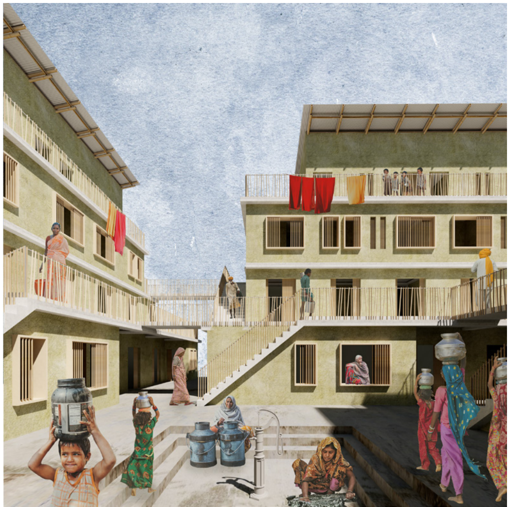



Global Housing Mixing Mumbai
Affordable Housing for Inclusive Development

# Towards a Sustainable Density

Fleur Anne Melchers
july 2019






# COLOPHON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# CONTENT

## argumentation of choice

What mainly appeals to me within architecture, is designing a living environment for people. Whilst traveling through several Global South countries, the way people dwell in those different cultural and built environments has always interested me. Besides, thinking about how to improve their housing conditions is a subject that was always on my mind.

The Global Housing Studio, Mixing Mumbai: Affordable Housing for Inclusive Development provides the opportunity to truly focus on the housing problems and human needs of people in a Global South county. Designing a living environment not only includes a building, but is most of all related to cultural, social, environmental, political and economic conditions. It is a subject that not only interests me, but is especially important and something needed to be addressed as it is something millions of people are exposed to every day.

# INTRODUCTION

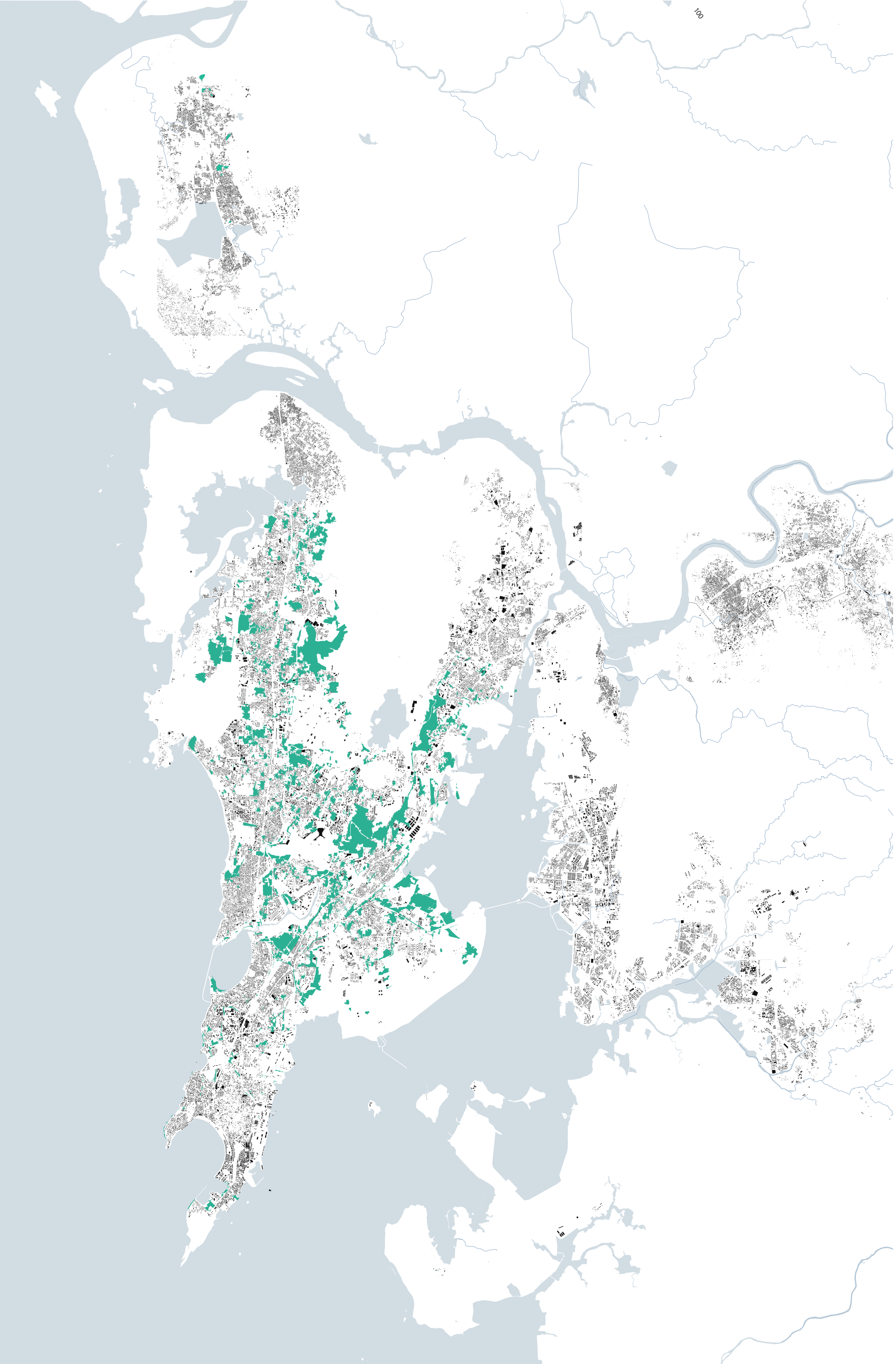
## introduction
location

This project will focus on the subject of affordable housing in the city of Mumbai. Mumbai is the capital city of the Indian state Maharashtra, which can be found at the west coast.

Mumbai's geographical location on a narrow peninsula has caused its growth and expansion to happen towards the north. Here, the design location can be found: Nala Sopara, in the Visai Virar Area.

## introduction
## informal settlements

Informality within Mumbai City has been well documented, however there is little to be found outside of the city. Most information is from visual analysis of urban form and is therefore an estimation. In most cases, informal settlements are centred along railway tracks.



### India

The population density in India is above average, ranking it amongst the top 20 most dense countries. The density has
gone up from 325 persons per square kilometer up to 382 persons per square kilometers in 2011. Even though the density in India has increased every year, the rate of increase has slowed down in the last decade.

### Mumbai Metropolitan Region

Mumbai's Metropolitan Region is in the top 5 of the most dense cities in the world. This is partly a consequence of the fact that more than 40% of the inhabitants of Mumbai live in slums. It's most infamous slum, Dharavi for example, has a population density of over 340.000 persons per square kilometers.

### Vasai-Virar

The density is lower that that of Mumbai's Metropolitan Region, however it is still very dense compared to other cities in the world.

### Nalasopara

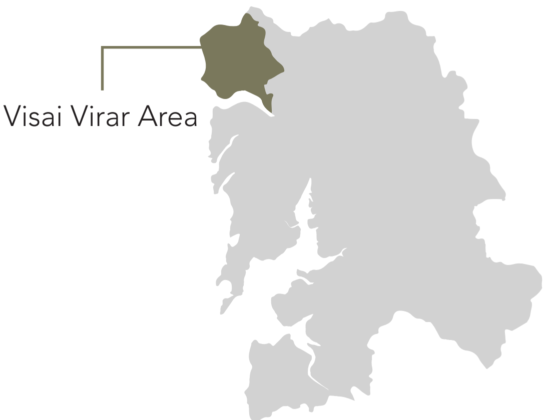
The density in Nalasopara is astonishingly high, with around 30% of the population of Vasai-Virar living in an area which makes up only 11% of the whole of Vasai-Virar.

# introduction
## density

India
3.287.259 km²
368 p / km²


Visai Virar Area
380 km²
3.200 p / km²

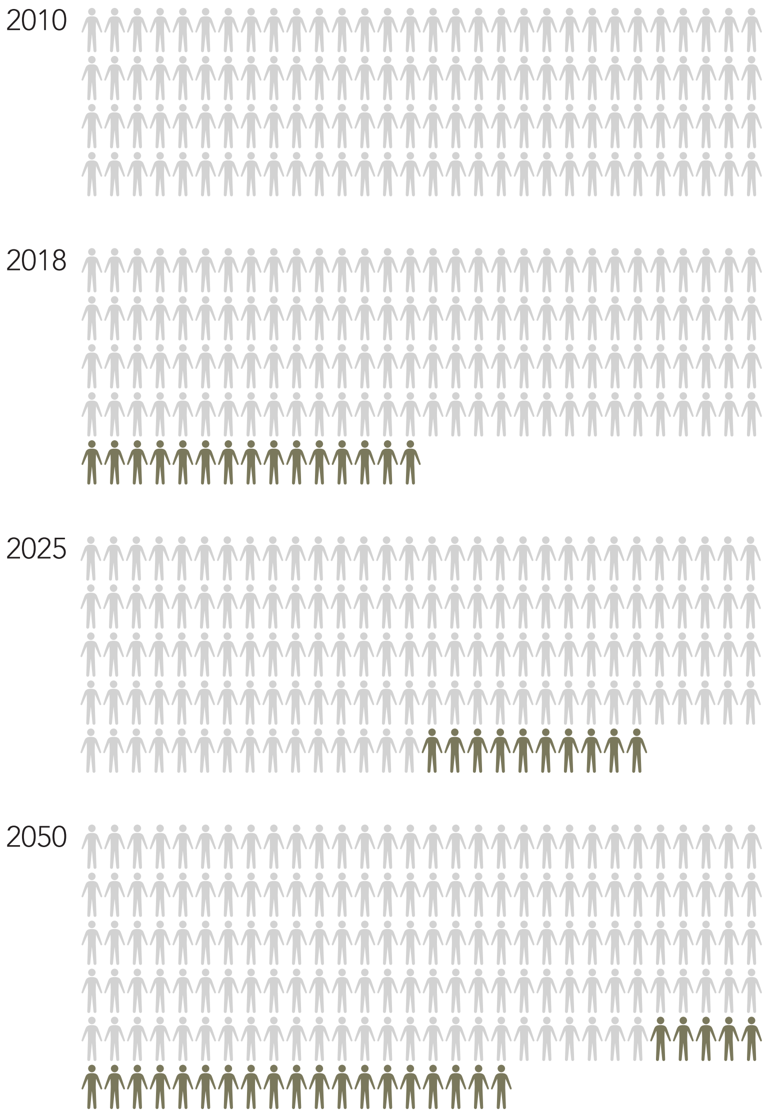

Mumbai Metropolitan Region
4.355 km²
4.793 p / km²

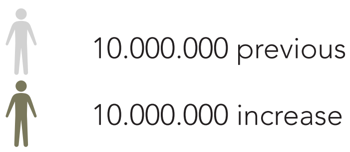


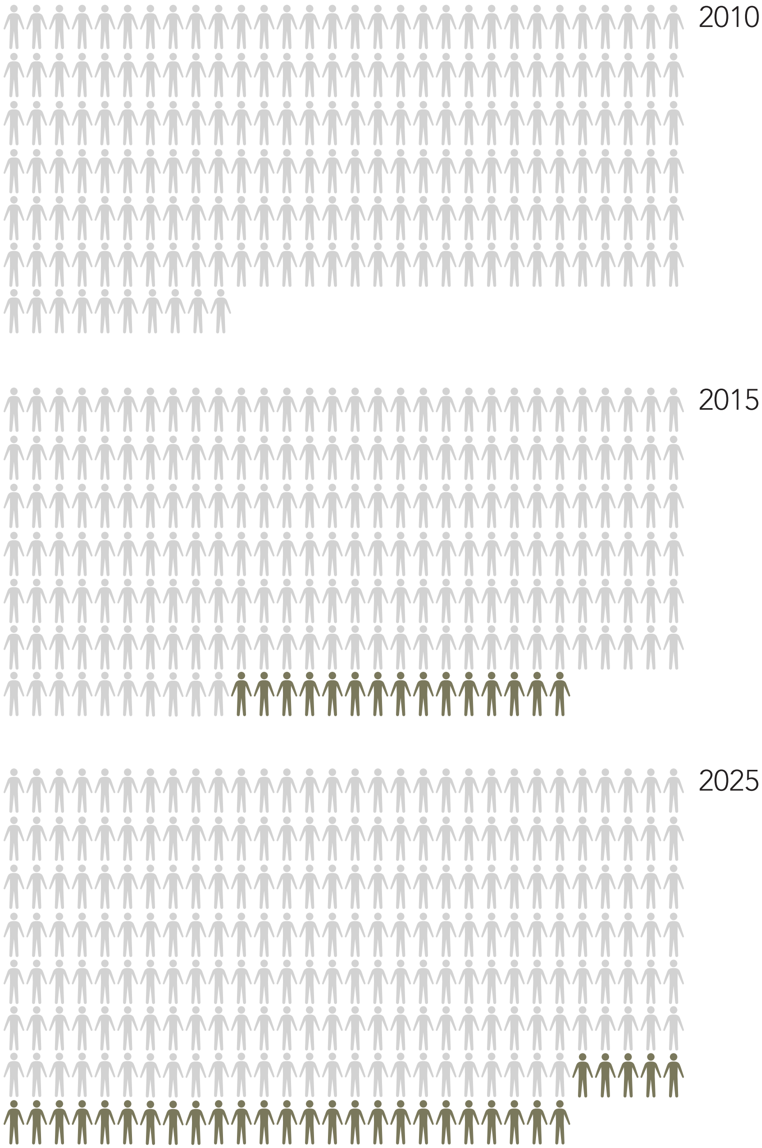

Nala Sopara
43 km²
10.700 p / km²

### India

India is currently the worlds second most populated country. Nearly a fifth of the world population lives in this one country. India is on its way of becoming the world's most populous country by 2024 and is expected to have around 1.5 billion inhabitants by 2030 and 1.7 billion inhabitants by 2050.






## Mumbai's Metropolitan Region

Mumbai's Metropolitan Region currently has a population of around 23 million and positions itself in the top 15 most populous metropolitan areas in the world. The growth rate of the outer and inner zones of MMR averages at 3-4% while the growth rate in the core has decreased to around 0.4% per annum.

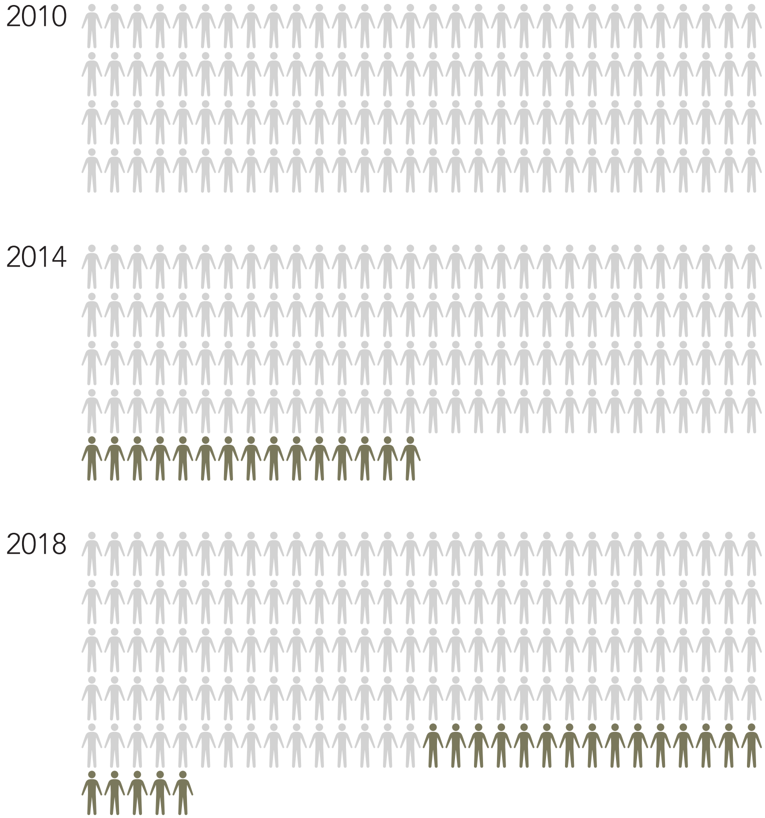
10.000 previous

10.000 increase

## population

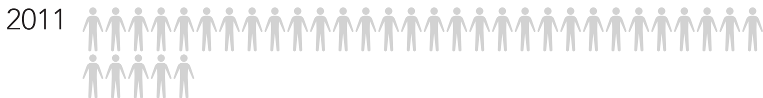
**Vasai-Virar**

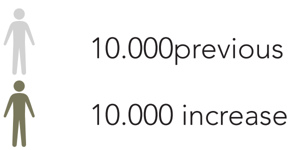
The population in Vasai-Virar is currently around 1.5 million. There has been a spike in the growth rate from 2012 on with the population increasing by about 4 % each year, whilst between 2010 and 2012 the growth rate was at 1%.




**Nalasopara**

The population in Nalasopara was around 460.000 during census 2011. It was however impossible to find any other dataon the population for other periods.

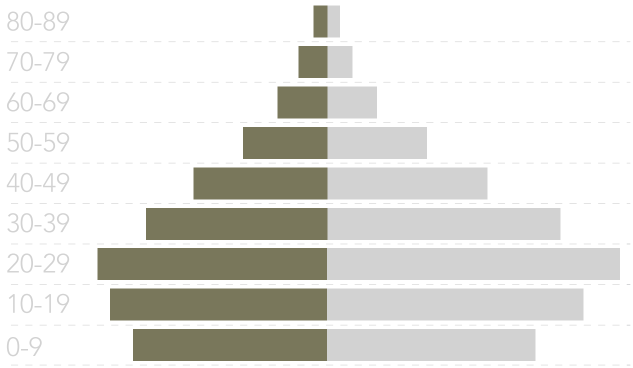



FREE
SPIRIT

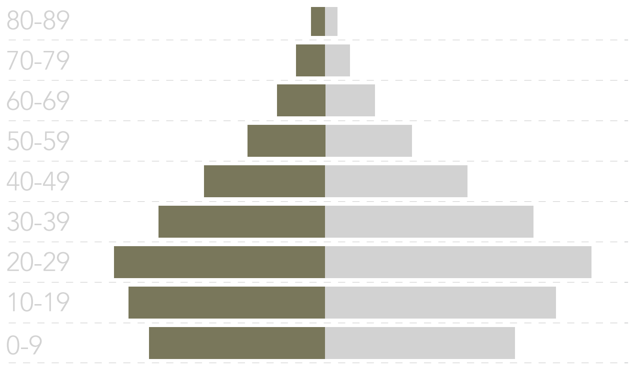
**India**

The largest concentration of people is between 20-29 years old, with the expectation that by 2020 the average age of people in India will be 29 years.



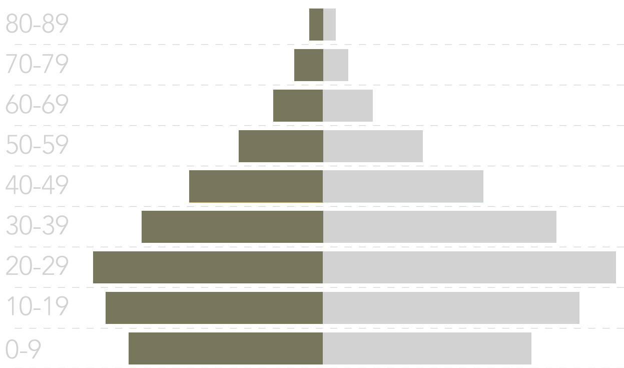

**Mumbai's Metropolitan Region**

The age pyramid is the same as that of India with the greatest number of the population being between 20 and 30 years old.

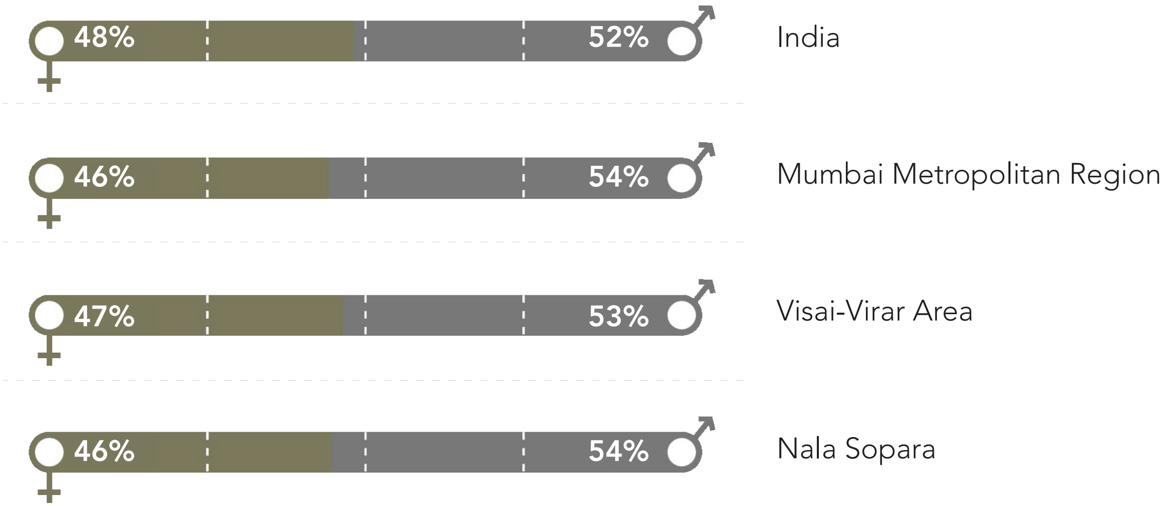



**Vasai-Virar**

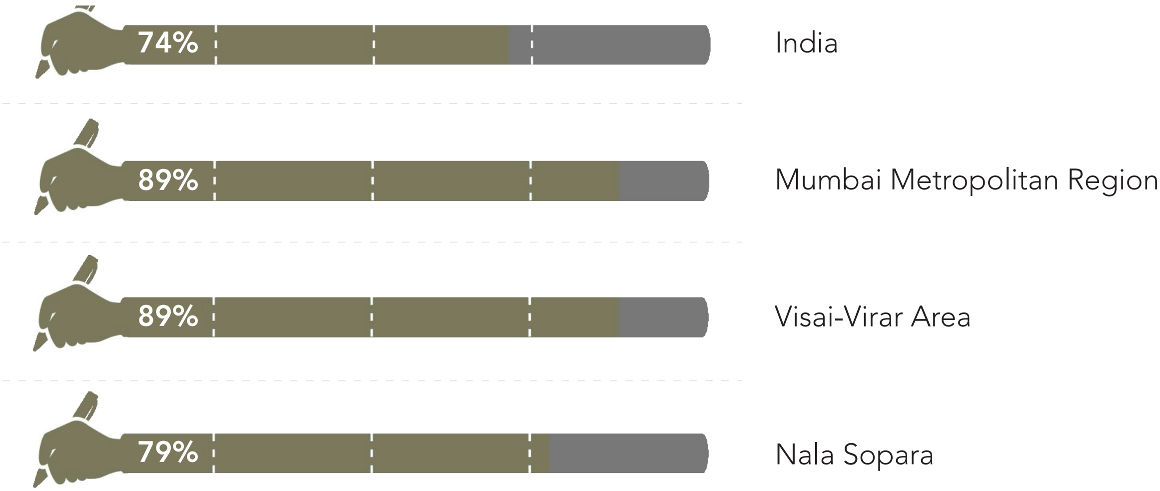
The age pyramid resembles almost the same data as the age pyramids for India and Mumbai Metropolitan Region, with most people being between 20 and 30 years old.



## introduction
### sex ratio




## introduction
### literacy rate



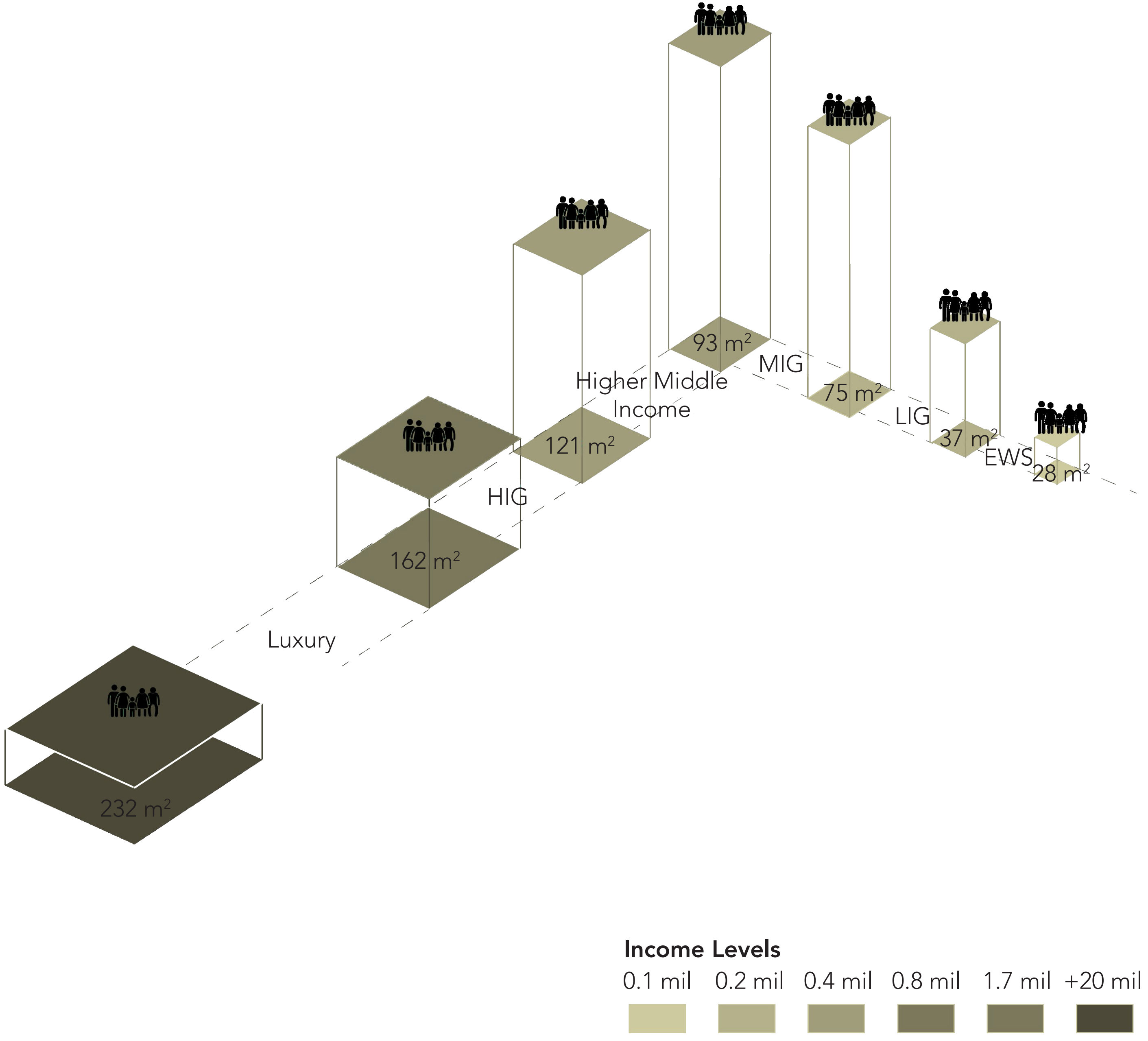
# introduction
## income groups

Out of total 228.4 million households of the country at the end of 2009-10, 47.6 million were high income households (20,44 %), 140.7 million (61,6%) were middle income households and 41.0 million (17,96 %) were low income households.

Middle Income households are the largest income group in modern India. as well as the largest consumer group for housing. On the other hand, affordable housing sector is the fastest growing segment in India, and there is a paradigm shift of affordable housing tailored to the aspirations of the middle class living style.

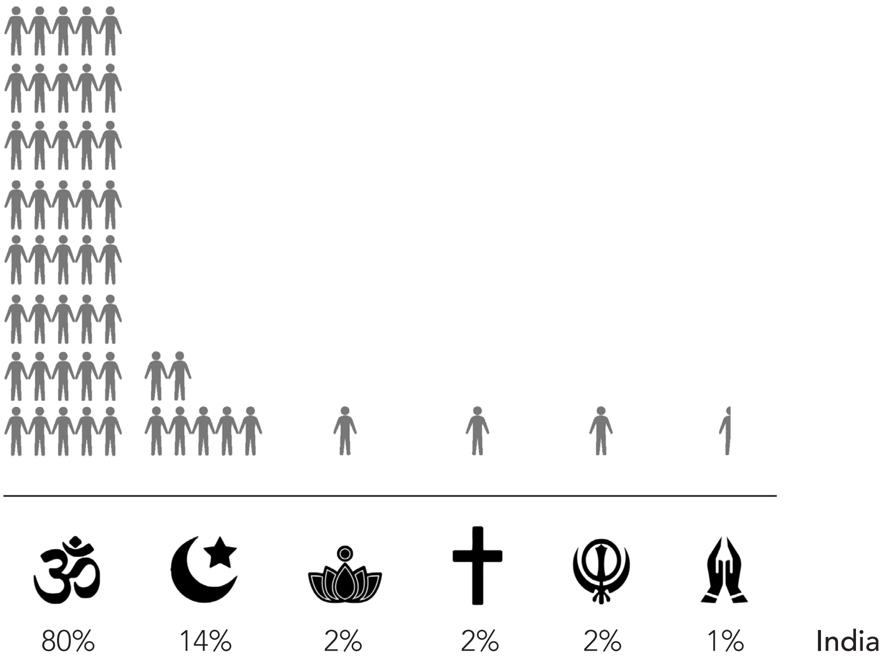
The huge disparity of income gap in India results in a wide range of differences in terms of square meters per household, ranging from 232 m$^2$ for most luxurious households to 28 m$^2$ per household in the  EWS.

LIG Low Income Group
MIG Middle Income Group
HIG High Income Group

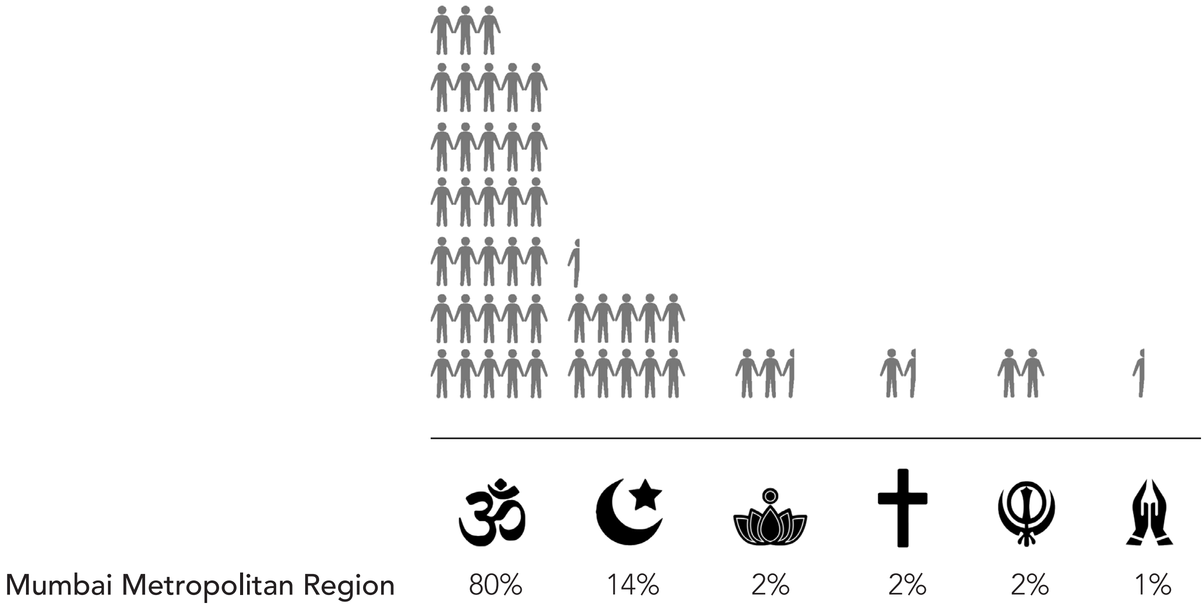

232 m²
Luxury
162 m²
HIG
121 m²
Higher Middle
Income
93 m²
MIG
75 m²
LIG
37 m²
EWS
28 m²
Income Levels
0.1 mil
0.2 mil
0.4 mil
0.8 mil
1.7 mil
+20 mil

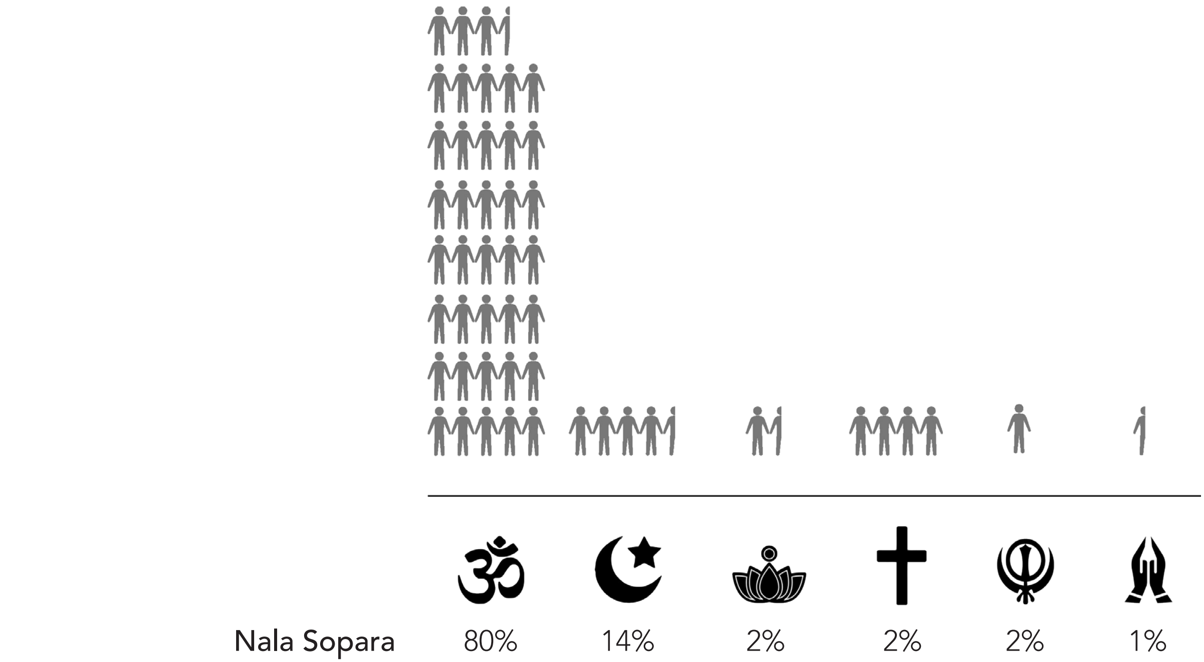
The last census on the religious demographics in India was done in 2011. Overall the religious division amongst the population in India has been the same. The only changes worth noting since the 2001 census is a 0.6% decline in Hindusand a 0.8 increase in muslims.

There are many different religious groups in INdia, however they ar enot represented by a huge number of people.
When looking at the different scales (as presented in figures 36, 37, 38) We see that there is an average 2% decline in the MMR and Nalasopara. Whilst in Mumbais Metropolitan Region the muslims present 21% of the population, in Nalasopara they only represten 9% of the population and share almost the exact percentage with christians (8%).



## religion


Mumbai Metropolitan Region
80%
14%
2%
2%
2%
1%


Nala Sopara
80%
14%
2%
2%
2%
1%

## problem statement

Today, nearly fifteen percent of the world's population lives in poverty in urban areas, of which the majority can be found in the Global South.[1] This includes India, which has the second largest urban population in the world.[2] An on-going process of urbanization has led to an increasing urban population of 109 million in 1971, to 377 million in 2011.[3] Mumbai is India's largest city with an estimated population of 21 million people. Besides, with around 21.000 people per square kilometer, it is the most densely settled city in the world.[4] Unfortunately, only 5 percent of the population can afford a house in the city of Mumbai, indicating that there is a mismatch between the households' stock and flow.[5] This causes more than half of Mumbai's population living in informal settlements, such as slums and chawls, covering only 6 percent of the city's land.[6] The inability of the government to provide sufficient formal, affordable housing to house Mumbai's growing population, has emerged as a serious crisis. With a still increasing urban population, the housing shortage is expected to reach 34.1 million units by 2022.[7] These chronic problems of slums and affordable housing will not change without synchronization between the people's incomes and the house prices, and an adequate provision of affordable housing.

During the 19th-century British rule in India, two major developments caused an important spatial transformation of Mumbai. The opening of the Suez Canal in the 1860s provided the opportunity to change the location of the dominant port from Calcutta to Mumbai. Furthermore, Mumbai developed itself into the foremost supplier of cotton for England. The amount of textile mills increased, and their profits provoked the development of other industries as food processing, pharmaceuticals and engineering.[8] The growing port and industries provided more employment opportunities, and together with the evolving cotton industry, this attracted many laborers from rural settlements and smaller towns to migrate to the city. With Mumbai as dream destination, these migrants hoped for a higher income and a better quality of life. But Mumbai's geographically limited location on a narrow peninsula could not promote the provision of basic amenities such as affordable housing for the majority of the, mostly poor, migrants. This put an enormous pressure on the housing stock. Because the concentration of economic and commercial activities in southern tip of Mumbai has caused an enormous increase in land prices in this area, a large proportion of the growing population was forced to live in informal settlements, such as slums and chawls.

In Nala Sopara, an area in the northern outskirts of Mumbai's metropolitan region, due to significantly lower land costs, both baithi chawls and midrise chawls can be found. Baithi chawls are brick ground story buildings with pitched roofs, consist of one room and are usually connected through a narrow community lane, which people use as an extension to their small houses. This lane in between the baithi chawls provides the availability to both live and work here, and supports the community feeling as it serves as a public place where people meet. Together with the direct accessibility to this lane, due to the ground-floor characteristics, it causes the residents to feel responsible for its maintenance and supplies social sustainability.
On the other hand, there are the midrise chawls. In order to house the increasing number of migrant workers, a significant amount of baithi chawls were demolished and replaced by a building with four more stories, while maintaining the original layout of the baithi chawls.[9] Hereby, the density increased up to 1250 persons per hectare.[10] And although these midrise chawls were originally meant for the male workers, the increasing population and housing shortage caused whole families to live in the small tenement rooms. The midrise chawl has now become an ordinary way of living.[11] Despite the fact that these buildings are not characterized as slums, the living conditions are comparable. The residents of the lower levels lack access to light and ventilation, and the higher stories do not have running water and electricity. Furthermore, not living on the ground floor hinders people in their economic activities, as they are not able to use their house as a shop. Since there is no direct accessibility to the street from their housing units, people do not use it as a place to live or work. They do not feel responsible for maintaining it, causing it to be a place for circulation and garbage, rather than a place to live.

Densification developments in the past decades show that more and more baithi

chawls in Nala Sopara are being replaced by midrise chawls. The concentration on the increasing need for housing due to a growing industry and migration, disregards the understanding of how the built environment affects social sustainability.[12] New housing developments, such as the exchange of baithi chawls for midrise chawls, have only focused on increasing the housing stock and have been ignoring the social aspects that improve the quality of life.
This social sustainability can be indicated by access to basic needs, local facilities, attachment to the localities, opportunities for income generation, social interaction,[13] health of the inhabitants, a community spirit and a sense of safety.[14]

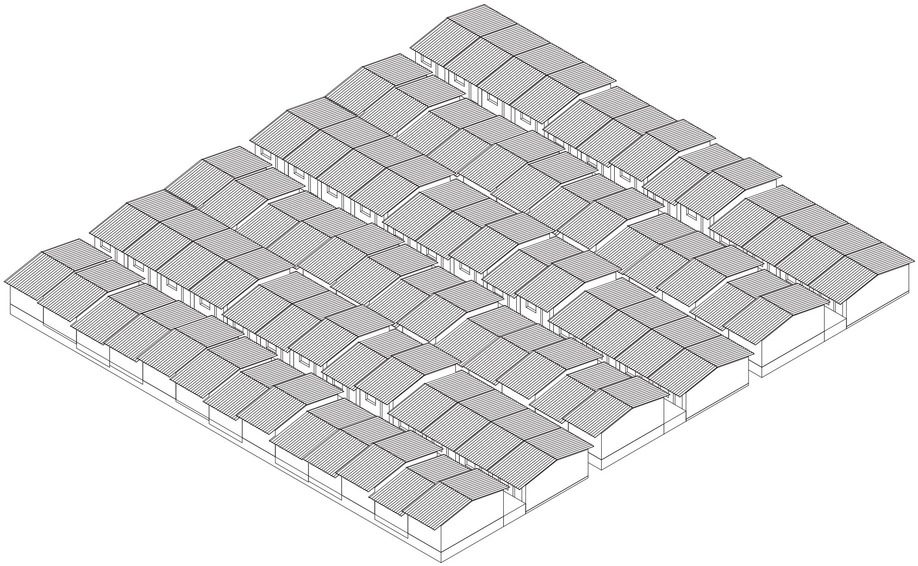
Although the baithi chawls are experienced as more sustainable than the midrise chawls, since they have access to water, light and ventilation, a community feeling and chances for economic activities, they remain ground-level buildings with a lower density. Therefore, the baithi chawls do not offer as much housing units as the midrise chawls. But with the population growing rapidly, Mumbai must deal with an increasing demand for affordable housing. However, while more housing units are desirable, densification by means of replacing the ground story buildings by midrise buildings is not a sustainable solution, as it threatens the area by the demolition of the social sustainability.

