LIVING WITH THE MONSOON

An exploration of how housing design may enhance community resilience in flood prone areas in urban northern Bangladesh

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graduation thesis MSc Architecture

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Living with the monsoon
An exploration of how housing design may enhance community resilience in flood prone areas in urban northern Bangladesh

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WITH THE **MONSOON**

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CONTENT

Floods submerged many houses on a riverside village
on Char Bara Dhul, a riverside village (Gettliffe, 2020)

INTRODUCTION

Context

In recent decades, climate change has emerged as a major global concern. Studies indicate that this is likely to intensify the global water cycle, leading to increased rainfall and reduced evapotranspiration, resulting in higher river flows worldwide (Parvin et al., 2016). This shift is expected to result in more frequent floods in many regions around the globe (Parvin et al., 2016). Flooding poses a major challenge to the sustainability of communities living along rivers globally. Between 1995 and 2015, floods claimed over 157,000 lives and impacted more than 2.3 billion people worldwide (Mondal et al, 2020). Despite Asia being the most severely affected by the floods, reports suggest that flood-related deaths are also rising in other parts of the world (Gotham et al., 2018).

Developing countries, particularly Bangladesh, face the most significant challenges related to climate change, including flooding (Parvin et al., 2016). Bangladesh, as a low-lying developing country, is considered as one of the most disaster-prone countries in the world and highly vulnerable to climate change (Gros et al., 2019). The combination of the country's geography, dense population, and widespread poverty makes the people of Bangladesh highly vulnerable to natural hazards (Parvin et al., 2016). The most frequent natural hazard in Bangladesh is flooding, threatening 60 percent of the country where areas below six meters above sea level are at risk. Each year, approximately 20,5 percent of the country experiences flooding, and in extreme cases, flood waters can cover up to 70 percent of the country (Paul et al., 2010). While flooding can be detrimental, it is also associated with economic and environmental benefits, such as increased soil fertility, leading to an increase in agricultural production. However, severe floods can lead to widespread crop damage and the destruction of homes, livelihoods, and social cohesion (Paul et al., 2010).

An example of such a river flood occurred in august 2017 and severely affected the northern region of Bangladesh, impacting 6.9 million people, destroyed over half a million houses and took the lives of over a hundred people (Mondal et al, 2020). Floods have the most severe impact on poor and landless families, also referred to as riverine communities, who often settle on temporary islands known as chars; riverine sand and silt landmasses that are formed but also washed away by the river (Gros et al., 2019). The August 2017 flood was particularly impactful for riverine communities, as it followed two earlier floods in March and July of the same year (Mondal et al., 2020). Food security was affected by the timing of the August flood, as it disrupted the year's agricultural production and led to a record price of rice. Additionally, many areas were inaccessible to emergency relief efforts because of damaged roads, railways, and bridges, and in the post disaster period, thousands of waterborne diseases were reported (Mondal et al, 2020). While most communities have adapted to regular flooding and developed a level of resilience, extreme floods like the one in 2017 exceed their ability to cope, resulting in loss homes, crops and assets (Gros et al., 2019).

PROBLEM STATEMENT

Aftermath floods

Bangladesh is home to over 200 rivers, with three major ones; the Brahmaputra, Ganges and Megha, merging within its borders to form one of the largest rivers in the world by flow volume (Roy et al., 2016). Since 1830, the Brahmaputra River, the primary branch of the most water-rich river in Asia originating from the Himalayas, has been widening and shifting its course. It has transformed into a braided river that has expanded by approximately 128 meters annually since 1973, when satellite imagery first became available landscape (Penning-Rowsell et al., 2013). As the river erodes its banks, sediment is deposited in the channel, forming shoals that gradually develop into riverine islands known as 'chars'. These islands are often settled by farmers but are underwater during normal floods. While many chars are washed away after a few years, some become permanent, allowing trees to grow and houses to be built on them (Roy et al., 2016). Consequently, residents in these areas are increasingly resorting to permanent migration to adapt to the shifting landscape (Penning-Rowsell et al., 2013).

