi Mumbai, many quarry settlements are waiting for an improvement in their living conditions. These settlements are under a similar urban context. They are close to the quarries, with heavy traffic passing through and close to slums. The previous design principles can use for upscaling and replicability.



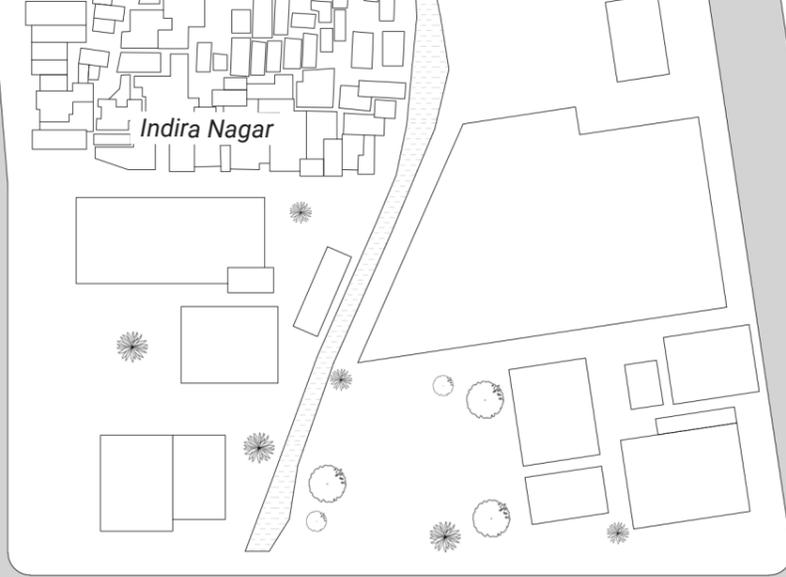
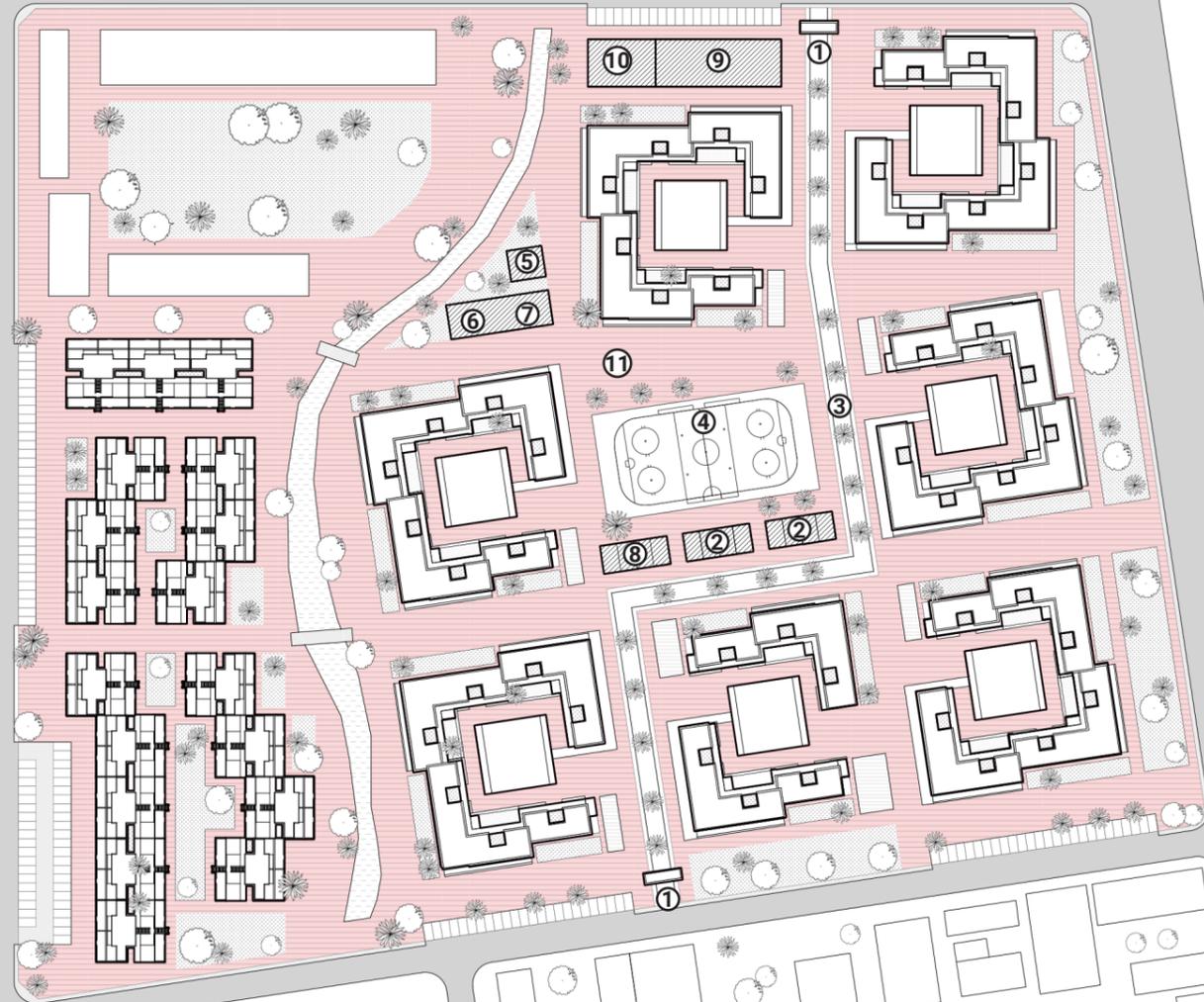
IV. RESIDENTIAL DESIGN

Master Plan



Units: 1278
FSI : 0.98
GSI: 0.30
Density: 135
Dwellings/ Ha

- 1 entrance
- 2 vendor center
- 3 vendor street
- 4 hockey court
- 5 Mosque
- 6 religious service
- 7 Hindu Temple
- 8 communal service
- 9 consultant center
- 10 career center
- 11 festival square



V. BUILDING TECHNOLOGY

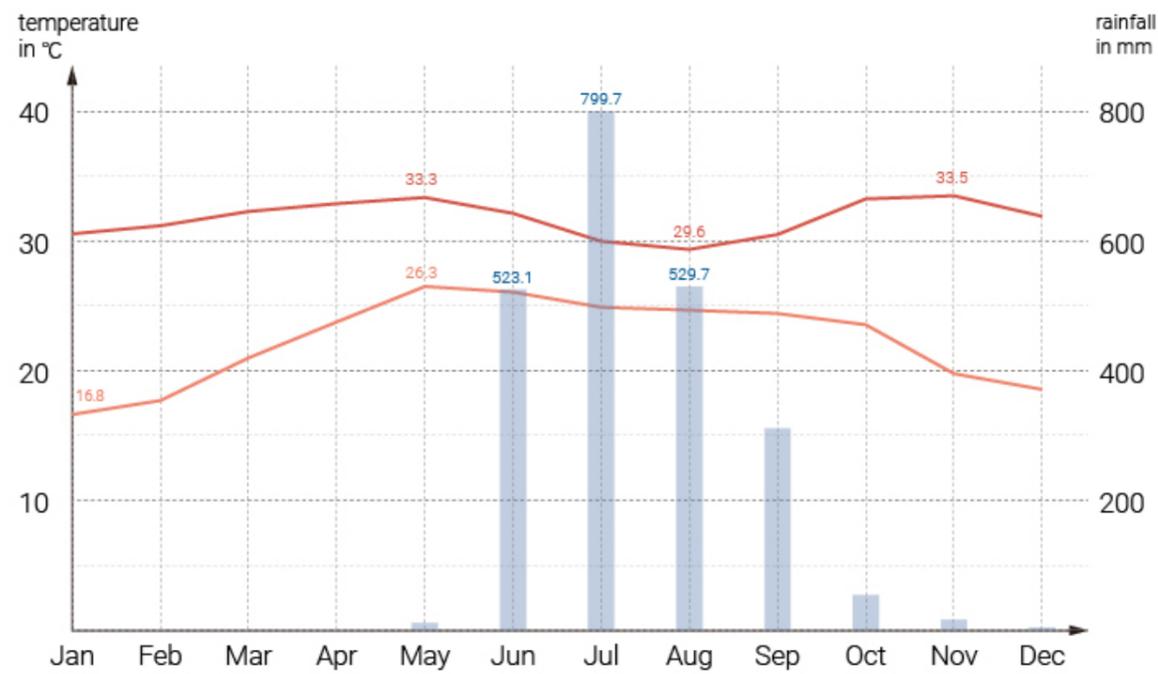
This chapter focus on the building technologies that based on local climate , geographical conditions and ecology system.