Since the need for shelter is a basic human need, every city must be able to provide its population with a safe, secure and affordable home.[15] Therefore, it is essential that the housing situation in Mumbai will change. If the situation of replacing the baithi chawls by midrise chawls continues, a significant part of Nala Sopara will be threatened by too much density and the disappearance of social sustainability, which can be detrimental to livability, health and urban well-being.[16]

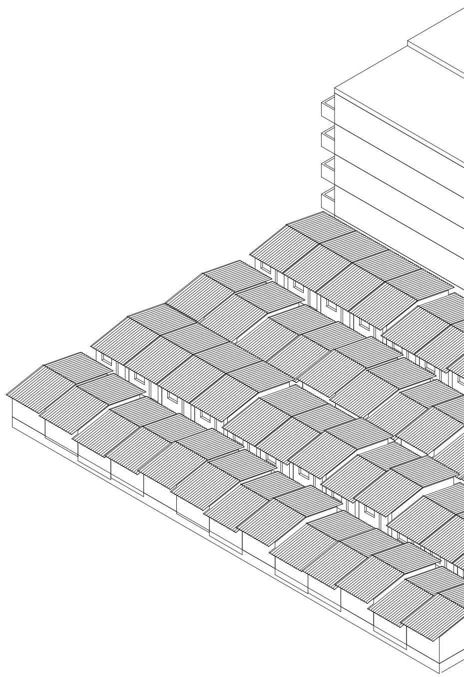
[1] David Satterthwaite, Urban poverty in the global south: scale and nature. (Routledge, 2012), 1.
[2] Lalit Batra, A review of urbanisation and urban policy in post-independent India. (Centre for the Study of Law and Governance, 2009), 3.
[3] Kalpana Gopalan, Affordable housing: Policy and practice in India. (IIMB Management Review, 27(2), 129-140), 130.
[4] R.B. Bhagat, Demographic Dynamics of Mega-Urban Regions: The Case of Mumbai. (Demography India, 43(1&2), 71-94), 79.
[5] Sahil Gandhi, Economics of affordable housing in Indian cities: The case of Mumbai. (Environment and Urbanization Asia, 3(1), 221-235), 228.
[6] Klaus Segbers, The Making of Global City Regions: Johannesburg, Mumbai/ Bombay, Sao Paulo, and Shanghai. (JHU Press, 2007), 76.
[7] P.K. Das, Chasing The Affordable Dream: A Plan to House Mumbai's Millions. (Bombaykala Books, 2018), 15.
[8] Priyanka Karandikar, Chawls: Analysis of a middle class housing type in Mumbai, India. (2010), 17.
[9] Tithi Sanyal, The Chawls and Slums of Mumbai: Story of Urban Sprawl. (2018), 27.
[10] Amol Rane, Chawls in Mumbai. (2012), 2.
[11] Tithi Sanyal, The Chawls and Slums of Mumbai: Story of Urban Sprawl. (2018), 33.
[12] S. Hemani, Influence of urban forms on social sustainability of Indian cities. (2012), 788.
[13] S. Hemani, Influence of urban forms on social sustainability of Indian cities. (2012), 787.
[14] Seema Dave, High urban densities in developing countries: a sustainable solution? (2010), 17.
[15] P.K. Das, Chasing The Affordable Dream: A Plan to House Mumbai's Millions. (Bombaykala Books, 2018), 38.
[16] Steffen Lehmann. Sustainable urbanism: towards a framework for quality and optimal density. (Future Cities and Environment, 2(1), 8), 1.

## densification development

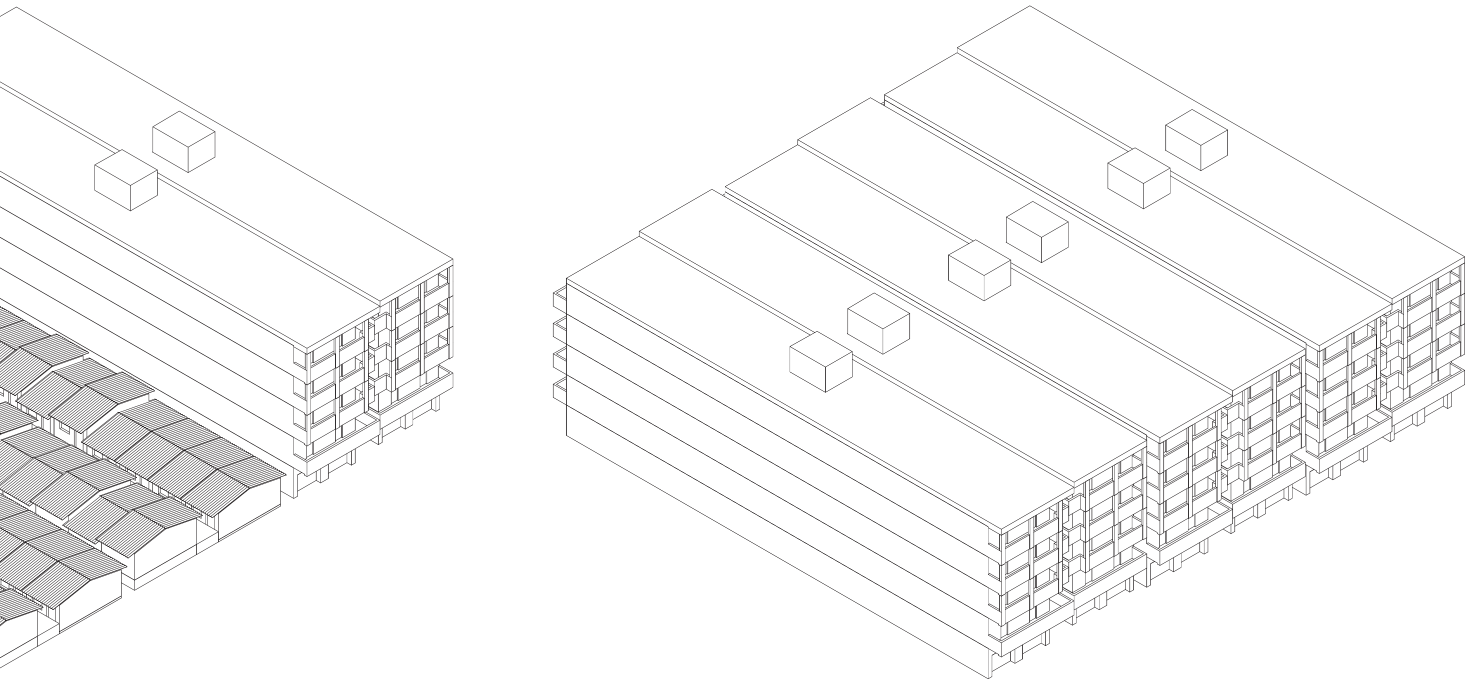
Densification developments in the past decades show that more and more baithi chawls in Nala Sopara are being replaced by midrise chawls.



**baithi chawls**
350 dwellings / hectare
1400 people / hectare
FSI : 0,8



These developments have only focused on increasing the housing stock and have been ignoring the social aspects that improve the quality of life.



**mid-rise chawls**

1400 dwellings / hectare

5600 people / hectare

FSI : 3

# RESEARCH

## research
research question

To find a possible solution for the problem as described before, this graduation project will focus on the question:

**"How does an increasing residential density influences social sustainability?"**

The following design process focusses on the question:

**"How can a redevelopment of the baithi chawls provide a higher residential density, without being detrimental to social sustainability?"**


EVERSHINE MEADOWS

### The importance of visual ethnography in the design process

Research provides architects a method to gain a better understanding about the way people dwell and the relationship between social and spatial practices. In order to integrate these conditions in an architectural design, the architect must determine the core of these terms. Research methods and heuristics techniques are indispensable to obtain this information, as it forms the base on which the design will develop and elaborate. The choice of the right research method requires a profound knowledge and awareness of the research methodologies, as the predetermination of the final design is hidden in them. Thus, the deeper a research-methodological awareness is integrated in the architectural profession, the better the designer will be able to respond to people's needs in the built environment.

As a preparatory study for the field trip to Mumbai, the heuristic methods of interpretive historical research and mapping were used to investigate the political, technical, geographical and sociological context of the design location. As a group work, a collective knowledge base was constructed by gathering this data to provide us with the fundamental information for an efficient excursion to India. During the following site visit of approximately one week, in-situ research was conducted, investigating local characteristics that offered starting points for innovative affordable housing possibilities. Whilst being there, it soon became apparent that only by visiting and participating in the community of the site, one can genuinely understand the cultural, social and environmental conditions. I used several visual techniques, among which photography and sketching, to learn and understand the complexity of the area. These ethnographic, visual methods as a means to investigate and depict the place, could capture complex narratives of the lived experience that were not, and could not have been, addressed through the course's previous study.[1]

It is by observing and interpreting, through watching and listening and paying attention, that we learn and understand. Ethnography is strongly connected to the notion of learning through observation and interpretation.

Likewise, ethnographic research is intertwined with visual technologies. When ethnographers produce visual images, as photographs, drawings or videos, the experience of producing and discussing them becomes part of their system of knowledge.[2] Ethnography is perceived as a difficult to define methodology. Hence, it is not surprising that differing definitions exist, and therefore not one specified, set statement of the exact meaning. Literally, ethnography means 'description of people', and derives from *ethnos* translated to 'people' and *graphia* to 'description'.

A literature review will highlight the current interpretations of visual ethnography, regarding an architectural point of view. In her 2012 book 'Ethnographic Methods', Karen O'Reilly states that ethnography is a theory about how research should be conducted. This ethnographic methodology includes research related methods as participant observation, in-depth interviews and conversations. Through direct contact with human beings in the context of their daily life, it provides understanding of their social life over a prolonged period of time.[3] Ethnography starts once the researcher has entered the area in which the examination should be conducted and involves gaining access to the people in this place. Tim Ingold defines ethnography as a methodology that aims to describe life as it is lived and experienced by people in a certain place and at a certain time.[4] This can be done through visually depict this description in graphic media, such as a written text, a drawing or a picture. Hereby he highlights the visual aspect of ethnography. According to Sarah Pink, in her 2012 book 'Doing Visual Ethnography', ethnography cannot take place without engaging with media forms, since these visual media is a part of the way ethnographic knowledge is constituted.[5] It involves an approach that engages with visual methods throughout its processes of research, analysis and representation. This reflects the definition of O'Reilly as ethnography being an iterative methodology: a practice of doing research in which the collection of information and the following analysis and processing of this data are not discrete phases, but inextricably linked.[6] Important to understand is the difference between ethnography and the methodology of anthropology. For in most of the researches, the anthropologist and the ethnographer are one and the same person, combining the tasks of anthropology and ethnography.[7] Both methodologies have much to contribute to one another, but their purpose and intention are different. An important distinction is the relationship with people during the conduction of the research. Ethnography aims to make studies of people, whereas anthropology is to study with people. The distinction is fundamental, since it converts observation into objectification. This causes anthropology to be a more speculative discipline concerning the conditions of human life.[8]

To understand what visual ethnography means today, it is important to comprehend where these methodologies have come from and how they developed over time. This will be done throughout identifying and describing the key sources and changes of ethnographic research. The urban sociologist Robert Park plays an important role in the development of ethnography. When he founded The Chicago School as a sociology department of The University of Chicago, Park adopted field-work methods from anthropology.[9] Between 1917 and 1942, The Chicago School produced several studies in which they analyzed the everyday life and interactions between people in the community of a specific group, in a specific location in an urban context. By living in communities for extended periods and asking people how they thought about the social and urban aspects of their life, the Chicagoans were experts in analyzing a community.[10] The School was also influenced by another urban sociologist, Ernest Burgess. During his collaboration with the community of Chicago ethnographers, their ethnographic approach became more intellectual based, combining quantitative and qualitative data.[11] The combination of Park, Burgess and the Chicago scholars has led to a developed methodology of ethnography, which is now recognized by sociologists throughout the world. The ethnographers of The Chicago School were central figures in this development and generated a vision for the study of human behavior and its embeddedness in specific people and places.[12] The general notion of ethnography as it was created in Chicago has not much changed over time. However, in the specific field of visual ethnography, an explicit evolution has occurred. The visual became to have a more settled role in social science research, including ethnography. New approaches effectuated a stronger connection between the examination of social experiences of people within their built environment and the representation of it. The first few years of the twenty-first century can be interpreted as a key moment in the development of visual ethnography, as a series of texts about this methodology was published. These texts suggested and emphasized manners in which visual methods could possibly assist ethnographers in their work, and hereby publicly approved visual ethnography as a set methodology. Furthermore, the rapid developments in visual and digital technologies that now facilitate visual research and representation, represent a new context for visual ethnography.[13] In other words, the production of new (affordable) media provided ethnographers new methods of visual research and new ways of representing this research, such as photography and videography. Although these methods had already been used for decades, it was now officially recognized that photographs and videos were a part of ethnography, as research methods themselves. To conclude, ethnography has emerged from the more classical approach in which the ethnographer spent extended periods or time, from months to even years, with the people they were researching.[14] Chicagoan procedure included observing behaviors, participating in activities, interviewing and writing notes in order to understand the way in which these people lived. These long-term engagements within the field of research have become too costly. Together with developments in visual technologies, it caused the emergence of a newer approach of ethnography. Ethnography now includes participatory and collaborative photographic, videographic and other techniques. Naturally, this new ethnographic approach does not produce the same system of knowledge that emerges from long-term fieldwork, but ethnographers should ensure that they take on board some of the lessons of the past.[15] That is, to aim to fully understand the character of the life of people that they live within their own community, in their own living environment. The traditional as well as the newer aspects of ethnography appeal to me. This is evident from the specific research I conducted during the field trip in Mumbai. For several days I studied the life of people in relation to their built environment, by means of observing, having conversations, sketching, photographing and making videos. These methods clearly match the research-methodological aspects of both the classical and the newer ethnography. However, after returning home, when I started processing the collected data, I realized that in my personal approach, both types of ethnography aimed to serve another purpose. First, observing the life in the research area and having conversations with the people of its population, has been intended to gain a deeper, more thoroughly understanding of how people experience living there. Only by direct contact with these people and through asking questions, it is possible to learn what cannot be seen from a picture: what do people think of their environment, and how do they feel living here? Secondly, making sketches and drawings whilst physically being present in the area being researched, provided me the opportunity to obtain a notion of the built environment and how people appropriate it. The transfer of what is seen by the eye to paper requires rigorous looking, which can be seen as in-situ analysis. Making photos and videos on the other hand, is just raw data.[16] These research methods offer me the possibility to 'get back' to the area and see how it looks, as a memory to the fieldtrip, without being an analyzation itself. Although, an important exception of photography as visual ethnography is the tactic of using photographs as a means to engage with people. By showing the pictures and discussing them with local people, more background information was collected. Summarizing, the conducted (visual) ethnography enabled me to expose the visible and underlying information of the research location, creating a frame of reference that will be the starting point for my design project.

[1] Kimberly Powell, Viewing places: Students as visual ethnographers (Art Education 63(6), 2010), 45.
[2] Sarah Pink, Doing Visual Ethnography (Sage, 2013), 1.
[3] Karen O'Reilly, Ethnographic methods (Abingdon: Routledge, 2012), 10.
[4] Tim Ingold, Anthropology contra ethnography (HAU: Journal of Ethnographic Theory 7(1), 21.
[5] Sarah Pink, Doing Visual Ethnography (Sage, 2013), 1.
[6] Karen O'Reilly, Ethnographic methods (Abingdon: Routledge, 2012), 5.
[7] Tim Ingold, Making: Anthropology, archeology, art and architecture. (London: Routledge, 2013), 3.
[8] Tim Ingold, Anthropology contra ethnography (HAU: Journal of Ethnographic Theory 7(1) 2017), 23.
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[10] Richard Sennett, Building and Dwelling: Ethics for the City (Farrar, Straus and Giroux, 2018), 64.
[11] Paul Atkinson, Handbook of ethnography (Sage, 2001), 14.
[12] Paul Atkinson, Handbook of ethnography (Sage, 2001), 22.
[13] Ana Isabel Alfonso, Working Images: Visual research and representation in ethnography (Routledge, 2004), 2.
[14] Sarah Pink, Ethnographic research in the construction industry (Routledge, 2012), 4.
[15] Sarah Pink, Ethnographic research in the construction industry (Routledge, 2012), 5.


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## research
## dwelling typology

### Slum

"Residential area where dwellings are unfit for human habitation by reasons of dilapidation, overcrowding, faulty arrangements and design of such buildings, narrowness or faulty arrangement of street, lack of ventilation, light, or sanitation facilities or any combination of these factors which are detrimental to the safety and health."

Census of India

Characteristics of slums

- inadequate access to safe water
- inadequate access to sanitation and other infrastructure
- poor structural quality of housing
- overcrowding
- insecure residential status

UN Habitat

# research
## dwelling typology

### Baithi chawls

Baithi chawls are brick ground story buildings with pitched roofs. They consis of one room and are usually connected through a narrow community lane.

Characteristics of baithi chawls

- informal settlements
- shared facilities, such as toilets and water pumps
- low-rise typology


d2h
VIDEOCON

# research
## dwelling typology

**Mid-rise chawls**

In order to house the increasing number of migrant workers, a significant amount of baithi chawls were demolished and replaced by a building with four more stories, while maintaining the original layout of the baithi chawls.

Characteristics of mid-rise chawls

- often informal buildings
- ground floor + 3 or 4  stories
- lack of daylight and ventilation

गणेश स्टील
एण्ड सेल्स सर्विस
जुना दो नया लो
हस्तकला मेंहदी
HASTKALA MEHENDI
Shop No. 2, Shivshakti Apt. Opp. Vedant School, Behind Sitara Bekary, Nagindas Pada, Nalasopara (E).
MH48N 1841

# research
## book of patterns

During our visit of Nala Sopara, we investigated the interrelation between patterns of inhabitation and the morphological and typological characteristics of the built environment. This book of patterns provides a clearer understanding of the local athmosphere of the design area.
Here, a selection of these patterns is shown, identified as contributing to the design process.
The research focusses on the categories:

social spaces

domestic activity

amenities

income generation

borders

building techniques


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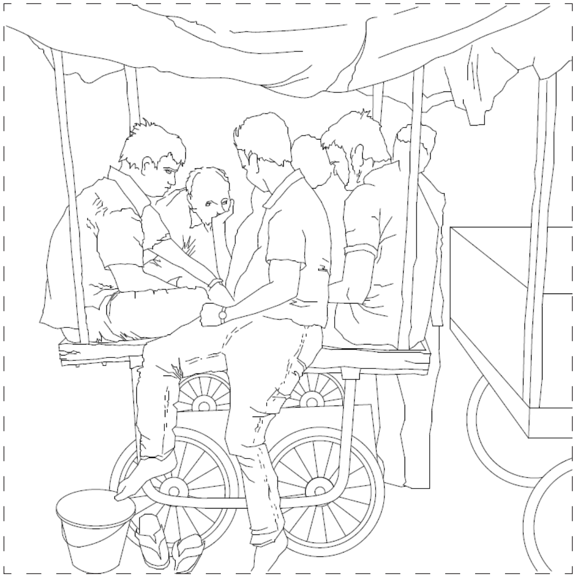
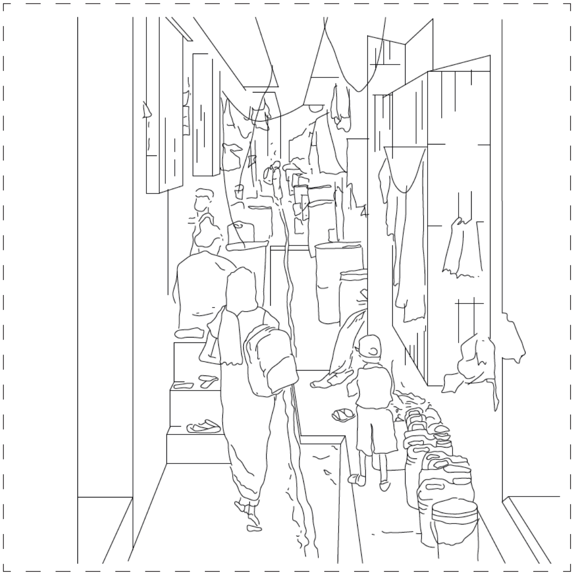
### social spaces

Almost all spatial components are found to be used as social spaces, whether they are or are not designed for this purpose. Where do people meet? What do they do?

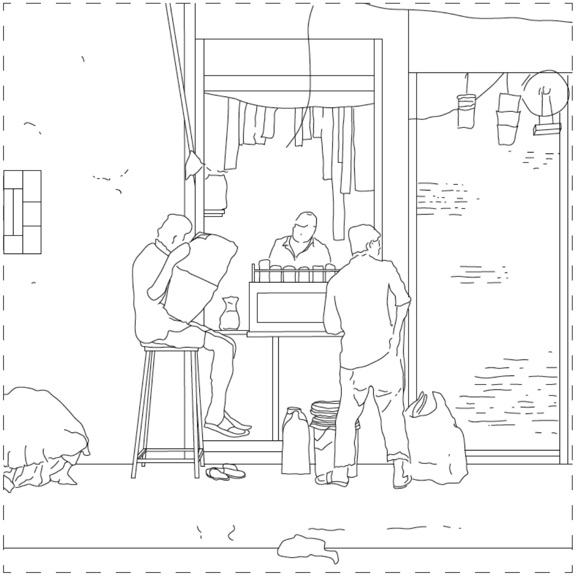


break in the shadow

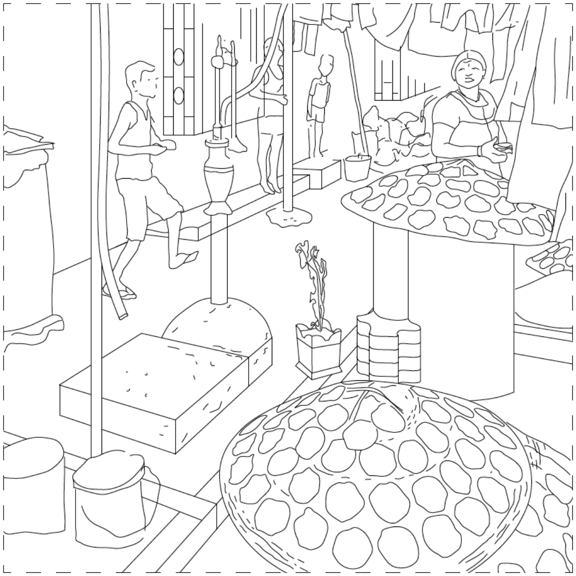
waiting plinth



intimacy alley



window chat



productive intersection

football

## domestic activity

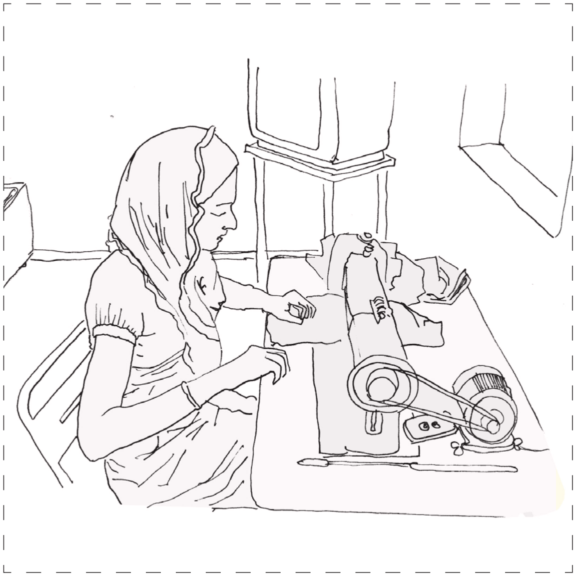
The dwelling unit often is not only a place to live, but also a place to work. Life expands towards the communal and open spaces in front of the houses, where it is shared with neighbours.

invitation doorstep

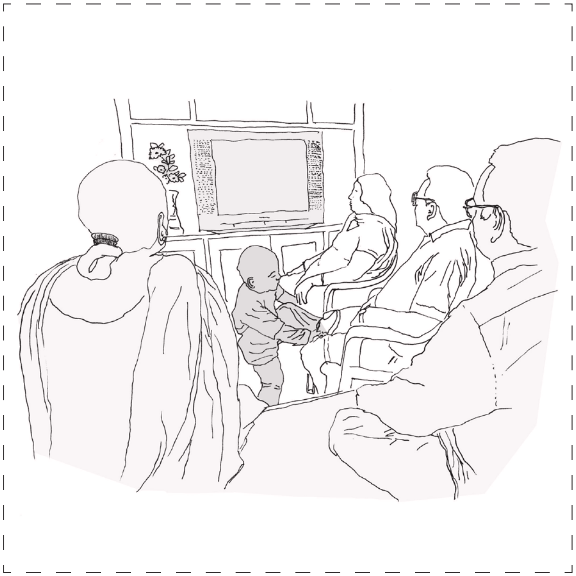
food preparation

drying laundry

eating together



homework



watching television

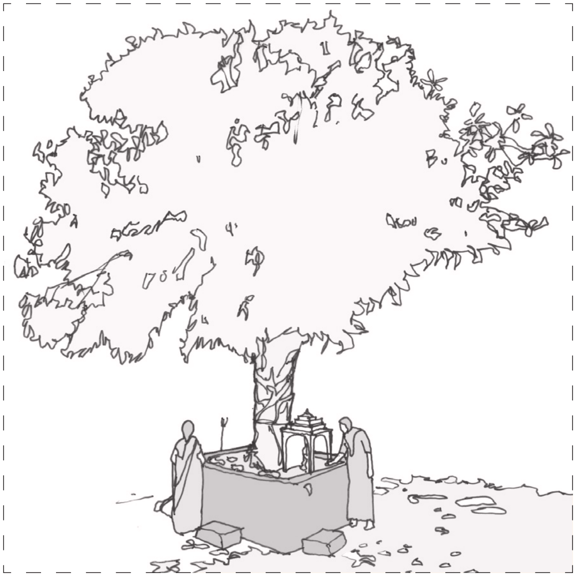
### amenities

Locally, many small amenities can be found in Nala Sopara. These examples refer to religion, health care, education and water accessibility. The small scale of these amenities relates to the low income level of the inhabitants of the area.

chawl school

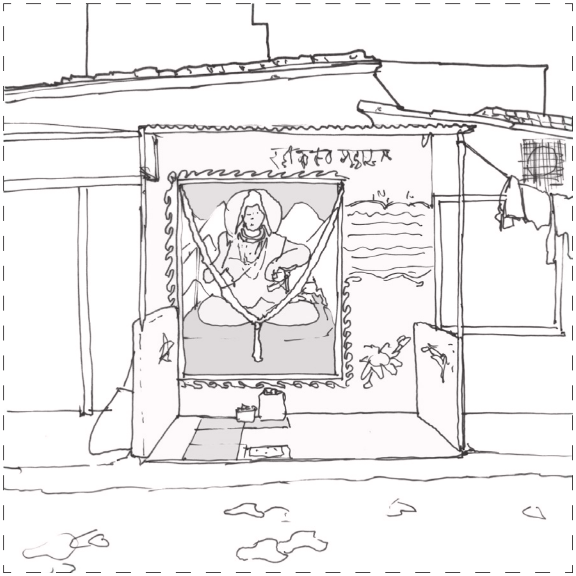

small clinic

# research
## book of patterns

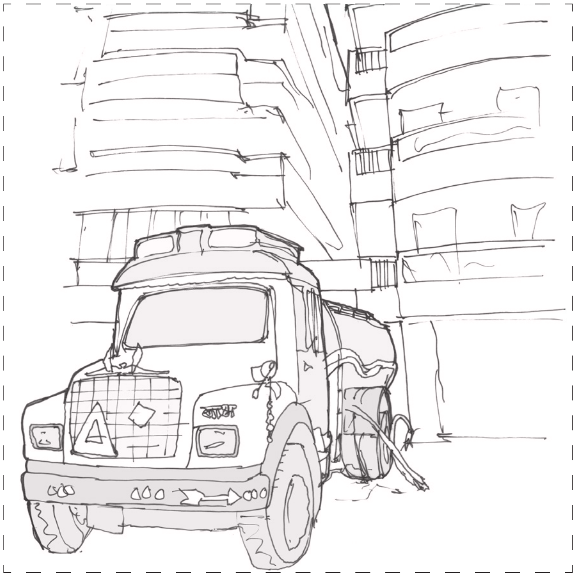


tree temple

water pump



shrine



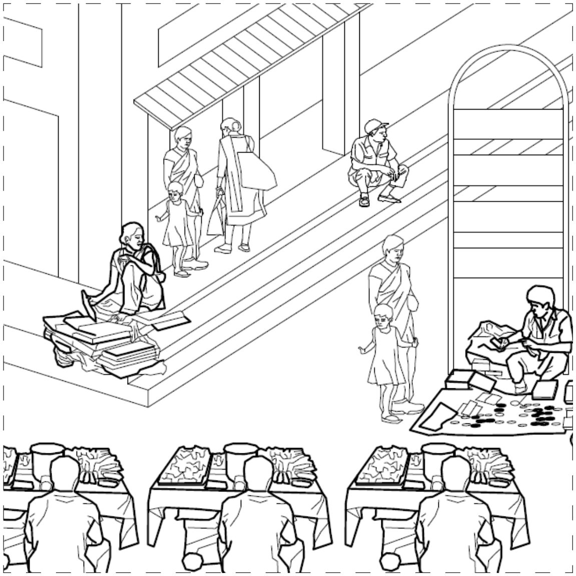
water truck

## income generation

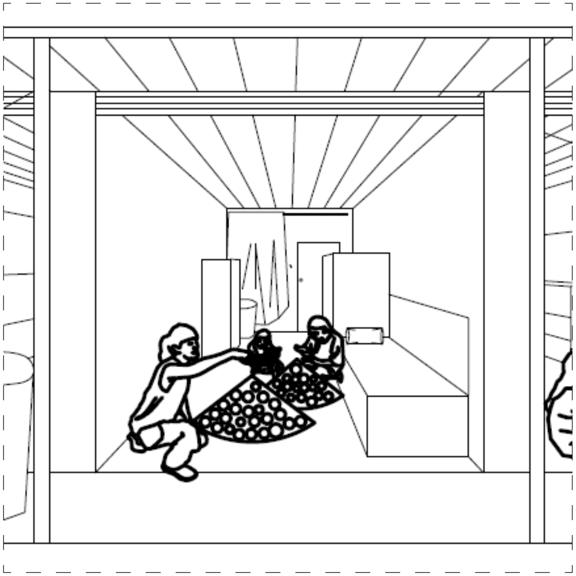
Due to the concentration of economic and commercial activities in southern tip of Mumbai, many of Nala Sopara's inhabitants commute by train to the city center every day. What is left of commerce and manners of generating income in Nala Sopara, is mostly informal and can be found on the street as well as in the private dwelling units.

commercial extension

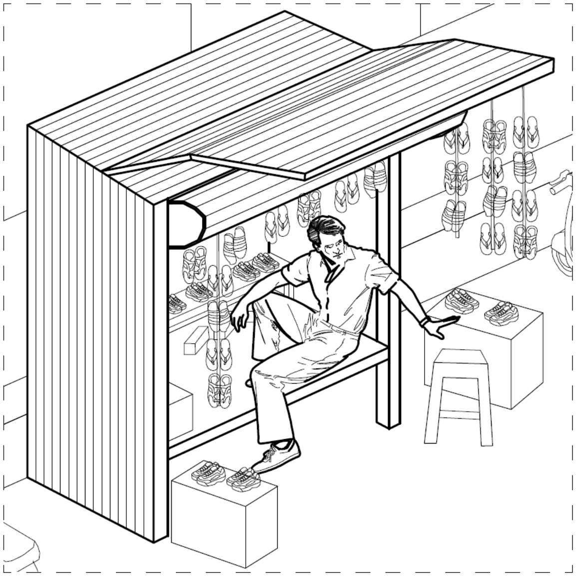
market



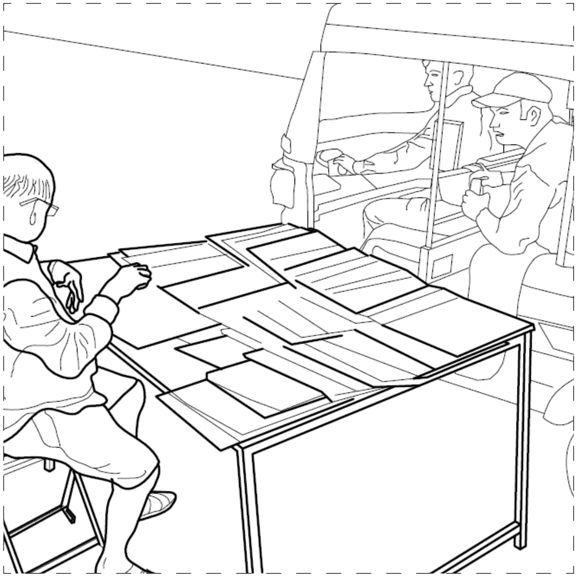
street vendors



working from home



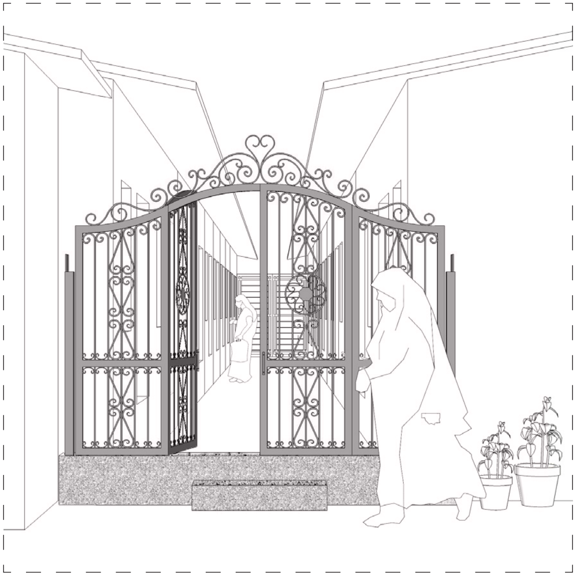
pop-up stall



drive-through

## borders

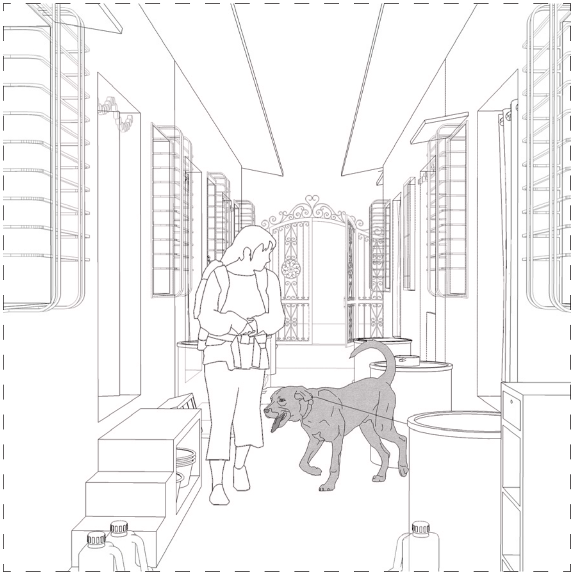
These borders are being used as a marker of people’s space, rather than a manner to keep others away. Gates are usually left open, and mostly just mark the boundary between public and private.



security gate

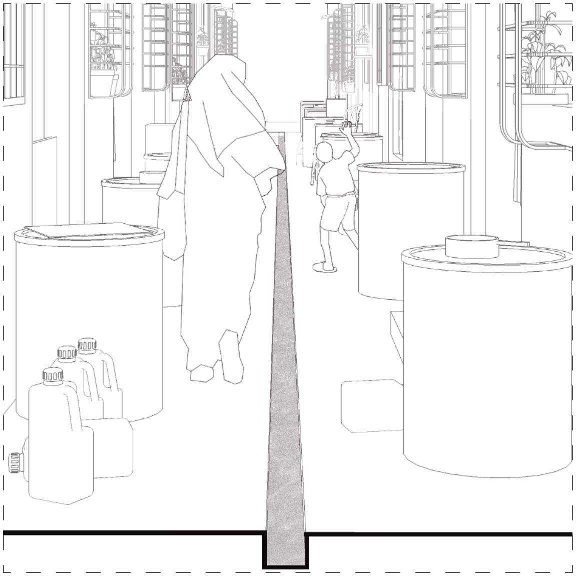
curtains

# research
## book of patterns

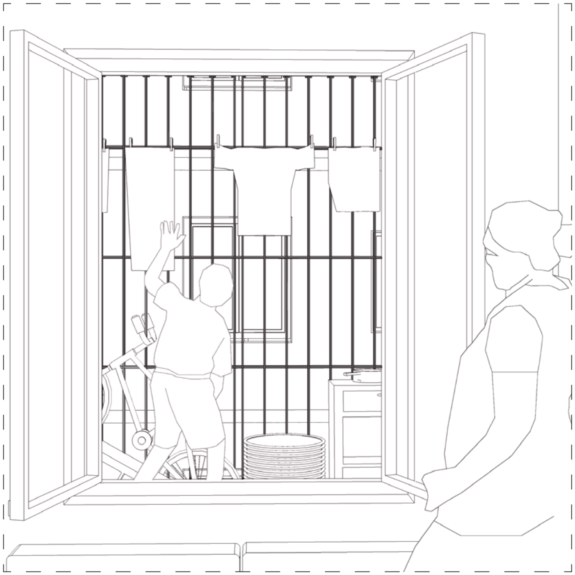


guard dog

block panel



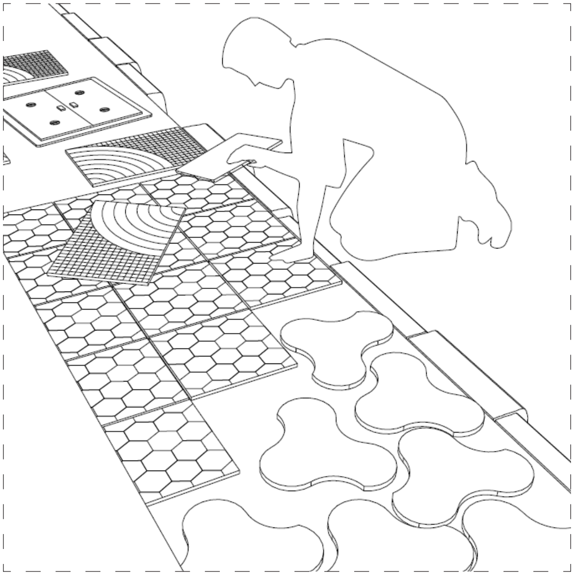
separating gutter



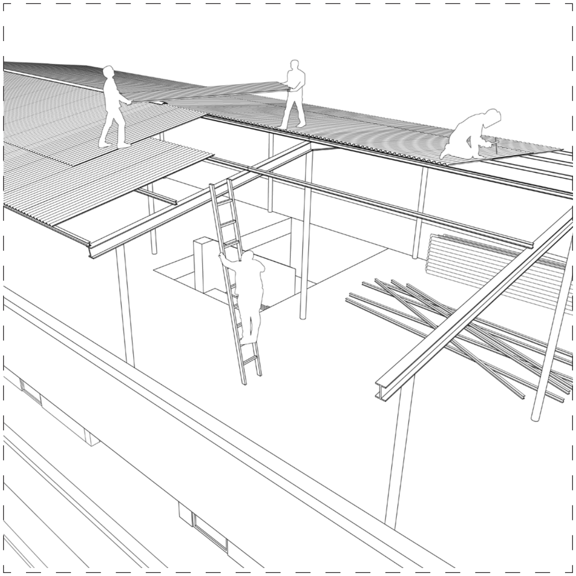
window grill

## building technology

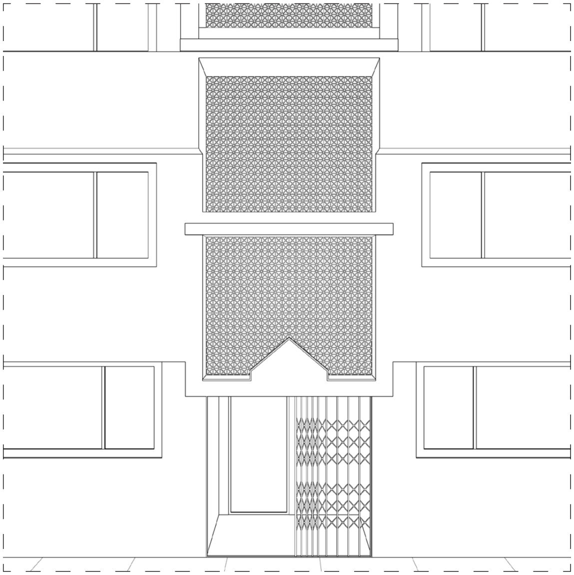
Local materials and techniques are frequently used. The current rapid construction developments in Nala Sopara offer job opportunities for the local population.