The rivers in Bangladesh cause almost all land types in Bangladesh to be subjected to flood, except the highlands which cover about 29 percent of the country (Penning-Rowsell et al., 2013). Most floods are not considered disasters and are a natural part of the country's ecology. However, the three major rivers have distinct catchment areas and its own rainfall and snowfall patterns. These factors, combined with Bangladesh's own variable rainfall causes every flood to be different (Roy et al., 2016). Bangladeshis use two distinct terms for floods; 'barsha' for monsoon conditions that include inundation, and 'bonna' for the less frequent but more destructive floods that occur approximately once or twice a decade (Roy et al., 2016). During monsoon season, barsha floods typically inundate 20 to 25 percent of the country for three to five months, with peak water levels lasting only one to two weeks (Roy et al., 2016). In contrast, bonna floods can inundate 40 to 70 percent of the country, sometimes even affecting the capital, Dhaka (Penning-Rowsell et al., 2013).

Individual flood resilience

As previously mentioned, communities have adapted their way of living and developed resilience to regular flooding. Over generations, the Bangladeshis have a set of risk reduction skills learned, such as building houses on the highest ground available, often with high earth plinths and platforms (Dasgupta et al., 2011). Farmers employ flexible management systems, adjusting their crops according to rainfall and flood patterns. They grow extra rice seedlings as a safeguard against potential losses from drought or floods and store short-season crop seeds to plant in moist soil after floods. A common strategy evolves planting both aus and aman rice simultaneously, allowing for the harvest of aus before flood waters rise too high and aman after the waters recede. This approach increases the likelihood of a successful crop, even in challenging years. To further minimize risk, even small farmers maintain multiple plots with different soil types and elevations (Roy et al. 2016).

Three major rivers in Bangladesh; the Brahmaputra, Ganges and Megha, merging within its borders (Author, 2024)

River transitions between the year 1984 and 2024, where the Brahmaputra, Ganges merge in Bangladesh. (Google Earth)

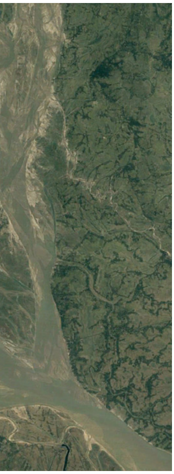
1984 1994

Larger scale flood resilience initiatives

On a larger scale, the government has initiated several flood resilience measures, including the construction of dams along the banks of the Boral River. While these efforts prevented destructive flooding, they also caused Chalan Beel, one of Bangladesh's largest wetlands, to dry out, eliminating both harmful and beneficial floods. In response, farmers protested in 2013, demanding the removal of the cross dams and road embankments built in the 1970s that had disrupted the natural flow of water (Roy et al., 2016).

Various flood management measures have been implemented in Bangladesh, including improved flood forecasting and warning systems, relief and rehabilitation efforts, and river modelling to predict erosion. The Flood Forecasting and Warning Center (FFWC) now provides flood forecasts up to eight days in advance using satellite data, with warnings disseminated through mobile networks and local centres that have links with local communities, NGOs and news media. NGOs help share flood warnings from the FFWC with local communities. However, challenges remain. While predictive models have advanced, their warnings are sometimes ignored, leading to preventable issues like resettlement along eroding riverbanks (Roy et al., 2016).

In case of cyclones, the United Nations Development program constructed over 9.000 disaster-resilient houses, targeting the most vulnerable populations in the areas most affected (Penning-Rowsell et al., 2013). In 2010, Bangladesh had more than 2.400 emergency shelters of various types (Dasgupta et al., 2010). Additionally, the World Bank agreed to provide loans for the rehabilitation of 350 existing shelters and the construction of 110 new ones, which could serve as schools during non-disaster periods (Penning-Rowsell et al., 2013). However, field research conducted by Penning-Rowsell et al. (2013) revealed that not all villages have nearby shelters, and that many people take shelter in the more robust houses within their communities.