V. BUILDING TECHNOLOGY

Climate and Materiality

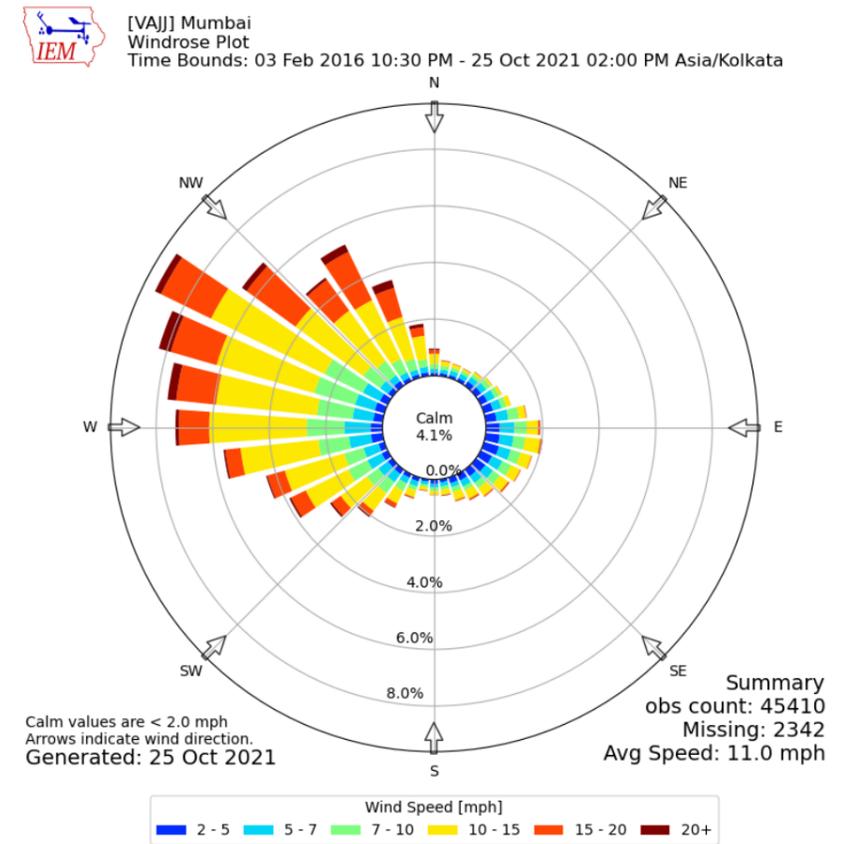
Rainfall/ Temperature

Yearly Climatology



Wind Direction

Yearly Climatology



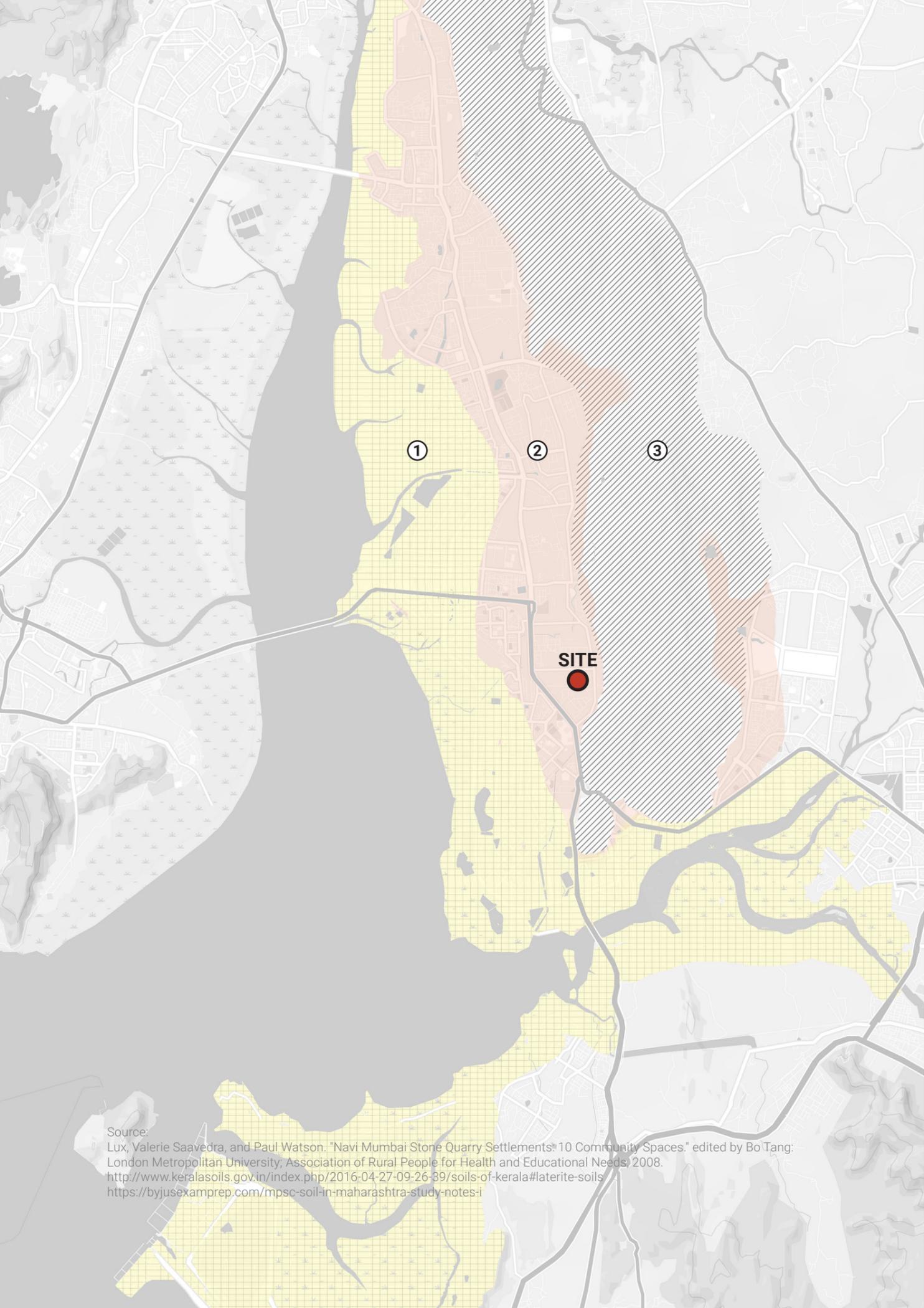
Data Source:
<https://www.weather-atlas.com/en/india/mumbai-climate#rainfall>
https://mesonet.agron.iastate.edu/sites/windrose.phtml?station=VAJJ&network=IN_ASOS

V. BUILDING TECHNOLOGY

Climate and Materiality



Image Source:
Lux, Valerie Saavedra, and Paul Watson. "Navi Mumbai Stone Quarry Settlements: 10 Community Spaces." edited by Bo Tang:
London Metropolitan University; Association of Rural People for Health and Educational Needs, 2008.



Source:
Lux, Valerie Saavedra, and Paul Watson. "Navi Mumbai Stone Quarry Settlements: 10 Community Spaces." edited by Bo Tang:
London Metropolitan University; Association of Rural People for Health and Educational Needs, 2008.
<http://www.keralasoils.gov.in/index.php/2016-04-27-09-26-39/soils-of-kerala#laterite-soils>
<https://byjsexamprep.com/mpsc-soil-in-maharashtra-study-notes-i>

V. BUILDING TECHNOLOGY

Climate and Materiality



Alluvial Soil

1. Coastal Area

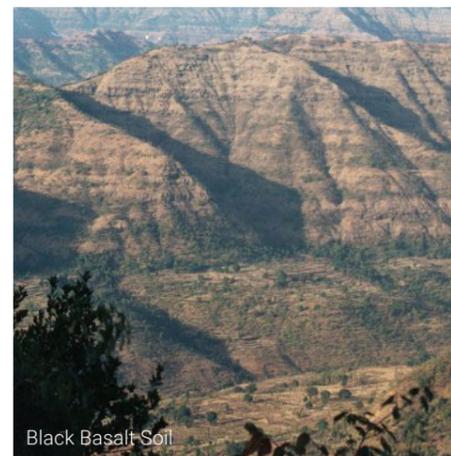
This region are mainly **alluvial soils**. They are **clayey**, with high amount of bases and have **high water holding capacity** (200-250 mm/m). The ground water table of these soils is generally high and it reaches above the surface during rainy season.



Lateritic Soil

2. Laterite Area

The soils located on moderately sloping residual hills are **lateritic** in nature. Laterite soil cannot retain moisture, so it is unsuitable for irrigation. It is less fertile for agriculture but generally suitable for orchards.



Black Basalt Soil

3. Hills

Rock is the most abundant material source with the quarry area. It is mostly **black basalt soil**. This type of soil is **clayey**, retains moisture. The quarry's land was used to produce paddy during rainy season. Some mango and coconut orchards was also practised by locals.



mango



coconut



jackfruit



pinapple



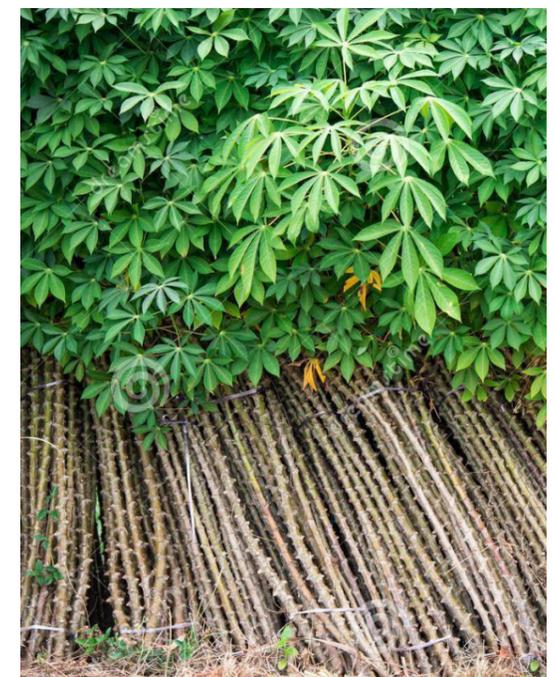
mango



paddy



pinapple

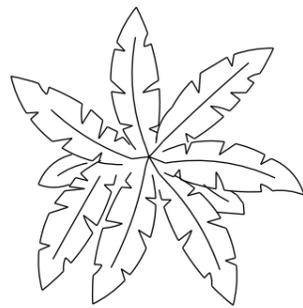
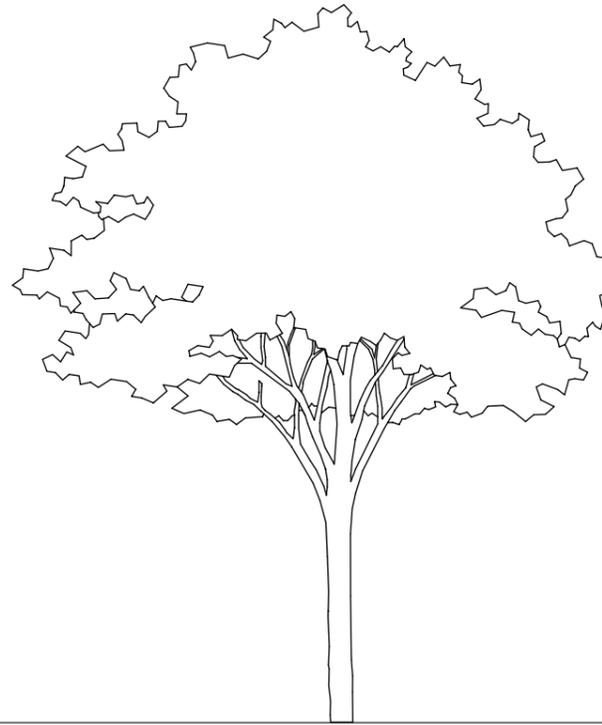
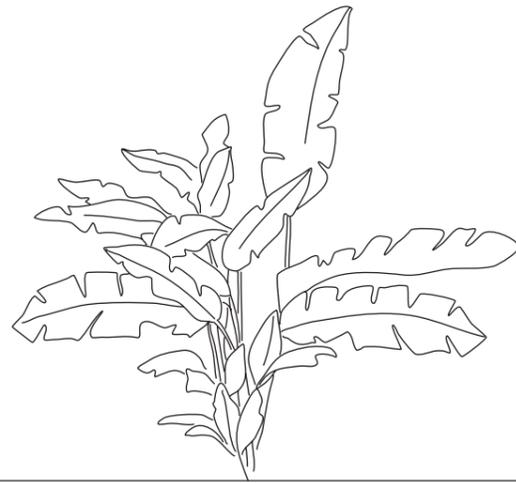


topioca

Image Source (from left to right):
<https://indianexpress.com/article/cities/rajkot/cyclone-impact-kutch-mangoes-get-a-boost-as-orchards-in-saurashtra-suffer-major-damage-7346912/>
<https://www.yearofthedurian.com/2013/07/indias-mango-belt.html>
<https://www.indiancooperative.com/co-op-news-snippets/india-takes-giant-strides-in-coconut-production-govt/>
<https://www.deccanchronicle.com/business/in-other-news/180620/indias-rice-production-could-hit-record-high-as-farmers-expand-area.html>

V. BUILDING TECHNOLOGY

Ecology



Lemon Grass

Banana Tree

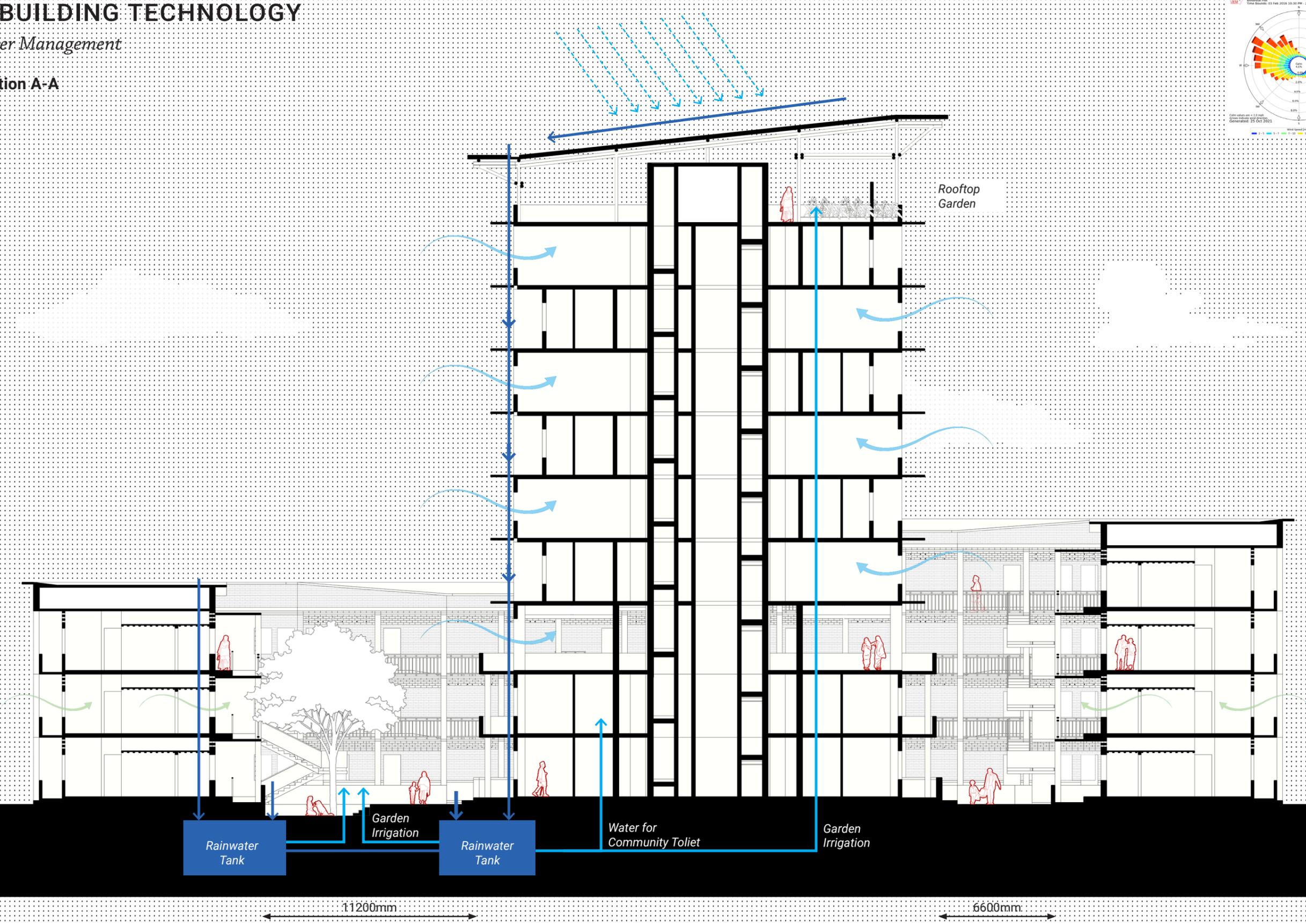
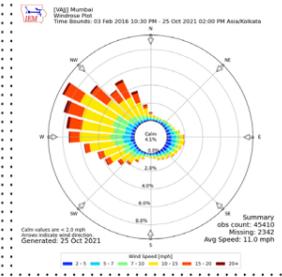
Mango Tree