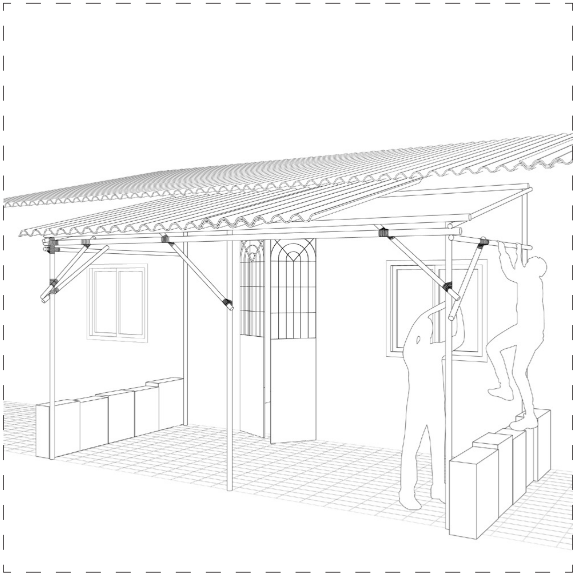
tiled pavements



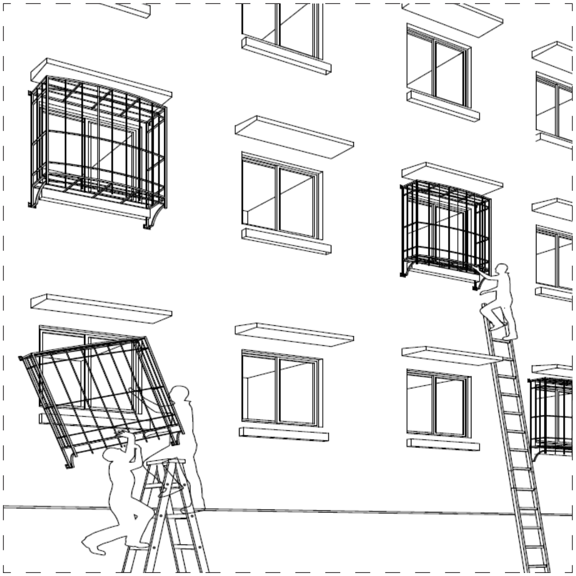
sloped steel roofs



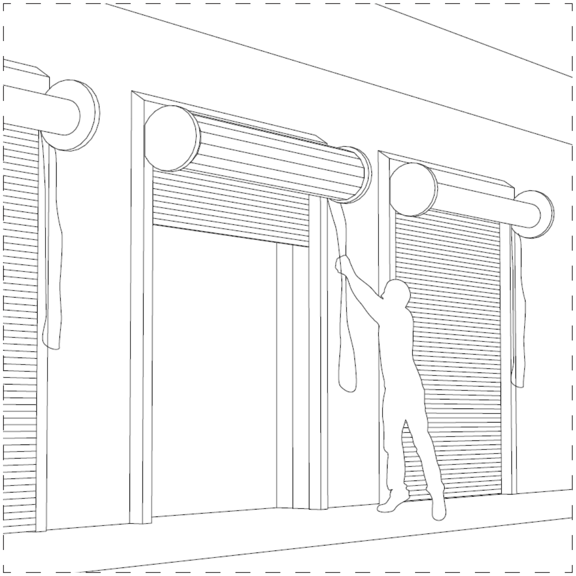
jali



home extension



window grills



rolling shutter

**Density**

One of the most crucial factors to make a city bloom, is density. Beyond a certain level, societal processes break down.

**Low-rise typology**

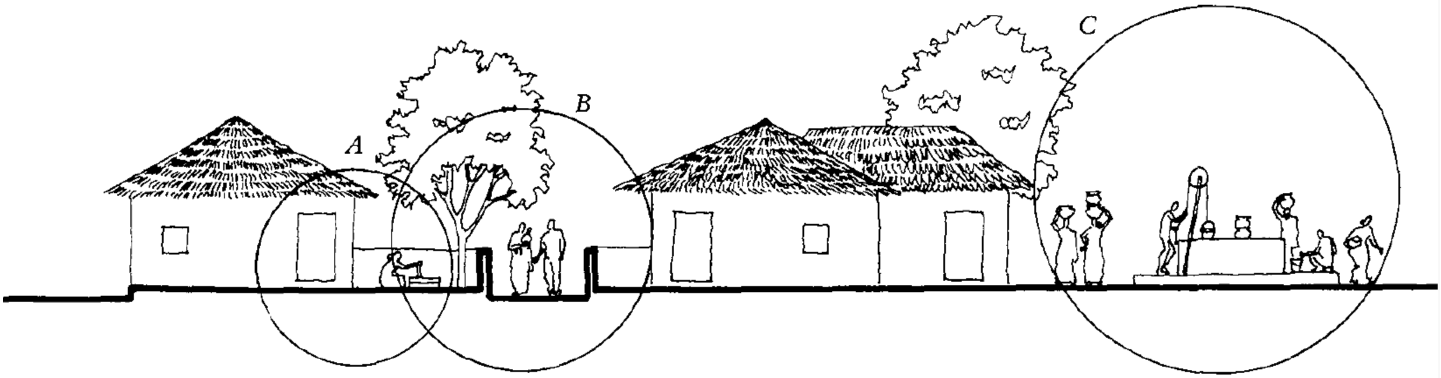
The crucial advantages of low-rise housing

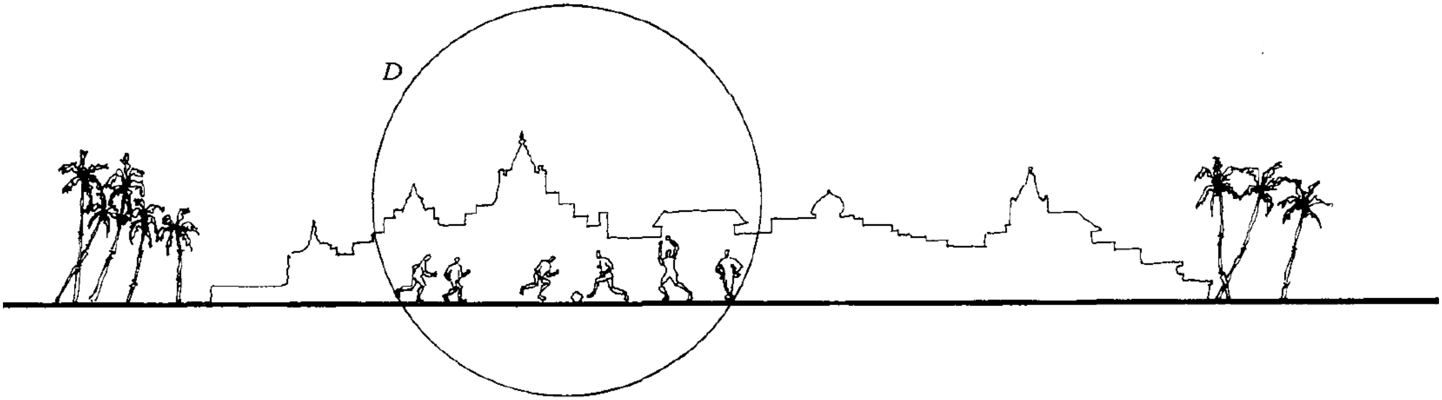
- incrementality
  The house can grow with the owner's requirements and his earning capacity.
- variety
  The individual owner can design and build the house according to his own needs.
- sensitivity
  People can adjust the spaces to suit their own preferred lifestyle.
- speedier construction
- lower interest costs
- no need to use high-priority construction materials
- renewability
- maintenance
- equity

**Hierarchy of spaces**

Urban living involves more than just the use of a small room. This room is only one element in a whole system of spaces that people need. It appears to have four major elements:

- the space needed by the family exclusively for private use (cooking, sleeping, storage)
- areas of intimate contact (where children play, where one chats with the nieghbours)
- neighbourhood meeting place (the city water gap, the village well, where one becomes part of the community)
- urban area, used by the whole city (maidan, open space)


A
B
C


D

"The ability of a community to develop processes and structures which not only meet the needs of its current members but also support the ability of future generations to maintain a healthy community."
Business Dictionary

"Social sustainability is a combination of traditional social principles, including initial basic needs (housing and health) employment, education, equality and social justice and new concepts that are also less measured such as identity, sense of place, happiness and quality of life."
Colantonio

"Social sustainability is a process for creating sustainable successful places that promote wellbeing, by understanding what people need from the places they live and work. Social sustainability combines design of the physical realm with design of the social world – infrastructure to support social and cultural life, social amenities, systems for citizen engagement, and space for people and places to evolve."
Social Life

"Social sustainability embodies the principles of futurity, equity, participation empowerment, accessibility, cultural identity and institutional stability."
Seema Dave

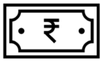
"Social sustainability occurs when the formal and informal processes; systems; structures; and relationships actively support the capacity of current and future generations to create healthy and livable communities. Socially sustainable communities are equitable, diverse, connected and democratic and provide a good quality of life."
WACOSS

# research
## social sustainability

Even though there is no standard, or generally understood definition of social sustainability, there are some broadly accepted common elements. I have identified several specific characteristics of social sustainability.

**access to basic needs**
the availability and accessibility of housing, water, hygiene, daylight, etc.

**access to local facilities**
accessibility of amenities, as schools, shops, health care facilities, etc.



**opportunities for income generation**
having a job gives people the chance to earn money, to take of their family, getting a feeling of responsibility and of contributing to the neighbourhood or community.

**social interaction**
knowing people and having social contacts in the neighbouwhood reduces social isolation.

**community spirit**
belonging to something bigger, and as a group feeling responsible for each other and the facilities you share.

**sense of safety**
feeling secure in your dwelling unit, because of available facilities, a permanent status of residence and social control.

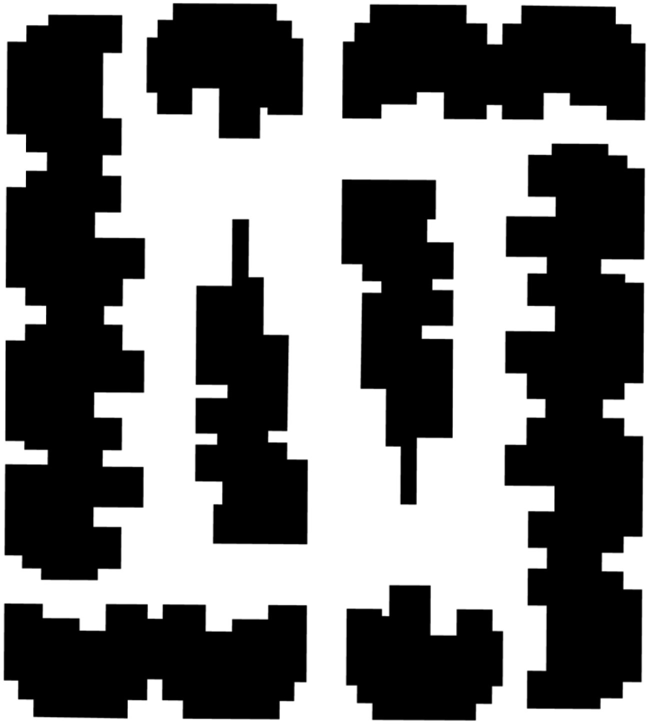
**health of the inhabitants**
stress-related and pollution-related health

## research
### case studies

To get a better understanding of the influence of density on social sustainability, three different housing projects have been studied. These case studies are housing projects we visited during our field trip to Mumbai. All of them have different sizes and densities. These projects have been compared to investigate which strategies the architects applied to achieve a certain queality, concerning social sustainability and density.

**Sangharsh Nagar**
PK Das

This project involves the rehabilitation of slumdwellers. Sangharsh Nagar has been designed to from a comprehensive and all-inclusive new town. It consists of 18.362 dwelling units, and includes a large, 1,6-hectare maidan as its central social space. Two more playgrounds and over 60 community spaces enliven its outdoors. The social infrastructure is formed by 14 schools, medical facilities (including two hospitals), two large community halls and religion institutions. Sangharsh Nagar has an urban scheme built up by pada's, or clusters. Each pada has 550 houses and 16 common units for shared facilities. It is built around a courtyard, to provide for openness, natural light and ventilation. Besides the shared open spaces, each dwelling unit has access to a private balcony. The unit itself measures 22,5 m$^2$ and includes one room, a kitchen and a bathroom. The pada's are connected with eachother by a network of pedestrian streets. They intersperse the clusters, promoting a sense of unity between the different parts of the development.

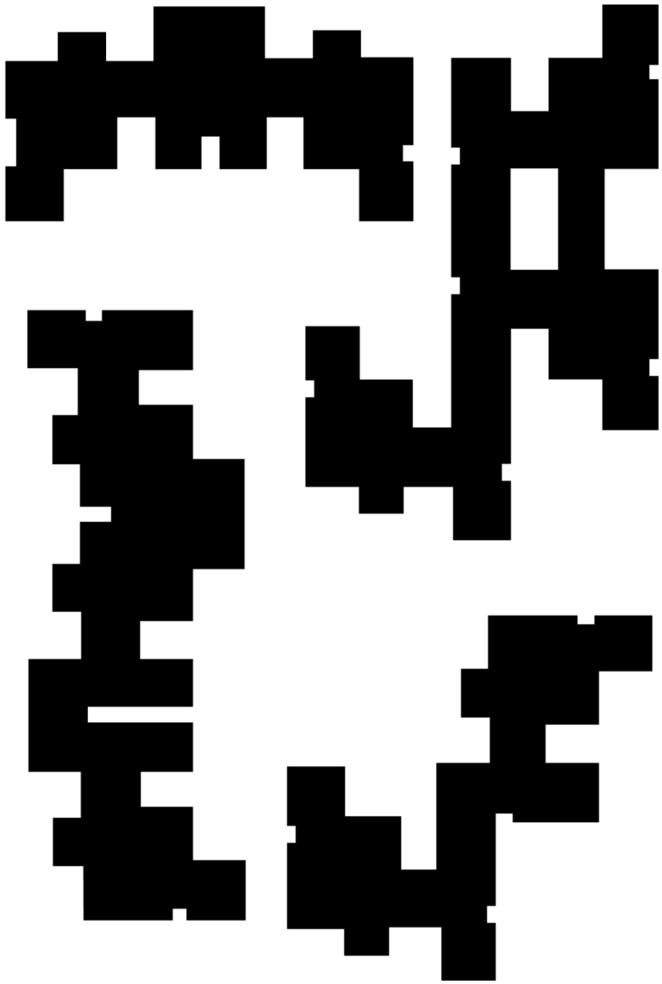



लक्ष्य क्लासेस
Lakshya Classes
गुरुकृपा
आर्यन अकॅडमी
Std:- 5th to 10th
Commerce - F.Y.J.C. To T.Y.B.Com
13/B
साई धा

## CIDCO Housing

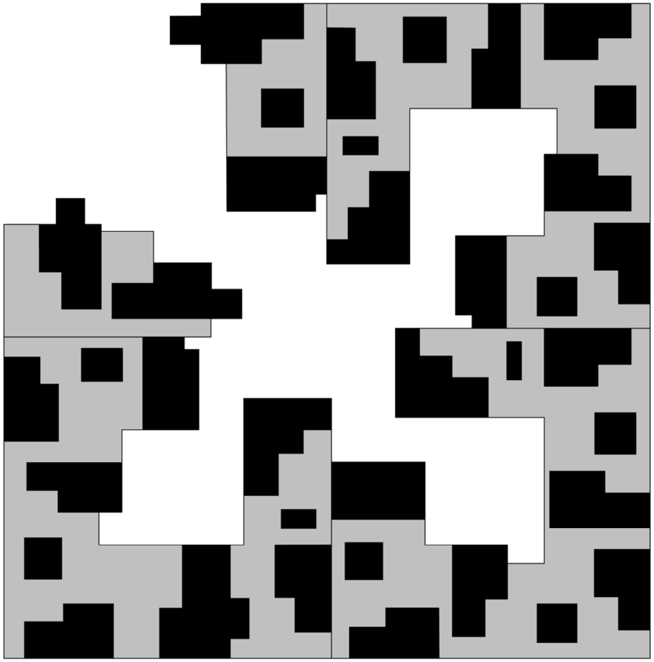
Raj Rewal

Cidco Housing has been built to house people from the Low Income Group (LIG). The project consists of 1048 units with one to three rooms each, varying in size from 18, 25, 40 and 71 $m^2$. The project was developed like a dense urban settlement. The dwelling units are fragmented into smaller clusters, creating a varied hierarchy of spaces on the sloping site, which are interconnected by pedestrian pathways. The units are arranged in such manner to create a network of courtyards and rooftop terraces, fostering community interactions. A traditional narrow street links all housing units, and provides intimate encounters between people and a sense of belonging to the neighbouwhood square. When planning the urban layout of the building blocks, the connections implied by communally used spaces were of great importance. People easily pass through the various building groups, increasing social interaction. People do not just live in their homes; to a large extent, life takes place on the street. In this layout scheme, with houses opened up towards the outdoor space, people are in intensive contact with their neighbours.



**Belapur Housing**
Charles Correa

In New Bombay, an area first promoted by Charles Correa as a means to reduce the density pressure on the old city of Mumbai, Belapur Housing has been built. This housing scheme focuses on Correa's theory of creating a spatial hierarchy, which ranges from the private, individual dwelling, to the greater public space. Besides, this project seeks to demonstrate how high densities can be achieved within the context of a low-rise typology. The basic element of the design is the house, which has a private yard. The dwellings therefore are incremental, enabling the owners to expand it to their wishes.
In the urban scheme, the basic unit is a shared courtyard of 8 by 8 meters, around which seven houses are grouped. Three of such courtyards are grouped to form a cluster of 25 houses, including some additional corner-unit dwellings. This cluster is then repeated to form a site plan for 600 families.



To compare the qualities of these three case studies and the chawls, this comparative diagram criticizes the aspects of social sustainability in relation to density.

Sangharsh Nagar has the highest FSI and the highest number of dwellings per cluster, due to the amount of stories of the building. The lack of open space between the mid-rise chawls causes their density of dwellings per hectare to be even higher. CIDCO Housing and Belapur Housing offer the lowest residential density, because of their low-rise typology. Since Sangharsh Nagar has not only a residential function but also includes many local facilities, it provides more opportunities for employment and income generation. This also has a positive influence on social interaction. But CIDCO Housing, Belapur Housing and the baithi chawls score higher on social interaction and community spirit, because they consist of low-rise typologies and a smaller number of dwellings per hectare. The urban form of these projects allows people to have a stronger and easier relationship with their neighbours. In Sangharsh Nagar this is harder, since people who live on the eighth floor cannot have direct contact with residents from lower levels, and neither with the public spaces on the ground floor. The stress-related health of the inhabitants of CIDCO Housing and BElapur Housing is probably better than in the other housing projects, since here every unit has sufficient access to natural light and ventilation and open space.

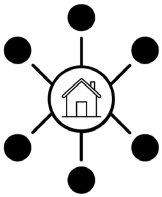
number of dwellings
dwelling size
dwellings / cluster
area
dwellings / hectare
people / hectare
FSI

access to basic needs
access to local facilities
opportunities for income generation
social interaction
community spirit
sense of safety
health of the inhabitants

| Sangharsh Nagar | CIDCO Housing | Belapur Housing | mid-rise chawls | baithi chawls |
|---|---|---|---|---|
| 18.362 | 1048 | 600 | - | - |
| 22,5 m² | 18, 25, 40, 70 m² | 45, 70 m² | 18 m² | 18 m² |
| 550 | 25 | 21 | - | - |
| 32 ha | 7,7 ha | 5,4 ha | 1 ha | 1 ha |
| 574 / ha | 136 / ha | 111 / ha | 1400 / ha | 350 / ha |
| 2296 | 544 | 500 | 5600 | 1400 |
| 4,8 | 1,5 | 0,7 | 3 | 0,8 |
| | | | | |
| +/- | + | + | +/- | +/- |
| + | - | +/- | +/- | +/- |
| + | +/- | +/- | +/- | + |
| +/- | + | + | +/- | + |
| +/- | + | + | +/- | + |
| + | + | + | - | +/- |
| +/- | + | + | - | +/- |

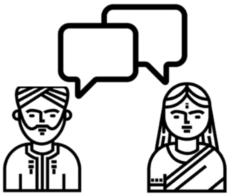
# research
## density & social sustainability

If density is related to social sustainability, several conclusions can be made. Literature studies and the research conducted through several case studies have shown that:



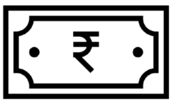
High densities make access to services and facilities easier.

High densities may cause a decline of community and weaking of social ties.



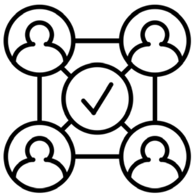
High densities can contribute positively to social equity, social interaction and vitality.

High densities have a negative influence on the health of the inhabitants, particularly stress-related health.





High densities have positive impact on employment opportunities.



High densities are likely to have an overall negative impact on satisfaction within the neighbourhood.

When it comes to density in relation to social sustainability, the urban form is equally important. This image shows three different urban layouts, all with the same density of 75 housing units per hectare. Although the residential density is equal, the perceived density is totally different. High-rise leaves more space for open, green areas. Low-rise offers a better relation between the private housing unit and the public street. Mid-rise offers an opportunity to create a community cluster.

"How density is perceived by residents or users (crowding of buildings or people) may have significant impacts on social interaction, community cohesion, satisfaction with the built environment, the reputation of an area, and on preferences for moving in or out of an area in the city."
Seema Dave

A core challenge for Mumbai and cities with comparable characteristics is the tension between urban form, compactness and liveability. A balance between the optimal density and matching urban form (compact or dispersed, formal or informal) has to be found. Density hereby forms the essential driver of the future. There are different ways of measuring the density of urban areas:

**floor area ratio**
The total floor area of buildings divided by the land area of the plot upon which is built.

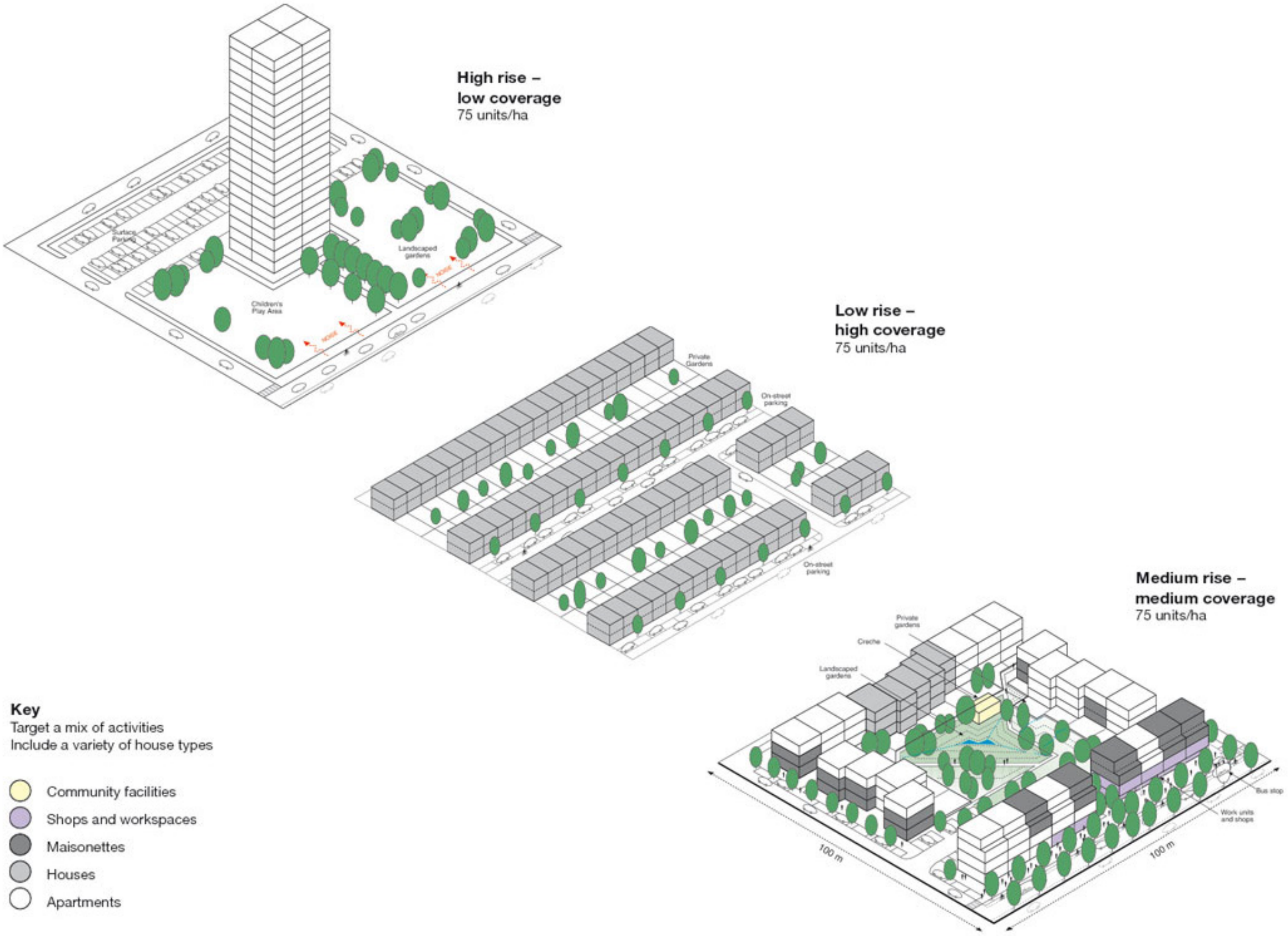
**residential density**
The number of dwelling units in any given area, for example per hectare.

**population density**
The number of persons living in any given area.

According to the density guidelines of the Mumbai Metropolitan Authority, these are the general calculations of residential density in Mumbai:

| | |
|---|---|
| **low density** | 0 - 200 units / hectare |
| **medium density** | 201 - 400 units / hectare |
| **high density** | 401 - 600 units / hectare |

# research
## density & urban form



# general building requirements

Habitable room:

"Room occupied or designed for occupancy by one or more persons for study, living, sleeping, eating, kitchen if it is used as a living rooms, but not including bathrooms, water-closet compartments, laundries, serving and store pantries, corridors, cellars, attics and spaces that are not used frequently or during extended periods."

Every dwelling units should at least have two habitable rooms:

| | | |
|---|---|---|
| 1. | h: | 2,75 m |
| | w: | 2,5 m |
| | s: | 9,0 $m^2$ |
| 2. | h: | 2,75 m |
| | w: | 2,1 m |
| | s: | 6,5 $m^2$ |

The total size of the habitable rooms:15,5 $m^2$

Kitchen with separate dining area:

h: 2,75 m
w: 1,5 m
s: 3,3 $m^2$

Kitchen including dining area:

h: 2,75 m
w: 2,1 m
s: 7,5 $m^2$

Bathroom without toilet:

h: 2,2 m
w: 1,0m
s: 1,2 $m^2$

Bathroom including toilet:

h: 2,2 m
w: 1,0 m
s: 1,8 $m^2$

Toilet:

h: 2,2 m
w: 0,9 m
s: 1,0 $m^2$

M.C.G.M
HEDEPT
WORKIN
PROGRESS
GOSLOW
INCONVENIE
NSE CAUSED
ISREGRETED

# ARCHITECTURAL DESIGN

# architectural design
## design hypothesis

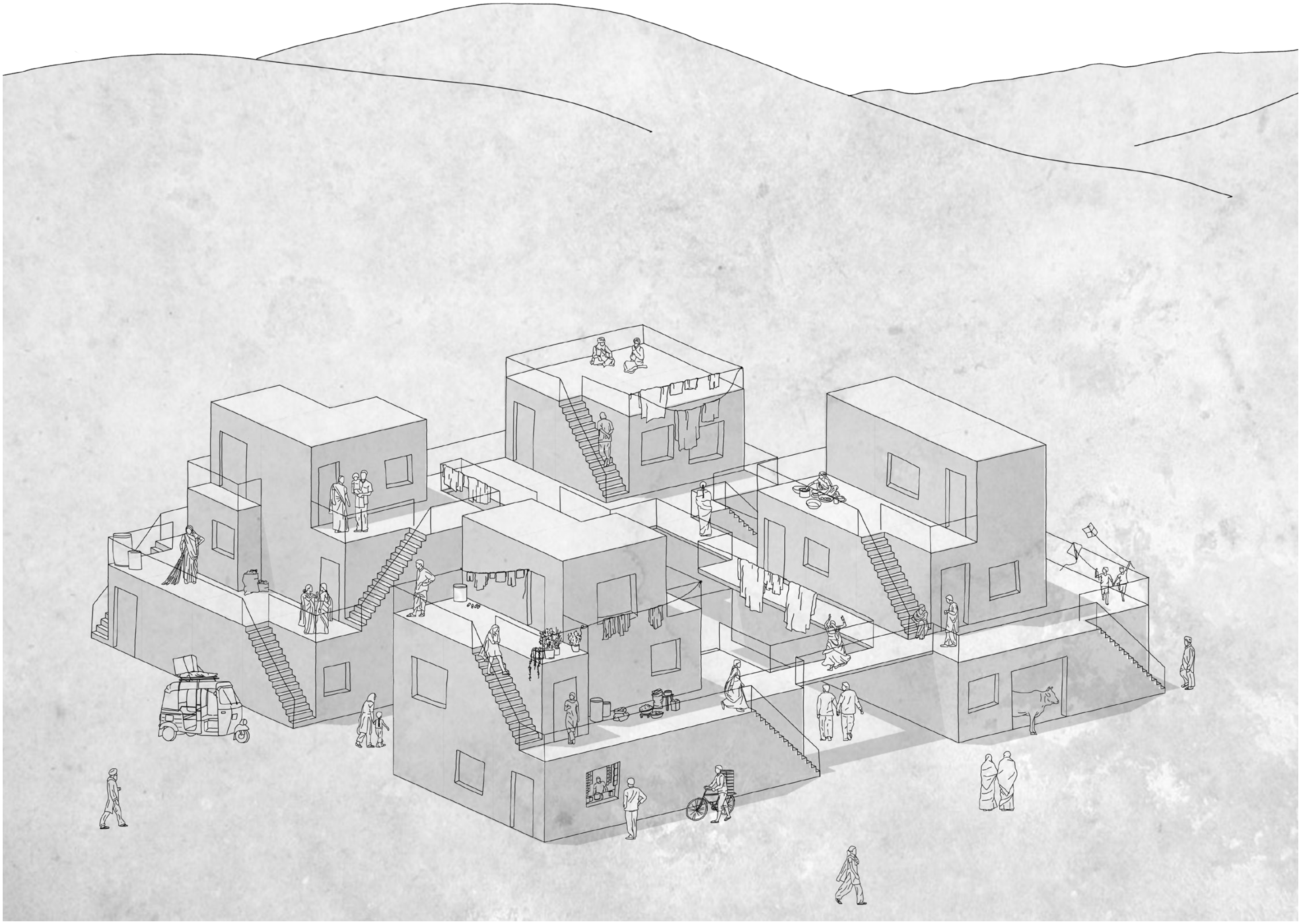
The core challenge of the project is to find a good-working ratio between the physical and perceived density and social sustainability. If the density is too low, it must be increased, and if it is too high, it must be allowed to decline, to arrive at an appropriate ‘quality density’.

The intention of the project is to create an alternative for the densification development of the baithi chawls, in which the density should increase to provide more dwelling units, whilst guaranteeing the social sustainability.

The design hypothesis shows the concept of the project: a cluster of different types of housing units, varying in size, grouped around a shared open space.

Each higher floor will be smaller than the one below, leaving space for shared open spaces and communal terraces, which support social interaction and a community feeling.

People easily pass through the cluster via interconnecting walkways on the first and second floor.



**1. The basic module - plan**
The basic module of the building has a size of 12 by 19,5 meters.

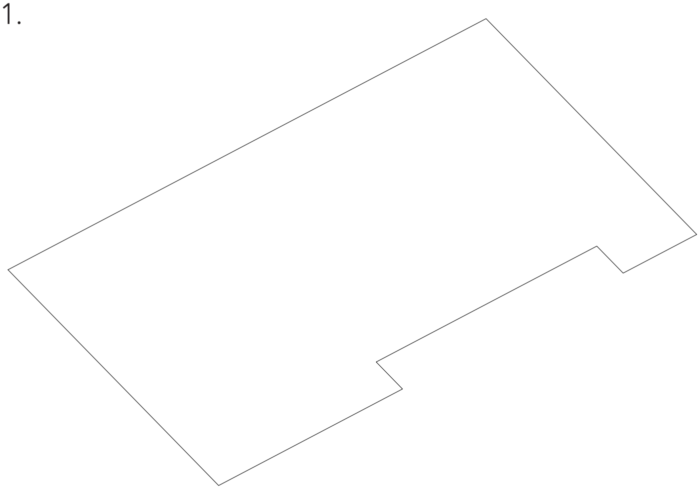
**2. The basic module - volume**
It consists of a ground floor plus three stories, containing 21 dwelling units. Each higher floor is smaller than the one below, leaving space for communal terraces and galleries.

**3. The cluster**
The basic module is duplicated and rotated, creating a cluster of four groups of housing units, with a shared courtyard in the center.

**4. The cluster - circulation**
Each building block has its own circulation system, consisting of external stairs and a system of shared galleries.

**5. The cluster - walkways**
Besides, the building blocks are also interconnected via walkways, which offer the residents to create different routes though the building. This links all housing units, providing intimate encounters between neighbours and a sense of belonging to the community.

1.



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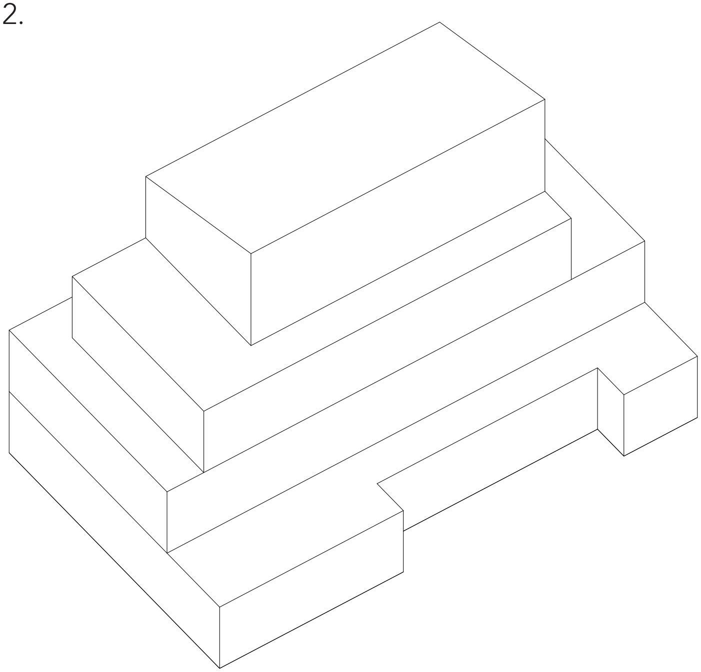

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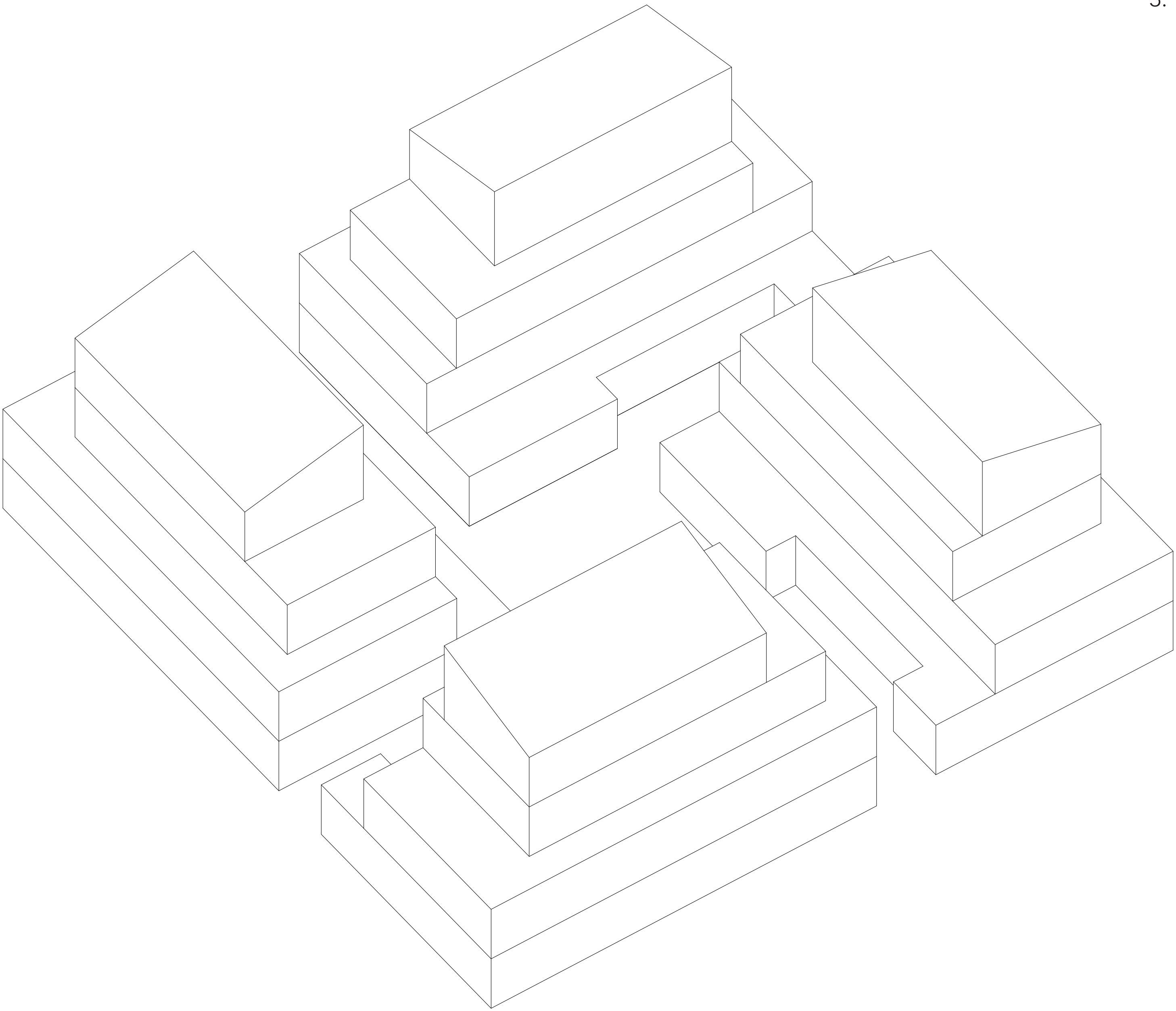

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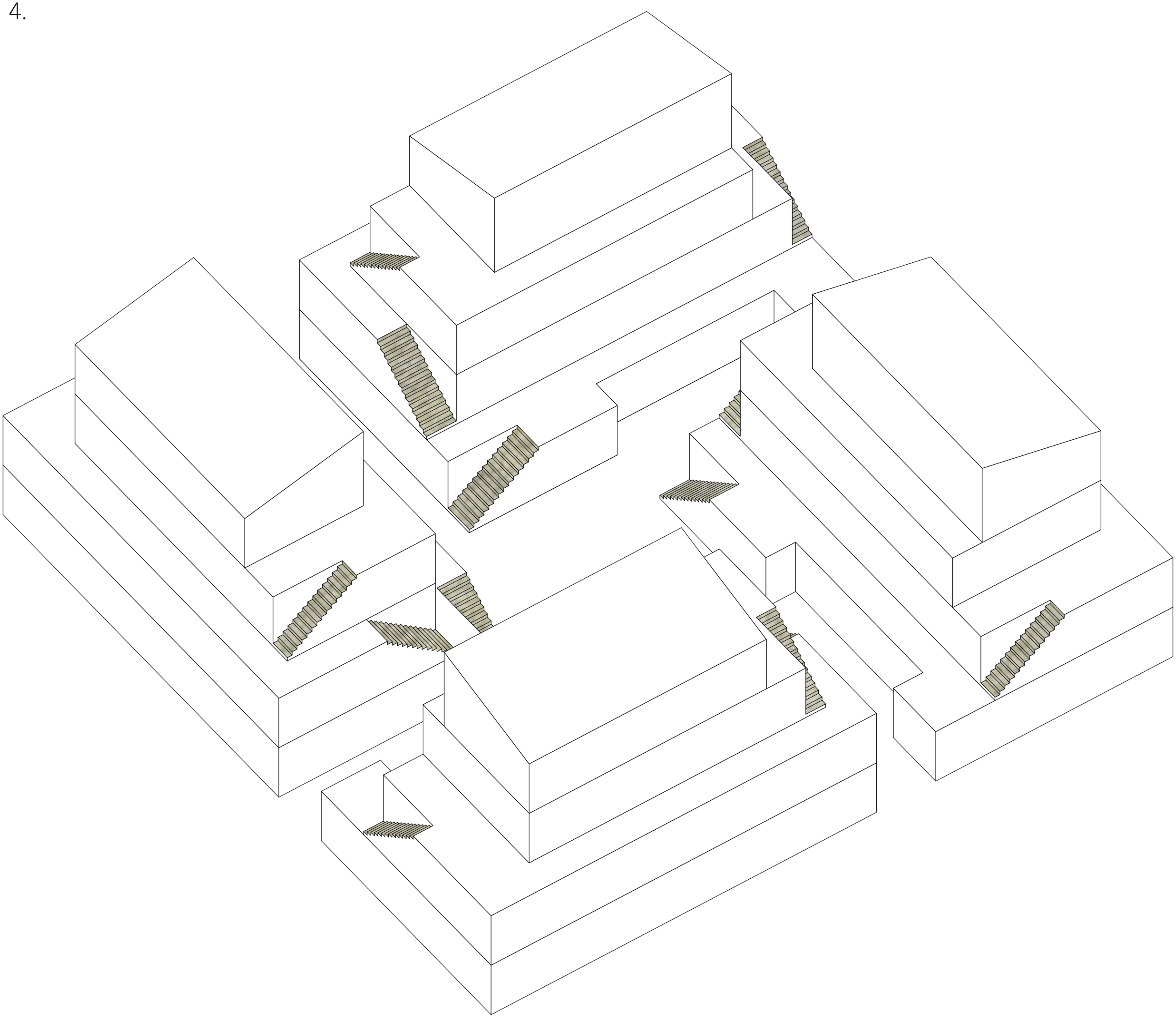