2004

2014

2024

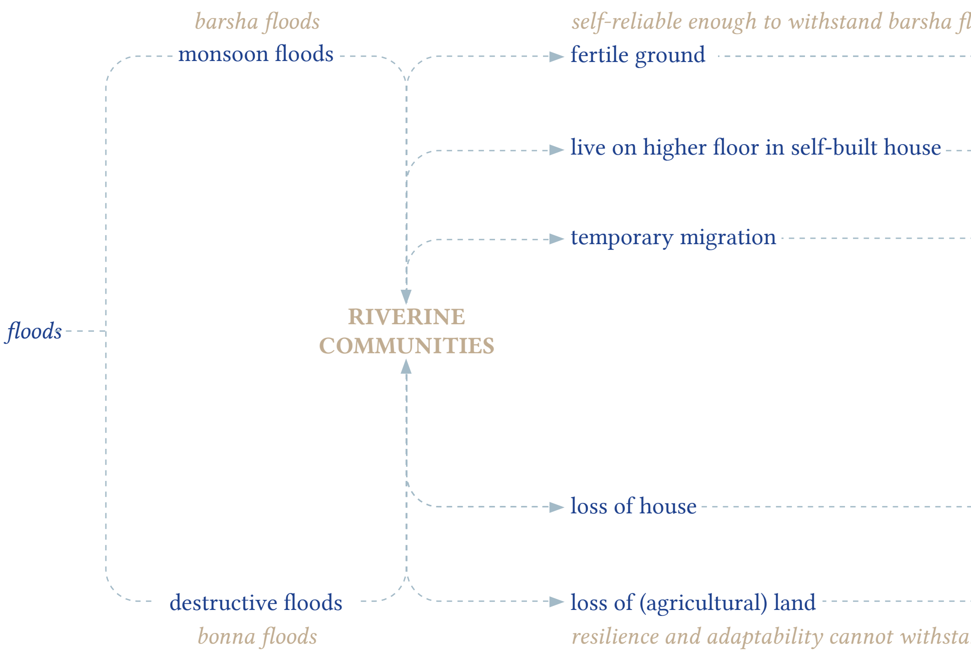
Migration response after climate disaster

The movement response to climate-related disasters varies depending on the type of disaster. During cyclones, people typically choose to stay in their houses, temporarily relocate to the safer houses of neighbours or relatives, or seek refuge in designated shelters, after which they move back to their own houses. In contrast, the movement response to erosion is fundamentally different, as it involves the long-term or permanent loss of land along with immovable property. Victims of riverbank erosion often resort to short-term solutions, such as moving in with nearby relatives or occupying public land. Those who lose both their homes and arable land may establish a homestead on someone else's' property or public land near their original homes, hoping that the riverbanks will eventually accrete, allowing them to reclaim their land. During severe (bonna) floods, if the raised platforms within their homes are inadequate, a part of the population seek shelter on boats. When both homestead and land are eroded for long periods in the chars, entire villages may relocate to new areas. They often retain their original village name, even if the new location is some distance away (Penning-Rowsell et al., 2013).

As a result of lost agricultural income in regions affected by climate disasters, another significant portion of the rural population migrates to overcrowded cities like Dhaka, Chittagong, Sylhet, and Comilla in search of work (Kamal et al., 2018). Although many of these individuals would prefer to stay, they often feel they have no choice. Dhaka attracts people due to job opportunities, where women can find work in garment factories and men often take jobs as rickshaw pullers. Unfortunately, living conditions in the slums are unhealthy and overcrowded, often situated in hazardous areas with a lack of basic services, sanitation, and hygiene. Additionally, these rural-urban migrants lose their traditional way of life, including their land and community, making the move to cities feel often feel like a last resort. (Roy et al., 2016).