Coconut Tree

V. BUILDING TECHNOLOGY

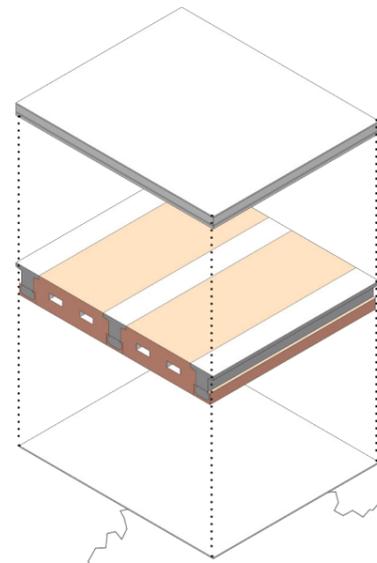
Water Management

Section A-A



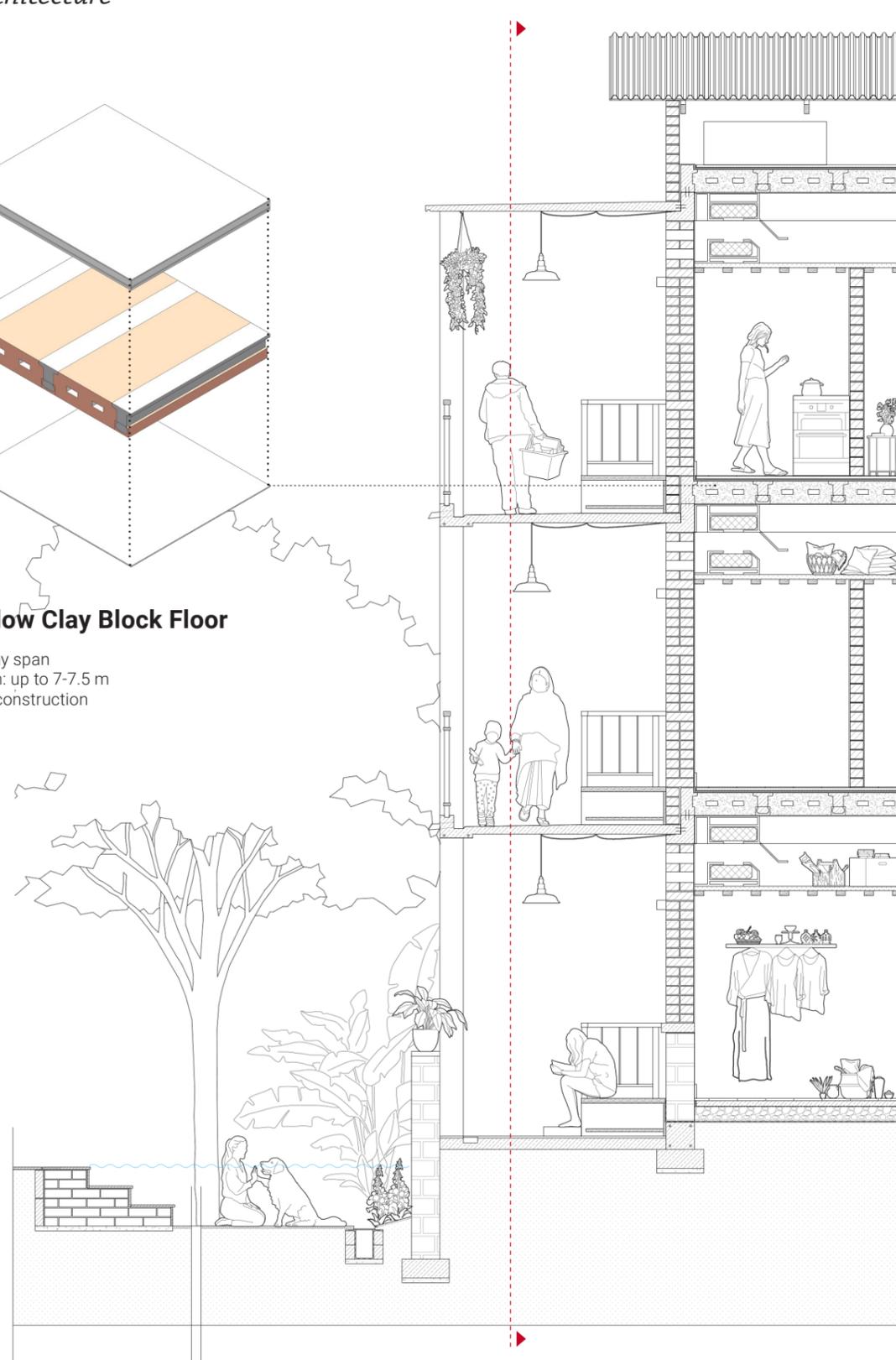
V. BUILDING TECHNOLOGY

Low Tech Architecture



Hollow Clay Block Floor

- 1-way span
- Span: up to 7-7.5 m
- Dry construction



-  CSEB Load Bearing Wall
-  Precast Concrete Beam
-  Hollow Clay Block floor
-  Marine Plywood Doorstep
-  Rubble Stone Retaining Wall

V. BUILDING TECHNOLOGY

Low Tech Architecture

Detail A 1:30

1 Floor Construction (interior)

- limestone floor covering 10mm
- screed 25mm
- seperated layer (1mm plastic sheet)
- impact sound insulation 20mm
- hollow clay block floor 240mm
- plaster to soffit 10mm