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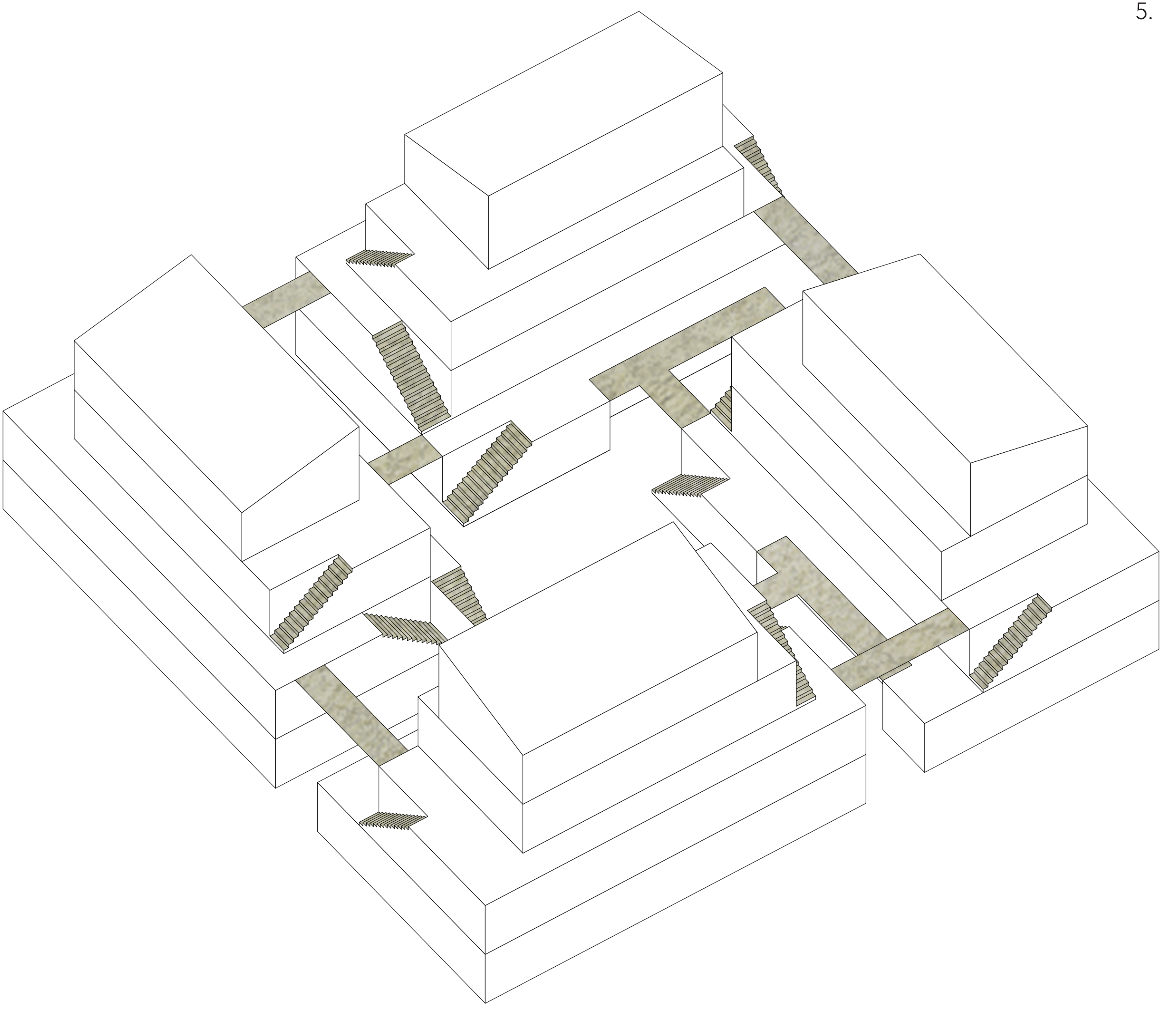
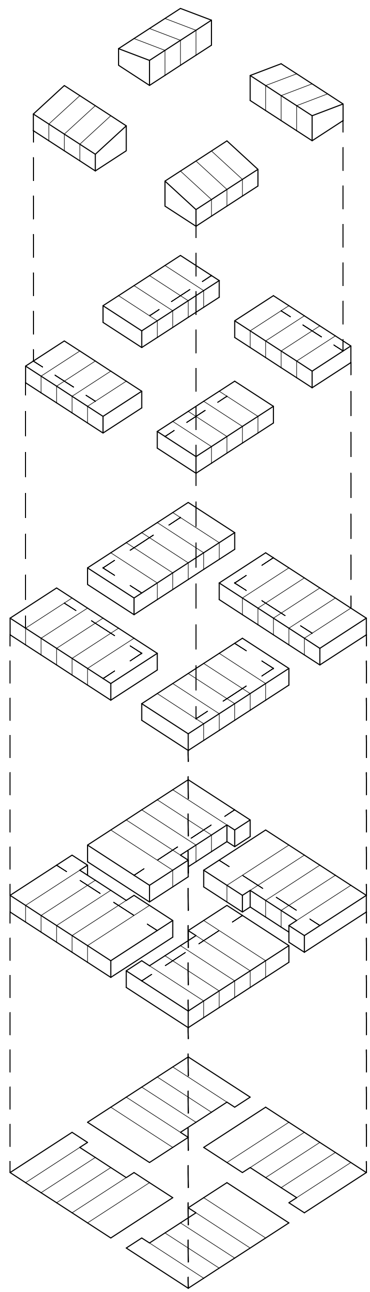
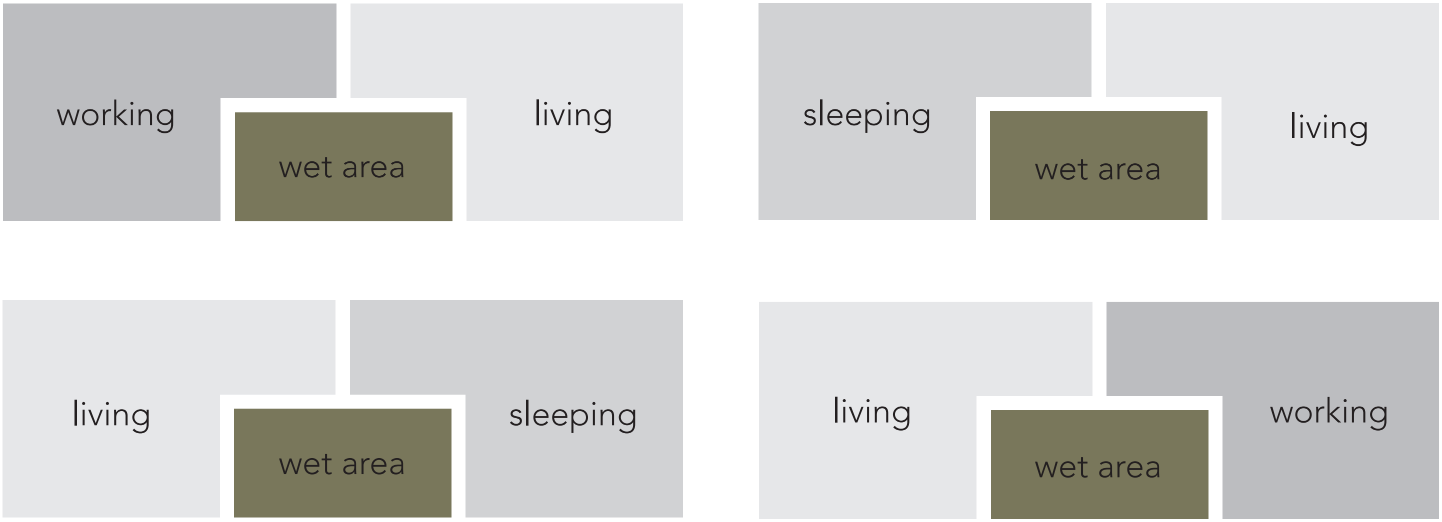
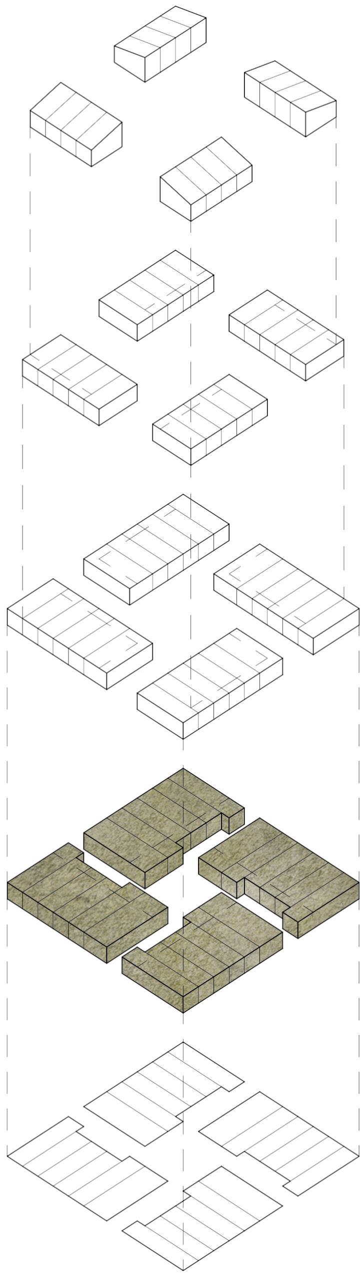


## architectural design
### typical dwelling unit

All dwelling units in the cluster have a narrow, rectangular shape. The width is always 3 meters, except for two dwelling types in the center, which have a width of 4,5 meters. The length of the units varies from 6 up to 12 meters, which creates units varying from 22,5 $m^2$ up to 54 $m^2$.
This rectangular shape provides the opportunity to have both a streetview and a connection towards the interior of the cluster.
In the typical layout of the dwelling, the wet area, consisting of the bathroom and kitchen, is placed in the center. Hereby, two spaces are created, which are freely divisble by the users. People may use the spaces as follows:

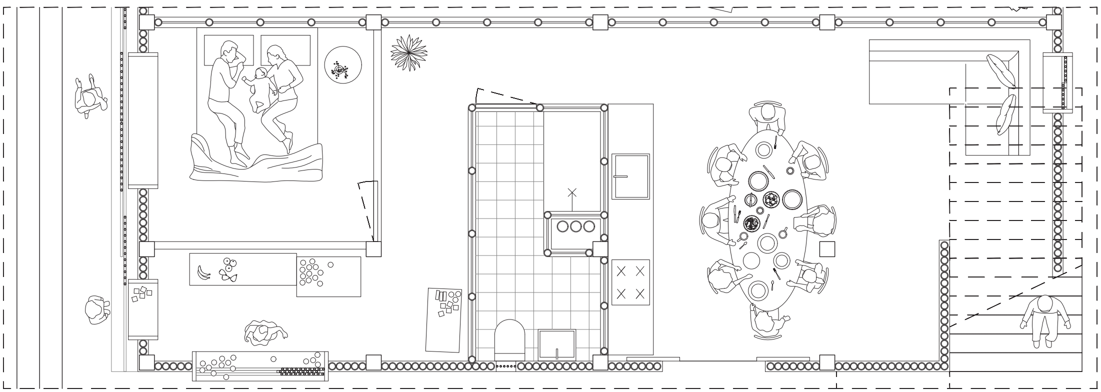


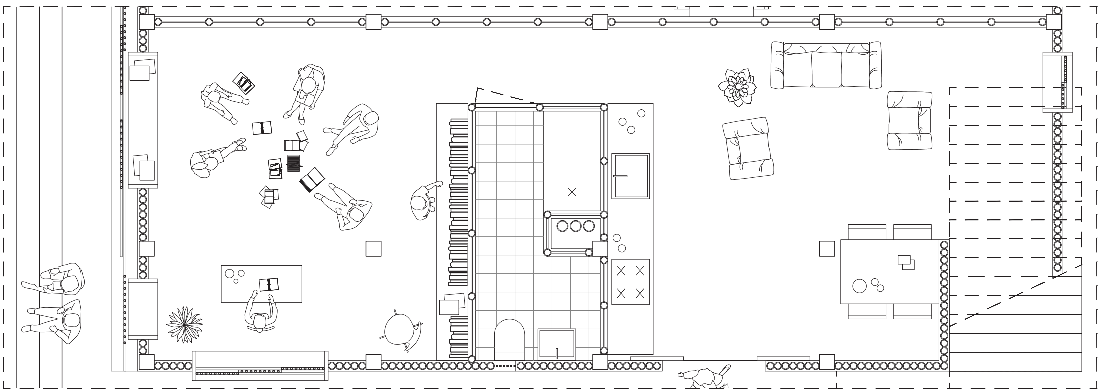

working
wet area
living
sleeping
wet area
living
living
wet area
sleeping
living
wet area
working

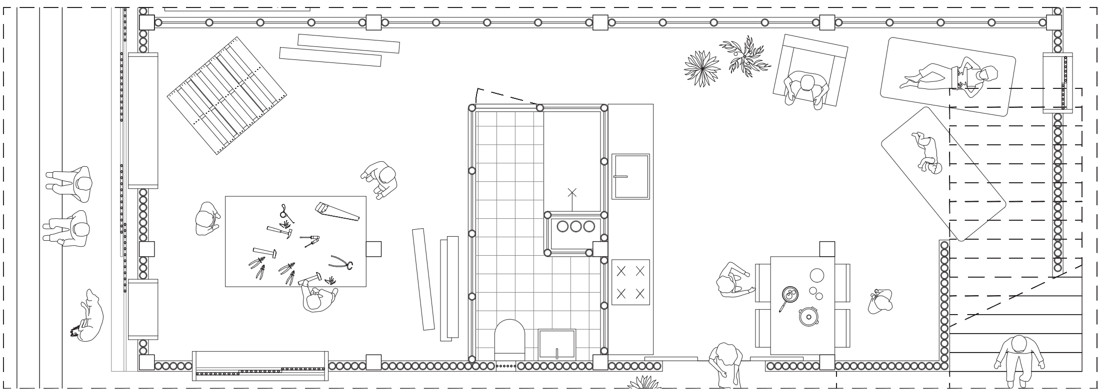


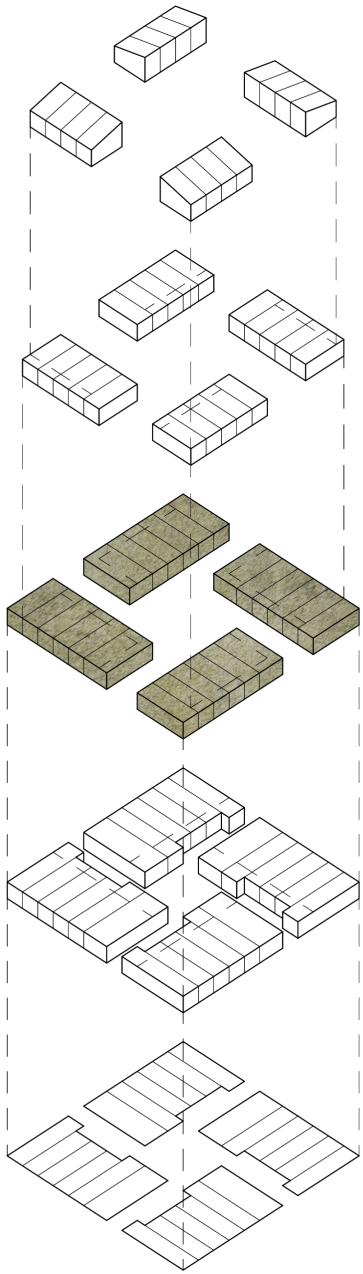
**Unit Type XXL**

| | |
|---|---|
| size | 12 x 4,5 m |
| area | 54 m2 |
| $m^2$ dwelling / person | 10,8 m2 |
| dwellings / cluster | 4 |
| situation | ground floor |
| type | LIG |



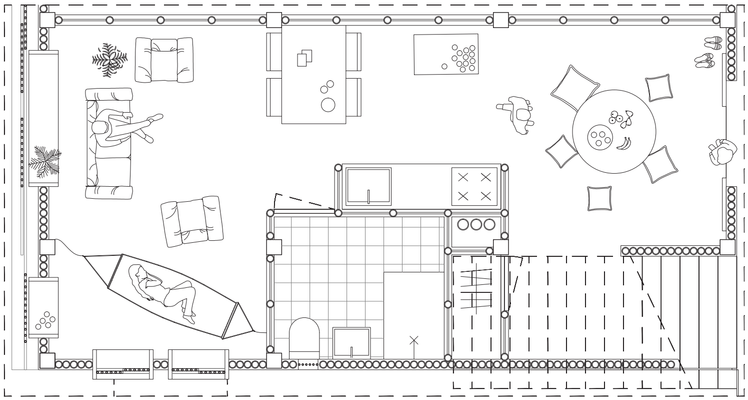


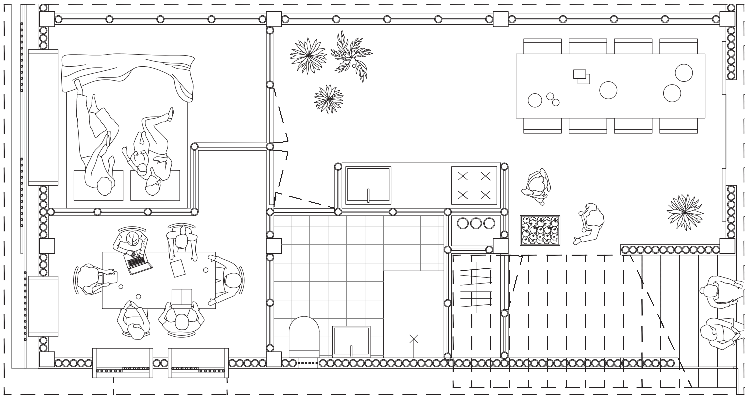


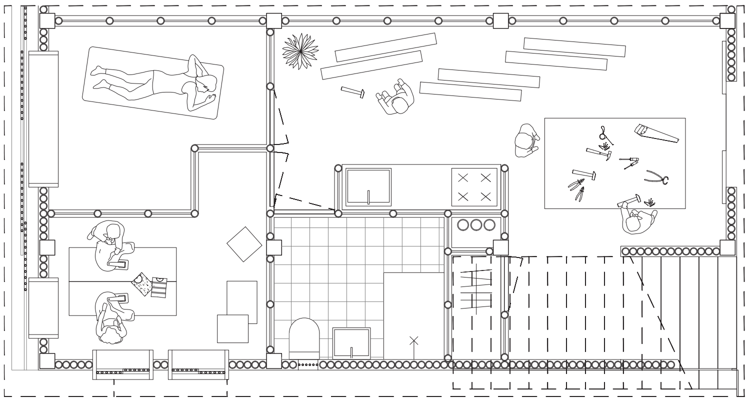


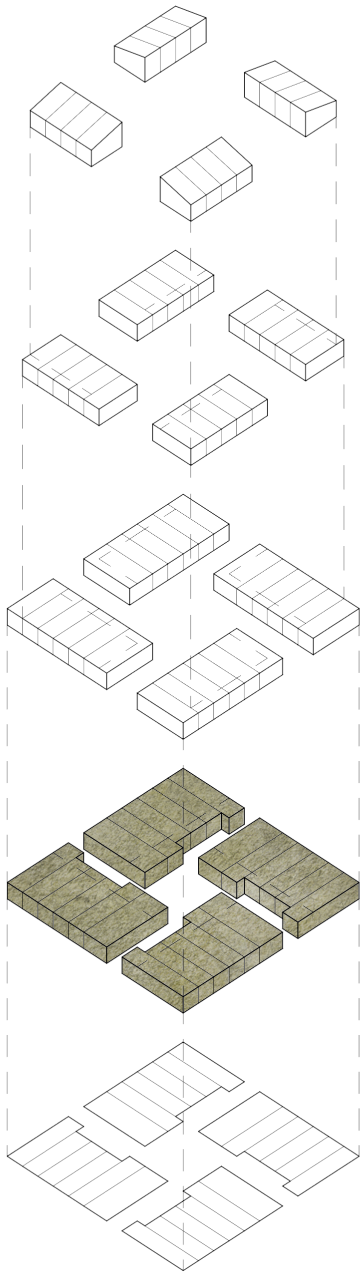
**Unit Type XL**

| | |
|---|---|
| size | 9 x 4,5 m |
| area | 40,5 m2 |
| $m^2$ dwelling / person | 8,1 m2 |
| dwellings / cluster | 4 |
| situation | first floor |
| type | LIG |



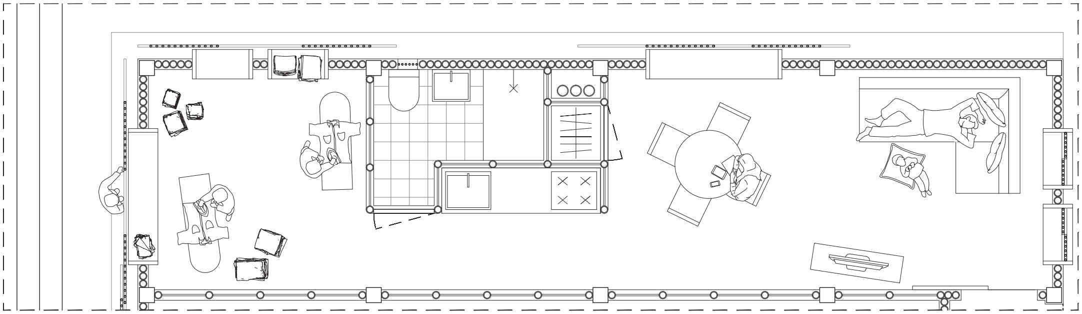


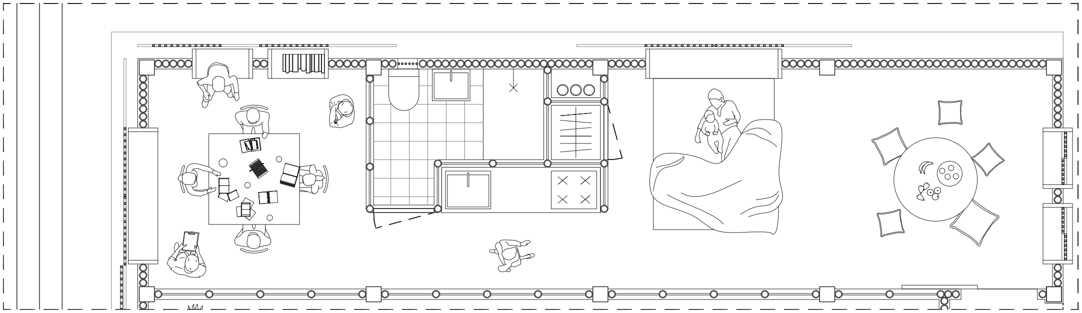


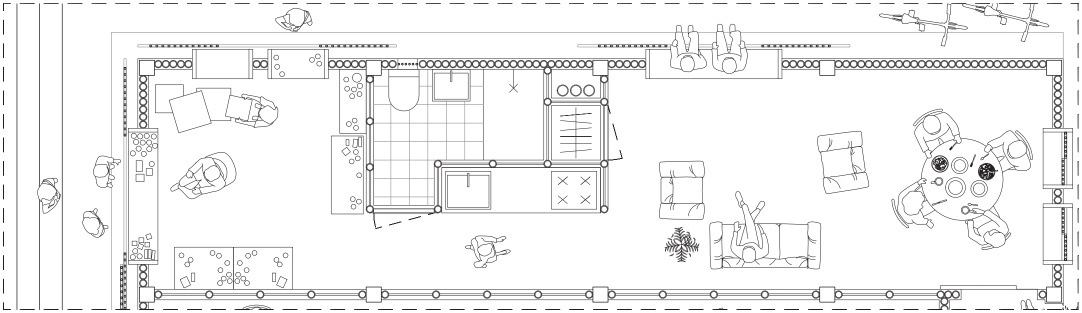


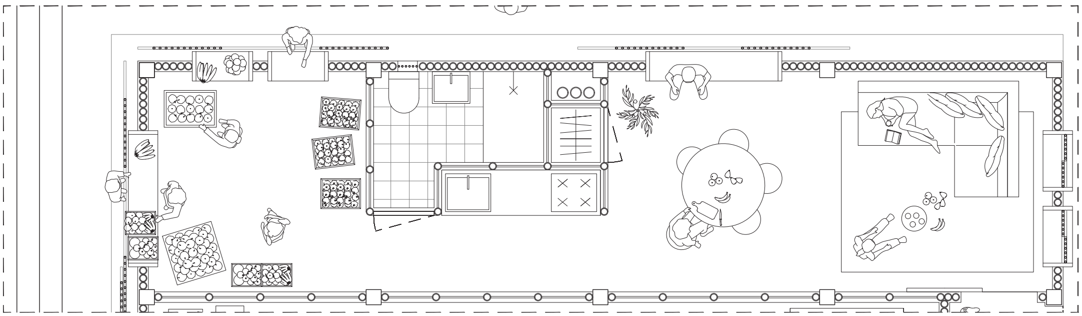
**Unit Type L - Corner Unit**

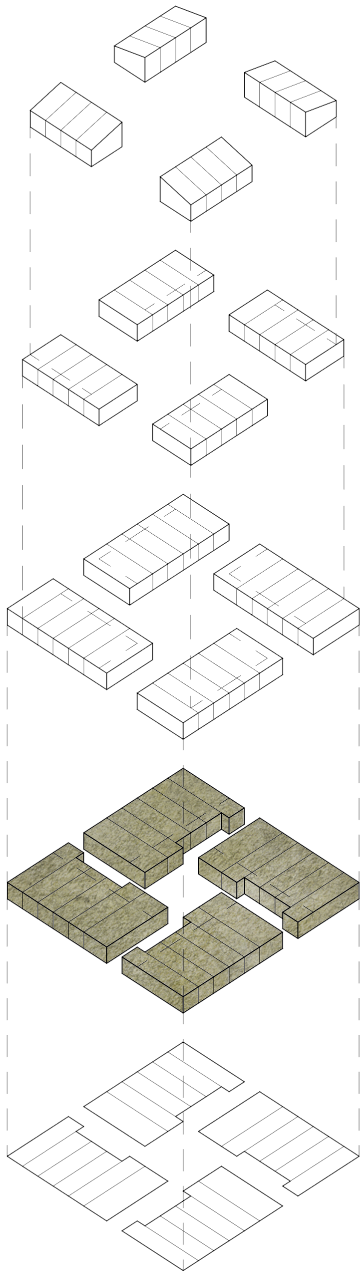
| | |
|---|---|
| size | 12 x 3 m |
| area | 36 m2 |
| $m^2$ dwelling / person | 7,2 m2 |
| dwellings / cluster | 4 |
| situation | ground floor |
| type | LIG |





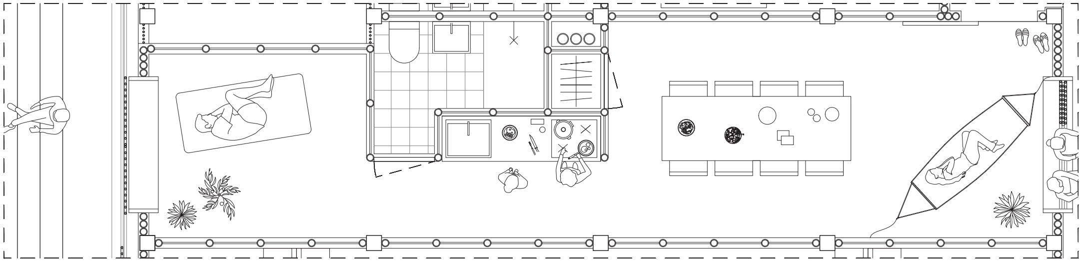


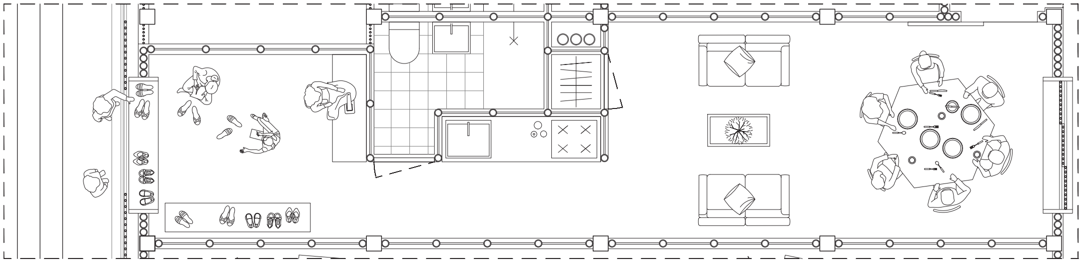


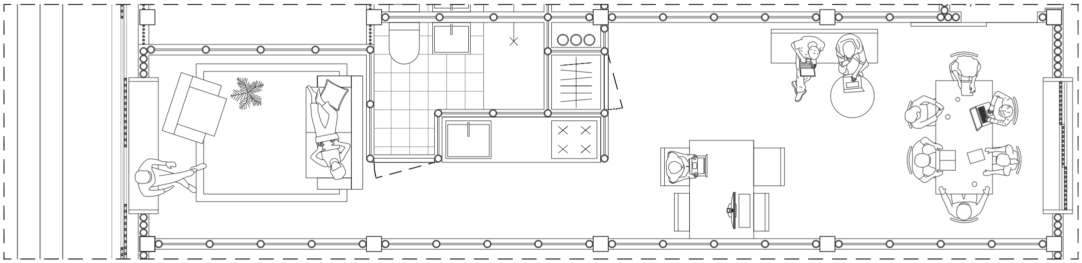


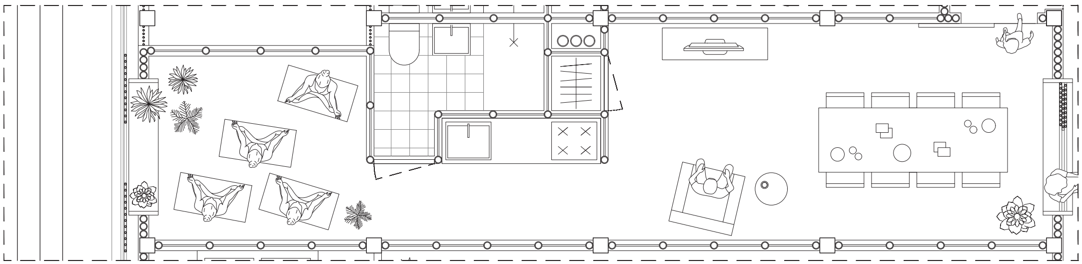
**Unit Type L**

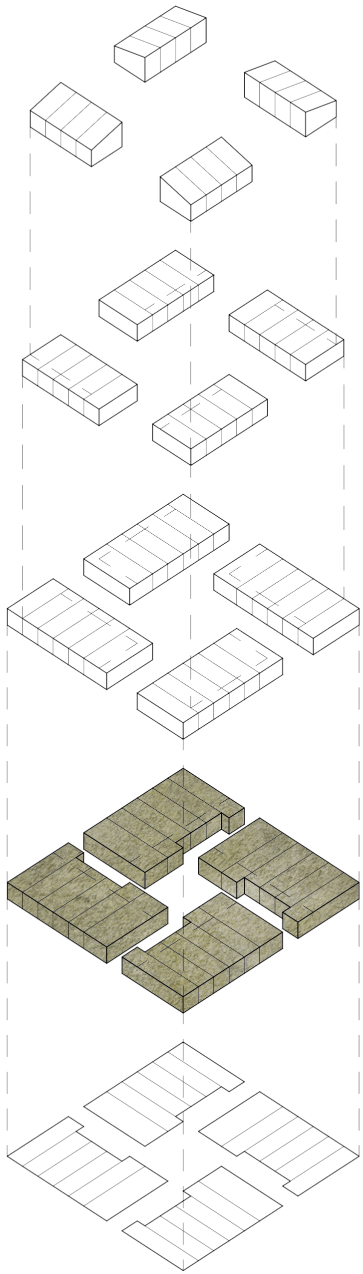
| | |
|---|---|
| size | 12 x 3 m |
| area | 36 m2 |
| $m^2$ dwelling / person | 7,2 m2 |
| dwellings / cluster | 4 |
| situation | ground floor |
| type | LIG |





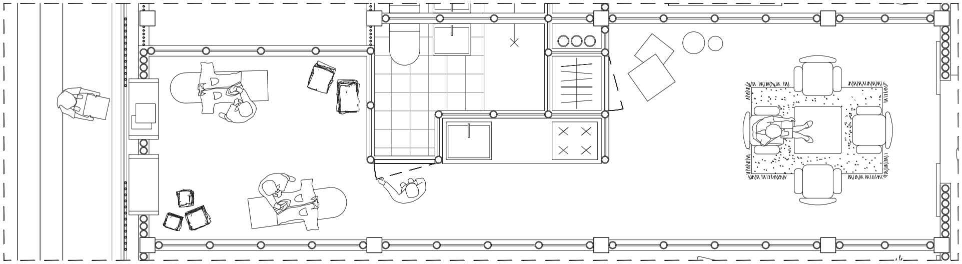


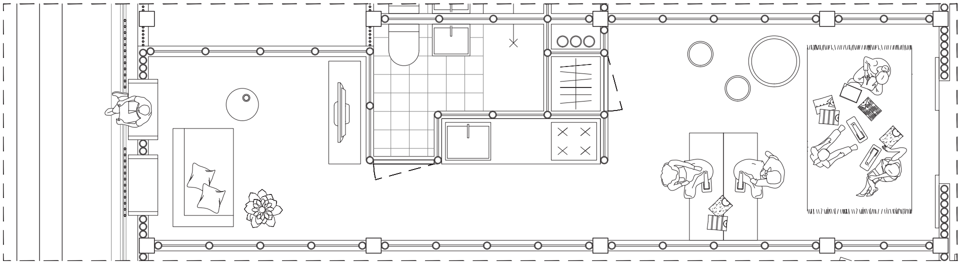


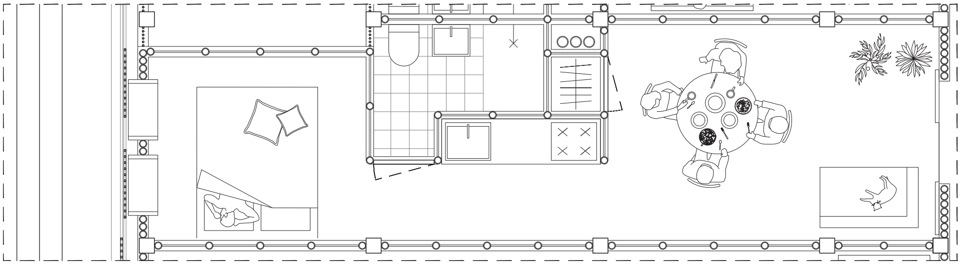


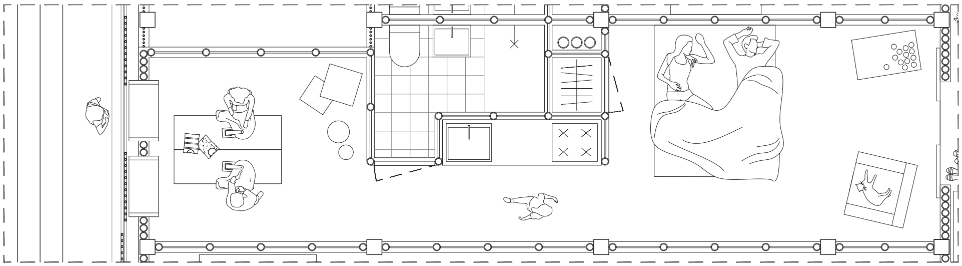
**Unit Type M**

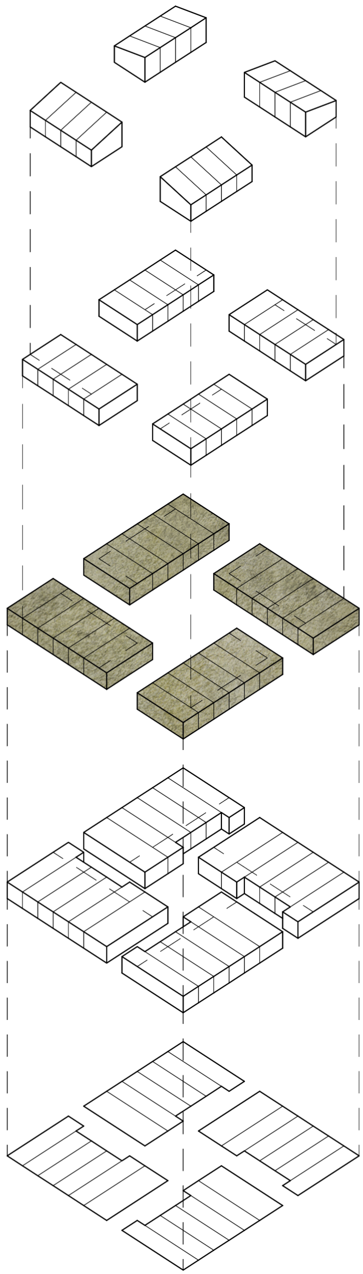
| | |
|---|---|
| size | 10,5 x 3 m |
| area | 31,5 $m^2$ |
| $m^2$ dwelling / person | 6,3 $m^2$ |
| dwellings / cluster | 12 |
| situation | ground floor |
| type | EWS |





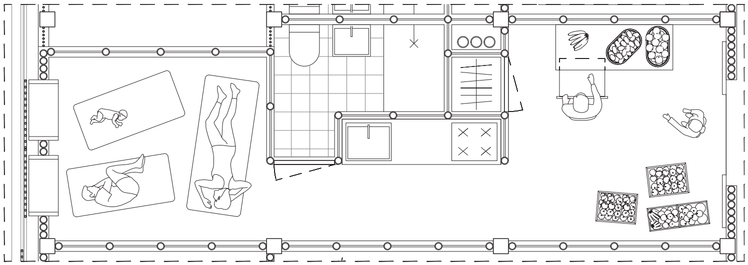


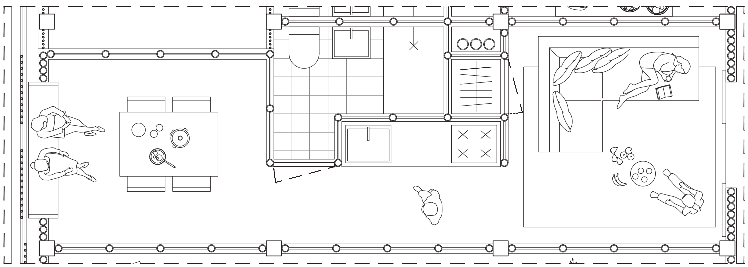


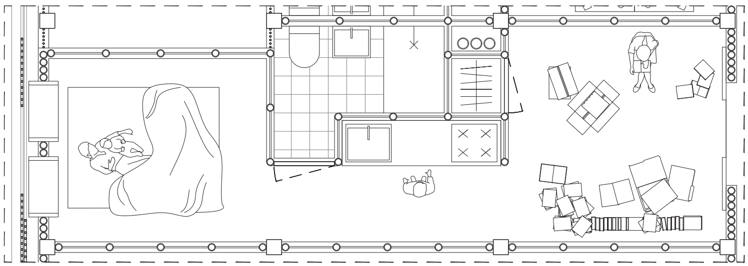


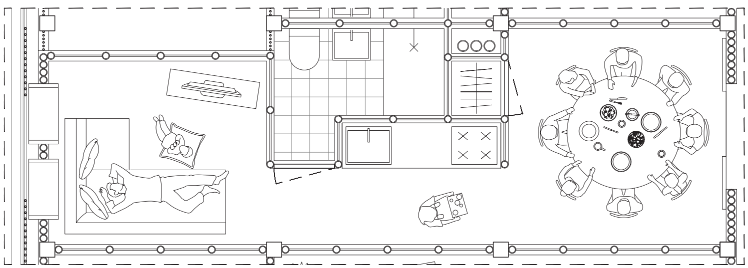
**Unit Type S**

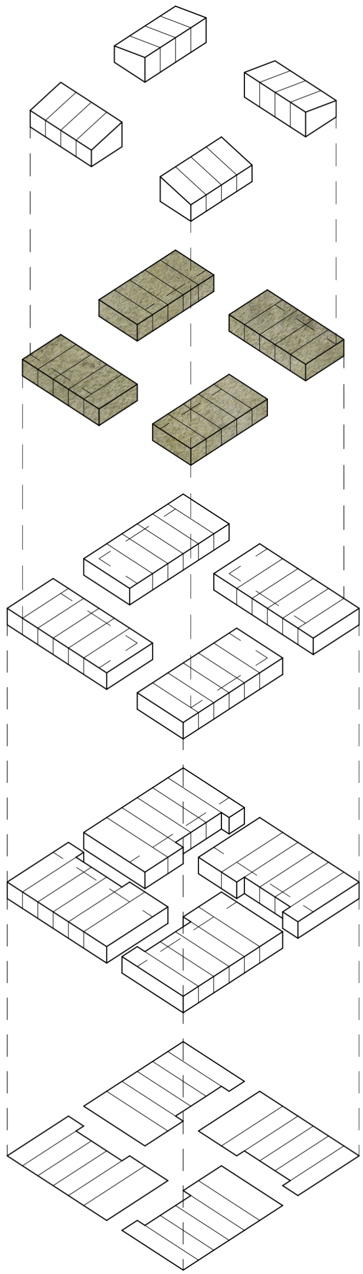
| | |
|---|---|
| size | 9 x 3 m |
| area | 27 m2 |
| $m^2$ dwelling / person | 5,4 m2 |
| dwellings / cluster | 20 |
| situation | first floor |
| type | EWS |