Problem statement

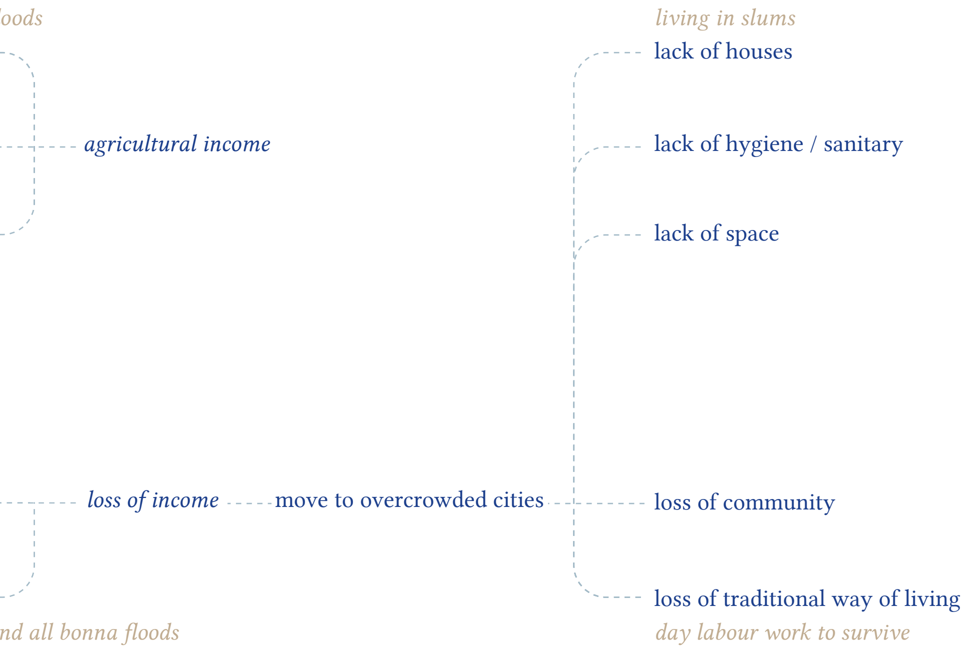
Despite the resilience and adaptability of the Bangladeshi people, even they cannot cope with the destructive bonna floods, which continue to destroy people's assets and livelihoods (Roy et al., 2016). Various flood management efforts have been implemented, yet significant gaps remain in addressing the needs of these communities. While dams prevent destructive floods, they also disrupt the normal flood cycle, drying out wetlands like Chalan Beel and harming farmers who depend on seasonal flooding for soil fertility. Improved flood forecasting provides early warnings, but these are often ignored, leading to preventable damage and forced



Problem statement diagram
(Author, 2024)

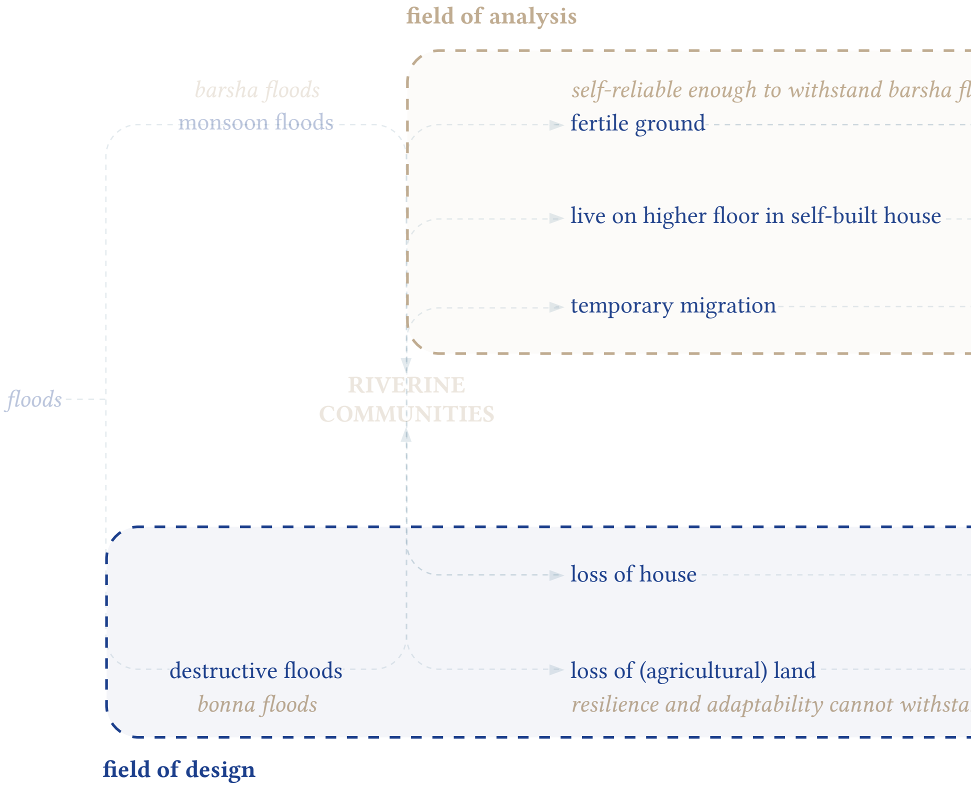
resettlement along eroding riverbanks. Multi-purpose shelters, though valuable, are insufficient in number and often too far for many communities. Lastly, migration to the already overcrowded cities, often seen as a last resort, brings new challenges like unsanitary living conditions, and loss of traditional livelihoods.