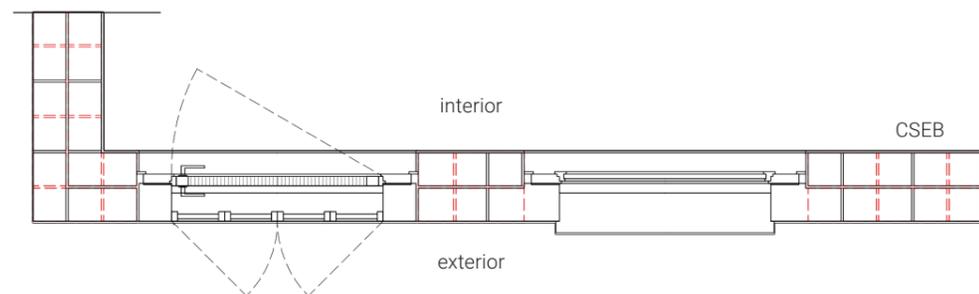
2 Ceiling

- plasterboard 50mm
- wooden beam

3 Floor Construction (gallery)

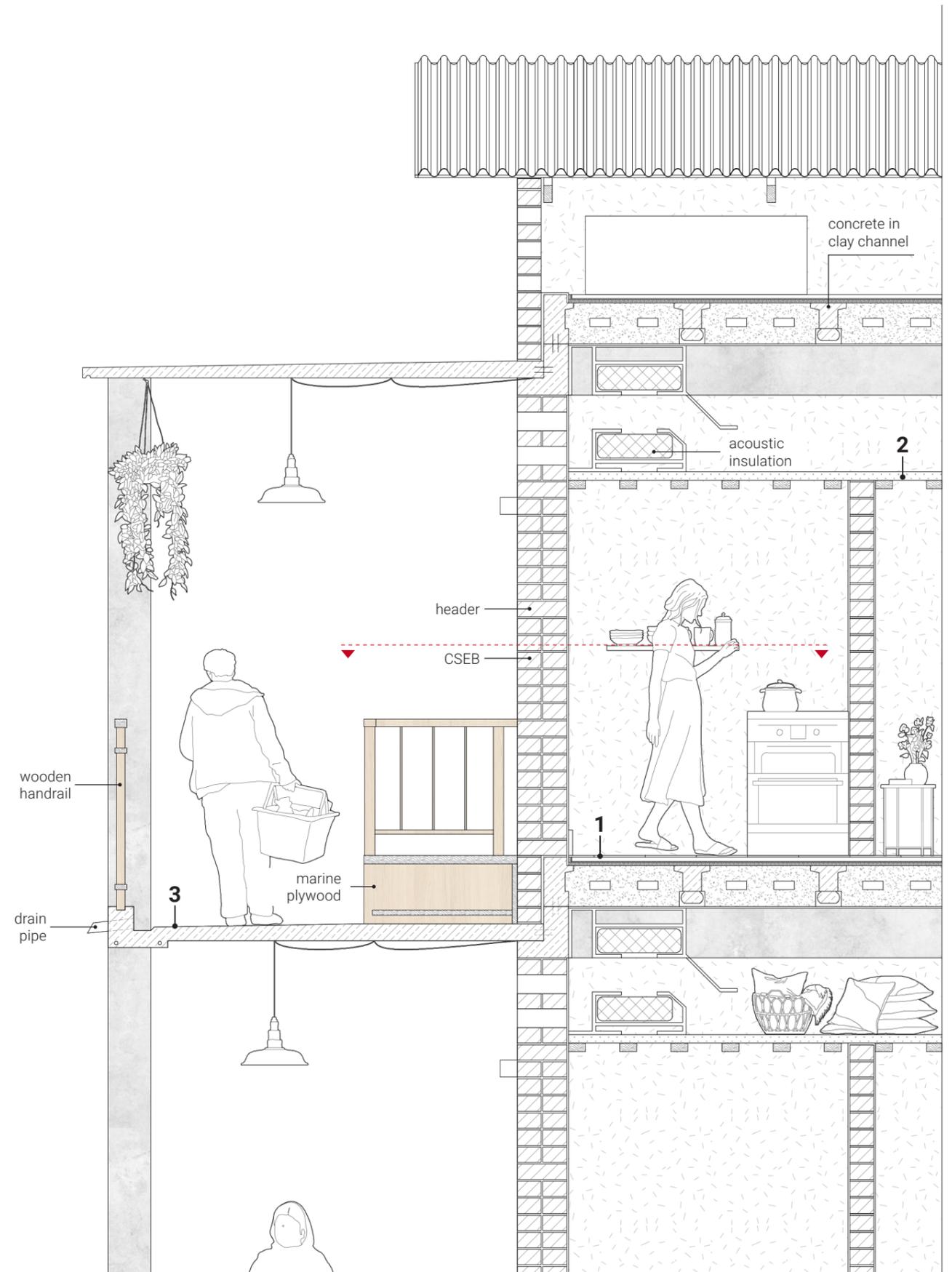
- precast concrete floor 80-100mm

Detail B 1:30



layer 1

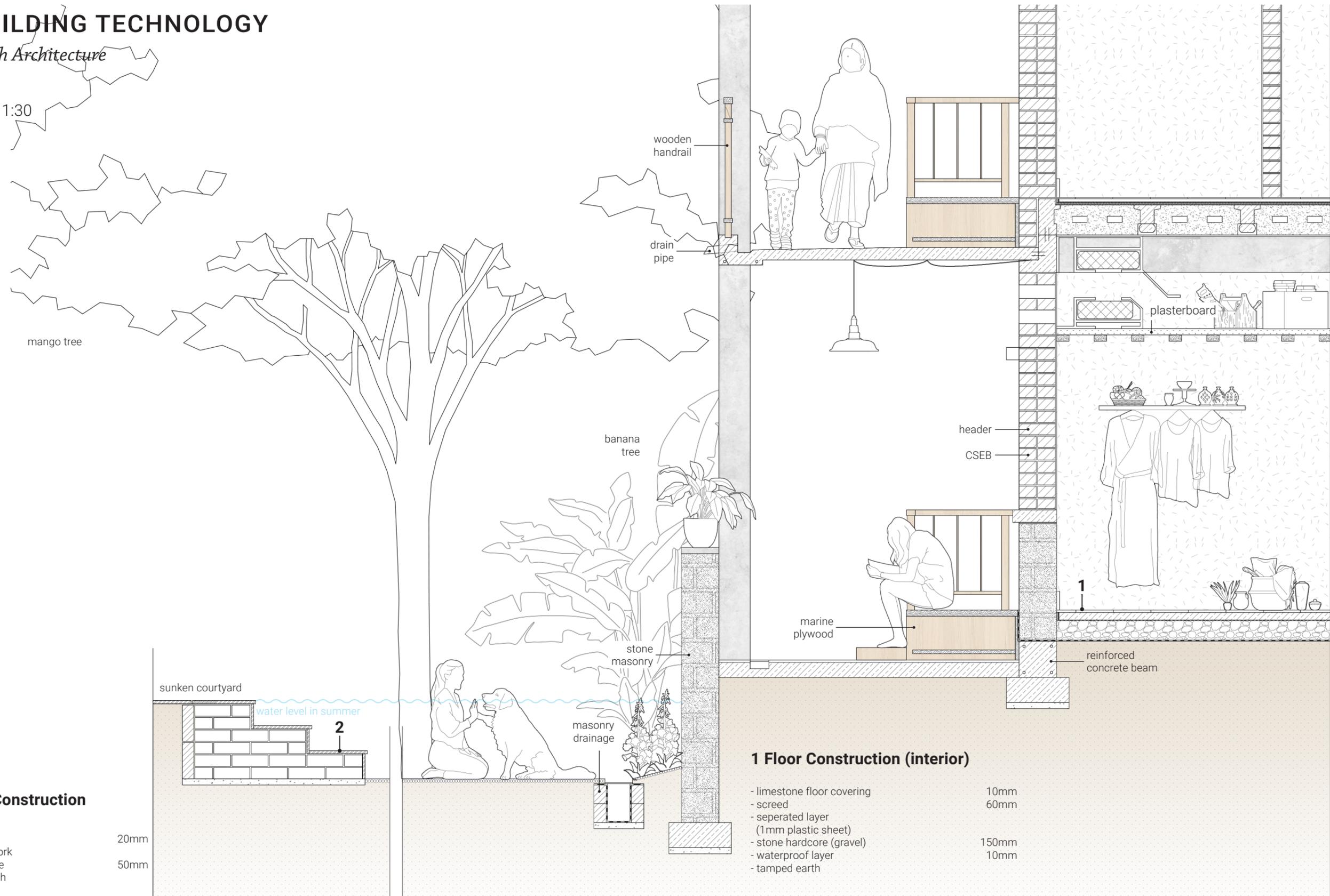
layer 2



V. BUILDING TECHNOLOGY

Low Tech Architecture

Detail C 1:30



2 Floor Construction (gallery)

- surface tiles 20mm
- fired brickwork 50mm
- thin concrete
- tamped earth

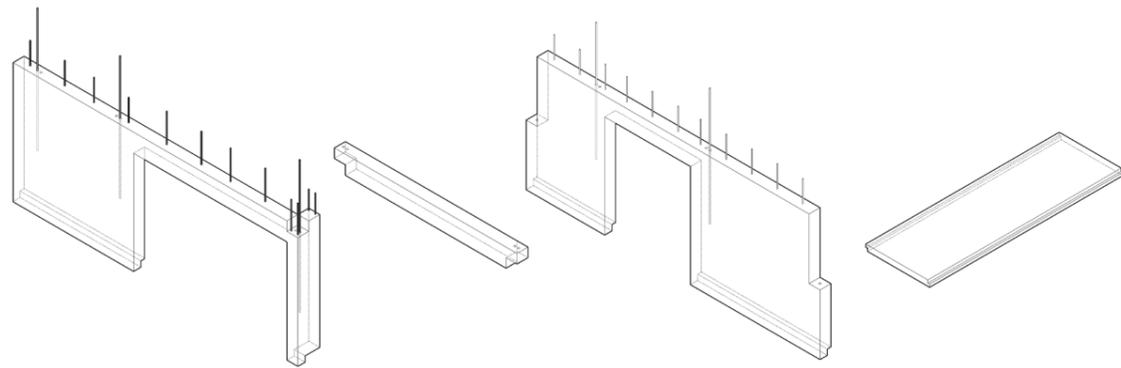
1 Floor Construction (interior)

- limestone floor covering 10mm
- screed 60mm
- seperated layer (1 mm plastic sheet)
- stone hardcore (gravel) 150mm
- waterproof layer 10mm
- tamped earth

V. BUILDING TECHNOLOGY

Precast Architecture

1. Components



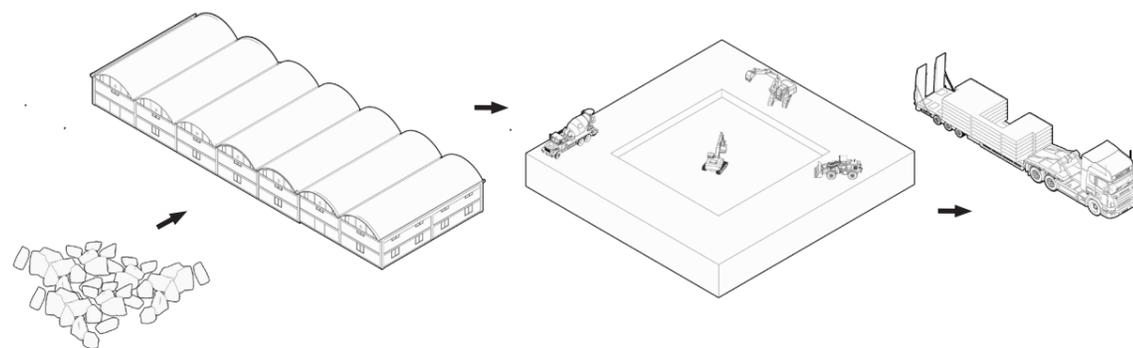
1 Structural Wall 1
Dimension:
7.8m * 3.3m * 0.3m

2 Beam

3 Structural Wall 2
Dimension:
8.1m * 3.3m * 0.3m

4 Floor Slab
Dimension:
1.8m * 0.15m * 5.4m

2. Process



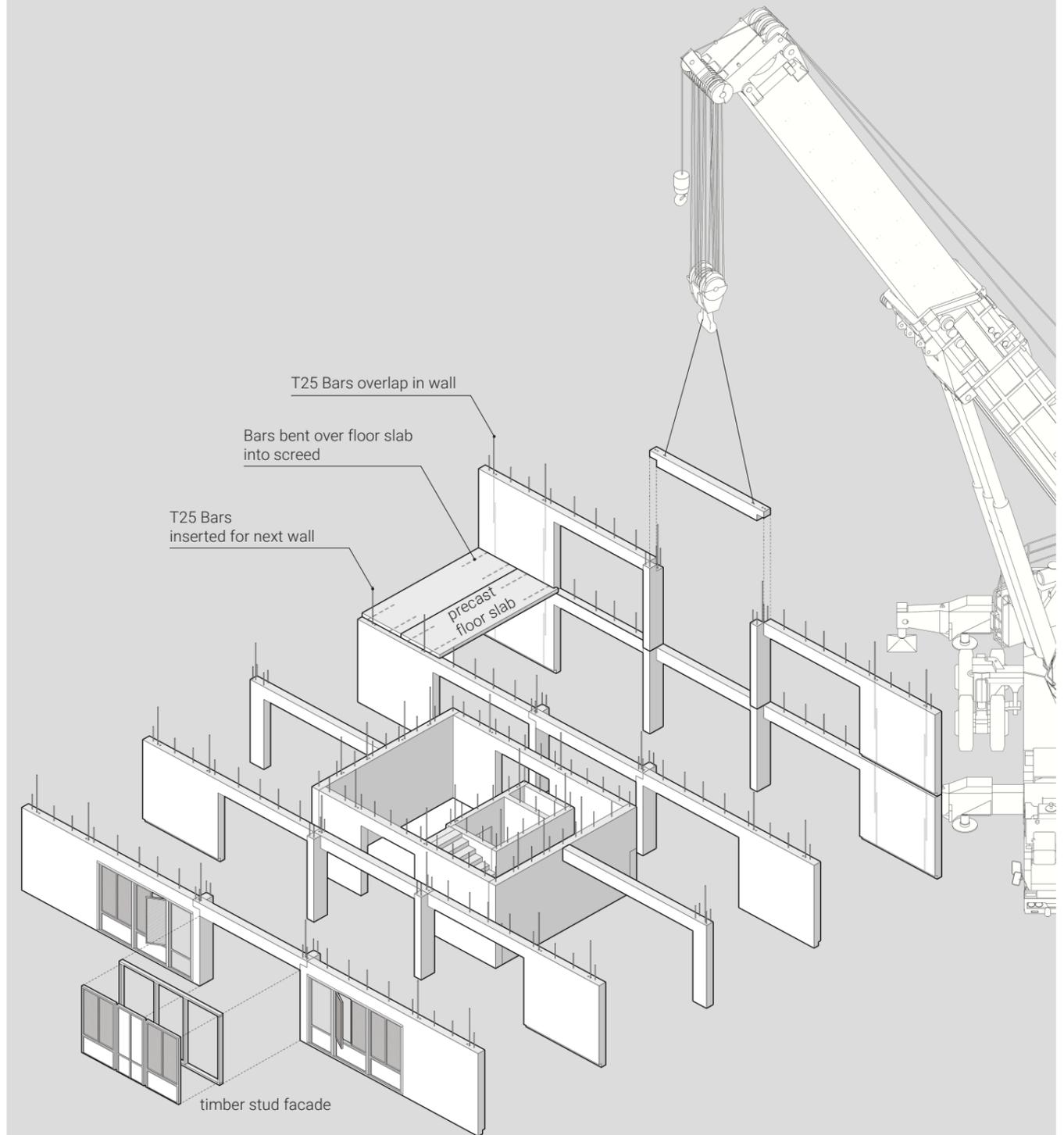
1 Material
Rock is the main and most abundant material source with the quarry area.