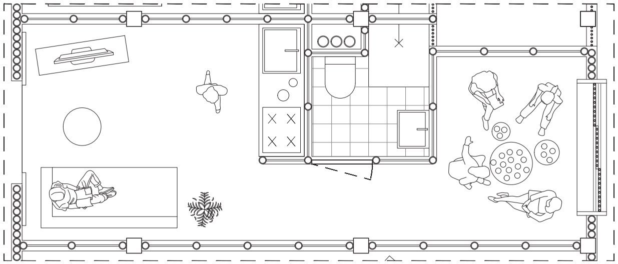


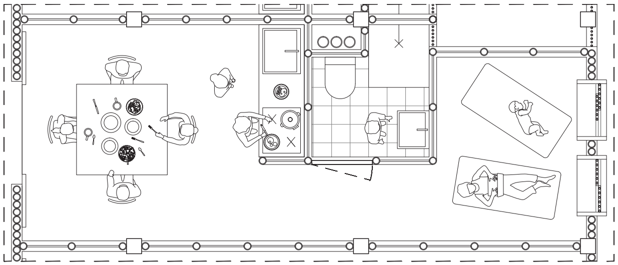


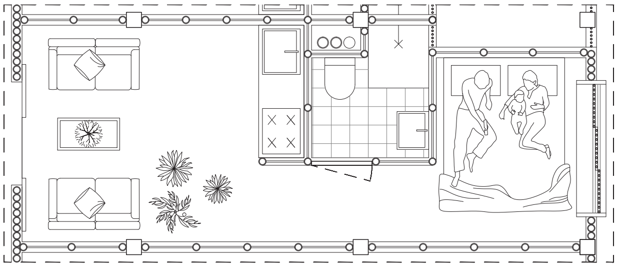


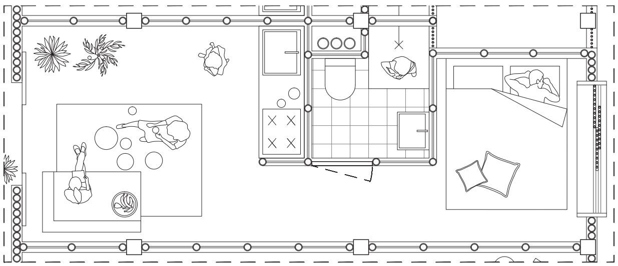
**Unit Type XS**

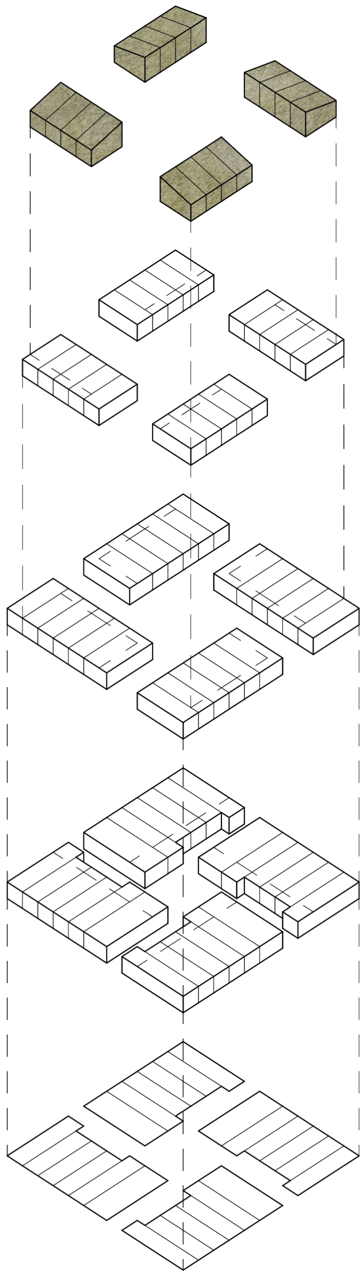
| | |
|---|---|
| size | 7,5 x 3 m |
| area | 22,5 m2 |
| $m^2$ dwelling / person | 4,5 m2 |
| dwellings / cluster | 20 |
| situation | second floor |
| type | EWS |





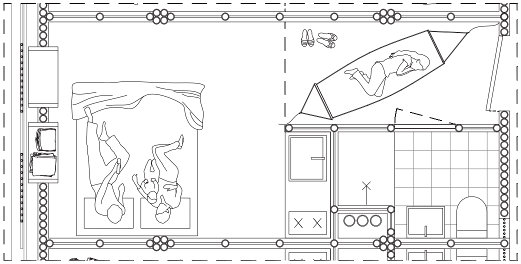
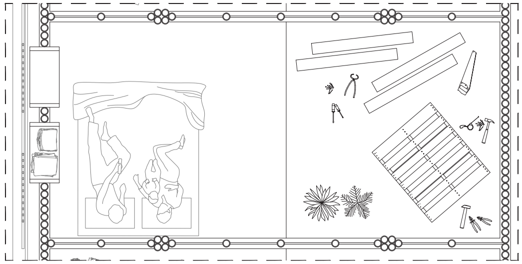
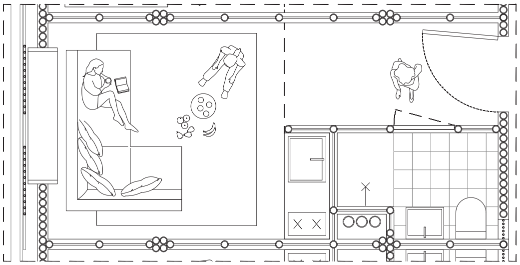
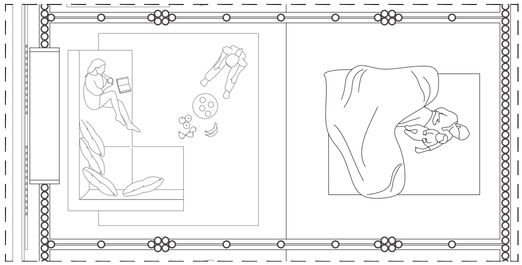
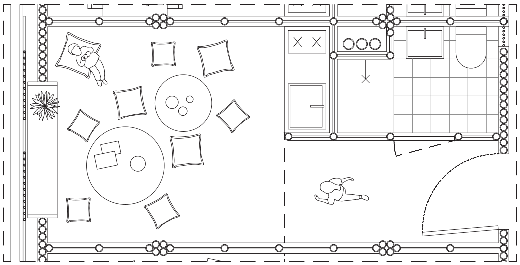
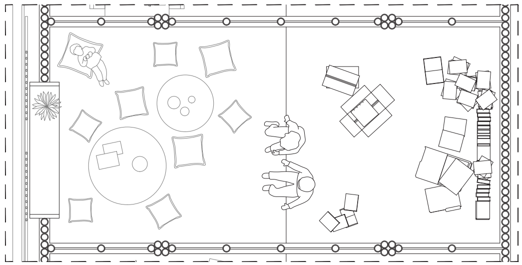
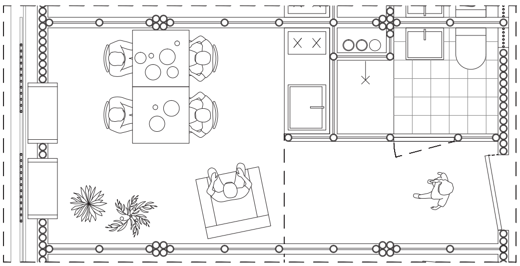
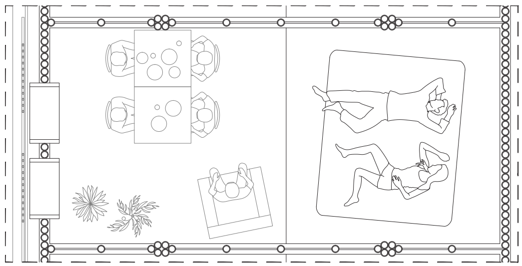




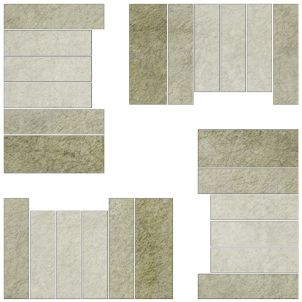


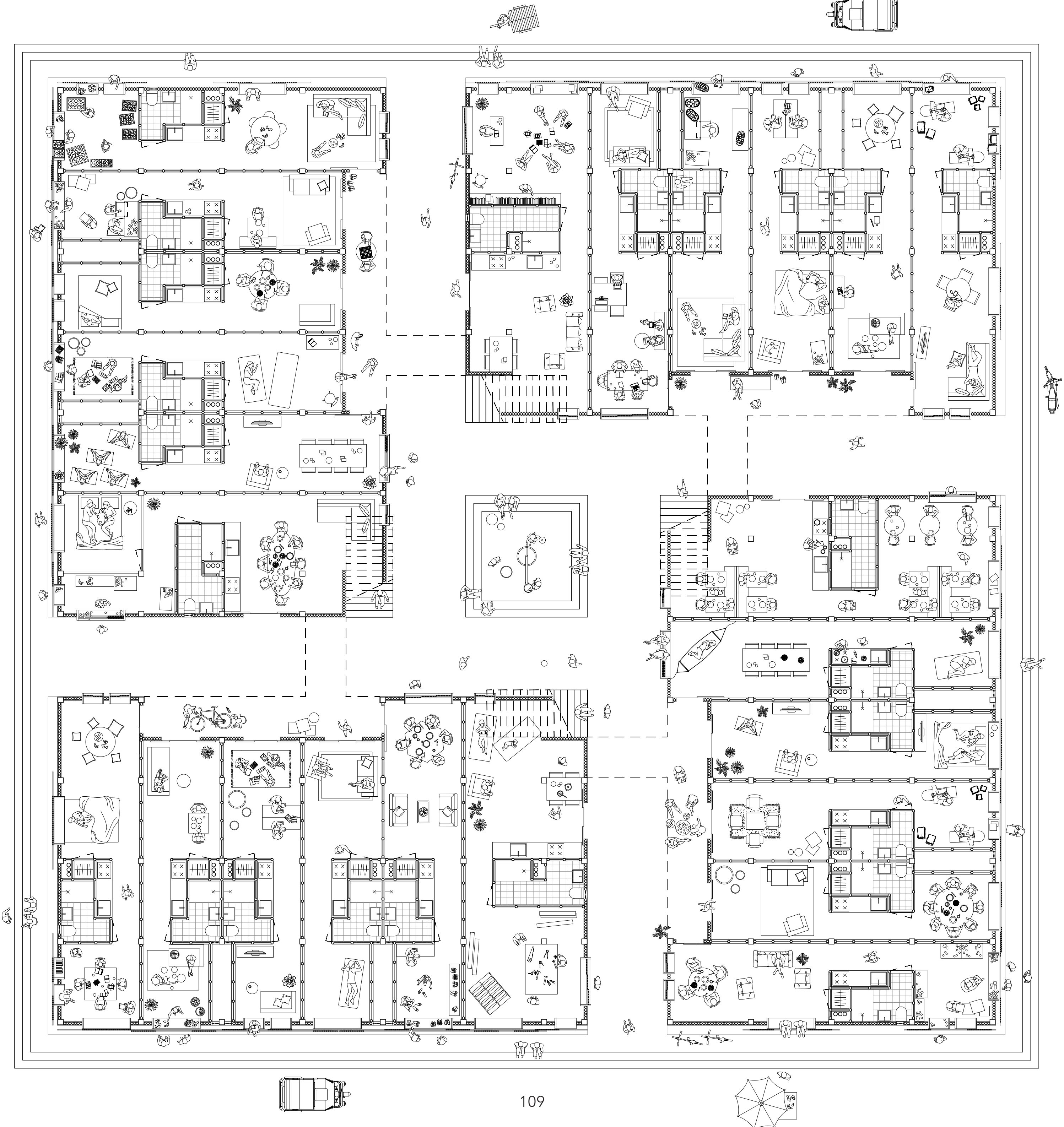
**Unit Type XXS**

| | |
|---|---|
| size | 6 x 3 m + 3 x 3 m |
| area | 27 m2 |
| $m^2$ dwelling / person | 5,4 m2 |
| dwellings / cluster | 16 |
| situation | third / fourth floor |
| type | EWS |

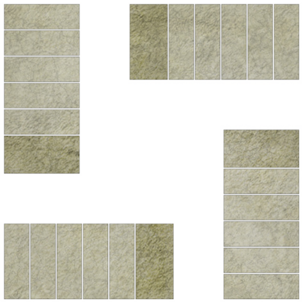









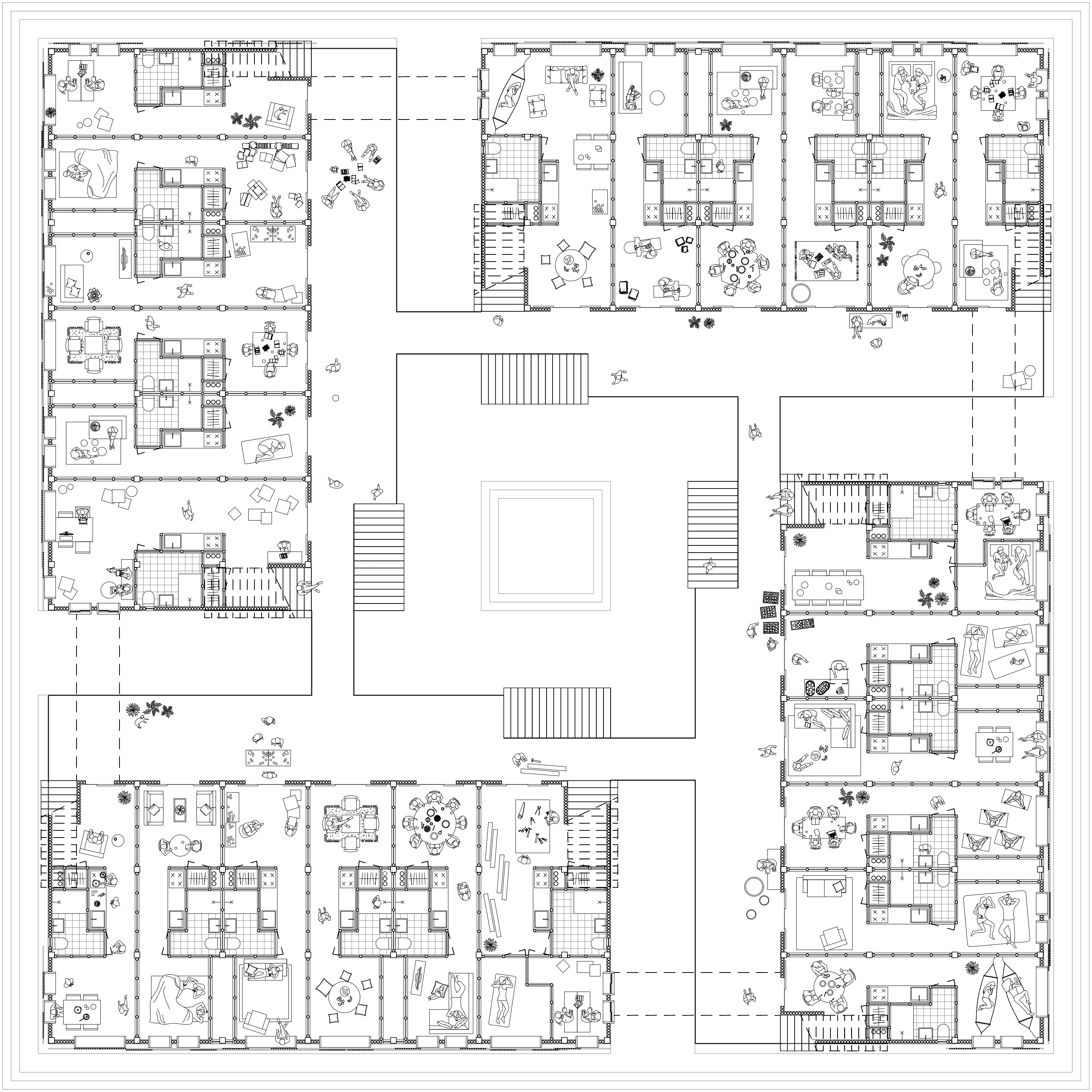
# architectural design
ground floor | 1 : 200



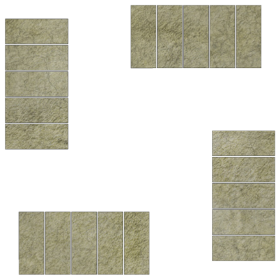


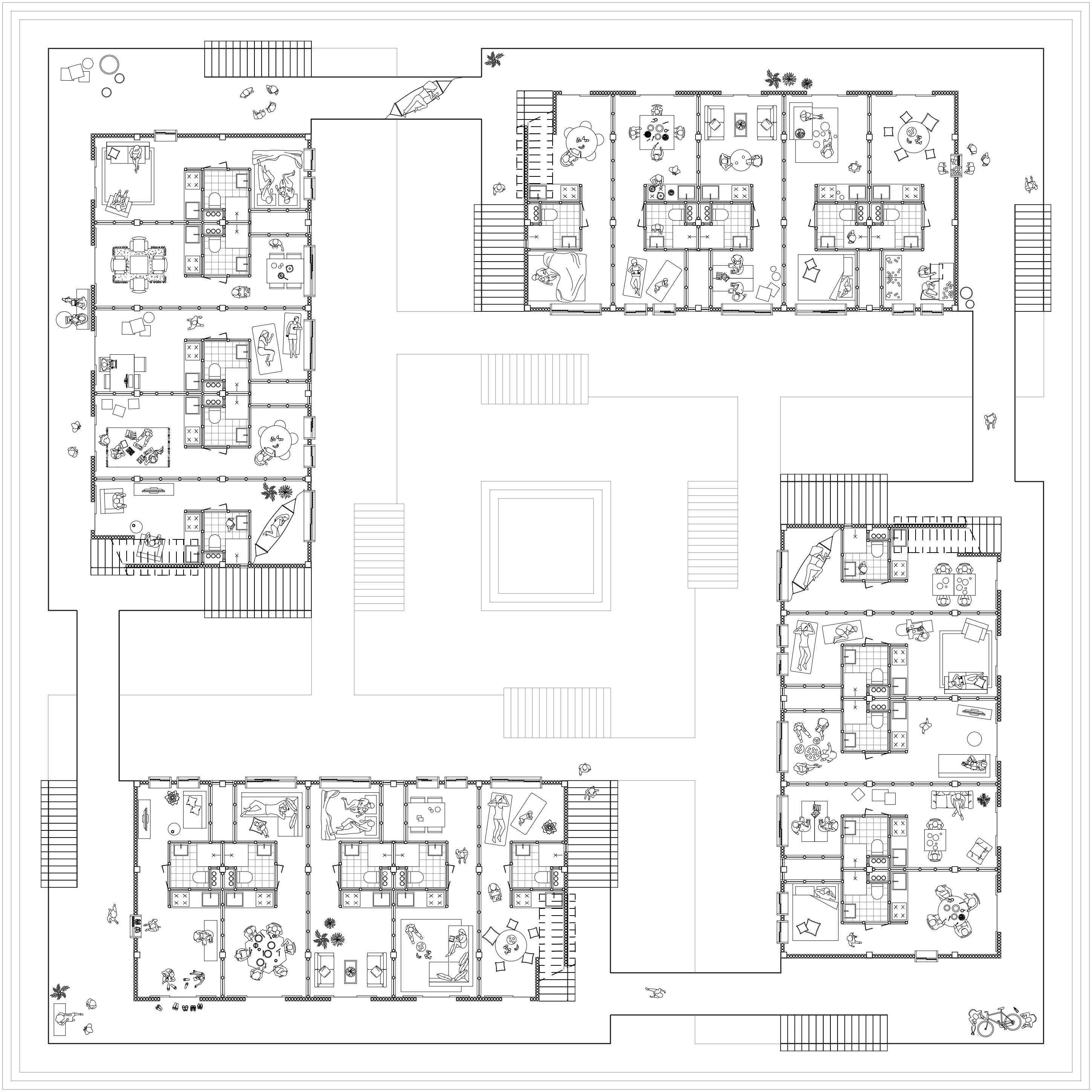
# architectural design
first floor | 1 : 200



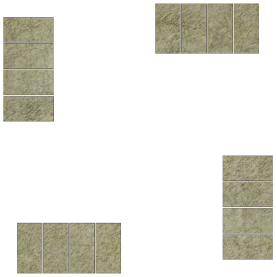


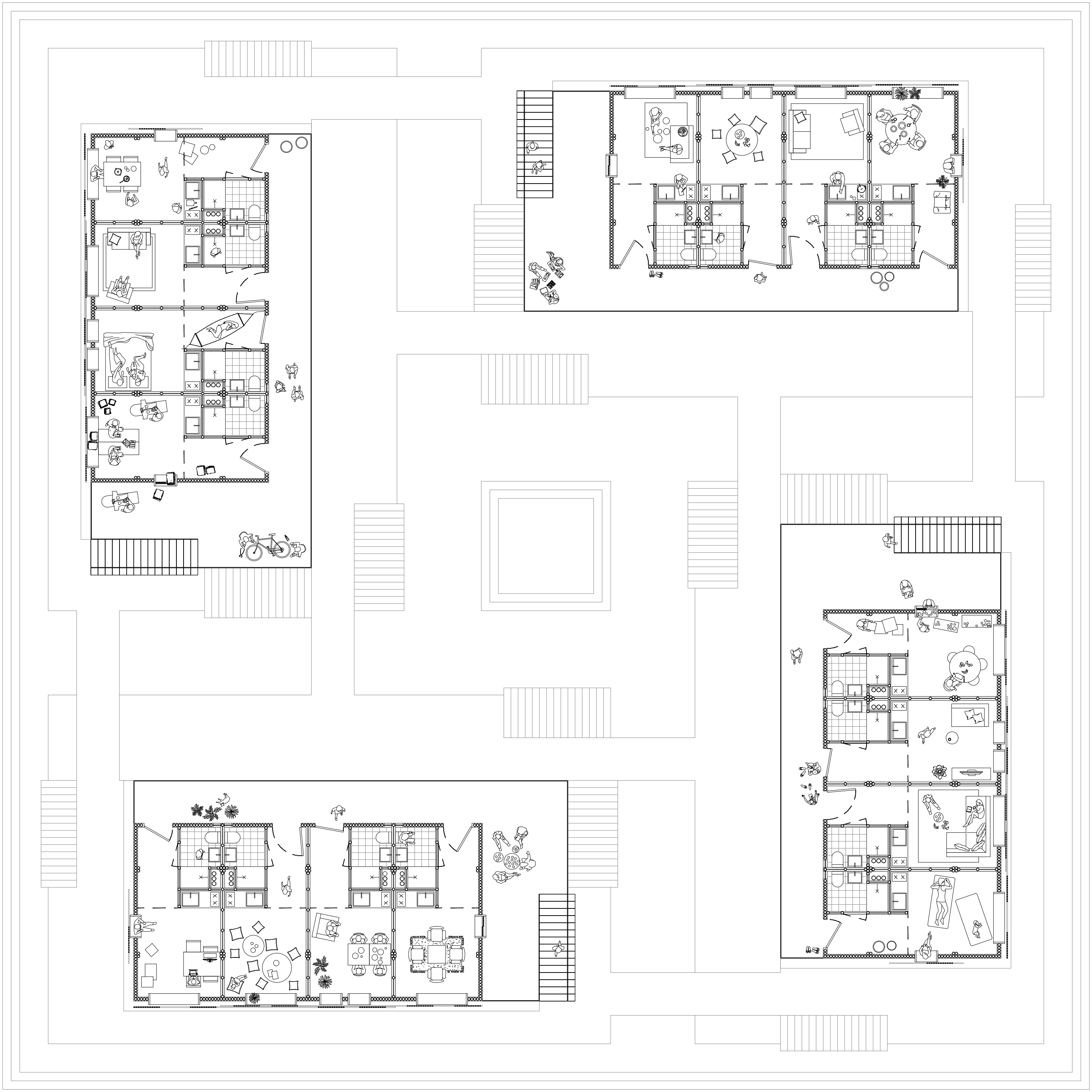
## architectural design
third floor | 1 : 200





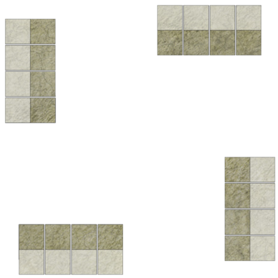
## architectural design
fourth floor | 1 : 200