This raises the question whether the existing flood resilience of communities in Bangladesh can be up scaled through design, using gentle adjustments that respect their traditional ways of life, allowing communities to cope with larger floods without losing their income.



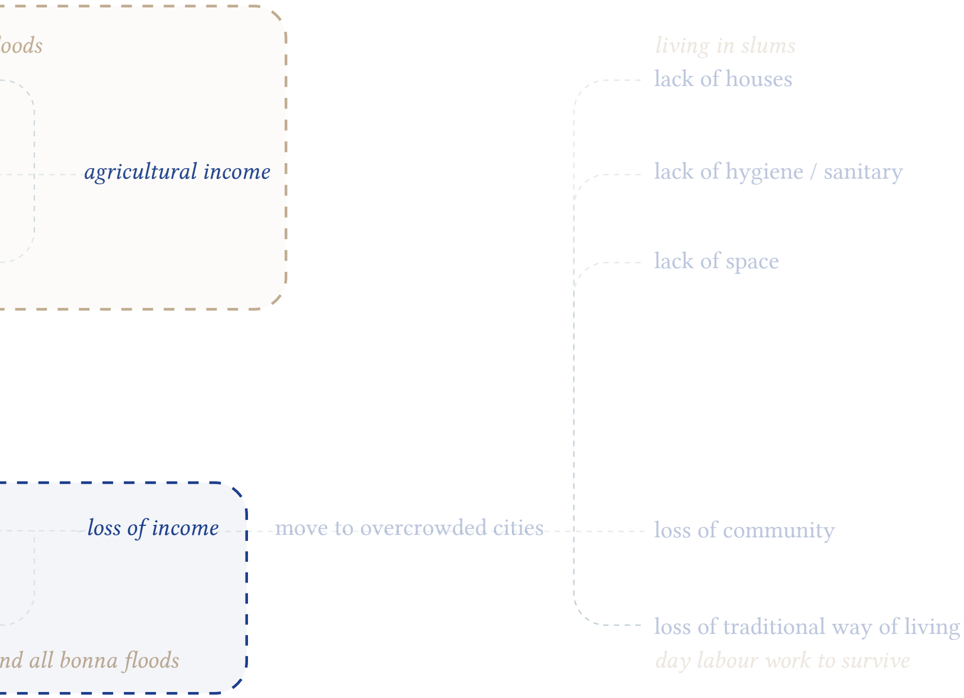
Project position

As this research acknowledges the position of being an outsider to the lived experiences and rooted knowledge of communities living in Bangladesh, it seeks to learn from the resilience these communities have already developed in coping with flooding. These communities have not only adapted their ways of living but also their way of farming to ensure they can continue generating income. The aim is to learn from their established practices and respectfully build upon these traditions to design housing solutions that align with their existing ways of life, while enhancing their capacity to withstand more destructive floods without compromising their livelihoods or way of living.



Research and design area within problem statement
(own work)

To achieve this, the research takes the communities' adaptation to monsoon floods as the primary area of analysis to learn from. These existing methods of flood resilience will serve as a foundation to design, which will focus on finding a housing solution that reduces the impact of destructive floods that lead to the loss of homes, agricultural land, and income. The objective is to explore whether the existing practices can be scaled up or adapted to help these communities cope with the more extreme, less predictable bonna floods that exceed their current capacities in dealing with floods.



Agriculture along the Boral river
(photo by Munmun, 2011)

RESEARCH QUESTION

Main research question

How can the existing resilience strategies of communities in Bangladesh, developed for coping with monsoon floods, be scaled up to urban housing solutions that enhance the ability to withstand more severe floods without compromising livelihoods and traditional ways of living?