2 Factory
In the factory, the concrete will be made into previously designed components.

3 On-site Foundation
The foundation will be excavated on site.

4 Transportation
The precast components will be transported to the construction site.

3. On-site Installation



T25 Bars overlap in wall

Bars bent over floor slab into screed

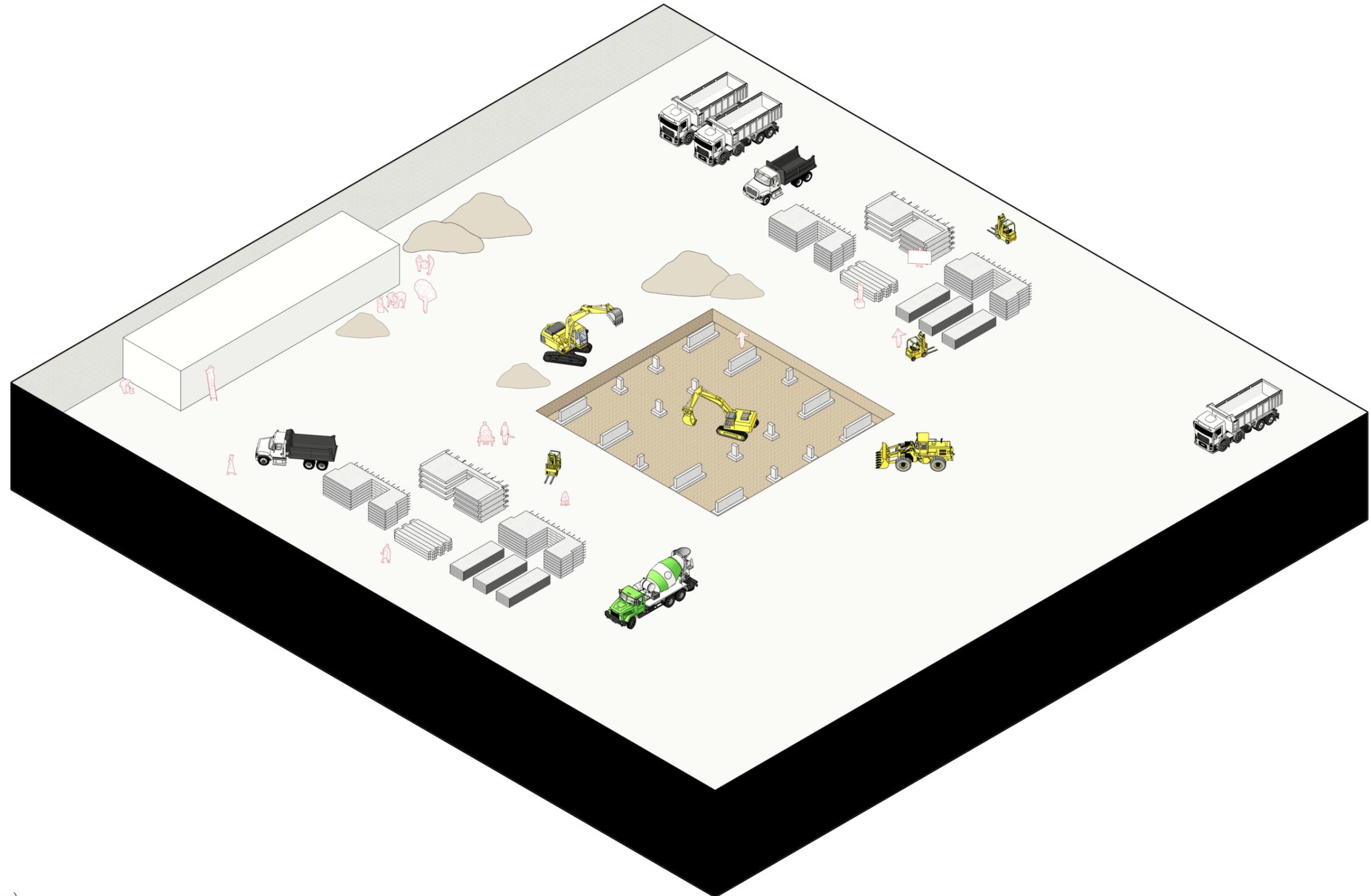
T25 Bars inserted for next wall

precast floor slab

timber stud facade

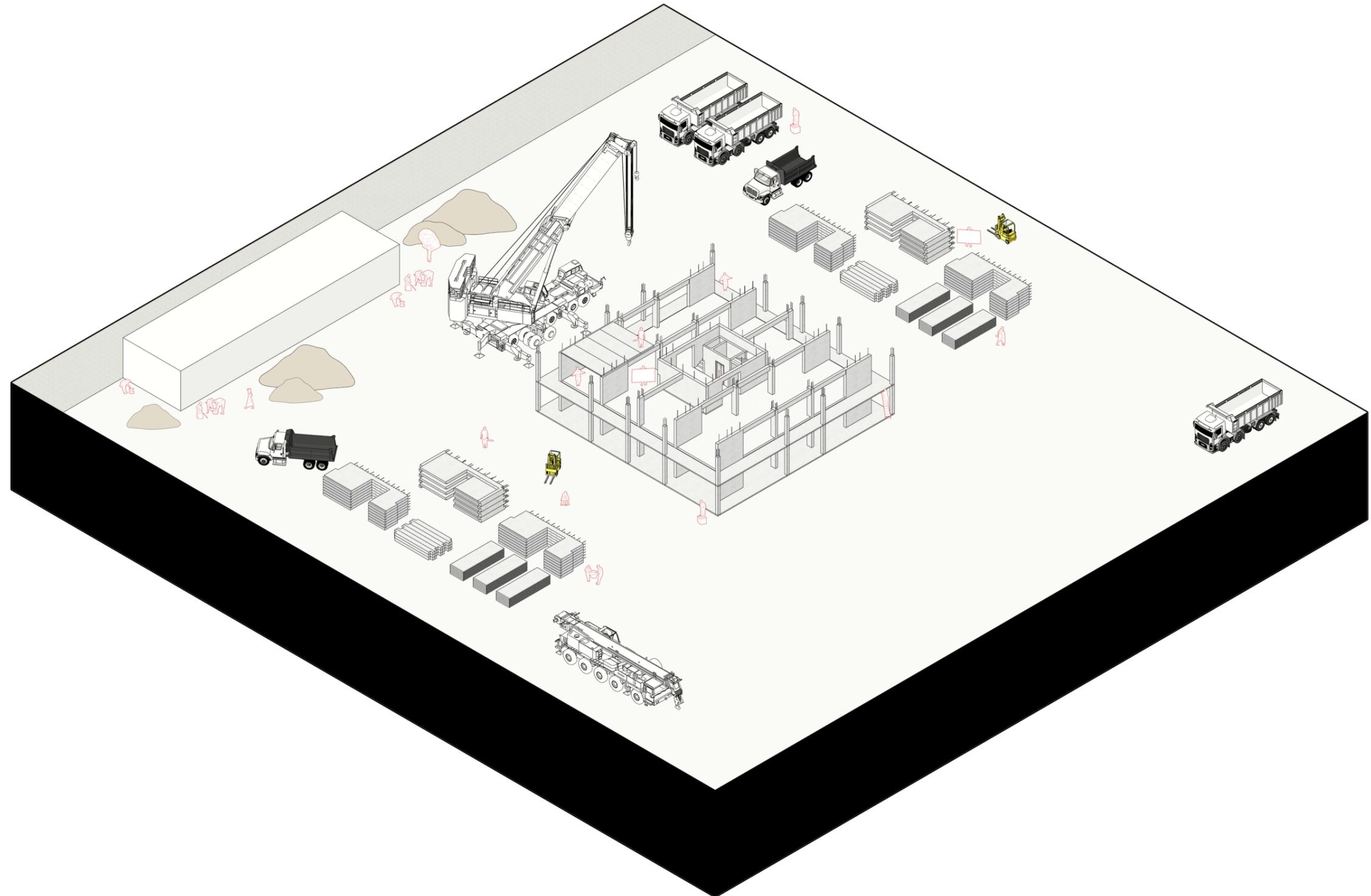
V. BUILDING TECHNOLOGY

Construction Process



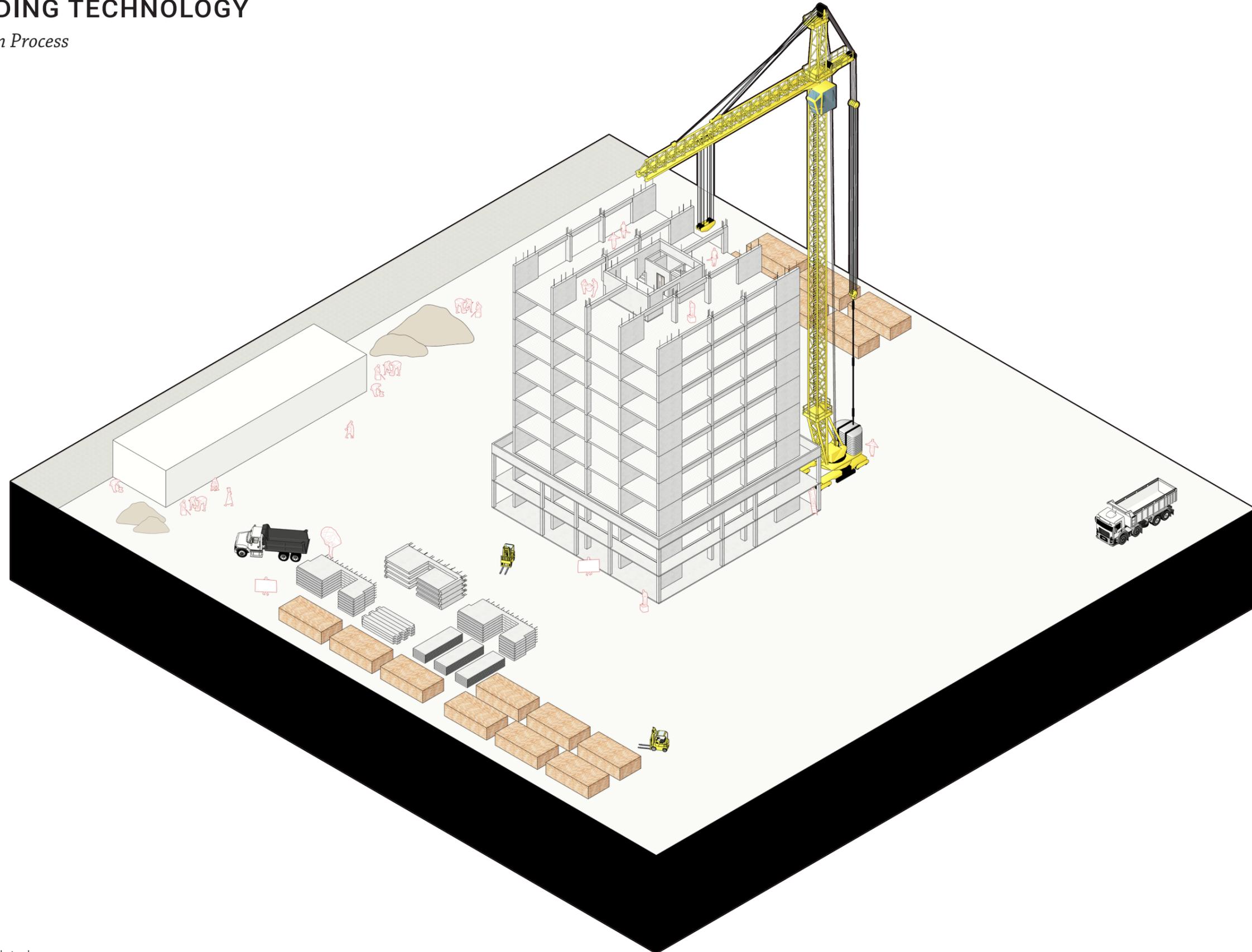
V. BUILDING TECHNOLOGY

Construction Process



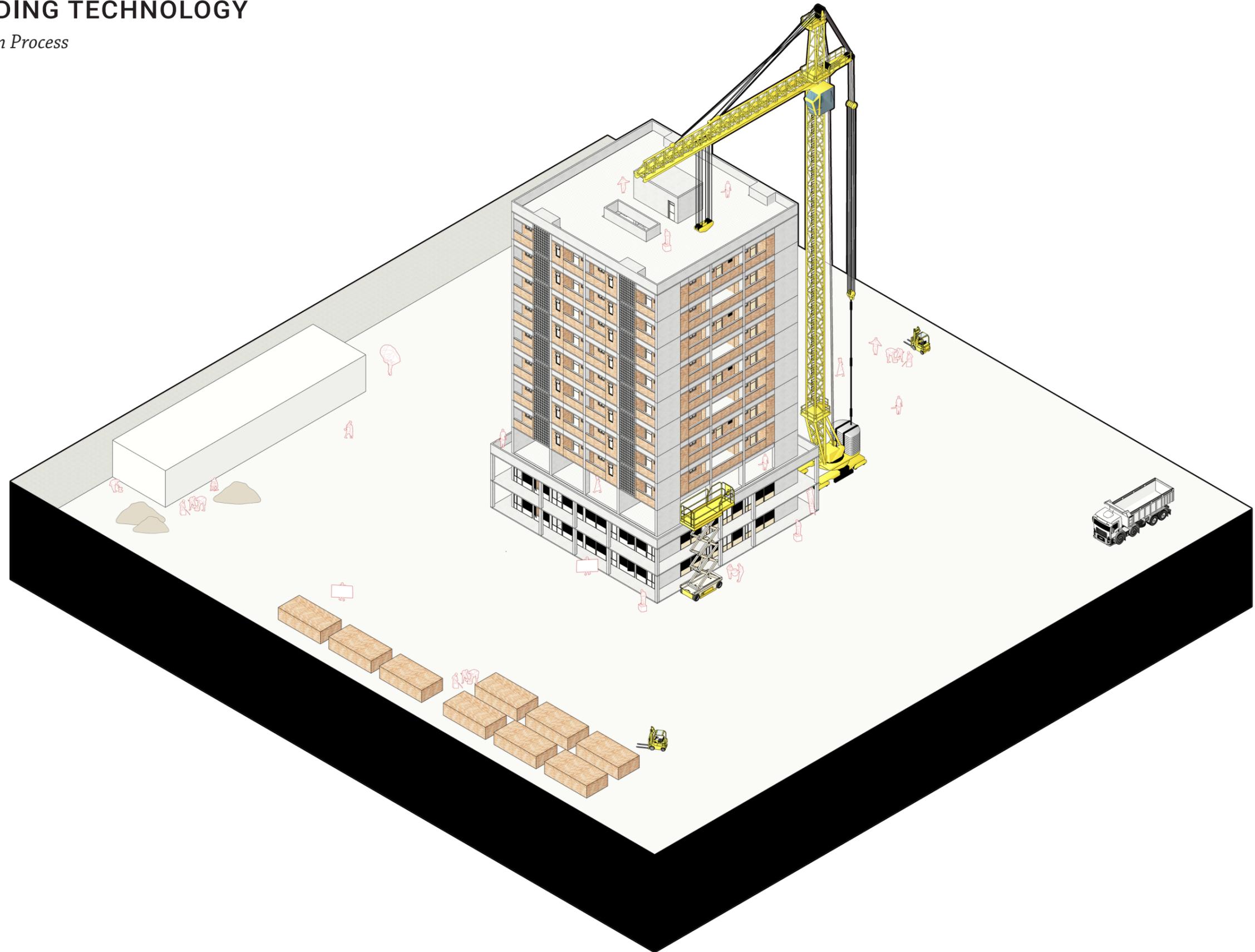
V. BUILDING TECHNOLOGY

Construction Process



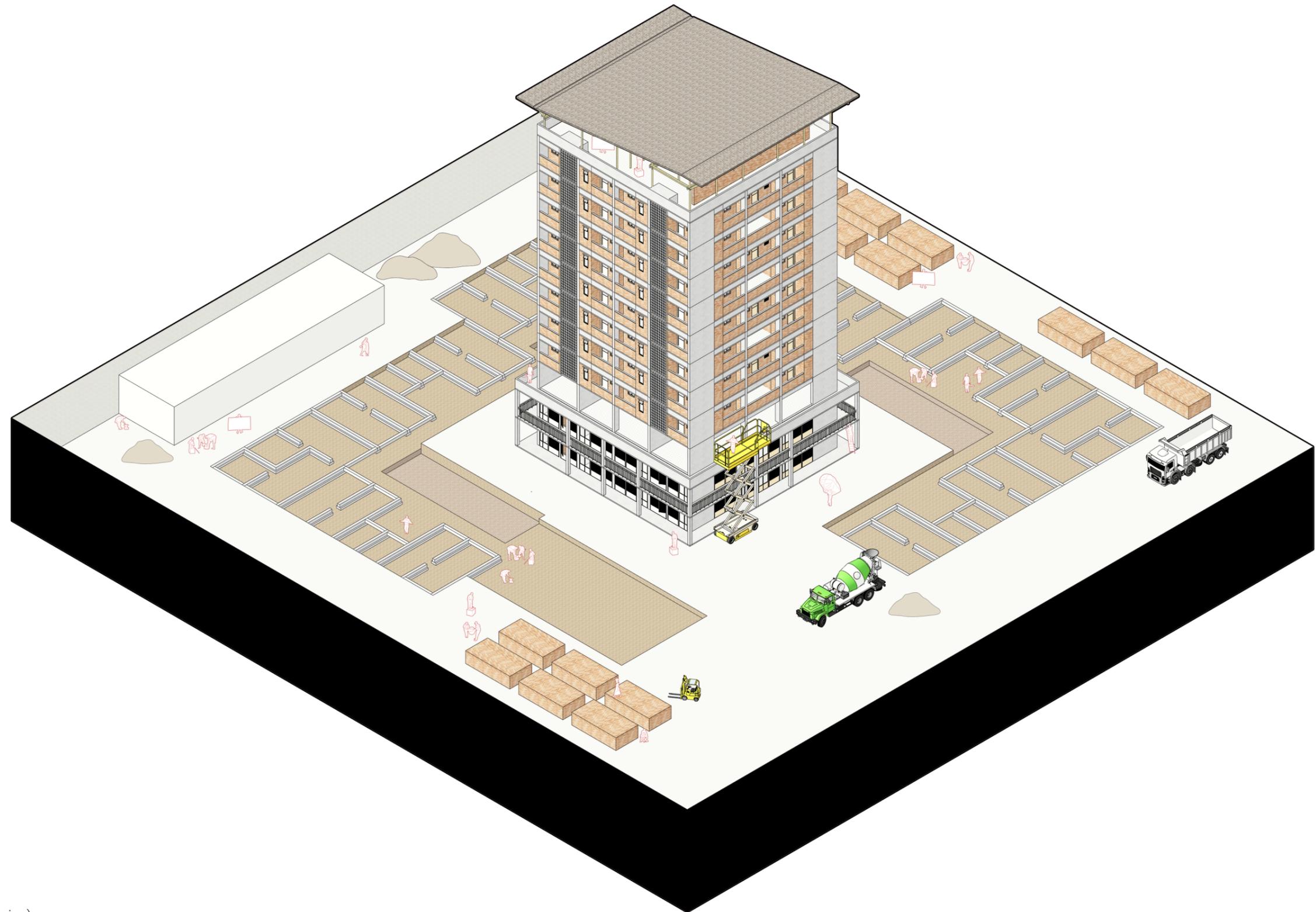
V. BUILDING TECHNOLOGY

Construction Process



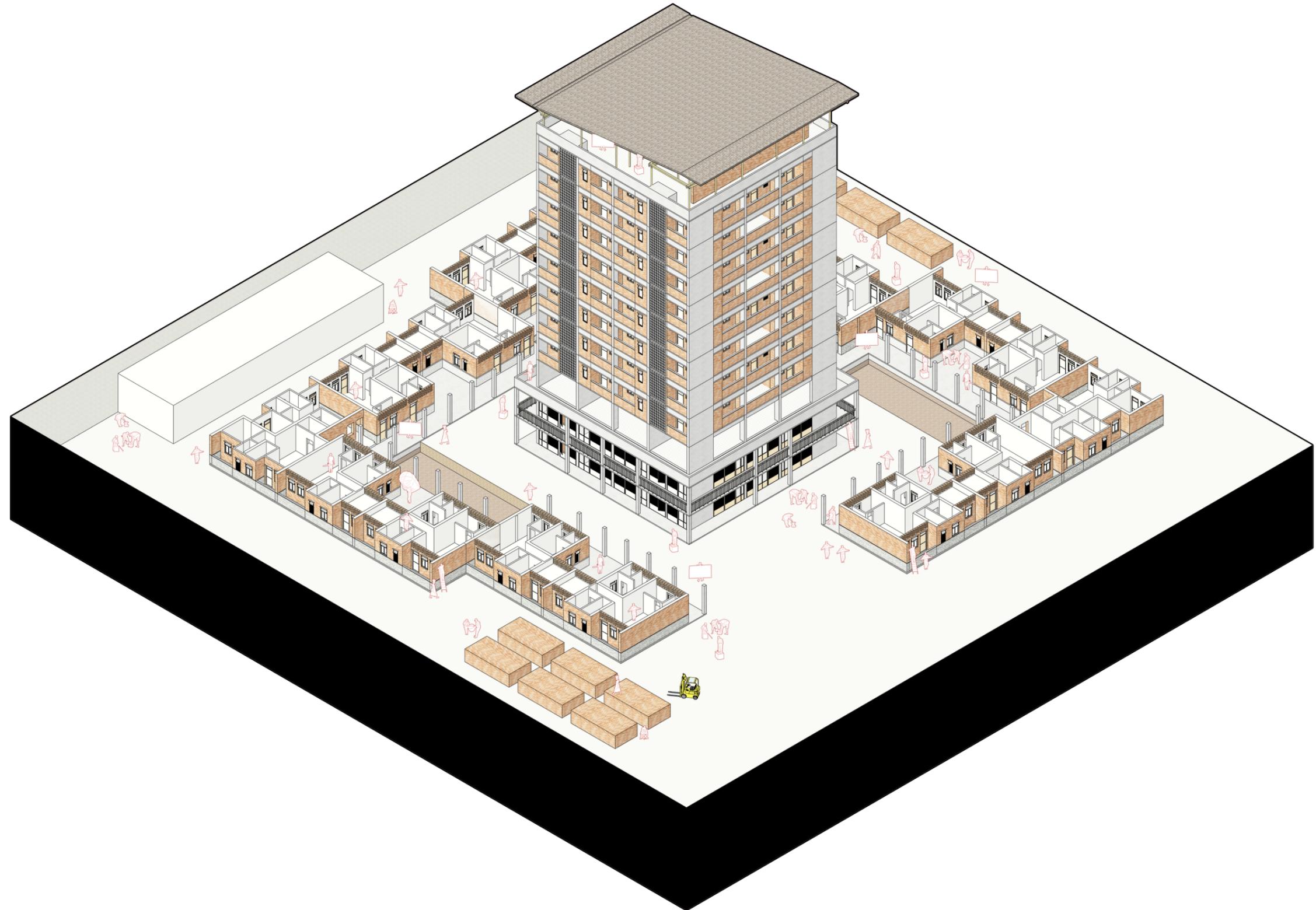
V. BUILDING TECHNOLOGY

Construction Process



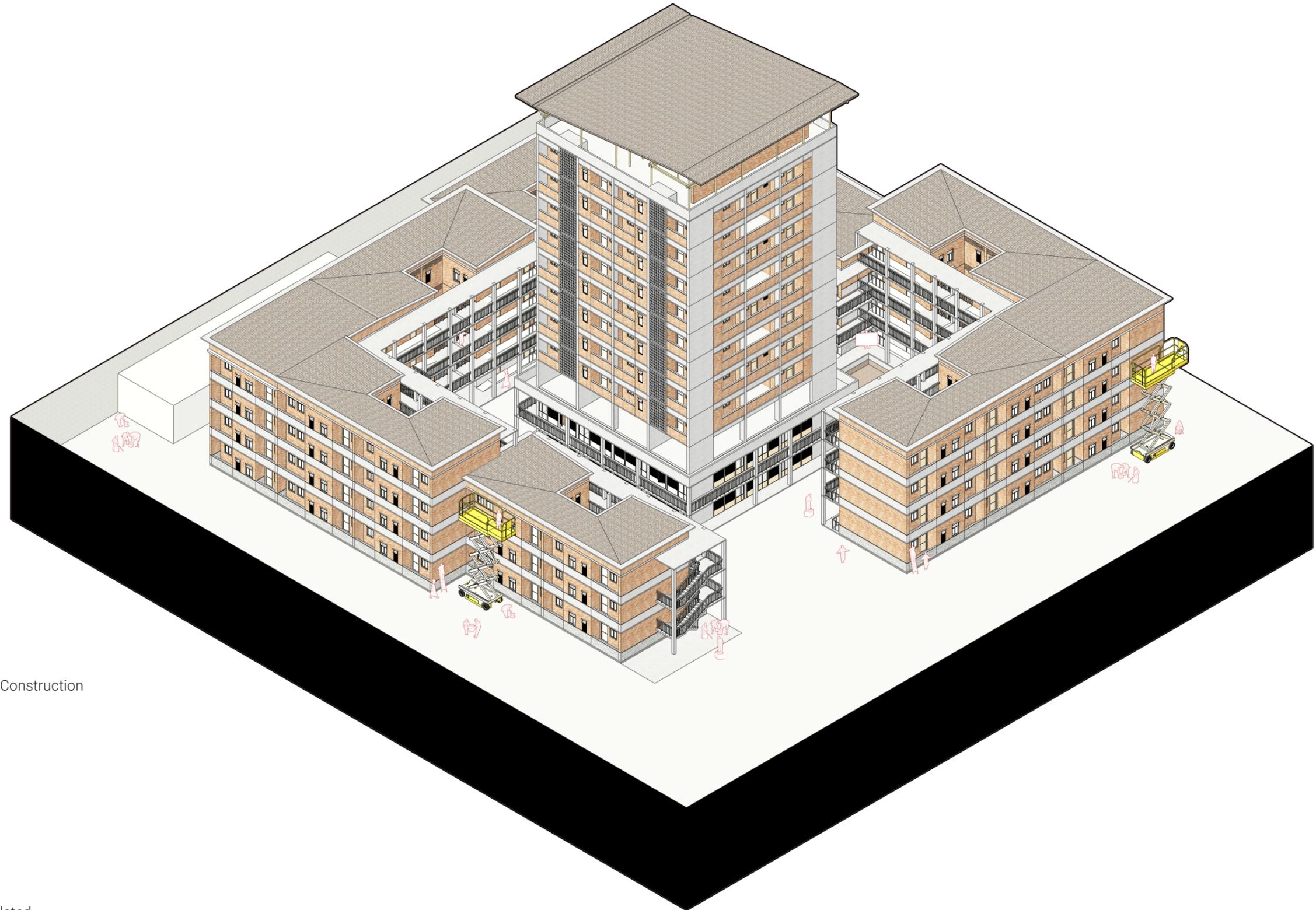
V. BUILDING TECHNOLOGY

Construction Process



V. BUILDING TECHNOLOGY

Construction Process



1.8
Environmental Construction

1.7
Structure Completed
90

V. BUILDING TECHNOLOGY

Construction Process



V. BUILDING TECHNOLOGY

Stakeholder Analysis



Subsidies from government enable a below-market prices from the housing to the poor.



Risk is shared between the Government and the developer.



Project can access to convenient transportation and other infrastructure, which guarantee more job opportunities and better living environment for migrant workers.



V. BUILDING TECHNOLOGY

Stakeholder Analysis

ARPHEN

Association of Rural People for Health and Educational Needs

The organisation works for the development of about 50,000 quarry workers, Tribals, Industrial workers and slum dwellers in Navi Mumbai and Mumbai. It along with net working organisational partners Facilitates the provision of basic health care and education for the community along with exciting govt support, the focus is on capacity building and empowerment of the people through groups and assisting them in developing access to basic facilities.