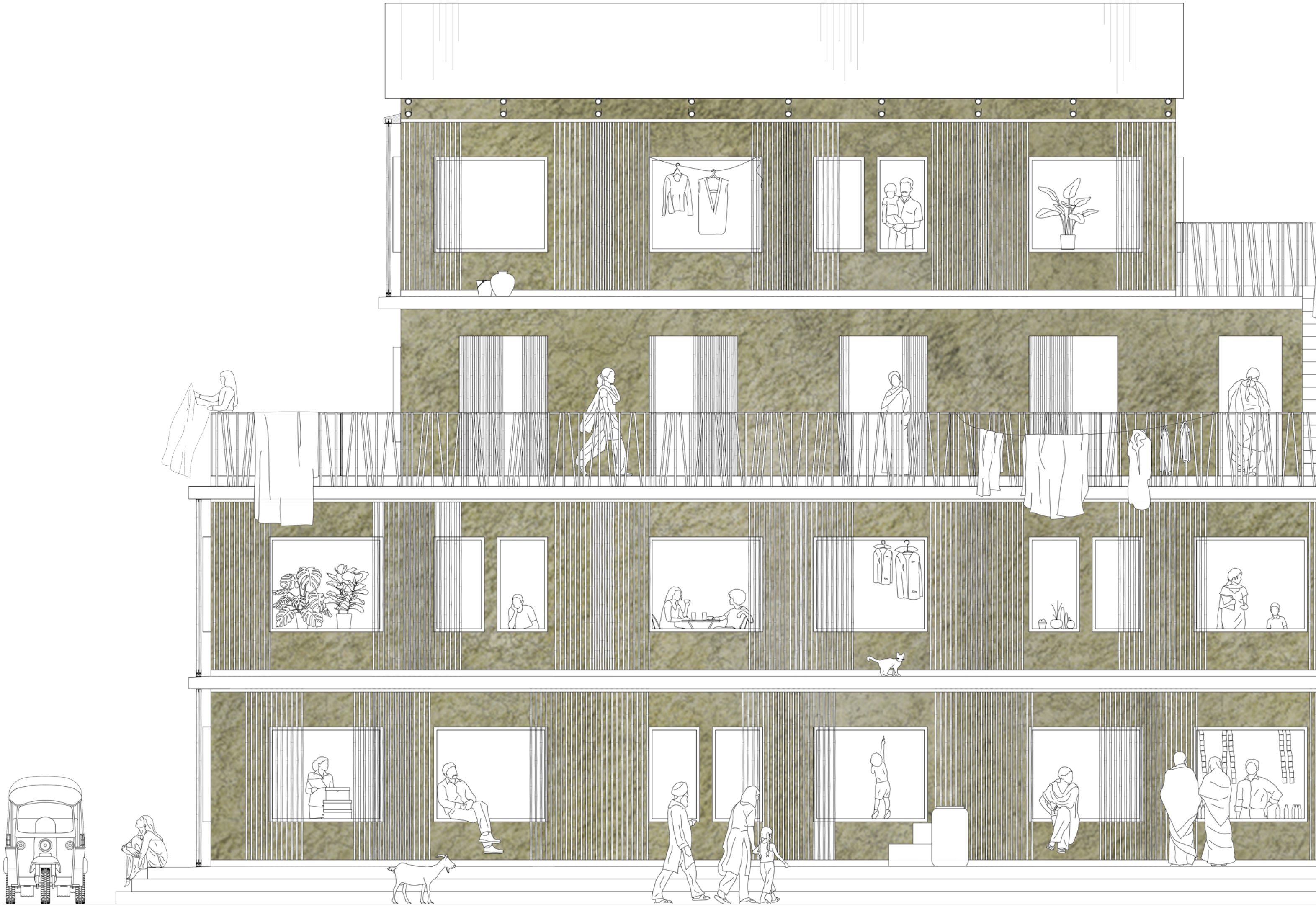
# architectural design

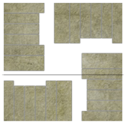
## fourth floor loft | 1 : 200



## architectural design

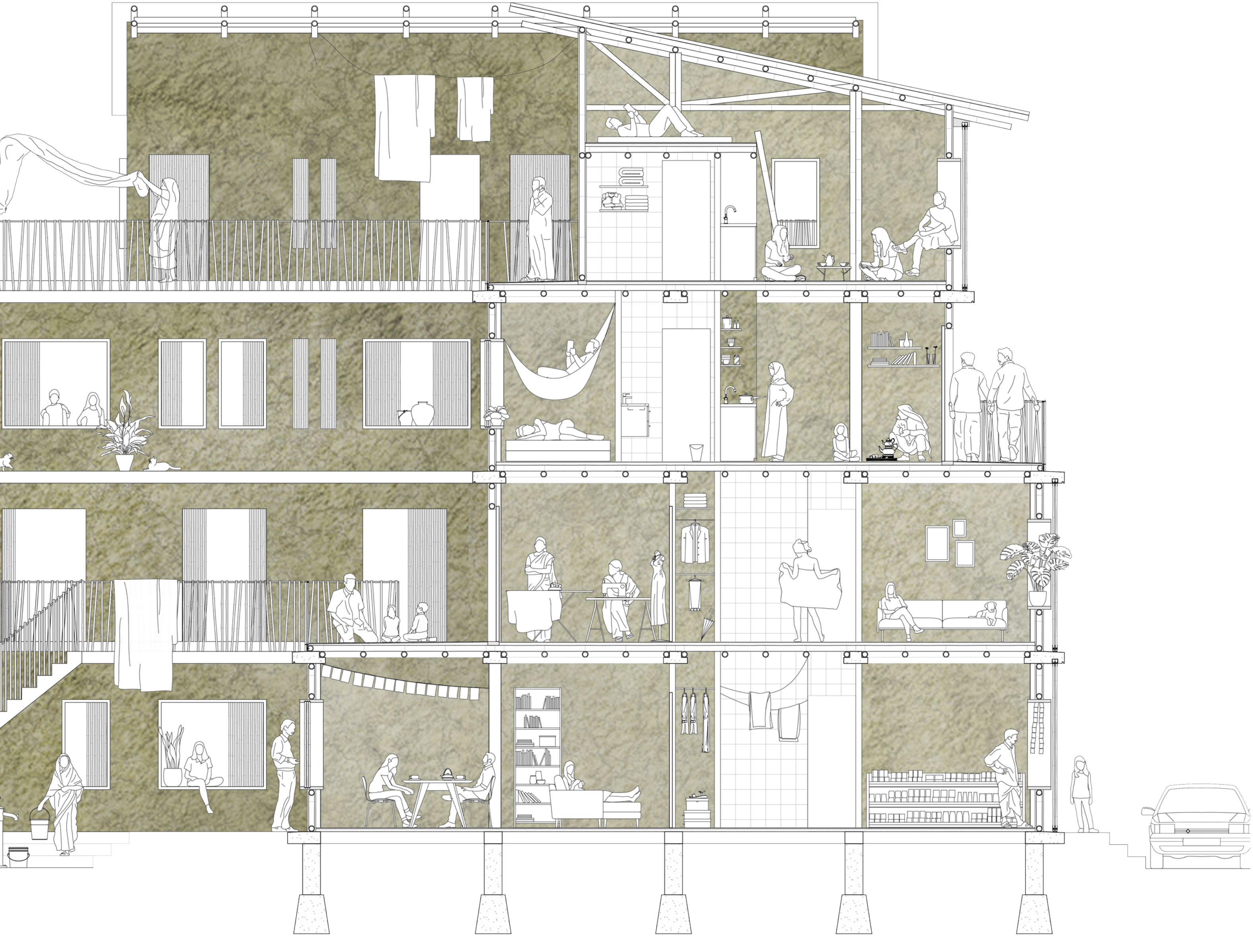
facade | 1 : 100

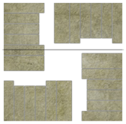




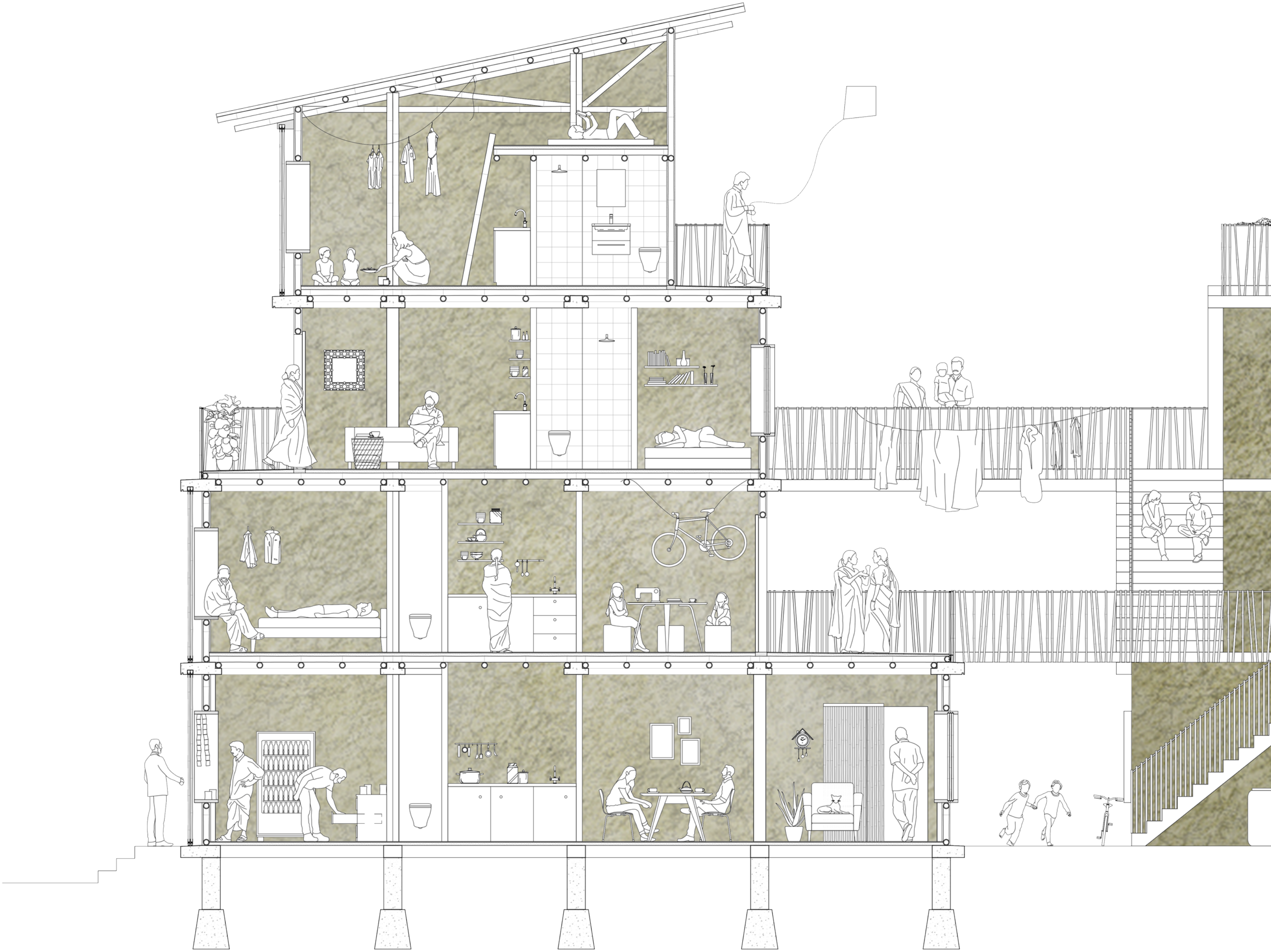
# architectural design

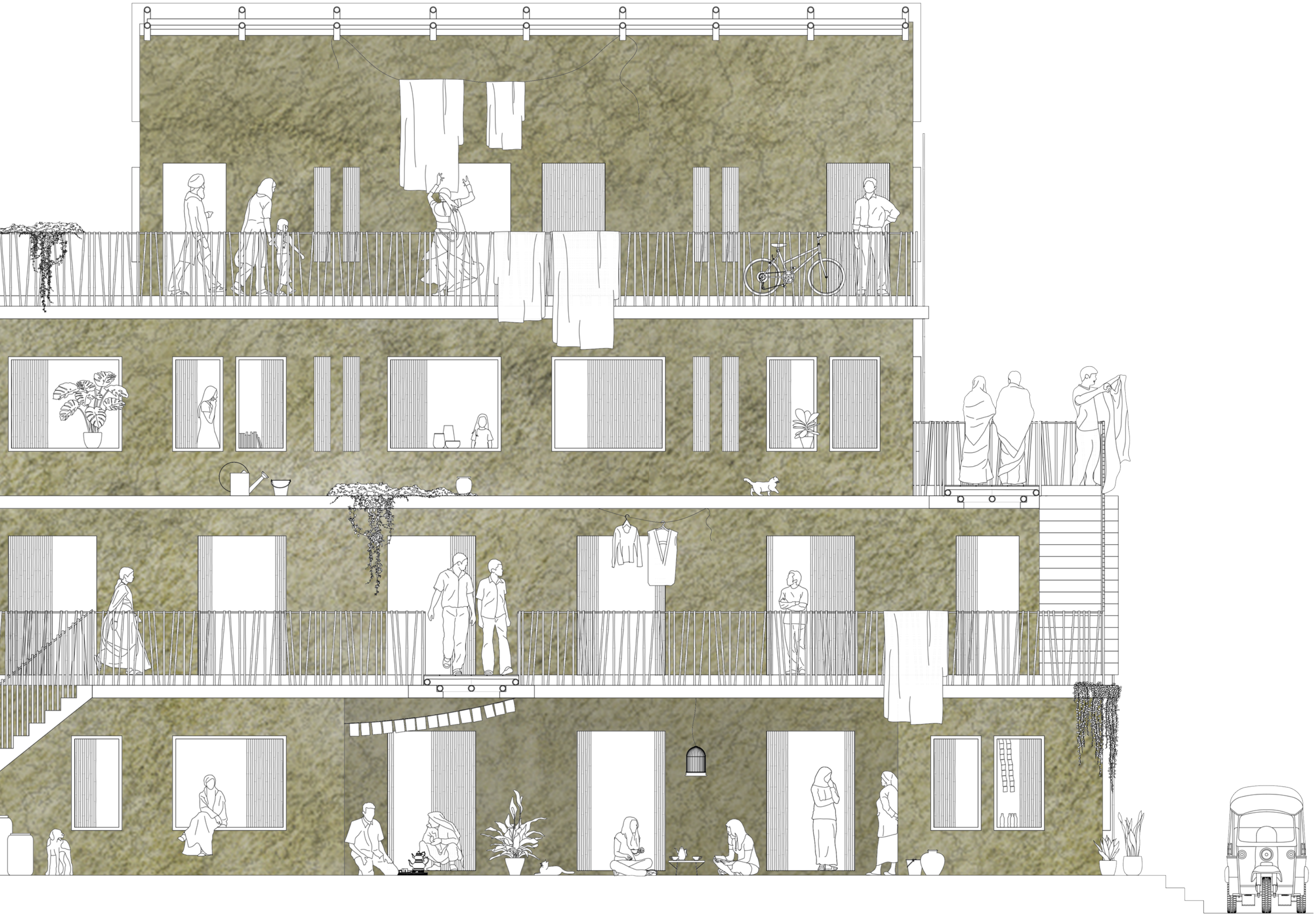
## section a | 1 : 100





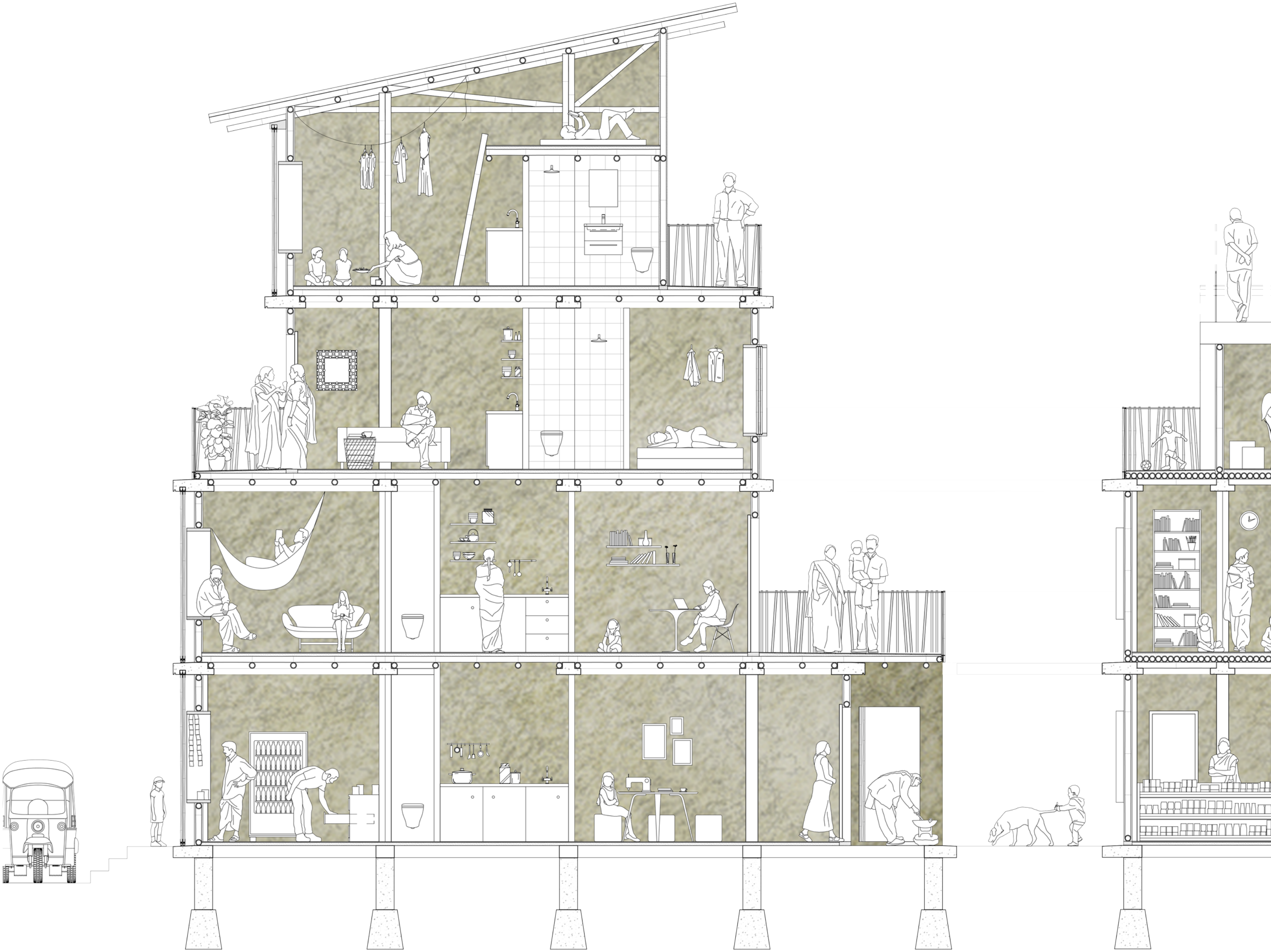
## section b | 1 : 100

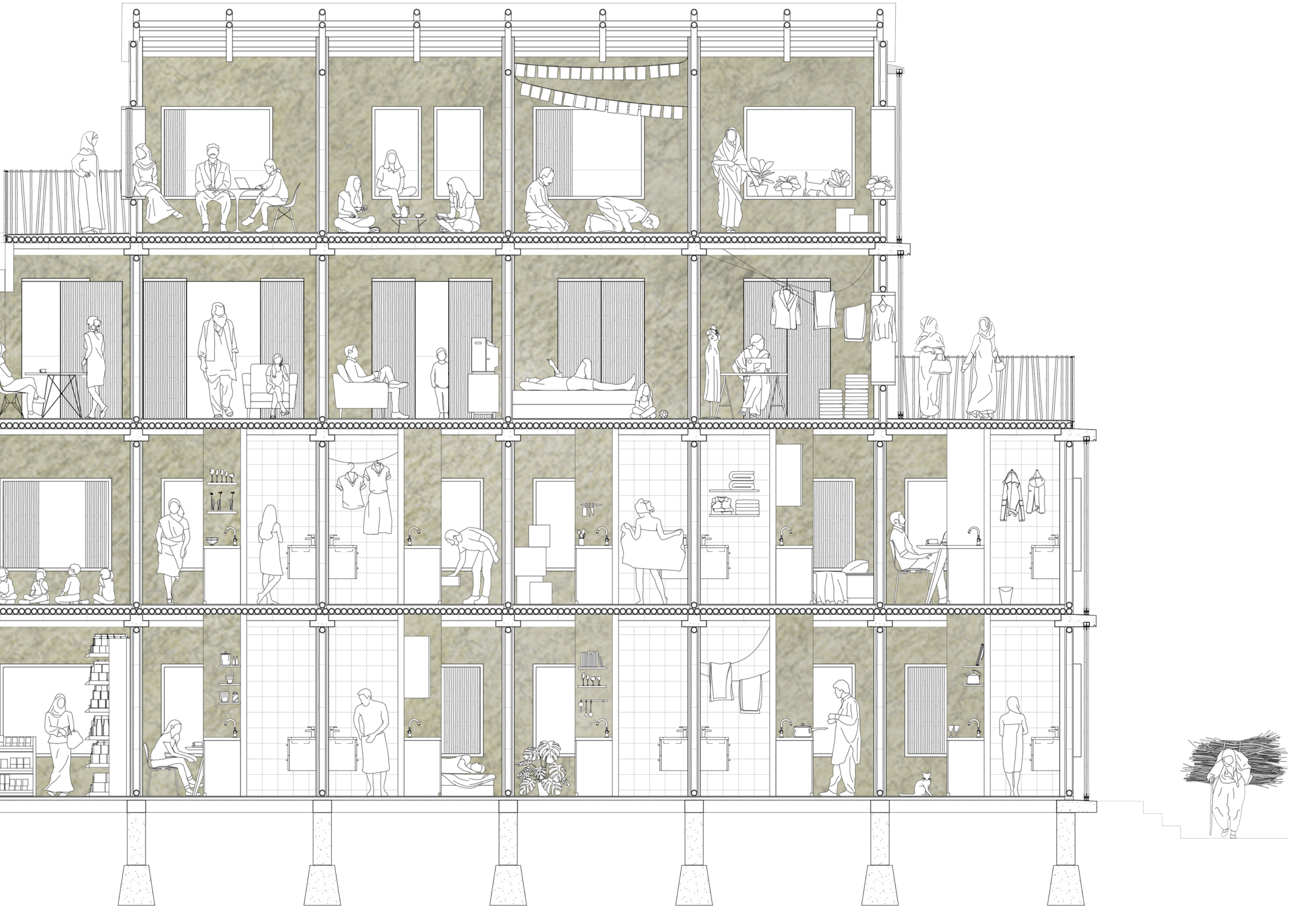




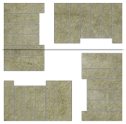
# architectural design

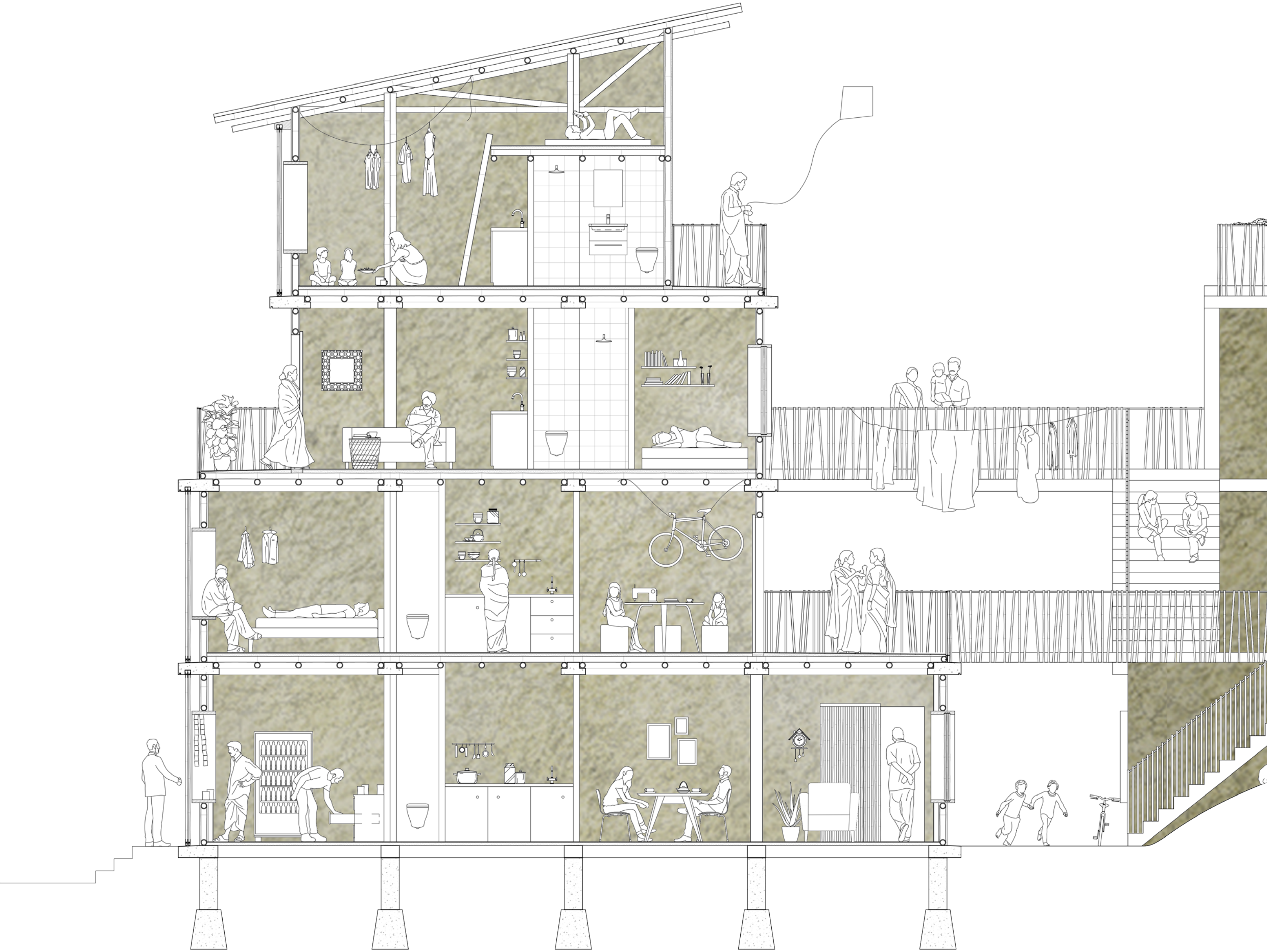
section c | 1 : 100





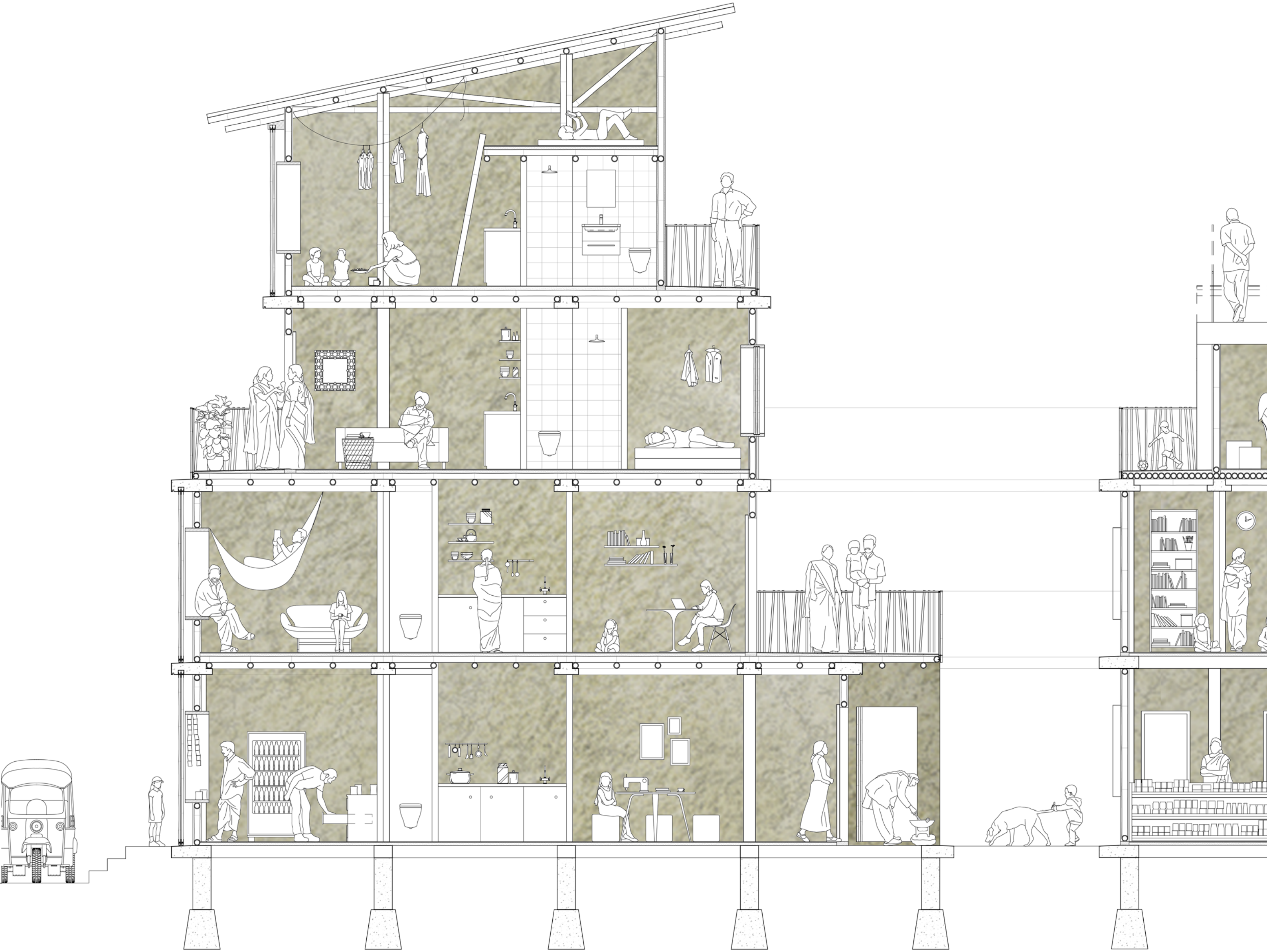
## architectural design
section d | 1 : 100

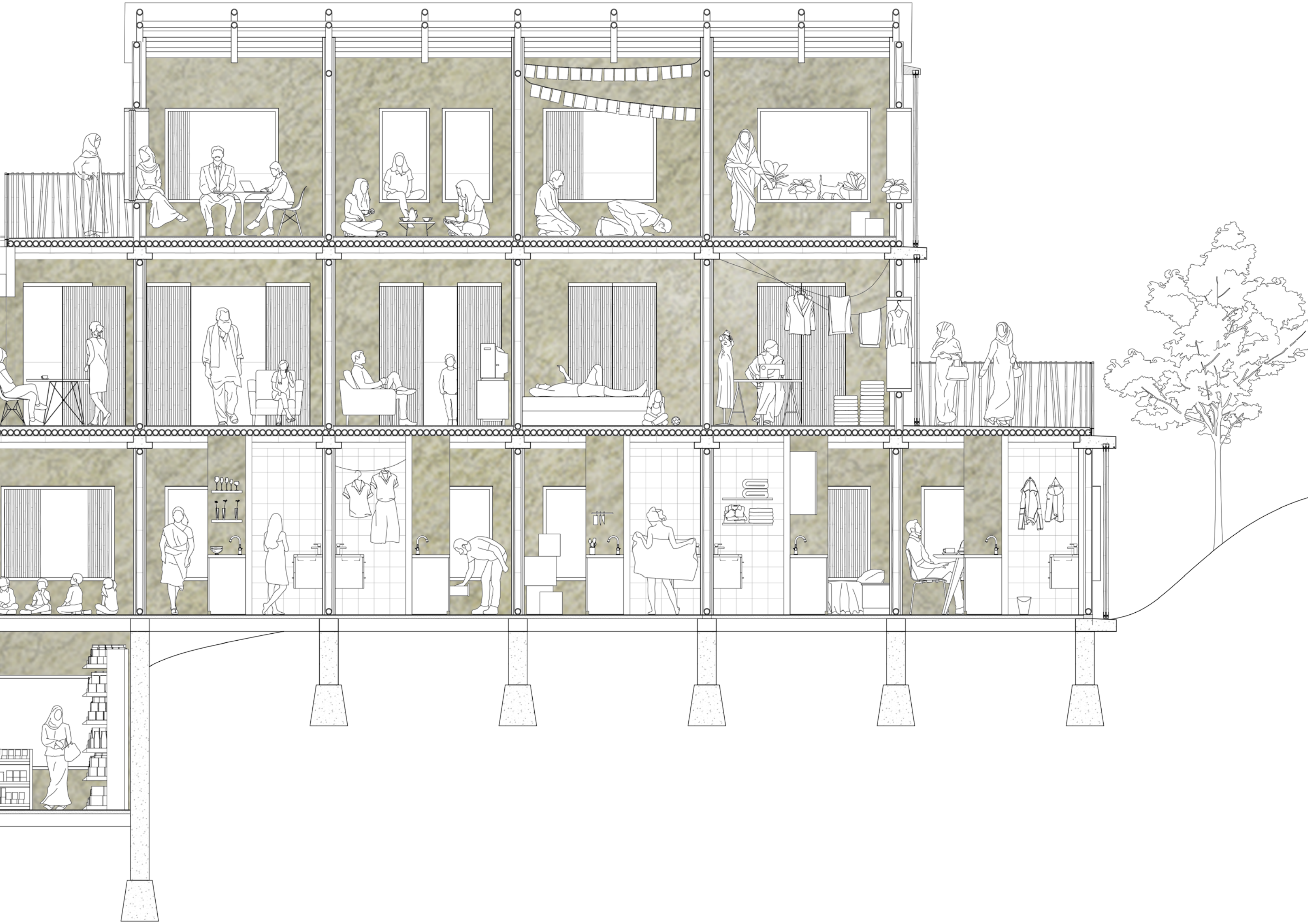




## architectural design

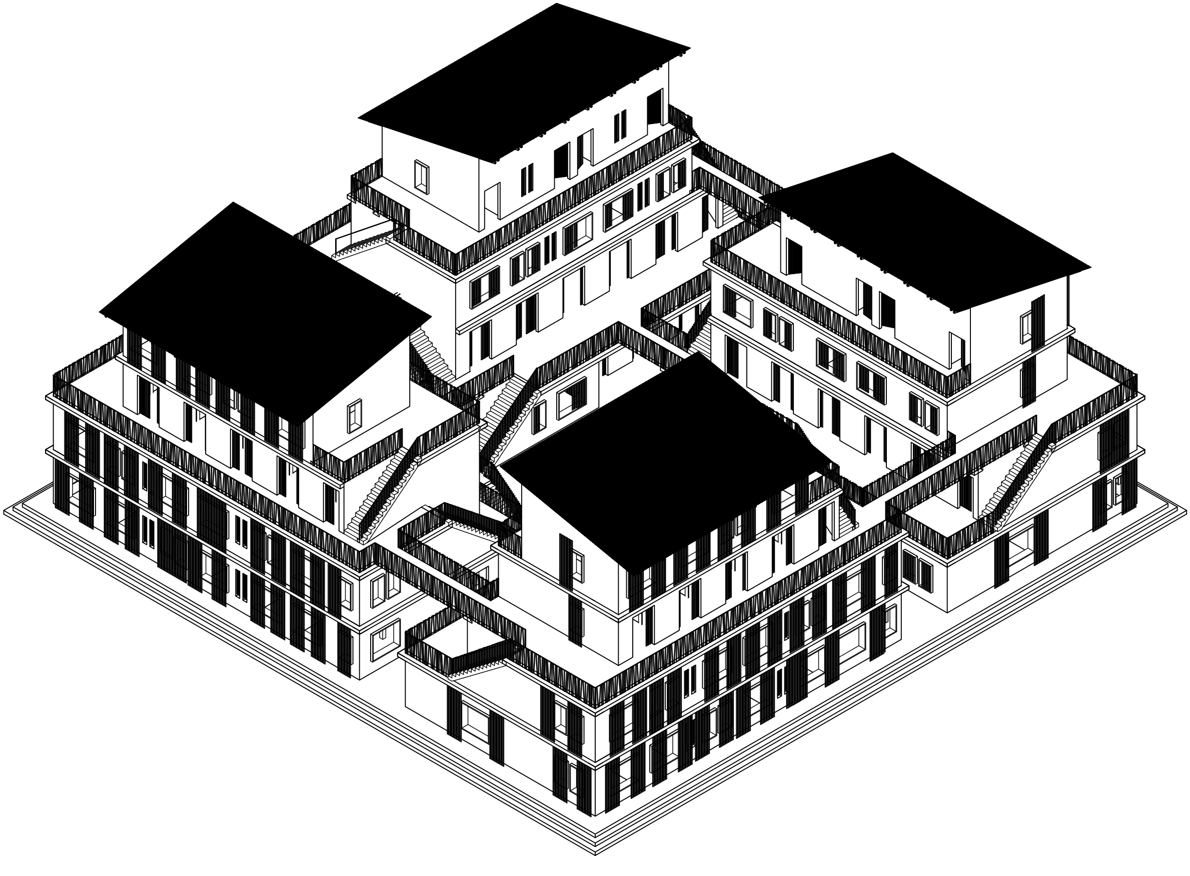
section e | 1 : 100

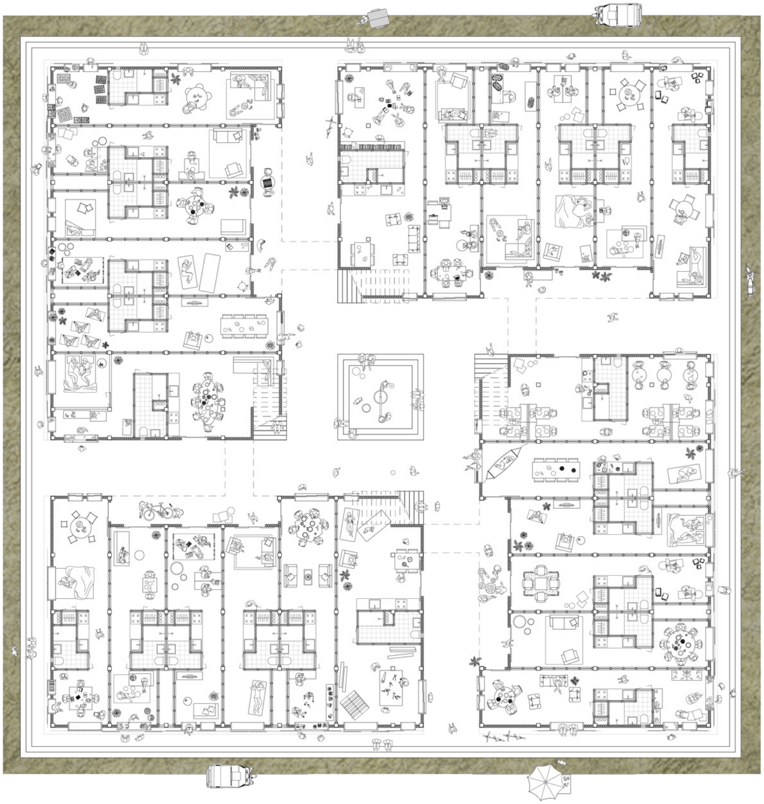




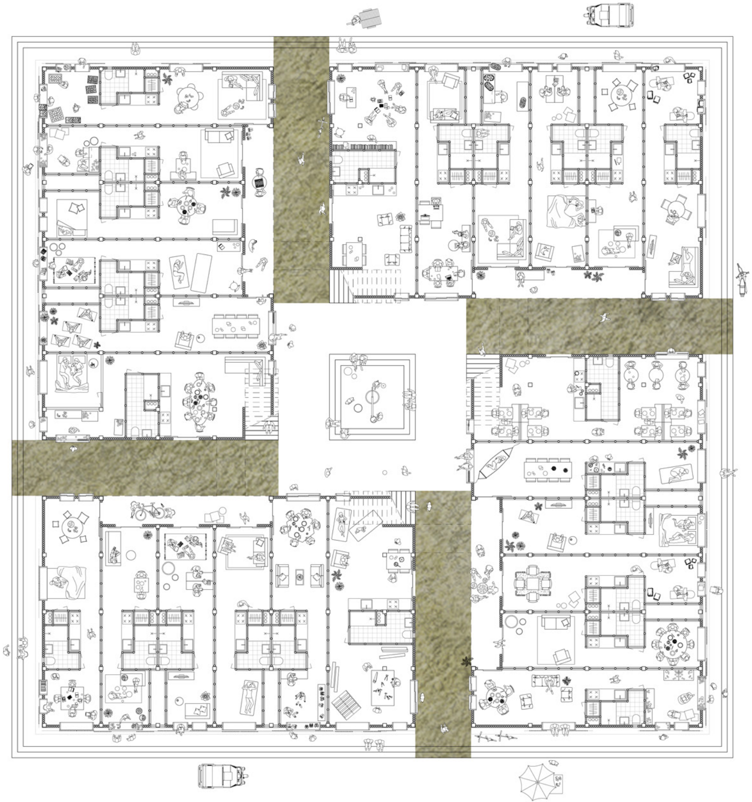
# architectural design
## quantative information

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| plot size | 34,5 x 34,5 m = 1190,25 m² | | | | | | |
| built footprint | 882 m² | | | | | | |
| total floor area | 2466 m² | | | | | | |
| open space | 940,25 m² | | | | | | |
| size of dwellings | 54 | 40,5 | 36 | 31,5 | 27 | 22,5 | 27 |
| number of dwellings | 4 | 4 | 8 | 12 | 20 | 20 | 12 |
| dwellings / cluster | 84 | | | | | | |
| average family size | 5 | | | | | | |
| persons / cluster | 420 | | | | | | |
| m² dwelling / person | 5,9 m² | | | | | | |
| m² open space / person | 2,3 m² | | | | | | |
| m² open space / dwelling | 11,2 m² | | | | | | |
| FSI cluster | 2,1 | | | | | | |
| OSR cluster | 2,6 | | | | | | |

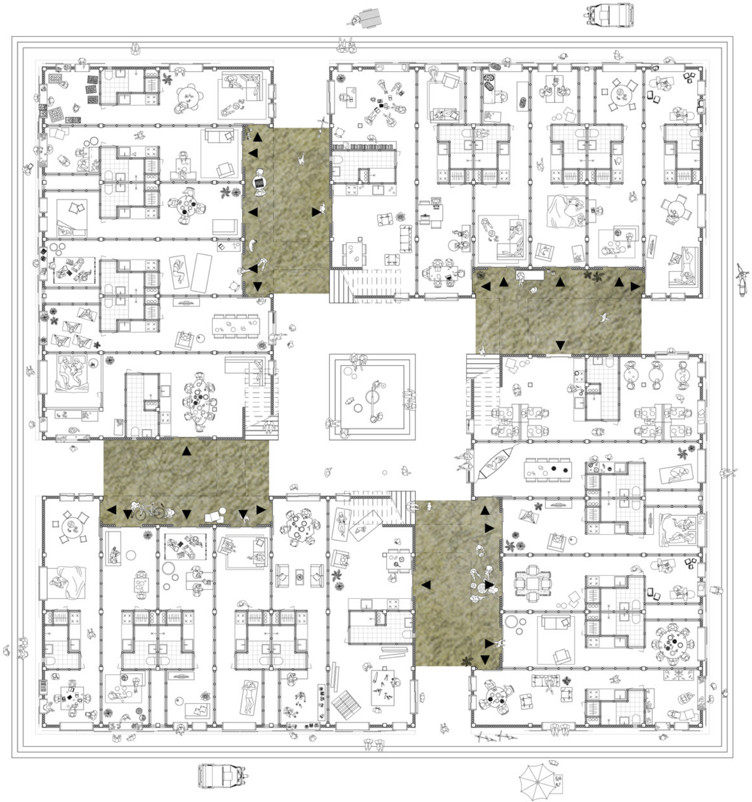




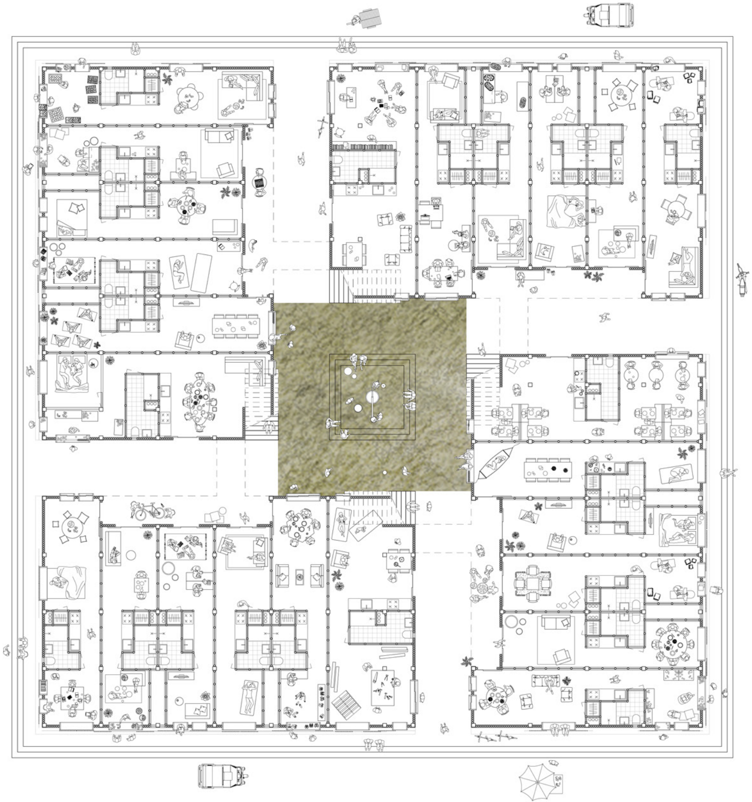
## impression | entering the cluster

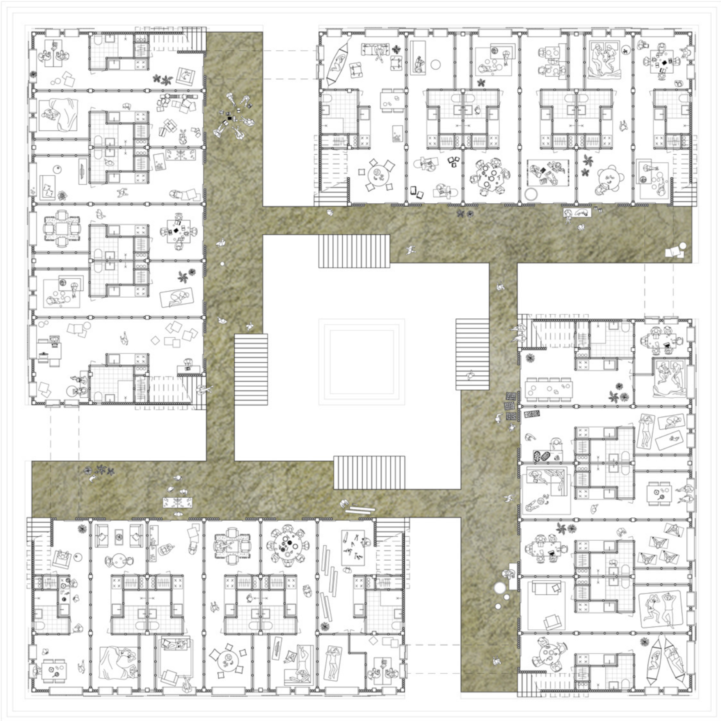


impression | entrance square



impression | cluster courtyard






India

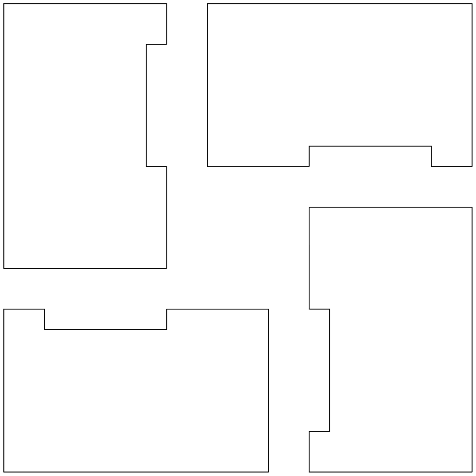
## architectural design
impression | window frame

# URBAN DESIGN

# urban design
## concept

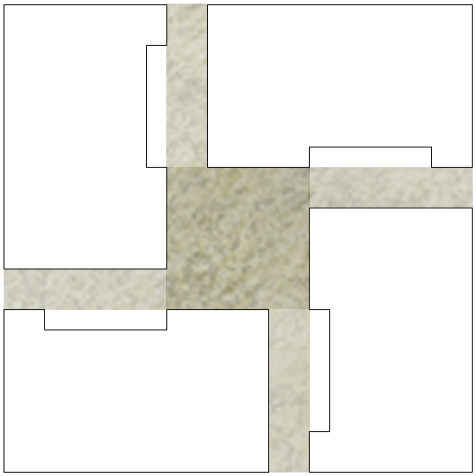
### 1. The basic module - cluster

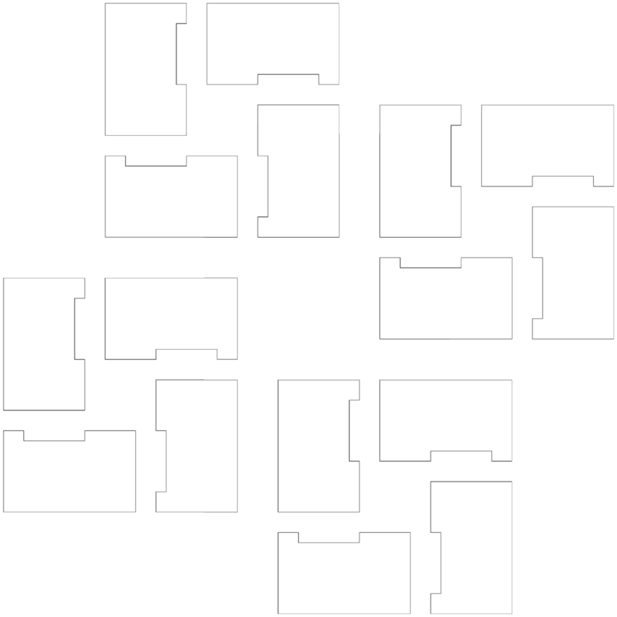
The basic module of the urban design is the cluster of four building blocks, interconnected by walkways.



### 2. The cluster - open spaces

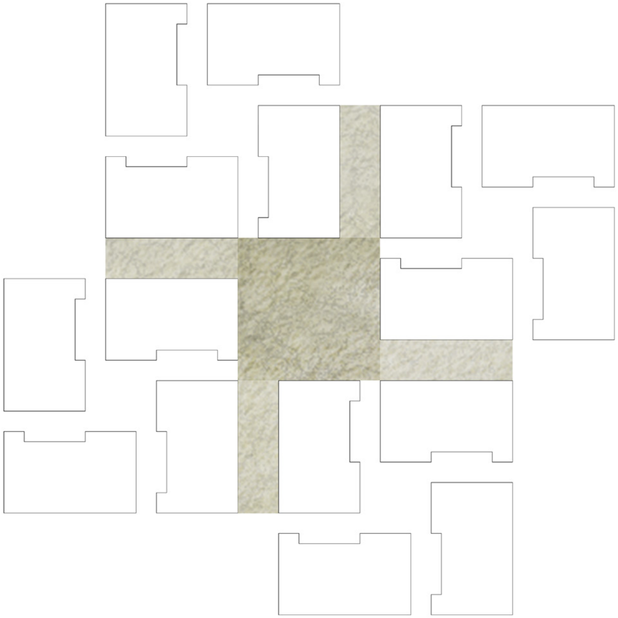
The cluster has alleys of 3 meters wide, and a shared courtyard of 10,5 x 10,5 meters.





### 3. The community

The clusters can be applied repeatedly, together forming a community.



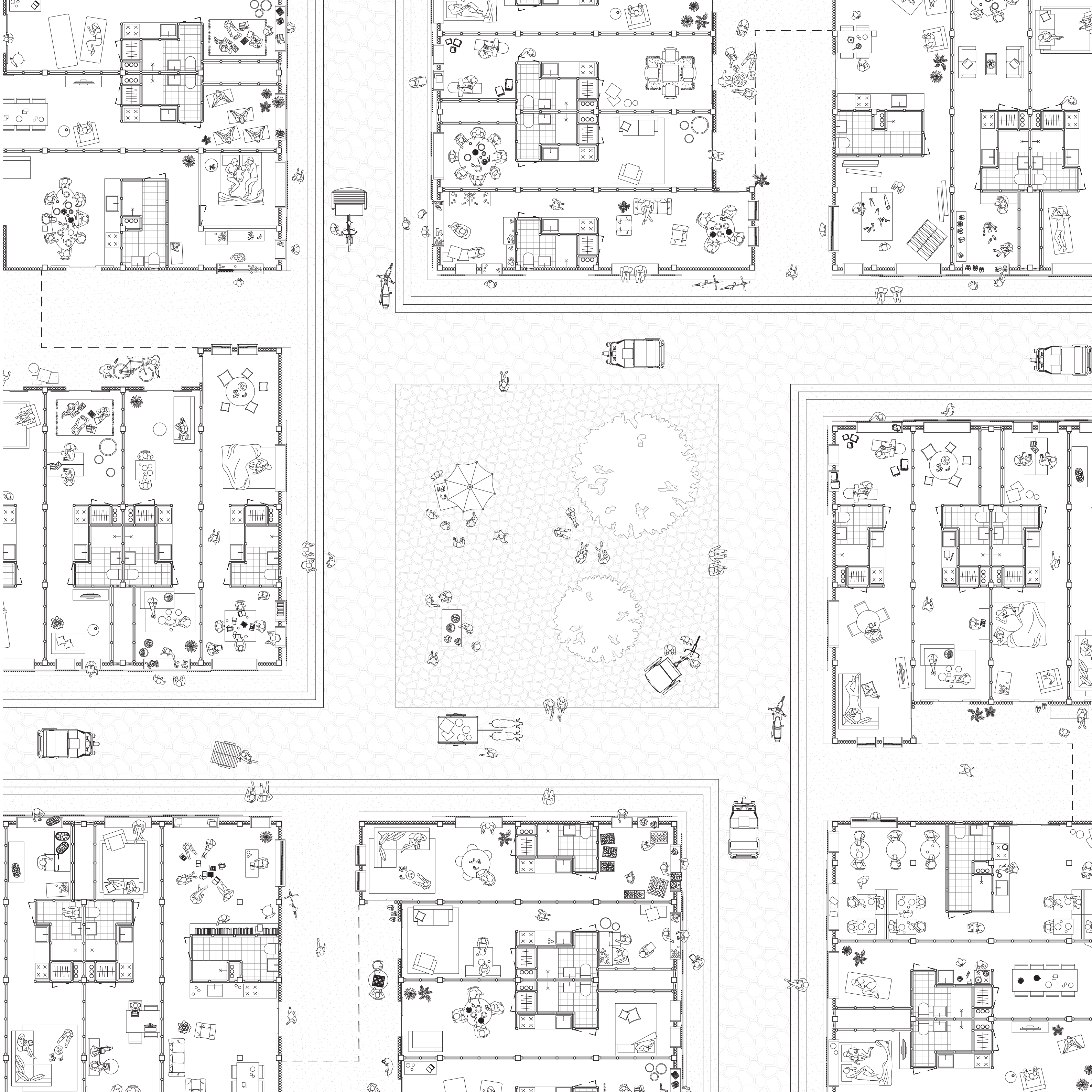
### 3. The community - open spaces

The community lanes in between the clusters are 6 meters wide. In this scheme, a community square appears. It has a size of 21 x 21 meters, twice as big as the cluster courtyard.

# urban design
## community square

The community square appears in the center of four combined clusters. It has a size of 21 x 21 meters, twice as big as the more private cluster courtyard.

This square functions as a more public space, used by the inhabitants of at least four clusters of dwelling units. Here you can find for example food- and marketstalls.



## urban design
chosen location

The chosen design location is situated in Nala Sopara, in the northern outskirts of Mumbai's Metropolitan Area. In the east of Nala Sopara, on the foot of the hill, a large concentration of baithi chawls can be found.