Bridge Classes



H.I.V/AIDS Awareness



Micro Insurance and Finance



Food Security

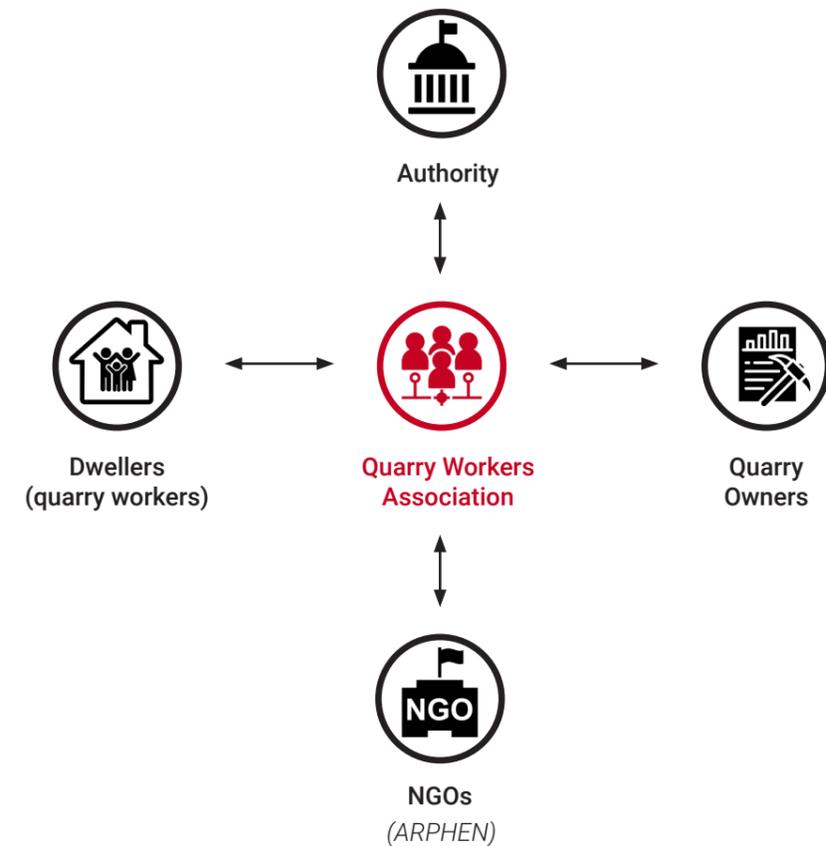
QOA

Quarry Owner's Association

Quarry Owners Association is a platform for all the quarry owners and it's stakeholders to exchange their technical knowledge & assisting each others

Existing Stakeholder in India
NGOs and QOA

Quarry Workers Association



The association will be organized by 10-15 representatives of quarry workers. It will negotiate with the government and quarry owners to express their requirements for improved living conditions. At the same time, it will work together with NGOs to run the income-generated projects.

Proposed new organization
Quarry Workers Association

V. BUILDING TECHNOLOGY

Stakeholder Analysis

Phase 0 Urban Strategies

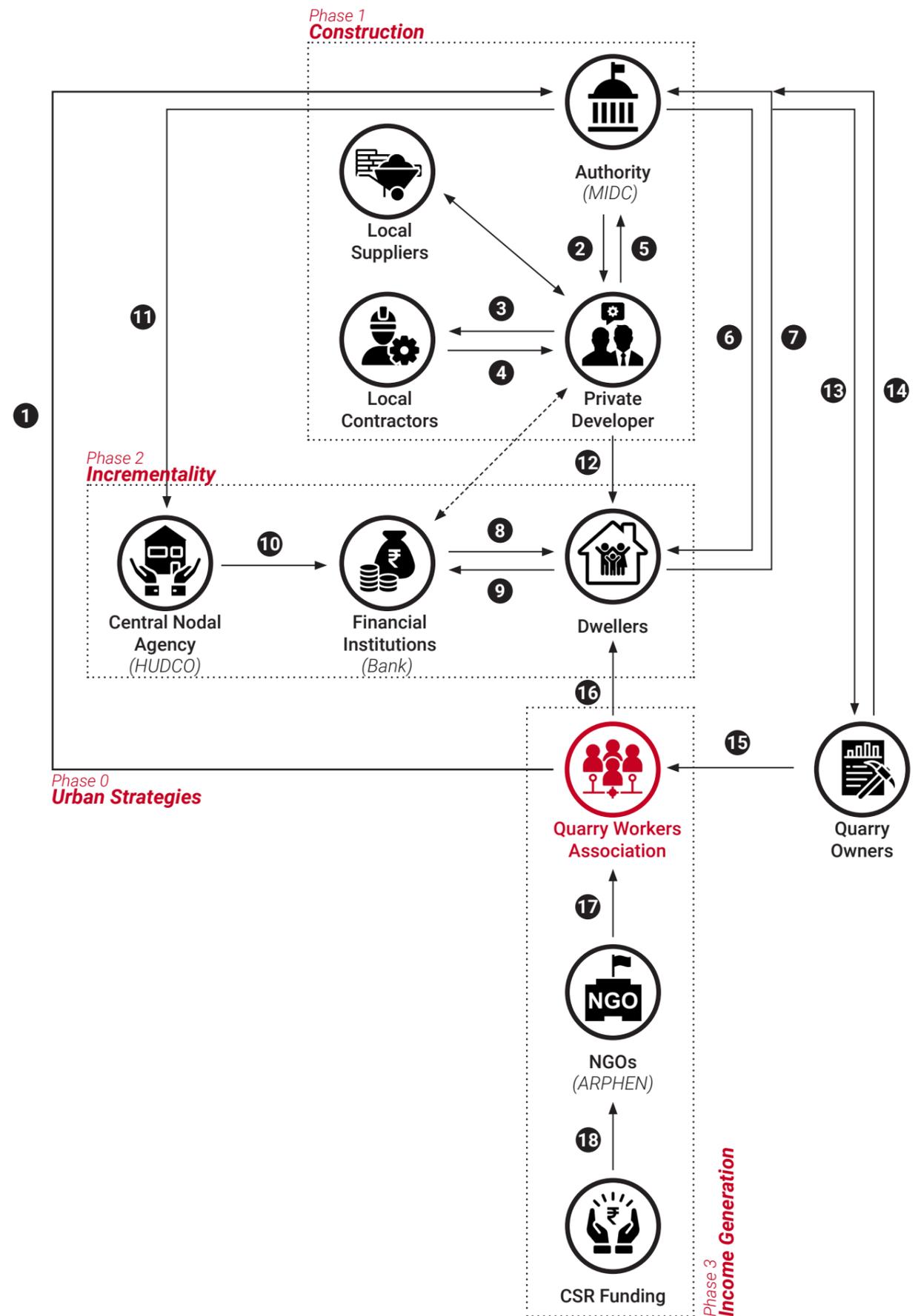
1 Predetermined number of units(density)

Phase 1 & 2 Construction & Incrementality

- 2 Call the bid & select Private Developer;
Provide land for development;
Milestone based payment (50%);
Long-term annuity for up to 10 years (50%);
- 3 Recruit local contractors for construction;
- 4 Be recruited by developer;
- 5 Design, build & finance by Private Developer;
Distribute housing units to Authority
- 6 Handover housing units under an allottee pre-identification
- 7 Pay the cost of housing unit
(lump-sum payment or equated monthly installment)
- 8 Provide subsidized loan
- 9 Pay the loan
- 10 Interest subvention
- 11 Complete ownership
- 12 Maintance
- 13 Provide accommodation to selected quarry owners to rent;
Provide subsidy/ compensation;
- 14 Pay the rental cost annually
- 15 Provide accommodation
- 16 Organize Free training;