## urban design
current situation | 1 : 2000

| | + | - | +/- |
|---|---|---|---|
| phase 0 | 0 | 0 | 0 |
| phase 1 | + 336 | - 0 | 336 |

## urban design
phase 1 | 1 : 2000

| | + | - | +/- |
|---|---|---|---|
| phase 0 | 0 | 0 | 0 |
| phase 1 | + 336 | - 0 | 336 |

## urban design
phase 2.1 | 1 : 2000

| | + | - | +/- |
|---|---|---|---|
| phase 0 | 0 | 0 | 0 |
| phase 1 | + 336 | - 0 | 336 |
| phase 2.1 | + 0 | - 54 | 282 |

# urban design
## phase 2.2 | 1 : 2000

| | + | - | +/- |
|---|---|---|---|
| phase 0 | 0 | 0 | 0 |
| phase 1 | + 336 | - 0 | 336 |
| phase 2.1 | + 0 | - 54 | 282 |
| phase 2.2 | + 168 | - 0 | 450 |



## urban design
### phase 3.1 | 1 : 2000

| | + | - | +/- |
|---|---|---|---|
| phase 0 | 0 | 0 | 0 |
| phase 1 | + 336 | - 0 | 336 |
| phase 2.1 | + 0 | - 54 | 282 |
| phase 2.2 | + 168 | - 0 | 450 |
| phase 3.1 | + 0 | - 110 | 340 |

## urban design
phase 3.2 | 1 : 2000

| | + | - | +/- |
|---|---|---|---|
| phase 0 | 0 | 0 | 0 |
| phase 1 | + 336 | - 0 | 336 |
| phase 2.1 | + 0 | - 54 | 282 |
| phase 2.2 | + 168 | - 0 | 450 |
| phase 3.1 | + 0 | - 110 | 340 |
| phase 3.2 | + 252 | - 0 | 592 |

## urban design
phase 4.1 | 1 : 2000

| | + | - | +/- |
|---|---|---|---|
| phase 0 | 0 | 0 | 0 |
| phase 1 | + 336 | - 0 | 336 |
| phase 2.1 | + 0 | - 54 | 282 |
| phase 2.2 | + 168 | - 0 | 450 |
| phase 3.1 | + 0 | - 110 | 340 |
| phase 3.2 | + 252 | - 0 | 592 |
| phase 4.1 | + 0 | - 264 | 328 |

## urban design
phase 4.2 | 1 : 2000

| | + | - | +/- |
|---|---|---|---|
| phase 0 | 0 | 0 | 0 |
| phase 1 | + 336 | - 0 | 336 |
| phase 2.1 | + 0 | - 54 | 282 |
| phase 2.2 | + 168 | - 0 | 450 |
| phase 3.1 | + 0 | - 110 | 340 |
| phase 3.2 | + 252 | - 0 | 592 |
| phase 4.1 | + 0 | - 264 | 328 |
| phase 4.2 | + 378 | - 0 | 706 |

## urban design
phase 5.1 | 1 : 2000

| | + | - | +/- |
|---|---|---|---|
| phase 0 | 0 | 0 | 0 |
| phase 1 | + 336 | - 0 | 336 |
| phase 2.1 | + 0 | - 54 | 282 |
| phase 2.2 | + 168 | - 0 | 450 |
| phase 3.1 | + 0 | - 110 | 340 |
| phase 3.2 | + 252 | - 0 | 592 |
| phase 4.1 | + 0 | - 264 | 328 |
| phase 4.2 | + 378 | - 0 | 706 |
| phase 5.1 | + 0 | - 246 | 460 |

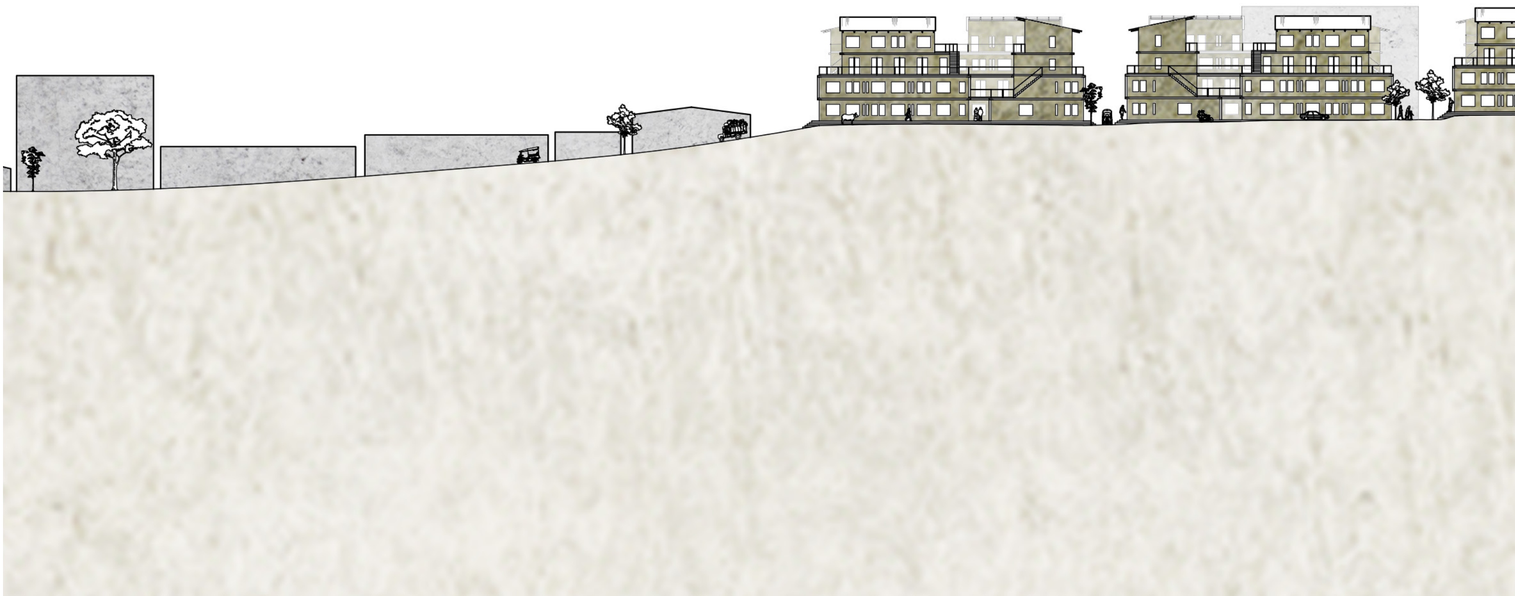
# urban design

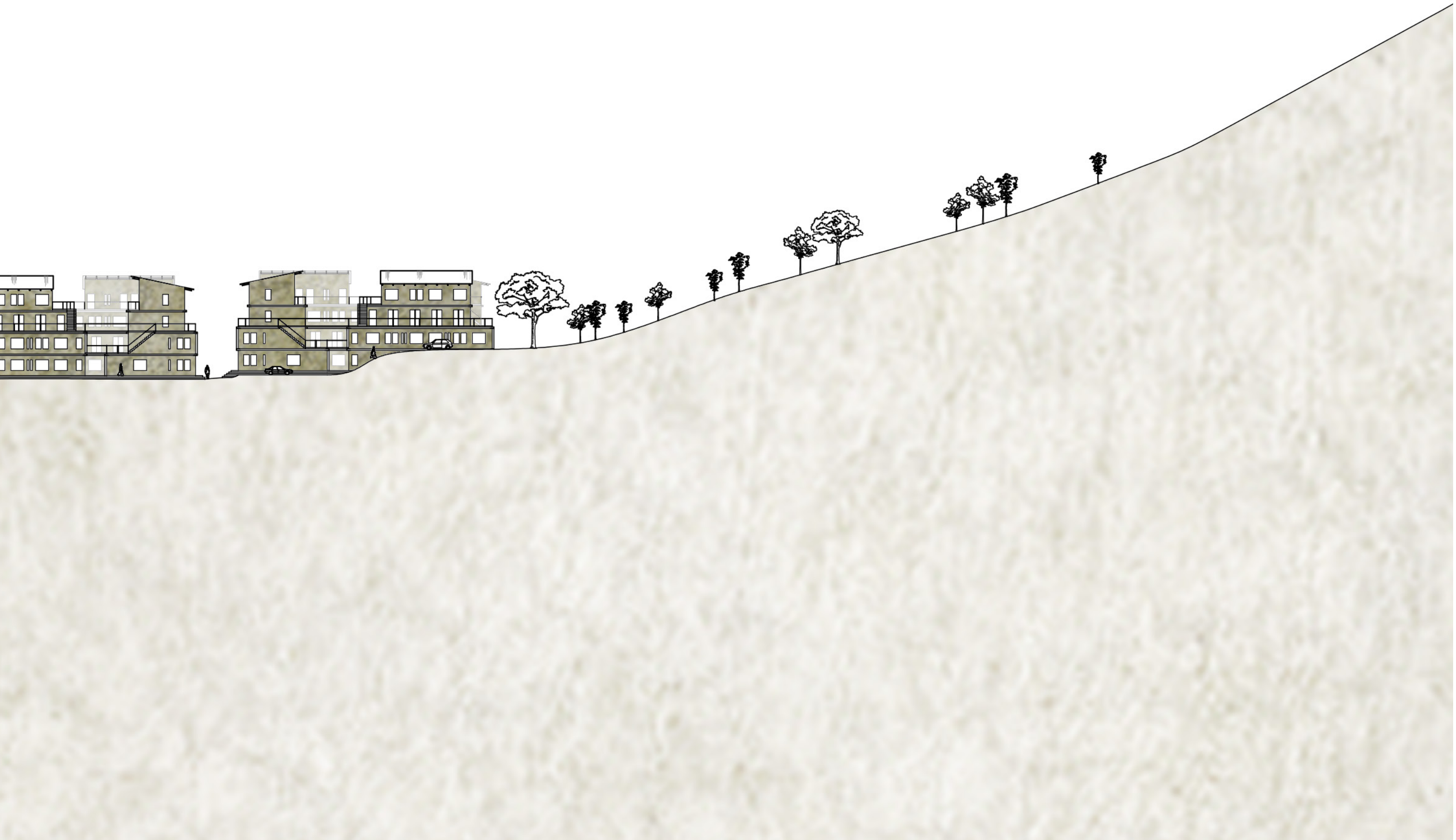
phase 5.2 | 1 : 2000

| | + | - | +/- |
|---|---|---|---|
| phase 0 | 0 | 0 | 0 |
| phase 1 | + 336 | - 0 | 336 |
| phase 2.1 | + 0 | - 54 | 282 |
| phase 2.2 | + 168 | - 0 | 450 |
| phase 3.1 | + 0 | - 110 | 340 |
| phase 3.2 | + 252 | - 0 | 592 |
| phase 4.1 | + 0 | - 264 | 328 |
| phase 4.2 | + 378 | - 0 | 706 |
| phase 5.1 | + 0 | - 246 | 460 |
| phase 5.2 | + 336 | - 0 | 796 |
| total | 1470 | 674 | 796 |

## urban design

section | 1 : 1000





## urban design

design proposal | 1 : 2000

| | old | new |
|---|---|---|
| area | 3 ha | 3 ha |
| number of dwellings | 675 | 1470 |
| total floor area | 12000 $m^2$ | 43155 $m^2$ |
| dwellings / hectare | 225 | 490 |
| people / hectare | 1125 | 2450 |
| FSI | 0,4 | 1,4 |

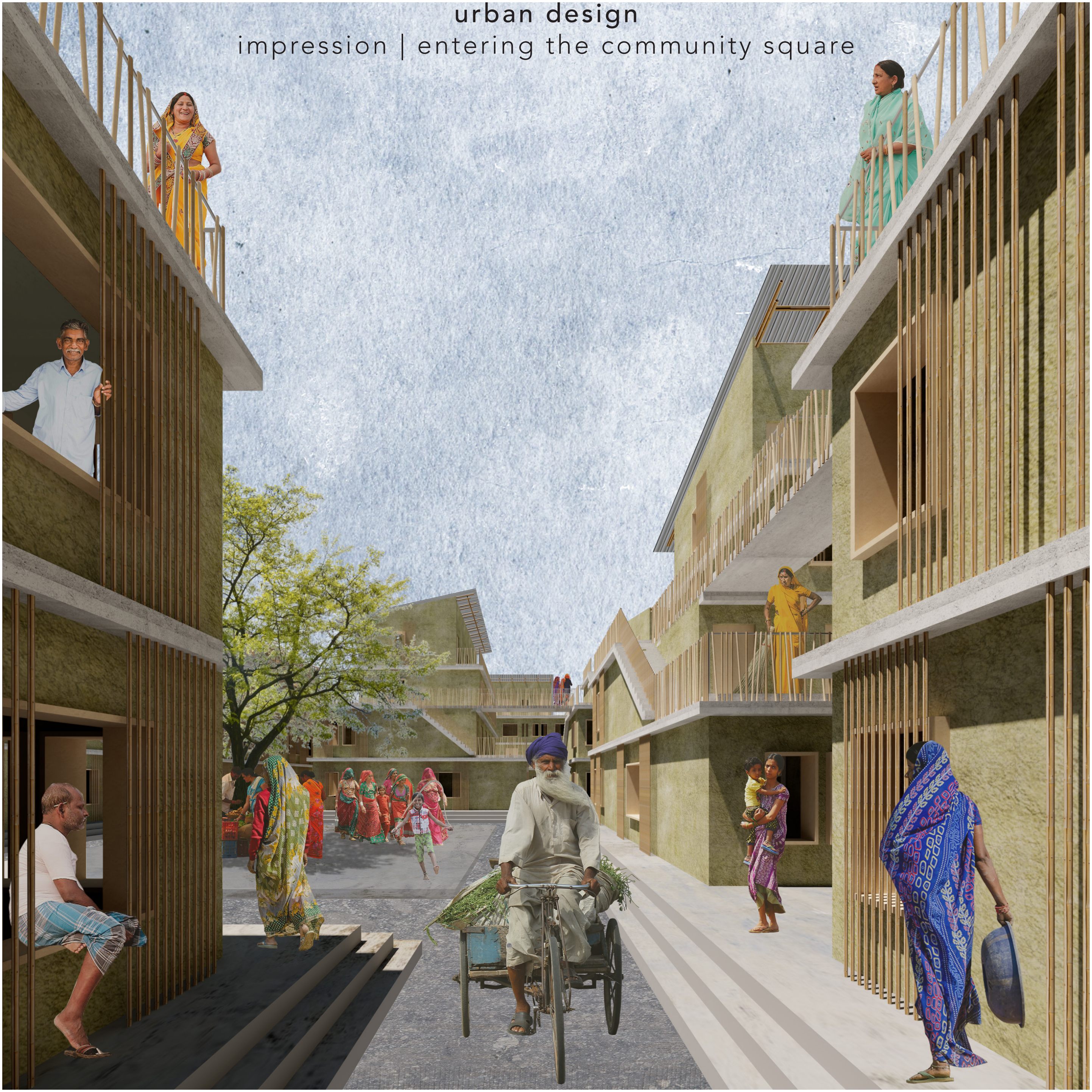
# urban design
## road network | proposal

# urban design

## impression | community lane

## urban design

### impression | entering the community square




urban design
impression | community square


bwin

# BUILDING TECHNOLOGY

### Bamboo

"Tall perennial grasses found in tropical and sub-tropical regions. They belong to the family *Poaceae* and sub-family *Bambusoidae*."

National Building Code of India

India is the second largest producer of bamboo in the world, after China.

### Bamboo bearing area

| | |
|---|---|
| India | 156.866 km$^2$ |
| Maharashtra | 15.927 km$^2$ |

### Amount of culms

| | |
|---|---|
| India | 28.103 million |
| Maharashtra | 1.816 million |

### Bamboo growth requirements

| | |
|---|---|
| temperature | 8 - 36 °C |
| annual rainfall | min. 1.000 mm |
| humidity | high |

Wheather a type of bamboo is suitable for structural utilization depends on the following characteristics:

| | |
|---|---|
| diameter of culm | |
| lenght of culm | 6 m |
| taper of culm | max. 5,8 mm/m |
| straightness of culm | max. 75 mm/6 m |
| inter nodal lenght | |
| wall thickness | 8 mm |
| density and strenght | |
| durability | |

Three main types of bamboo housing exist

- traditional houses, which use bamboo culms as a primary building material
- tradional *bahareque* bamboo houses, in which a bamboo frame is plastered with cement or clay
- modern prefabicated houses made of bamboo laminated boards, veneers and panels

### Advantages of bamboo

- light, strong and versatile
- environment friendly
- accessible to the poor
- self renewing resourse
- fast growing
- highly productive
- easy to work with
-

### Disadvantages of bamboo

- durability
- fire prone
- prone to attack by insects and funghi
- jointing techniques

### Crushed Bamboo Mats

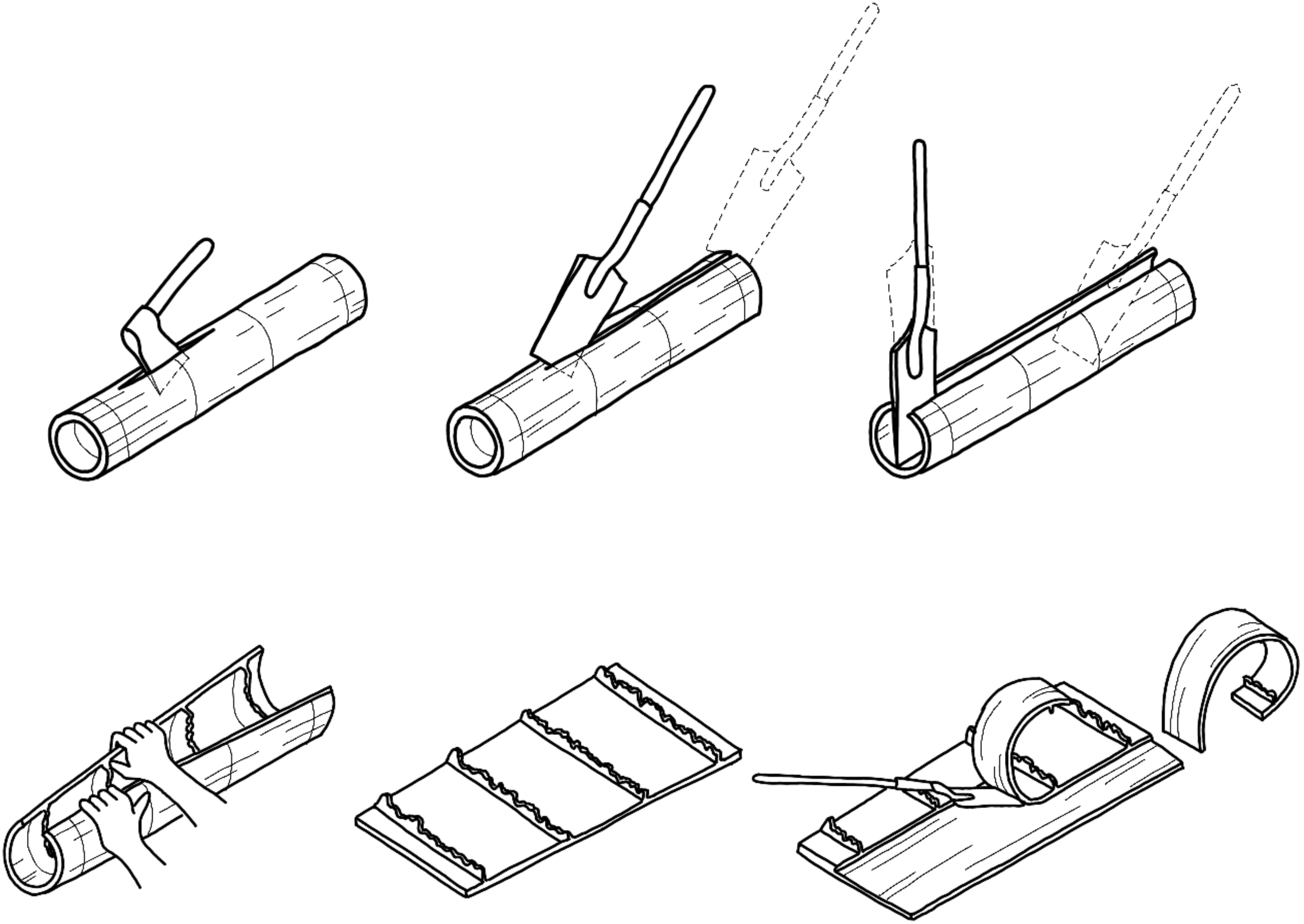
Crushed bamboo mats are boards created out of flattened bamboo poles. It is crucial to use fresh cut, green bamboo poles of around five years old, which is easier to split and clean.

1. Break the nodes of the bamboo pole with a hatchet.
2. Make a vertical incision in the pole with a spade.
3. Perforate all nodes.
4. When all the nodes are broken, open up the bamboo pole.
5. Flatten the bamboo panel.
6. Remove the inner bamboo layer with the node remnants.

The bamboo mats have to be cleaned and treated against insects and mold. This is done by submerging the panels in a mixture of water and non-toxic preservatives. After several days, the panels can by dried in the sun. This air drying process takes around six weeks.

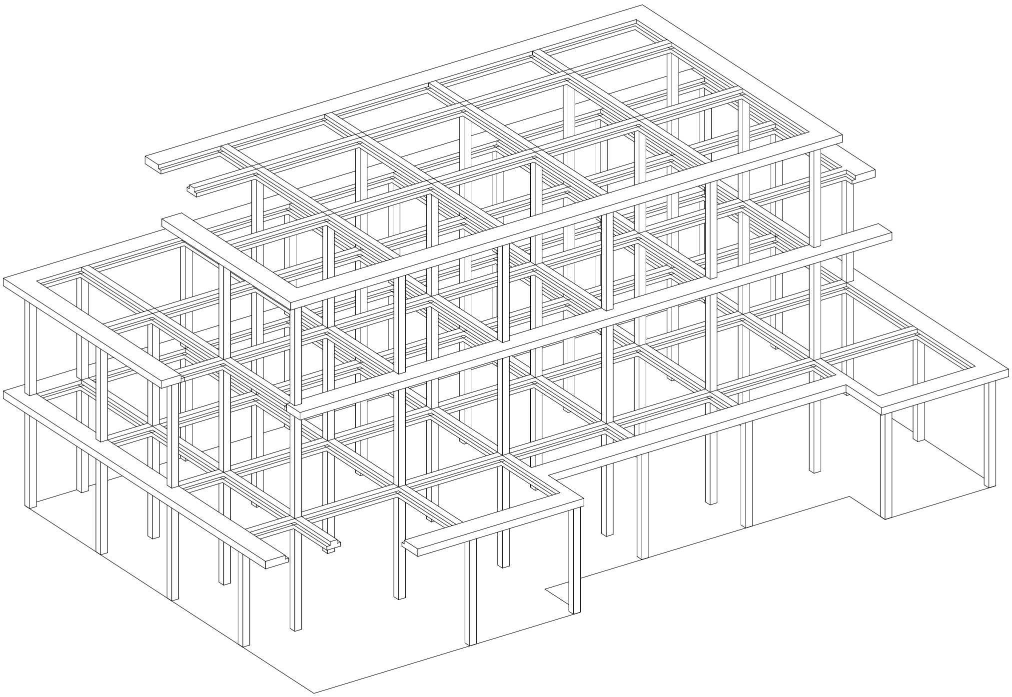
In the design, the crushes bamboo mats are being used for flooring, as well as for the window frames.

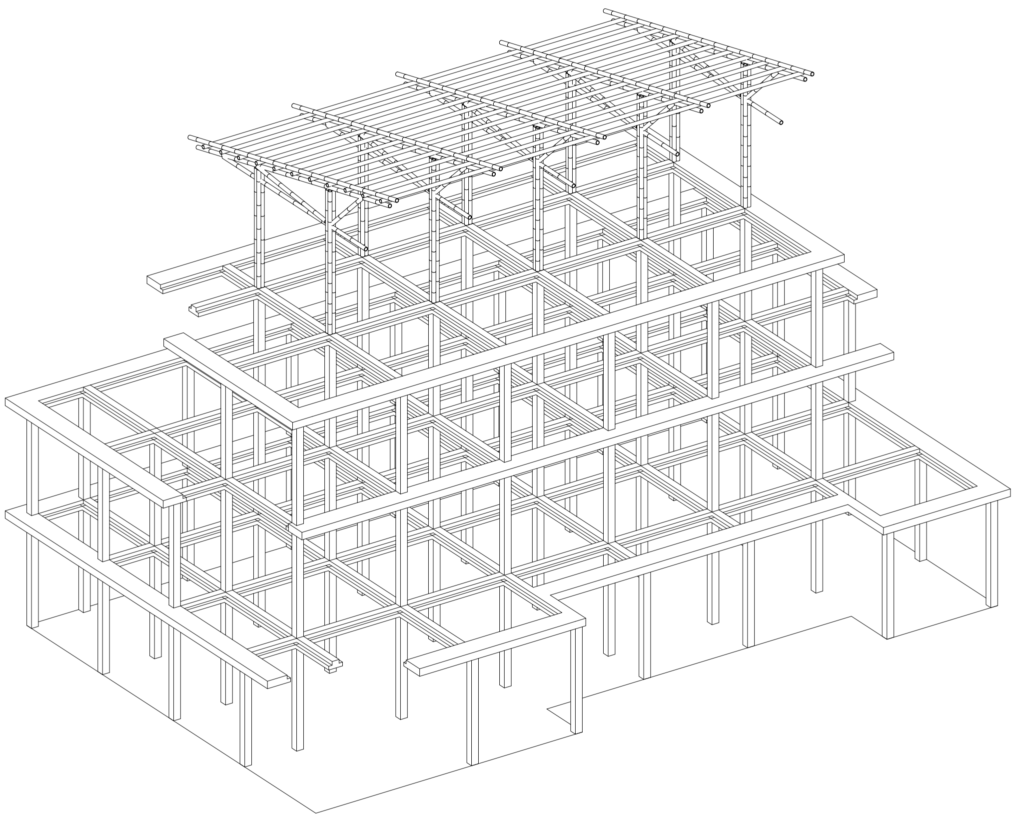
# building technology
## bamboo



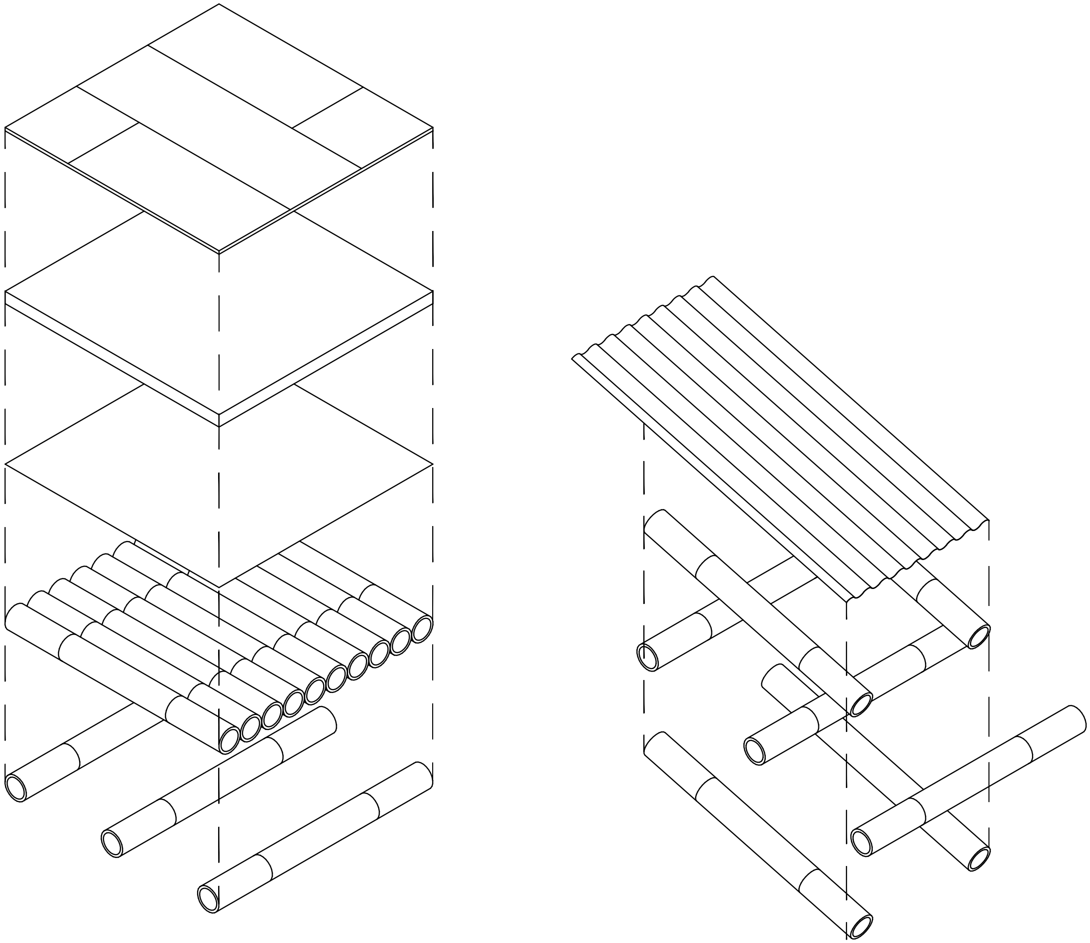
## building technology

construction | cast-in-place concrete



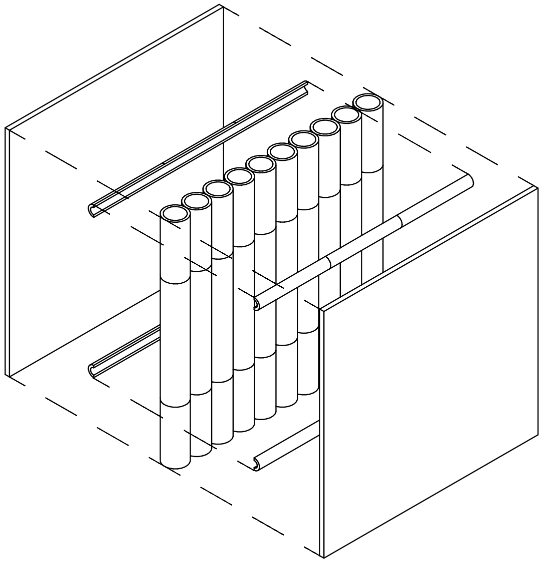


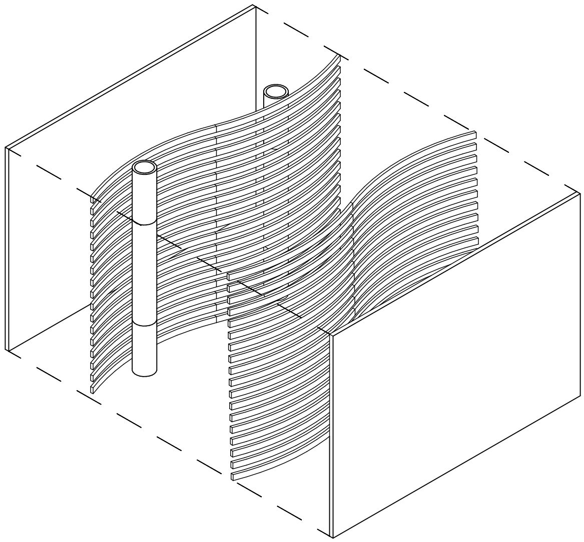
# building technology
## structure



| | floor | | roof |
|---|---|---|---|
| 14 | crushed bamboo panels | 25 | corrugated steel |
| 50 | structural earth base | 100 | bamboo beam |
| | waterproof membrane | 100 | bamboo beam |
| 100 | bamboo culms floor | 100 | bamboo beam |
| 100 | bamboo joists | | |
| 200 | concrete beam (inverted T) | | |

# building technology
## structure





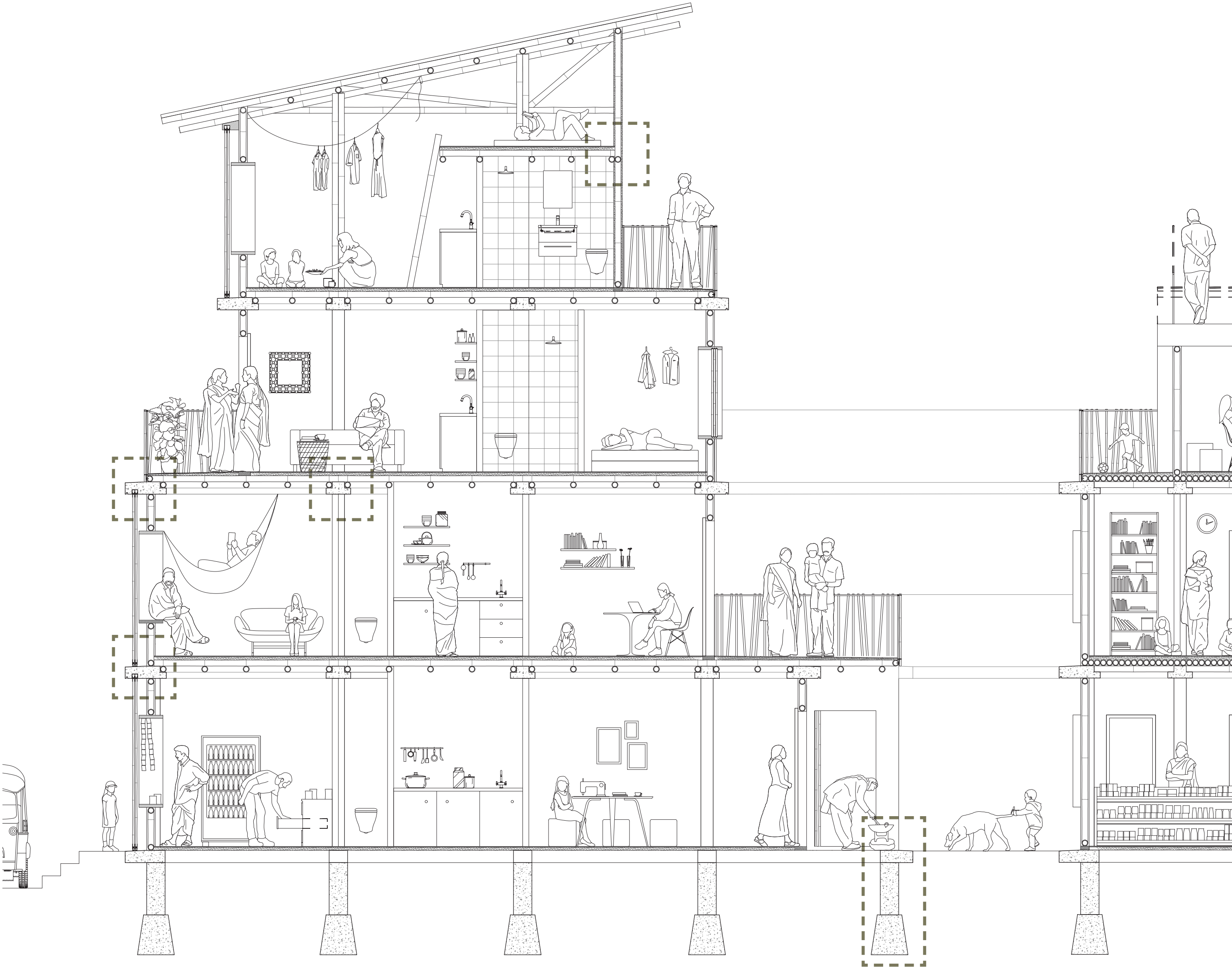
### facade

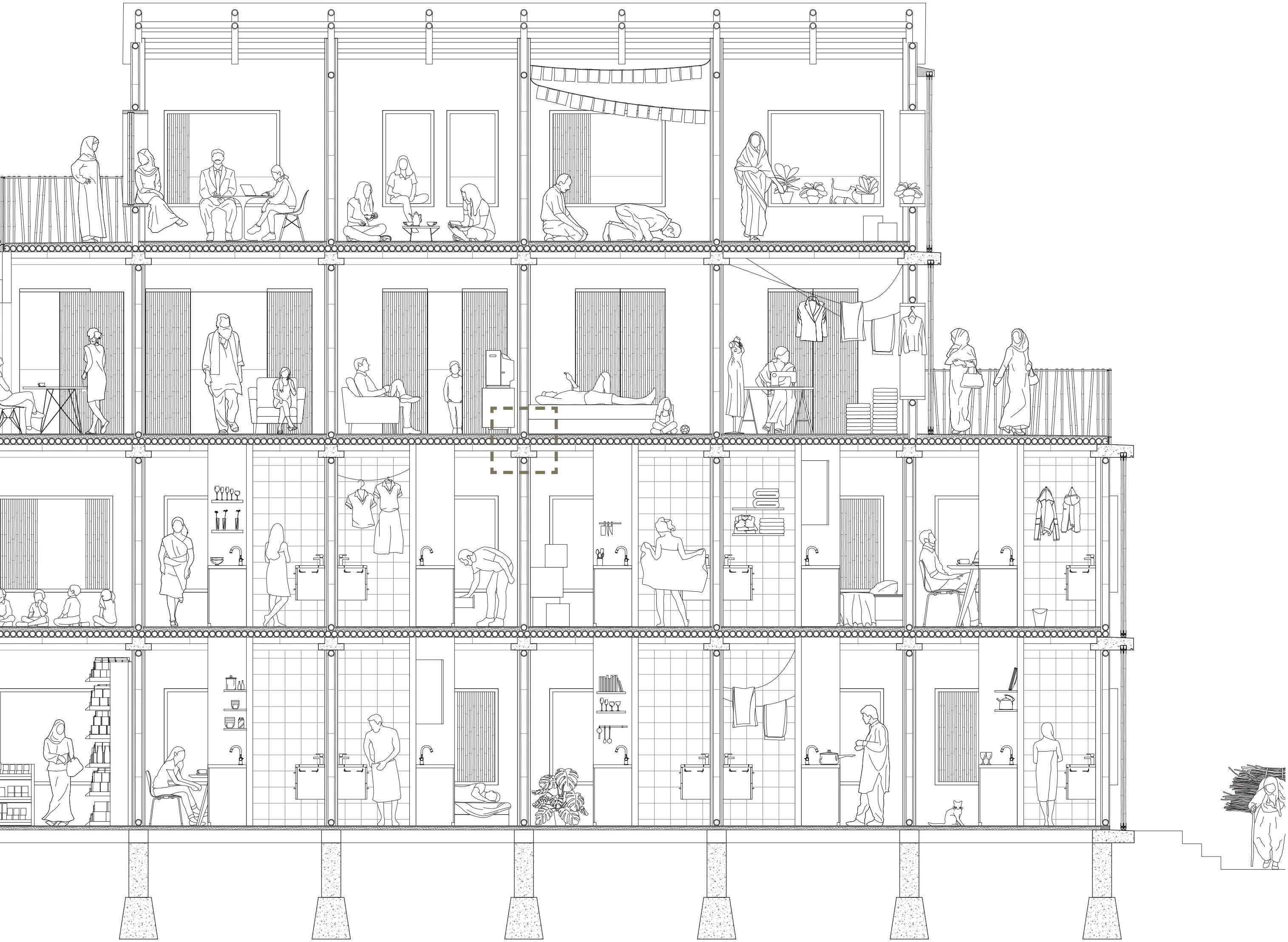
| | |
|---|---|
| 20 | clay plaster |
| 15 | halved bamboo culms |
| 100 | bamboo culms |
| 15 | halved bamboo culms |
| 20 | clay plaster |
| | aluminium profiles with bamboo shutters |

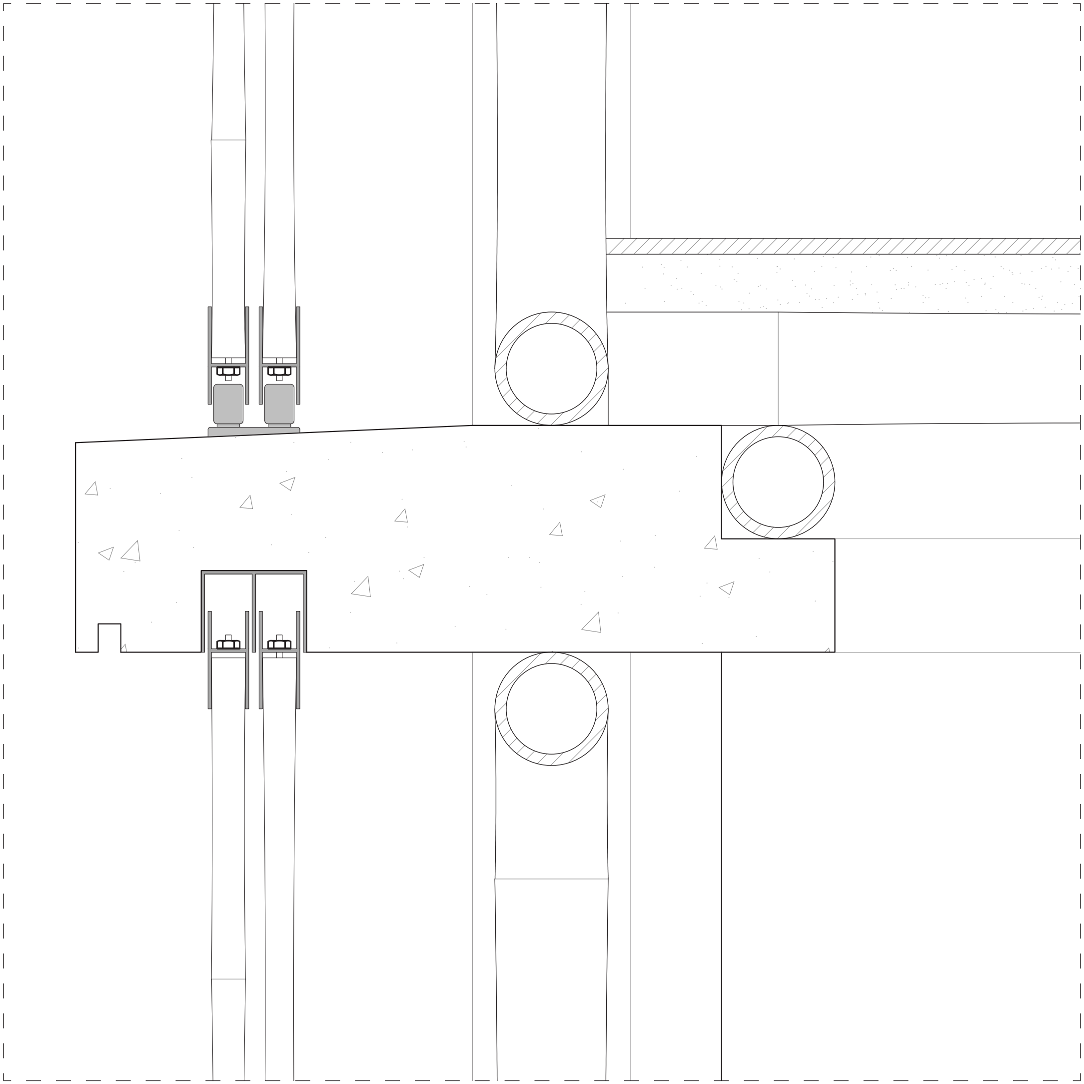
### partition wall

| | |
|---|---|
| 20 | clay plaster |
| 20 | bamboo woven mat |
| 100 | bamboo culm |
| 20 | clay plaster |

# building technology
## details





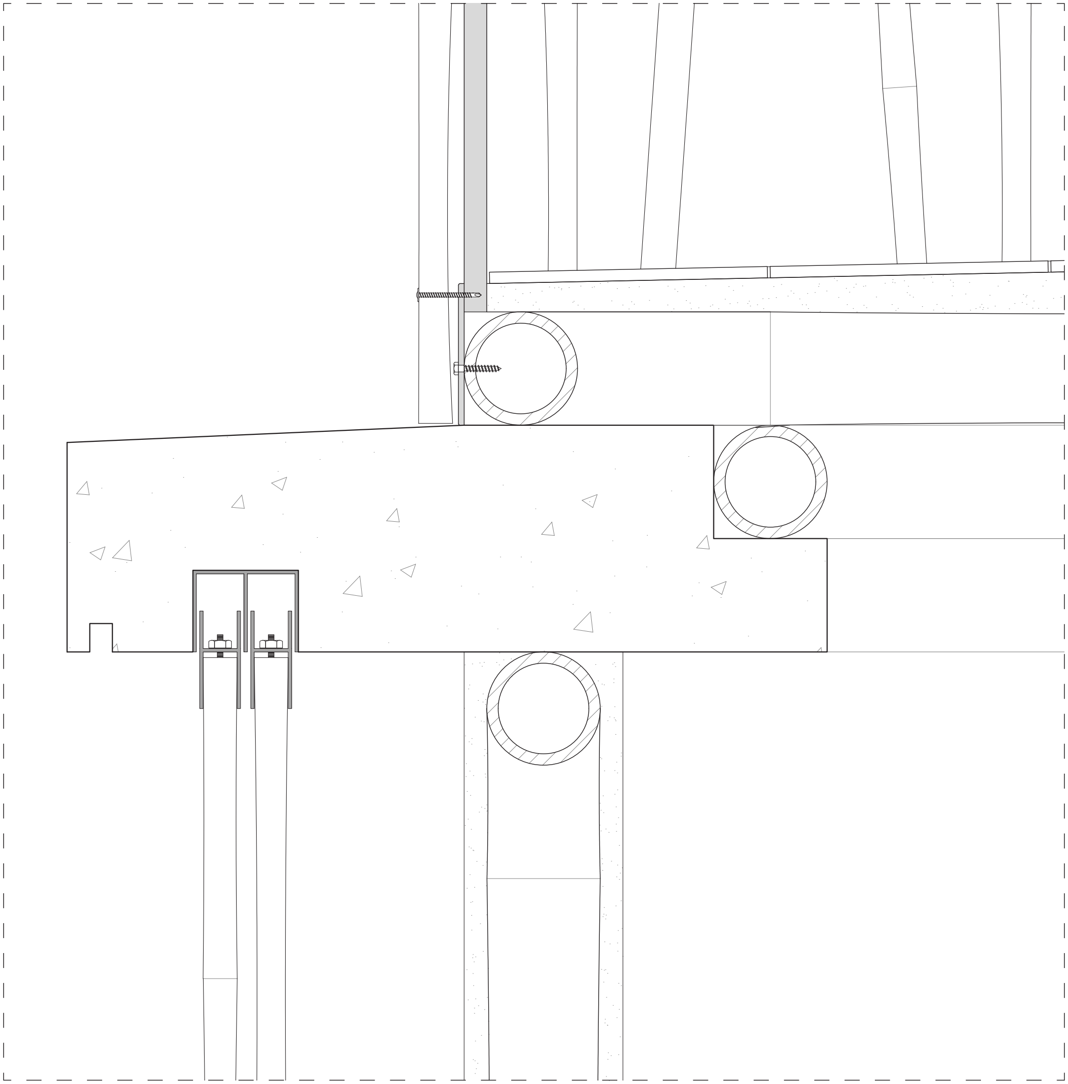


**facade**

| | |
|---|---|
| 20 | clay plaster |
| 15 | halved bamboo culms |
| 100 | bamboo culms |
| 15 | halved bamboo culms |
| 20 | clay plaster |
| | aluminium profiles with bamboo shutters |

**floor**

| | |
|---|---|
| 14 | crushed bamboo panels |
| 50 | structural earth base |
| | waterproof membrane |
| 100 | bamboo culms floor |
| 100 | bamboo joists |
| 200 | concrete beam (inverted T) |

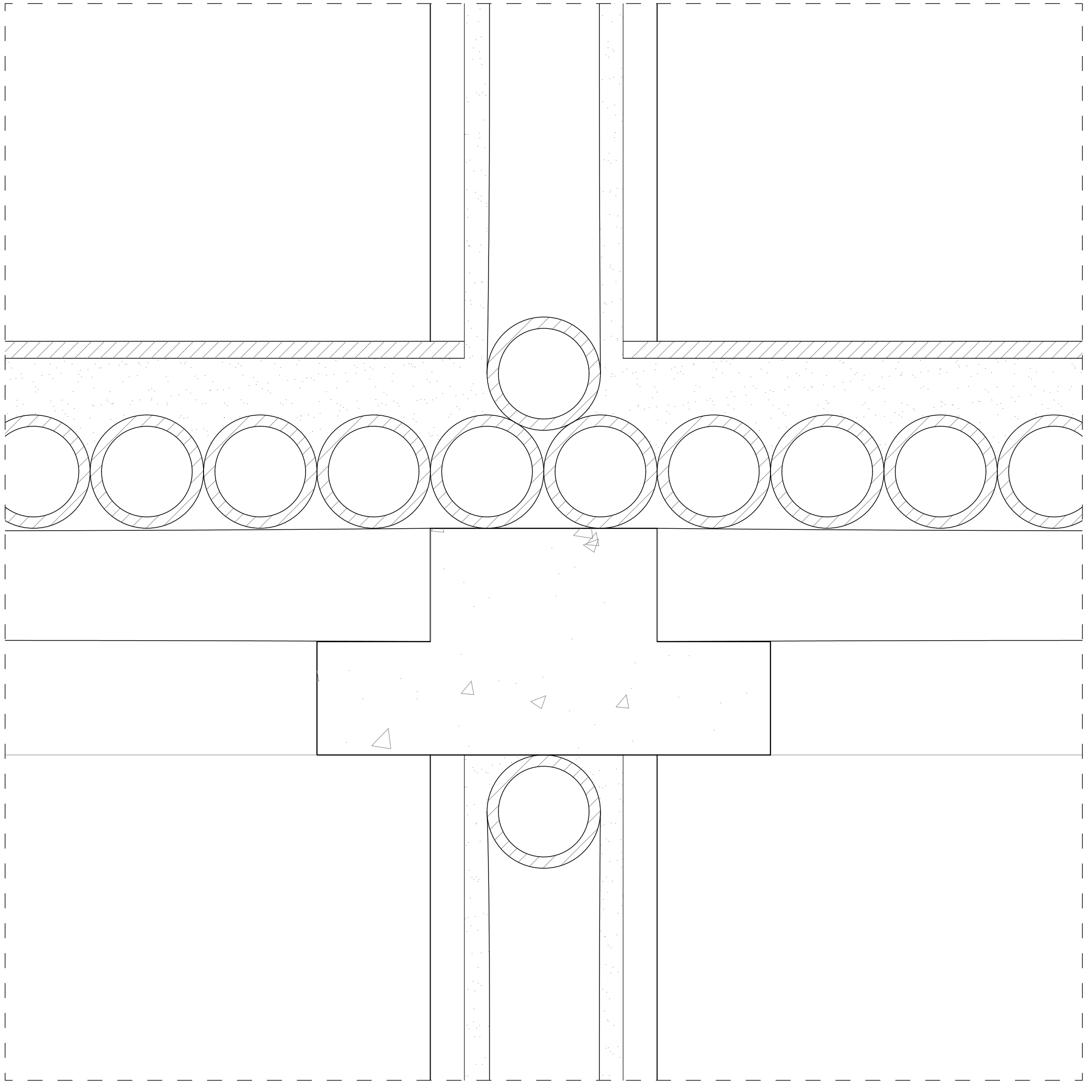


**facade**

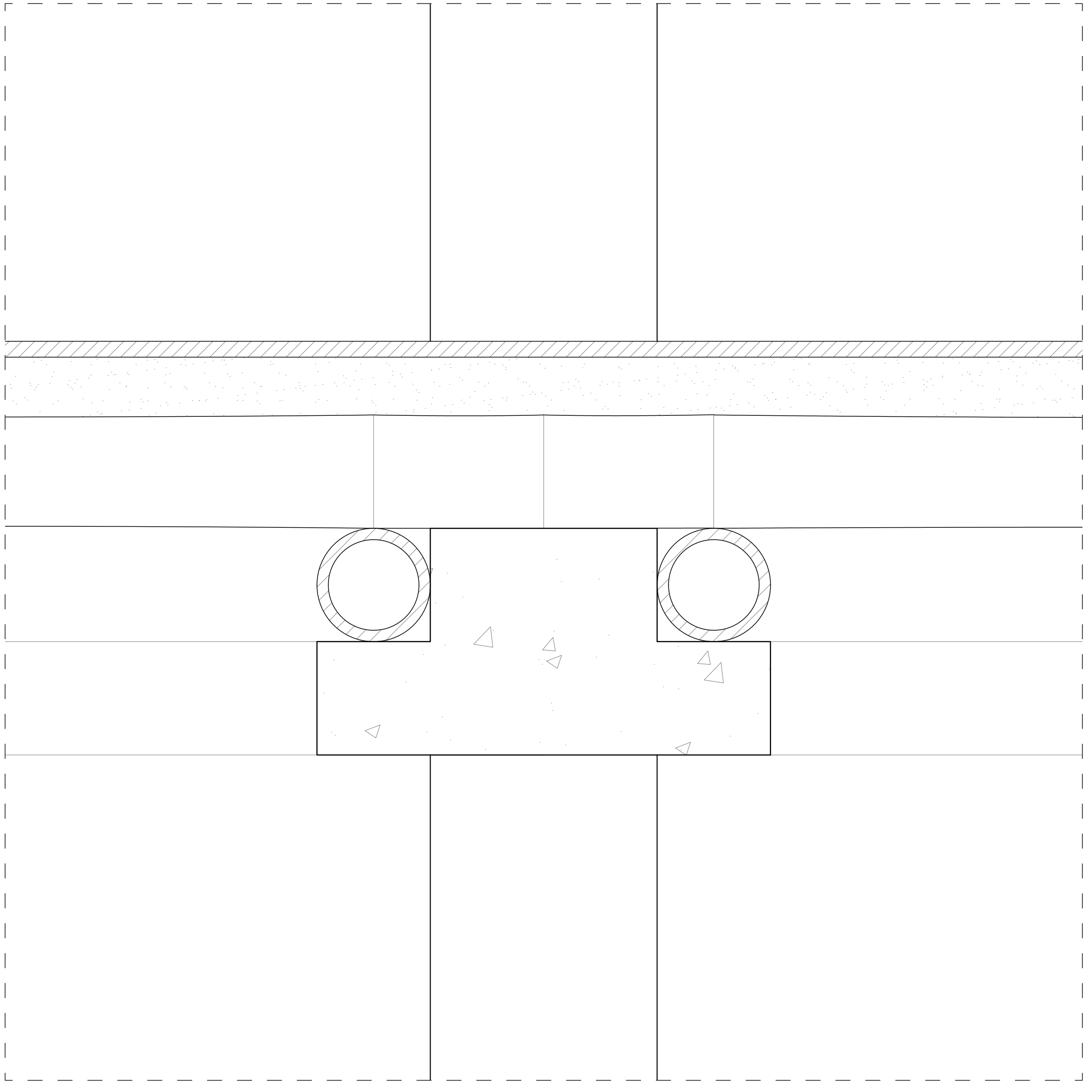
| | |
|---|---|
| 20 | clay plaster |
| 15 | halved bamboo culms |
| 100 | bamboo culms |
| 15 | halved bamboo culms |
| 20 | clay plaster |
| | aluminium profiles with bamboo shutters |

**gallery**

| | |
|---|---|
| 10 | tile finishing |
| 50 | structural earth base (slope 20 mm / m) |
| | waterproof membrane |
| 100 | bamboo culms floor |
| 100 | bamboo joists |
| 200 | concrete beam |



| | **floor** | | **partition wall** |
|---|---|---|---|
| 14 | crushed bamboo panels | 20 | clay plaster |
| 50 | structural earth base | 20 | bamboo woven mat |
| | waterproof membrane | 100 | bamboo culm |
| 100 | bamboo culms floor | 20 | clay plaster |
| 100 | bamboo joists | | |
| 200 | concrete beam (inverted T) | | |

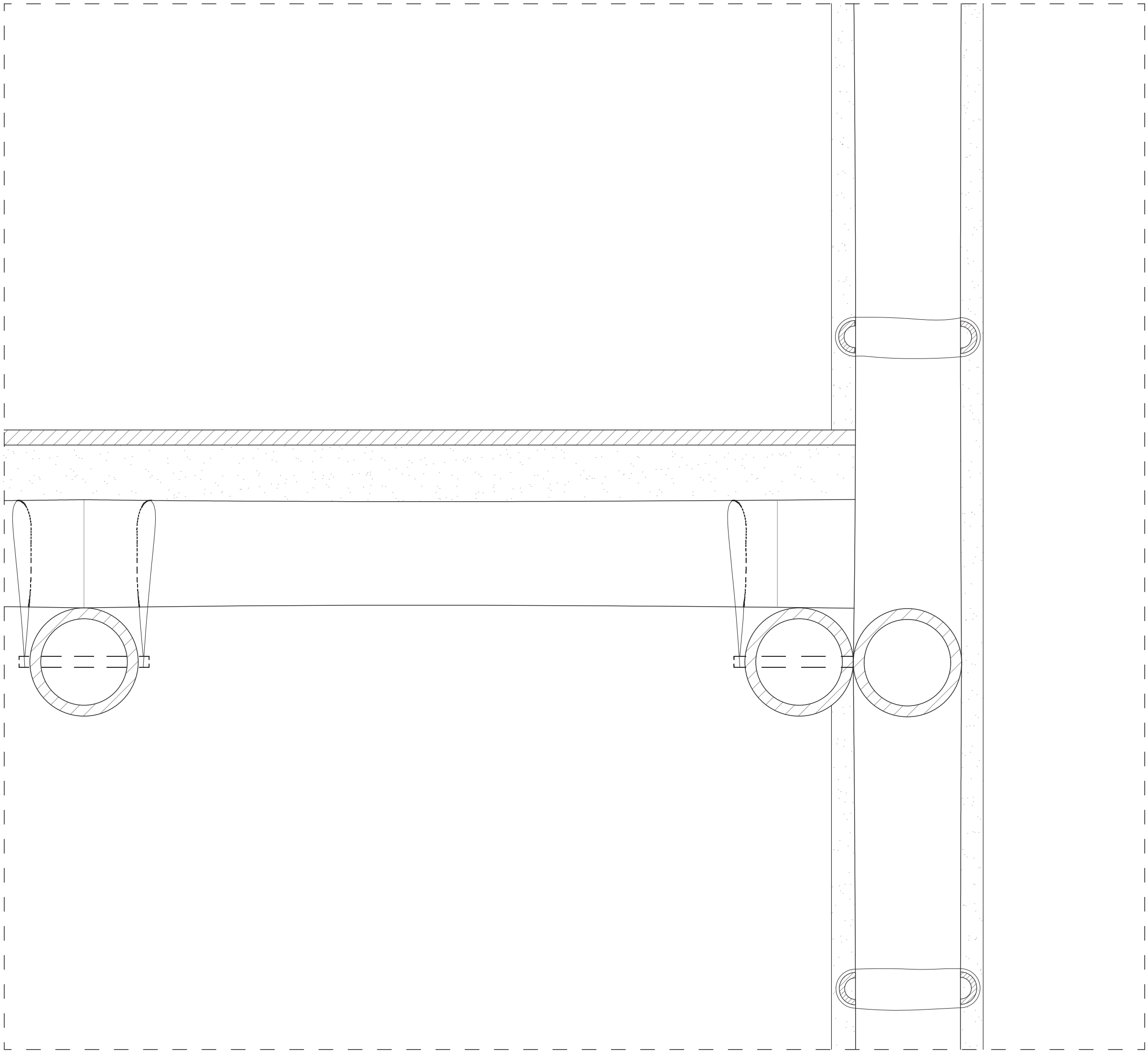


**floor**

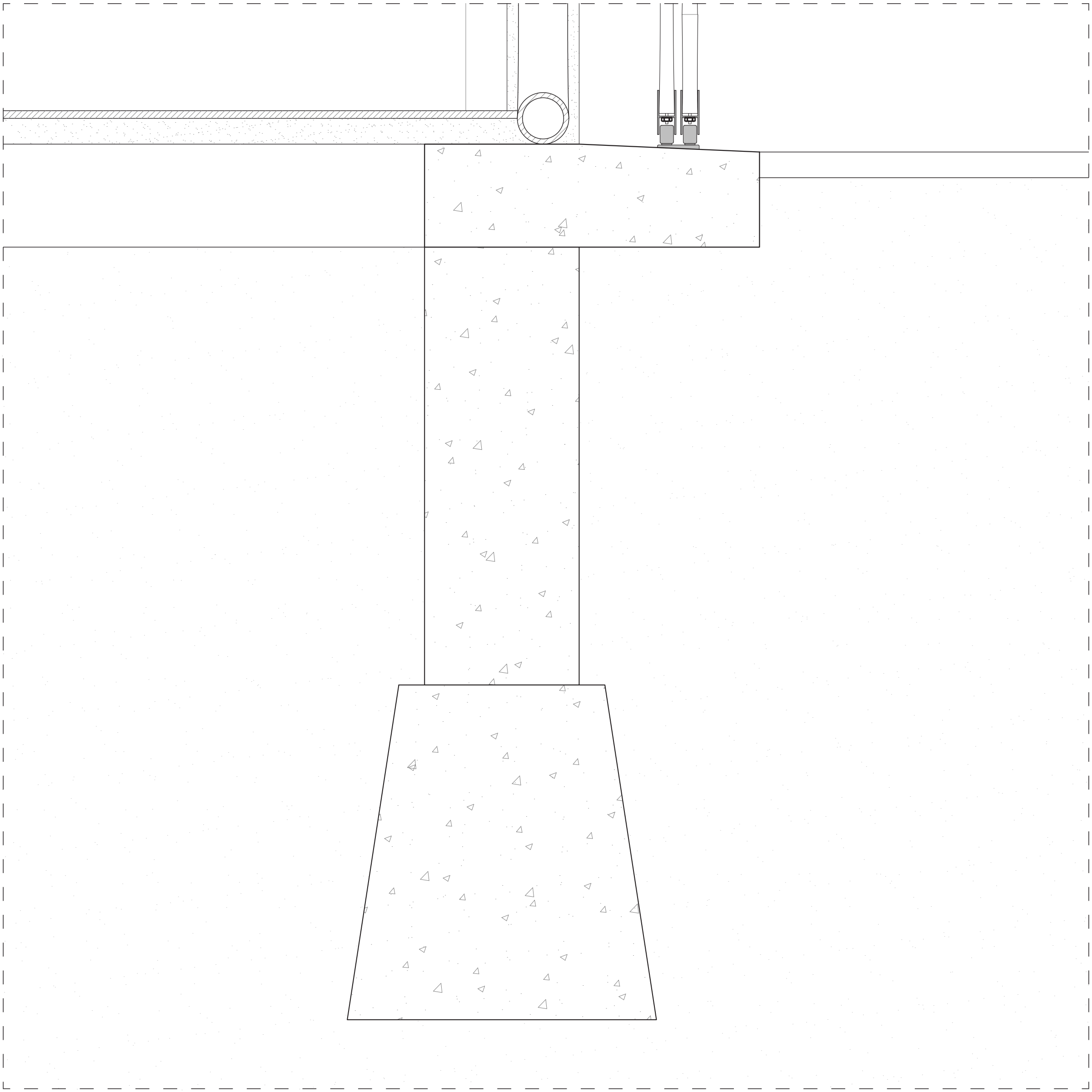
| | |
|---|---|
| 14 | crushed bamboo panels |
| 50 | structural earth base |
| | waterproof membrane |
| 100 | bamboo culms floor |
| 100 | bamboo joists |
| 200 | concrete beam (inverted T) |

**partition wall**

| | |
|---|---|
| 20 | clay plaster |
| 20 | bamboo woven mat |
| 100 | bamboo culm |
| 20 | clay plaster |



| facade | | loft floor | |
|---|---|---|---|
| 20 | clay plaster | 14 | crushed bamboo panels |
| 15 | halved bamboo culms | 50 | structural earth base |
| 100 | bamboo culms | 100 | bamboo culms floor |
| 15 | halved bamboo culms | 100 | bamboo joists |
| 20 | clay plaster | | |
| | aluminium profiles with bamboo shutters | | |



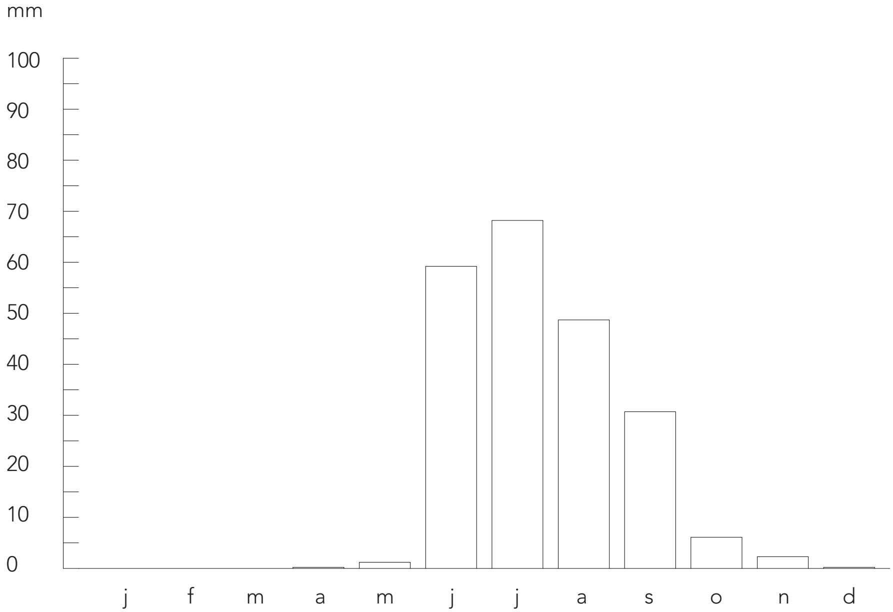
**ground floor**

| | |
|---|---|
| 14 | crushed bamboo panels |
| 50 | structural earth base |
| | waterproof membrane |
| 200 | concrete beam |
| | concrete foundation |

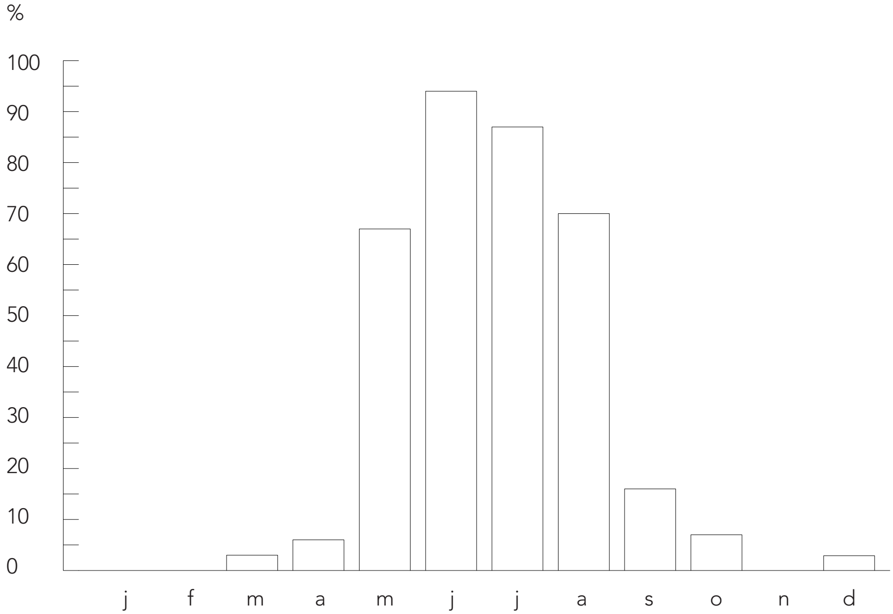
CLIMATE DESIGN


Struggle
IS
Real

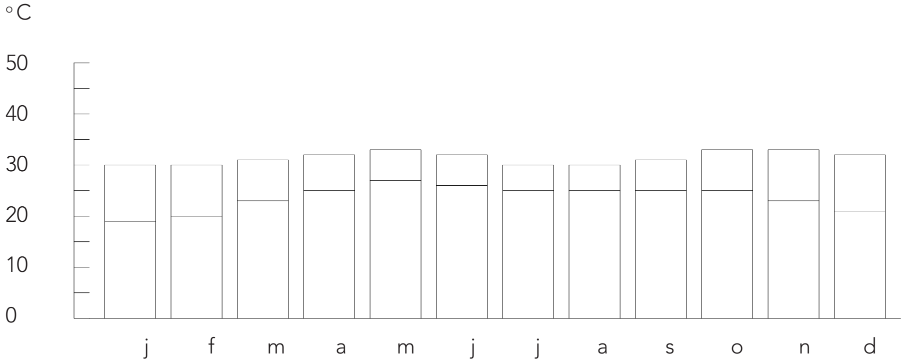
## rainfall



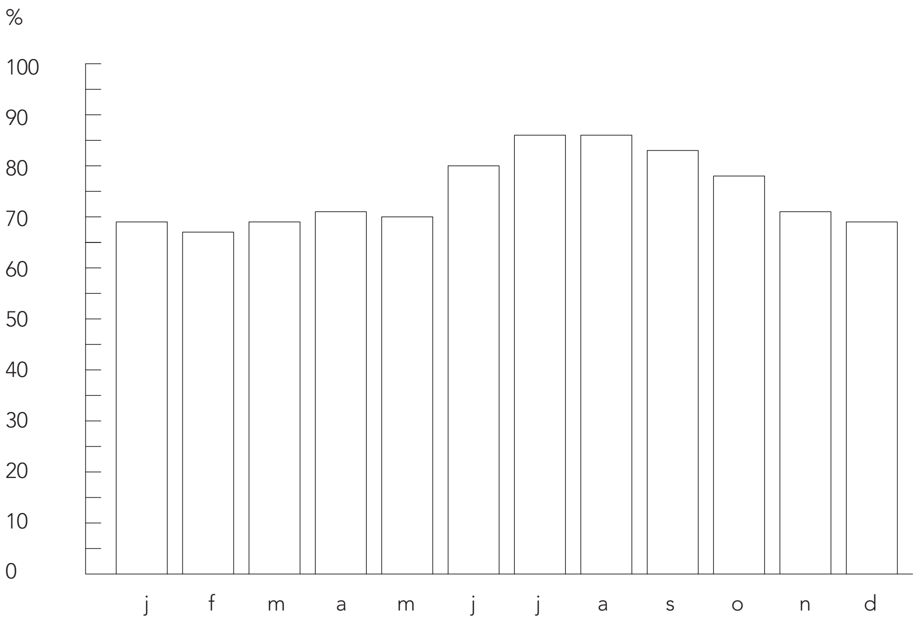

## chance of rain



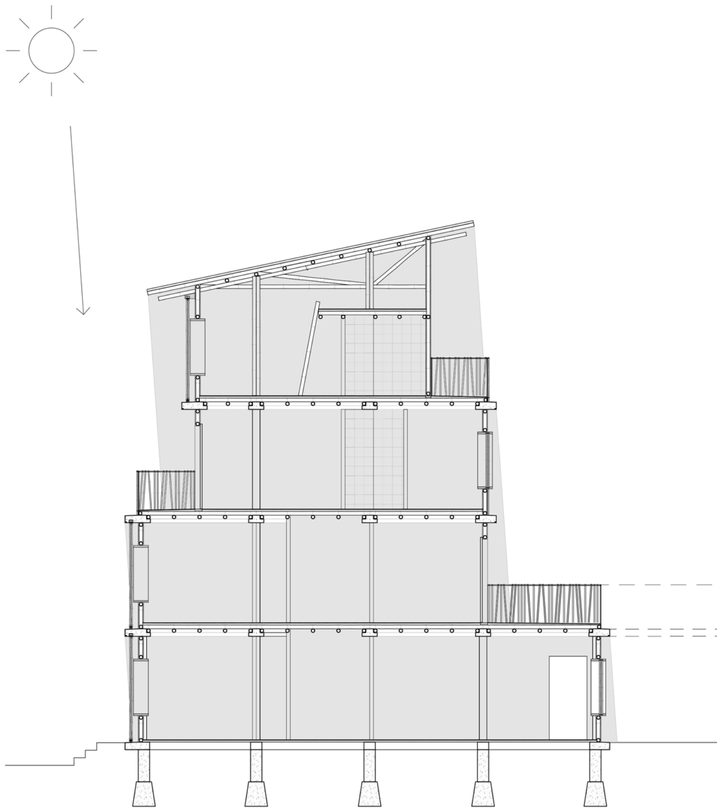
temperature




humidity

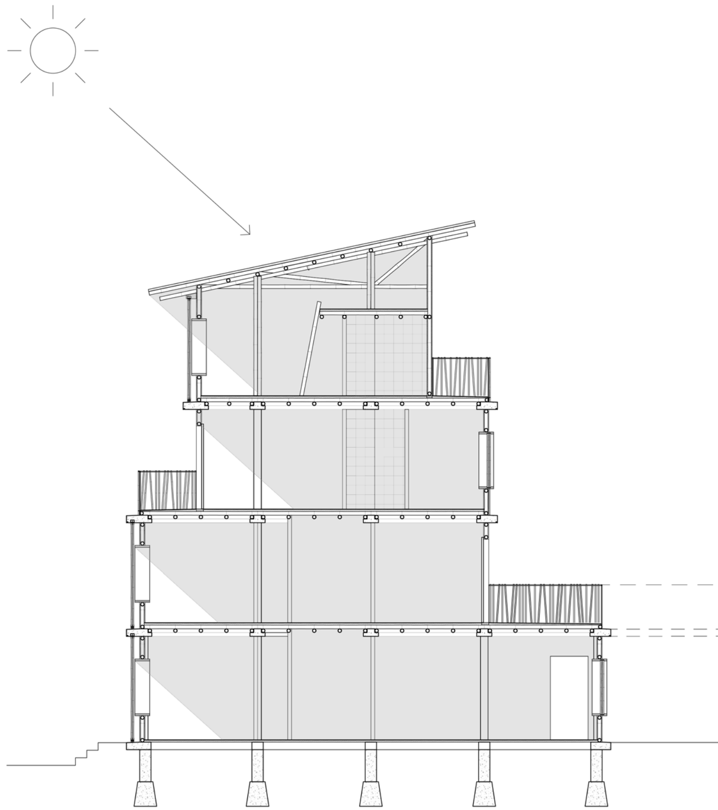


## climate design
sun



**summer**

94 °

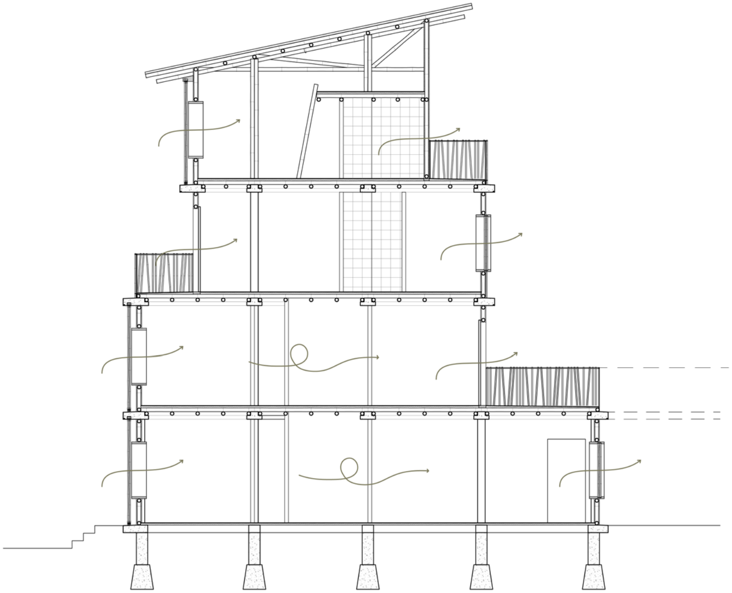


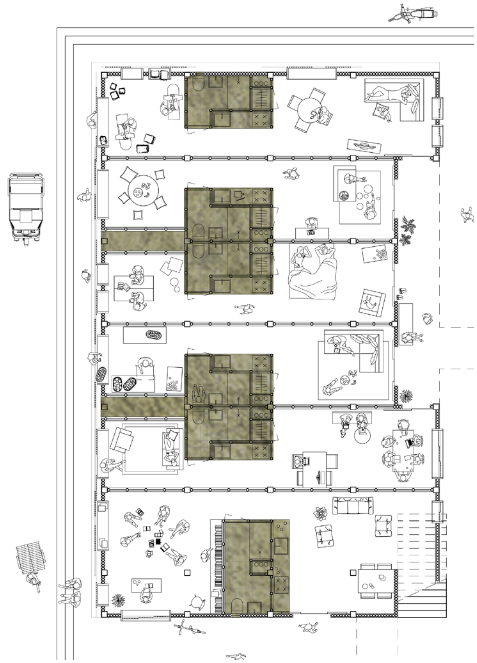
**winter**

48 °

Mumbai's climate asks for sufficient shadow. The extended roof provides shadow on the terraces below, and bamboo shutters, constructed in between the concrete beams, prevent the sun from entering the dwelling units.

# climate design
## ventilation



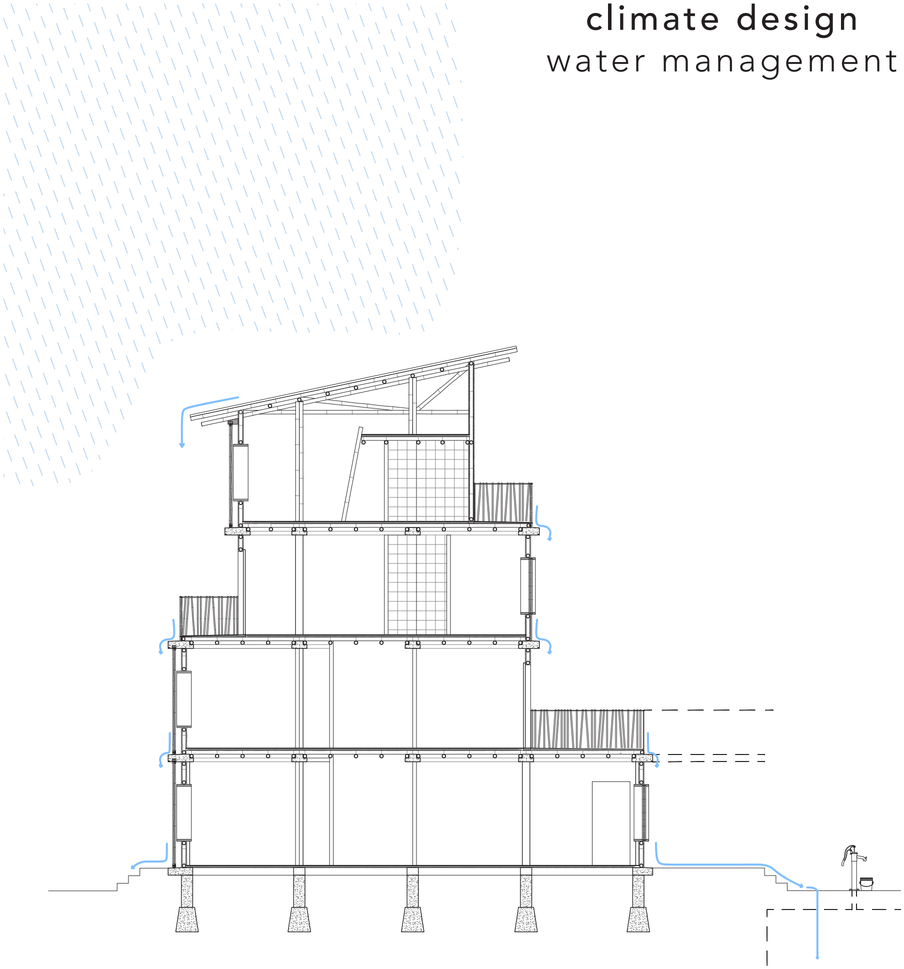


The fact that all dwelling units have openings at the street side as well as the interior cluster side, and thus are located opposite of each other, creates cross-ventilation throughout the apartment.

In order not to block these openings, the bathroom and kitchen are placed in the center of the unit. A horizontal shaft towards the facade provides ventilation.

## climate design

### water management



During monsoon season, which takes place from june to september, an average rainfall of 1800 mm is expected. The concrete beams, sticking out of the facade, prevent the rain from dripping along the clay plaster.
When the water reaches the ground floor, it is collected and stored in an underground collector. Meanwhile, the lowered cluster square filled with rainwater can be used to play in.

In the dry season, this water can be pumped up with a water pump in the center of the cluster courtyard.

# REFLECTION

# reflection
## comparison

| | Sangharsh Nagar | CIDCO Housing |
|---|---|---|
| number of dwellings | 18.362 | 1048 |
| dwelling size | 22,5 $m^2$ | 18, 25, 40, 70 $m^2$ |
| dwellings / cluster | 550 | 25 |
| area | 32 ha | 7,7 ha |
| dwellings / hectare | 574 / ha | 136 / ha |
| people / hectare | 2296 | 544 |
| FSI | 4,8 | 1,5 |

| | | |
|---|---|---|
| access to basic needs | +/- | + |
| access to local facilities | + | - |
| opportunities for income generation | + | +/- |
| social interaction | +/- | + |
| community spirit | +/- | + |
| sense of safety | + | + |
| health of the inhabitants | +/- | + |

## reflection
comparison

| Belapur Housing | mid-rise chawls | baithi chawls | design proposal |
|---|---|---|---|
| 600 | - | - | 1470 |
| 45, 70 $m^2$ | 18 $m^2$ | 18 $m^2$ | 22,5 - 54 $m^2$ |
| 21 | - | - | 84 |
| 5,4 ha | 1 ha | 1 ha | 3 ha |
| 111 / ha | 1400 / ha | 350 / ha | 225 / ha |
| 500 | 5600 | 1400 | 1125 |
| 0,7 | 3 | 0,8 | 0,4 |
| + | +/- | +/- | + |
| +/- | +/- | +/- | + |
| +/- | +/- | + | + |
| + | +/- | + | ++ |
| + | +/- | + | ++ |
| + | - | +/- | + |
| + | - | +/- | + |

# conclusion

Today, nearly fifteen percent of the world's population lives in poverty in urban areas, of which the majority can be found in the Global South. This includes India, which has the second largest urban population in the world. An on-going process of urbanization has led to an increasing urban population of 109 million in 1971, to 377 million in 2011. Mumbai is India's largest city with an estimated population of 21 million people. Besides, with around 21.000 people per square kilometer, it is the most densely settled city in the world. Unfortunately, only 5 percent of the population can afford a house in the city of Mumbai, indicating that there is a mismatch between the households' stock and flow. This causes more than half of Mumbai's population living in informal settlements, such as slums and chawls, covering only 6 percent of the city's land. The inability of the government to provide sufficient formal, affordable housing to house Mumbai's growing population, has emerged as a serious crisis. With a still increasing urban population, the housing shortage is expected to reach 34.1 million units by 2022.

The Global Housing studio 'Mixing Mumbai: Affordable Housing for Inclusive Development' aims to rethink the current systems of affordable housing production. It focuses on the specific location of Nala Sopara, an area in the northern outskirts of Mumbai's metropolitan region. In general, two dwelling typologies can be found here. Baithi chawls are constructed out of brick and built by a local contractor. These ground storey buildings with pitched roofs consists of one room and are usually connected through a narrow community lane, which people use as an extension to their small houses. Densification developments of the past decades show that more and more of these low-rise baithi chawls are being replaced by mid-rise chawls. These ground floor plus four storey chawls consist of a series of one-room tenements, connected with each other by a communal corridor. In order to house the increasing population, the baithi chawls are demolished and replaced by the mid-rise version, whilst maintaining the original layout. Hereby, the five storey chawls are only separated by a narrow alley, causing the residents of the lower levels to lack access to daylight and ventilation, and enabling the higher residents to almost literally 'shake hands' with their neighbor. This approach to provide more dwelling units to deal with the increasing demand for affordable housing is only focused on efficiency (building as much, as quickly and as cheaply possible) and totally ignores the aspects that improve the quality of life. It can be seen as a unilateral concentration on the densification development that disregards the understanding of how the built environment affects social sustainability. If this situation of replacement continues, a significant part of Nala Sopara will be threatened by and the disappearance of social sustainability, which can be detrimental to livability, health and urban well-being. This graduation studio challenged me to explore alternative solutions for these problems, and to develop an architectural project that uses design as a means to deal with the technical, social and spatial challenges of Mumbai's housing situation. Besides, it provided the opportunity to truly focus on the housing problems and human needs of people in a Global South country. To me, architecture and designing a living environment does not only includes a building, but is most of all related to cultural, social, environmental, political and economic conditions.

Architecture can be seen as a practical approach to serve the needs of people. It goes beyond the field of the built environment as it affects the daily life of real people. Within the Chair of Architecture and Dwelling, research provides a method to gain a better understanding of the way people dwell. As a preparatory study for the field trip to Mumbai, literature research and mapping were used to investigate the political, technical, geographical and sociological context of the design location. As a group work, a collective knowledge base was constructed by gathering this date to provide us with the fundamental information for an efficient excursion to India. During this field trip, we visited a selection of housing projects throughout the city, varying from the informal settlements of Dharavi, the biggest slum of India, to the luxury apartments of Kanchanjunga. Especially the housing projects designed and built for the low-income group and the economically weaker section interested me, as the visit to these projects gave an exploratory impression of how people live there. Moreover, we visited the design location: Nala

Sopara. Here, in-situ research was conducted, investigating the local characteristics of the site. Although the preparatory conducted information about the location contributed to a better understanding of the general situation, it soon became apparent that only by visiting and participating in the community of the very location, one can genuinely understand the cultural, social and environmental conditions. As fits the methodical line of inquiry of the Global Housing studio, visual ethnography was used to investigate these conditions. I used several visual techniques, among which photography and sketching, to learn and understand the complexity of the area. These ethnographic, visual methods as a means to investigate and depict the place, could capture complex narratives of the lived experience that were not, and could not have been, addressed through the course's previous study.

The differing conditions I experienced whilst being in the midst of the chawl redevelopment and densification processes have been very helpful in defining what problem I wanted to tackle in my project. It was already there, in Nala Sopara, that I realized I wanted to seek for an architectural solution that offers a higher density than can now be found in the baithi chawl area, without losing the social sustainability aspects as happened in the mid-rise chawls. I believe that the preparatory research through literature studies and mapping has been an essential aspect of the course of the design process. However, the conducted (visual) ethnography enabled me to expose the visible and underlying information of the location, creating a frame of reference that served as the starting point for the design project. During the weeks after the site visit, the processing of the collected information through pictures, interviews, sketches and general experience took place, creating a Book of Patterns. This helped me to identify the relationships between the housing typologies and patterns of inhabitation. Moreover, during the whole further process of designing, this valuable collected data functioned as a benchmark in defining architectural elements of space- and placemaking, and how they facilitate the everyday life of people. This was an important step in the relation between research and design and the methods I used to develop a housing scheme. The feedback given by the mentors reminded me not to forget I was designing a building for people, and to use the book of patterns in order to realize how people would actually use and appropriate the spaces I was creating.

The cluster scheme I introduced could provide an alternative for the current densification processes. Not only considering the built mass and configuration of the dwellings, but also regarding building material. Currently, brick is the most commonly used building material in India. Meanwhile, bamboo is seen as 'poor man's timber'. In other words, bamboo has an undervalued status since it is always associated with the economically weaker section. Although my project is indeed meant for inhabitants with a low income, I think my project could serve to raise awareness of the possibilities of bamboo. In addition, it would be a great achievement when bamboo could be added as an official building material to the strict building regulations that apply to Mumbai.

The issue of the lack of affordable housing does not only apply to Mumbai. As the studio's name 'Global Housing' already indicates, the notion of rapid urbanization does not only take place in India, but in most of the Global South countries. Therefore, the research conducted in this academic context are generally applicable to these countries, which deal with comparable issues of overpopulation, urbanization and housing shortage. The Global Housing graduation studio challenges the students to think of different solutions for the housing problems. The research conducted as a group work could help to make people aware of these problems. It could contribute in highlighting the problem from a different point of view; that redevelopment and the supply of affordable housing is not only about making as much dwelling units as possible in the most efficient way, and that seeing it from the user's position is just as important. Most of all, changing the focus to integration at spatial, economical, political and social levels could lead to enable people to live very densely without negatively affecting the living quality.

# HOLI

During Holi festival, one celebrates the arrival of spring and signifiec the victory of good over evil. Holi is also known as the Festival of Colors, as participants shower each other with brightly colored powder. Holi may be tradionally Hindu, but currently, the festival is celebrated by people of all relegions. The colors hide all class-lines and the caste-system disappears.

# DIWALI

Diwali, also known as Deepavali or the Festival of Lights, lasts five days and takes place between mid-october and mid-november. Cleaning, renovating and decorating the homes is part of the preparation. During the festival, oil lamps are used to illuminate the interior and exteriors of the dwellings, firework is lighted and gifts are shared.


BEST
boy's