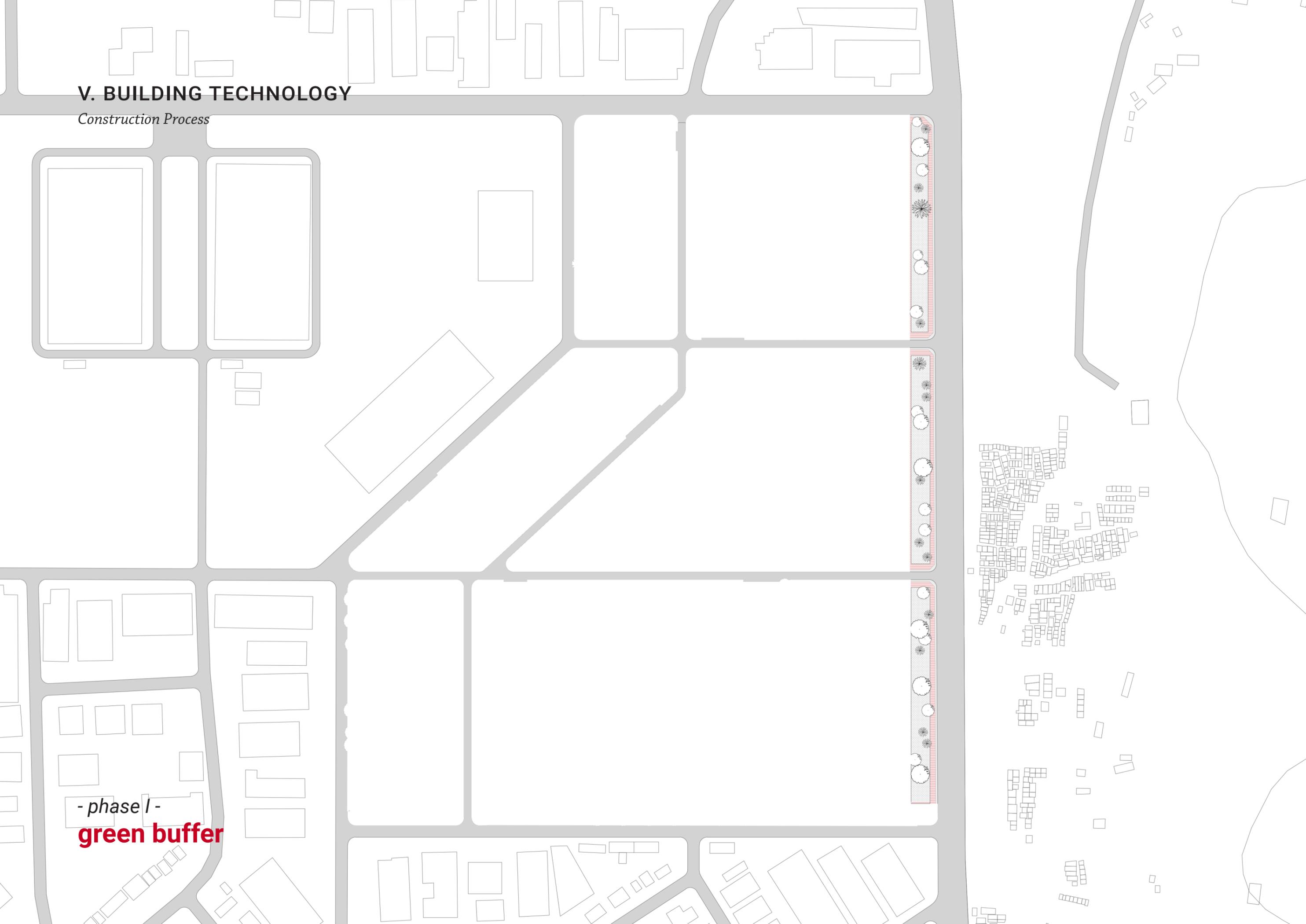
Phase 3 Income Generation

- 17 Organize Free training;
Pay the community workers;
- 18 Funding



V. BUILDING TECHNOLOGY

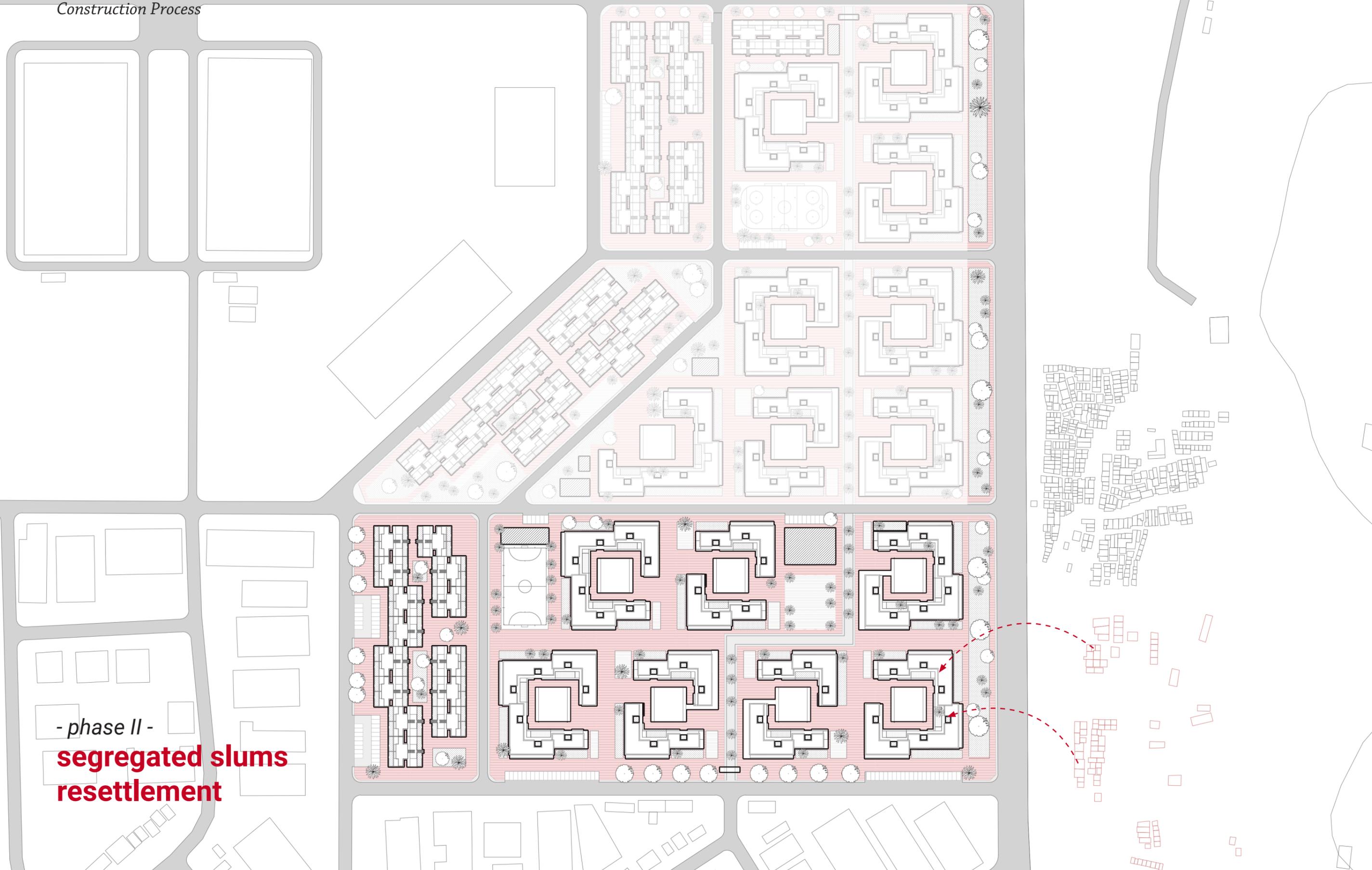
Construction Process



- phase I -
green buffer

V. BUILDING TECHNOLOGY

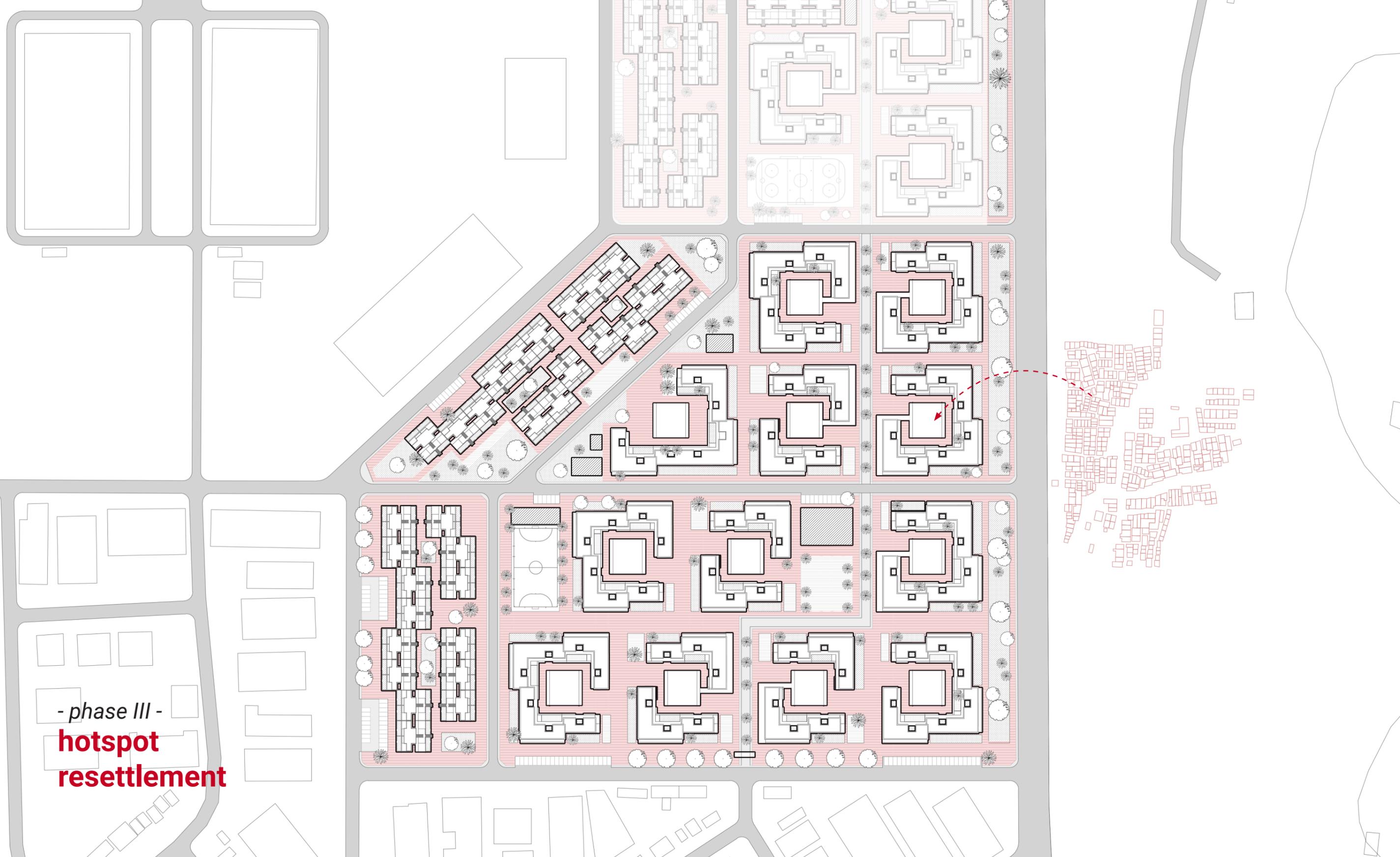
Construction Process



- phase II -
**segregated slums
resettlement**

V. BUILDING TECHNOLOGY

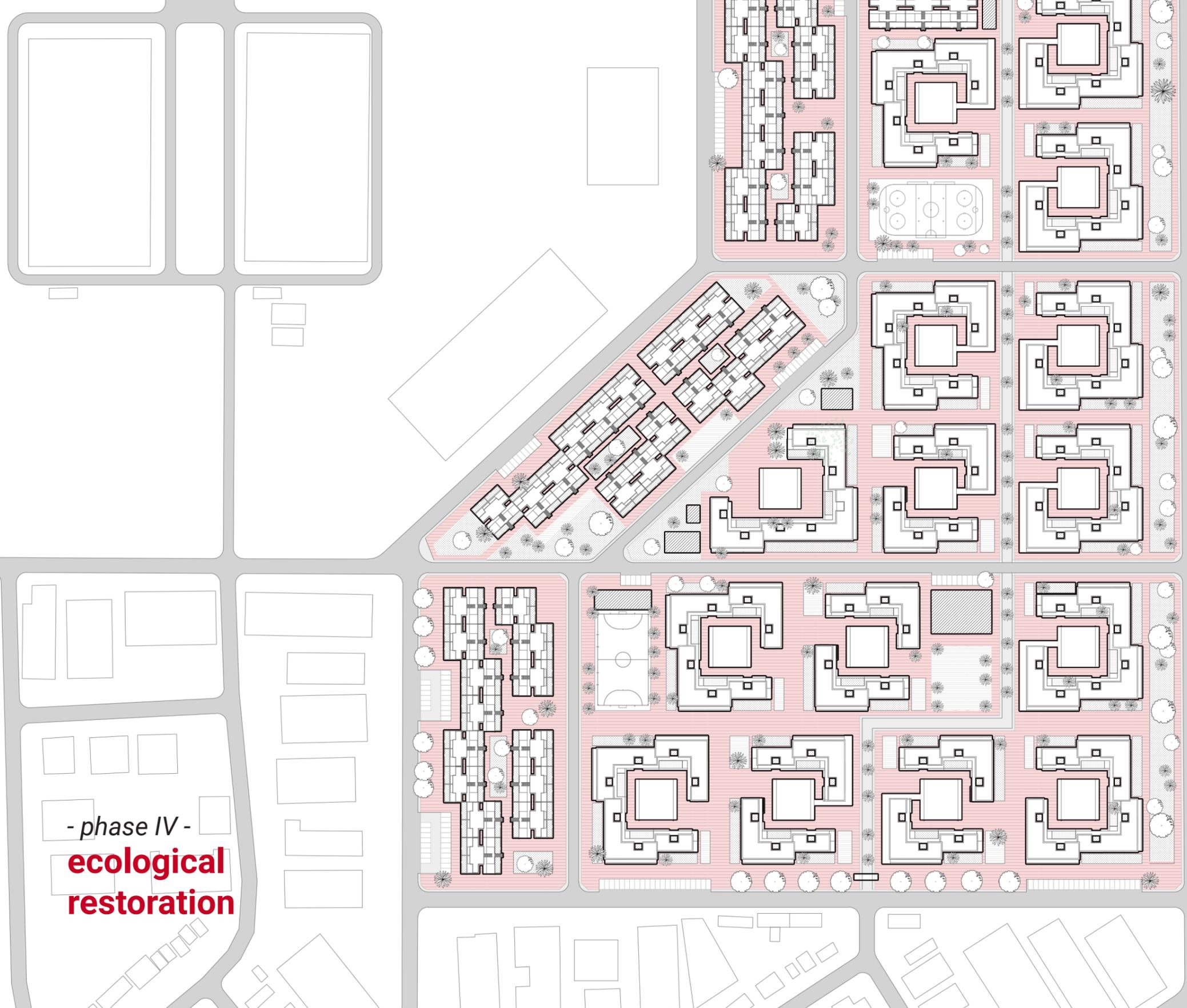
Construction Process



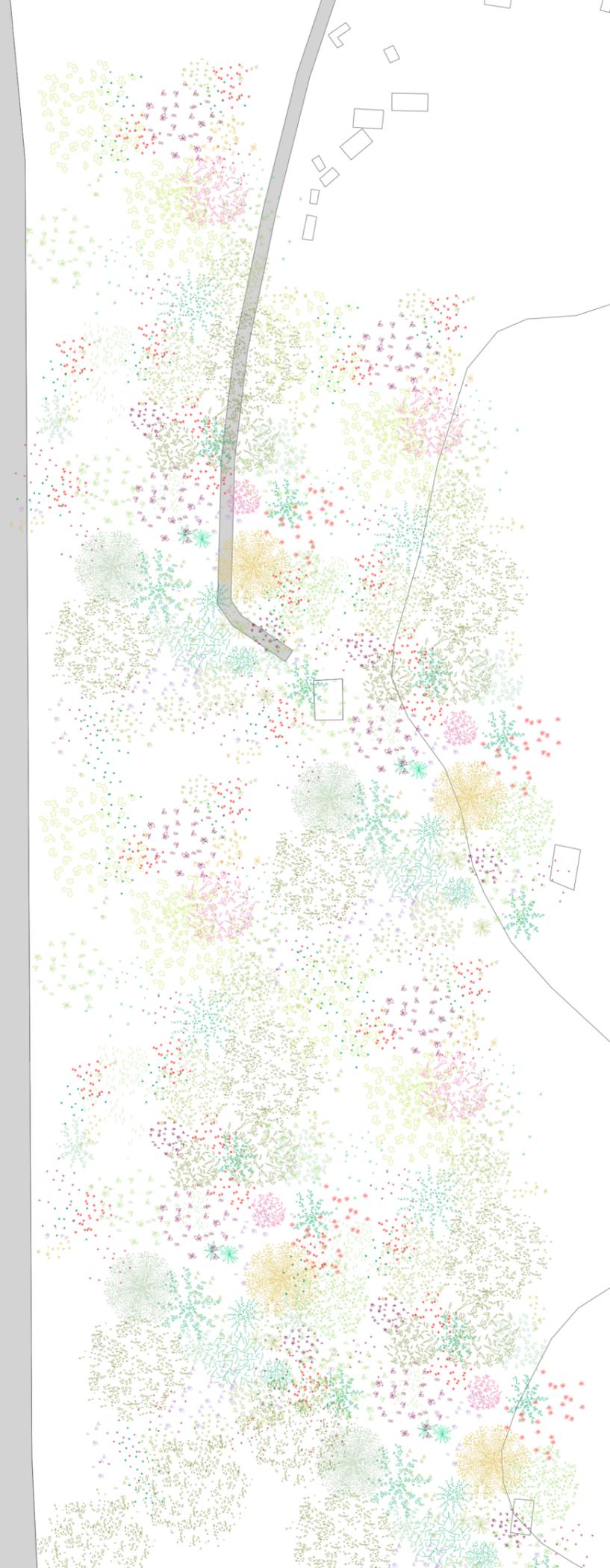
- phase III -
**hotspot
resettlement**

V. BUILDING TECHNOLOGY

Construction Process



- phase IV -
ecological restoration





Thank you for watching!