Sub-questions

To address the main research question, the research is divided into two parts: analysing what currently works well for communities during monsoon floods and exploring why those same strategies fall short during more severe flood events. Additionally, the research will examine external solutions that could be integrated into the communities' practices to enhance their resilience to extreme flooding.

First, the research will investigate the current flood-resilient strategies under regular flood conditions and what can be learned from this that can be integrated into the design.

(1) **What can be learned from the current flood-resilience strategies of communities in Bangladesh during monsoon floods regarding economic stability, social cohesion, and housing?**

Next, it will analyse the factors that cause these strategies to not work during extreme floods and how these events disrupt the communities' economic stability, housing, and social structures.

(2) **Why do the current resilience strategies of communities in Bangladesh fail during more severe floods, and how do these events impact economic stability, social cohesion, and housing?**

Lastly, the research will look at solutions from other flood-resilient solutions that have been effective in different contexts. It will explore how these solutions can be adapted and integrated into the communities' existing strategies to enhance their ability to withstand more destructive floods.

(3) **What can be learned from other flood-resilient solutions, beyond those of communities in Bangladesh, that can be integrated into their existing practices to enhance their ability to withstand severe floods?**

RESEARCH AIM

Relevance

This research addresses a critical challenge faced by communities in Bangladesh, where climate change is amplifying the frequency and severity of floods, threatening both livelihoods and traditional ways of life. Although people in Bangladesh have generations of experience in adapting their homes and agricultural practices to withstand regular seasonal floods, their strategies are increasingly overwhelmed by the scale and unpredictability of extreme flood events, such as the river flood in August 2017, which displaced millions and destroyed homes and farmland.

Previous flood management interventions seem valuable, such as dams, improved flood forecasting, and multi-purpose shelters, but do not connect to the specific needs of riverine communities. Dams have disrupted natural flood cycles, affecting agriculture-dependent wetlands, flood warnings are often not acted upon and multi-purpose shelters remain too scarce and distant. This research aims to bridge the gap between these existing flood management interventions and the lived circumstances of communities in Bangladesh by exploring housing solutions that build upon their own resilient practices while addressing the challenges posed by extreme floods.

Research aim

In alignment with Sustainable Development Goal 11: Sustainable Cities and Communities (United Nations, n.d), this research aims to learn from established flood-resilient practices in Bangladesh and respectfully build upon traditions to design housing solutions that align with their existing ways of life, while enhancing their capacity to withstand more destructive floods without compromising their livelihoods or way of living.

Design hypothesis

Existing flood management interventions in Bangladesh operating on a larger scale, fail to meet the specific needs of communities during severe flooding that exceeds their resilience and adaptive strategies. This leads to destroyed homes, loss of livelihoods, significant amount of displaced people, and loss of income, forcing many to move to overcrowded cities and live in slums. Consequently, the design hypothesis is;

Housing solutions that integrate local knowledge, materials and resilient practices to enhance flood resilience of communities in Bangladesh with long-term adjustments, thereby reducing the risk of impoverishment and preserving traditional livelihoods.

THEORETICAL FRAMEWORK

Literature review

To explore how the existing resilience strategies of communities in Bangladesh can be scaled up to address flooding while preserving their traditional ways of living, this research builds on various studies that have already been conducted. Earlier studies document the coping strategies of communities facing frequent flooding in Bangladesh. Research on riverine floods, riverbank erosion, and urban slum floods highlight a range of strategies that help households manage the immediate challenges they face during flood events (Mondal et al., 2020; Sultana et al., 2021; Ferdous et al., 2019; Chanda Shimi et al., 2010). Common strategies include elevated construction, seasonal migration, crop modification, and income diversification to buffer economic impacts (Dasgupta et al., 2011; Ferdous et al., 2019; Roy et al. 2016). Additionally, temporary relocation and reduced food consumption are used by some households, though these can lead to impoverishment as people lose income and assets with each flood, from which they can only partially recover (Ferdous et al., 2019). Among communities living on chars, migration to urban centres for work has become a common strategy, allowing people to sustain their agricultural livelihoods by returning after floodwaters lower (Sultana et al., 2017). As most of these strategies remain short-term, Ferdous et al. (2019) critically questions the assumption that Bangladeshis have successfully adapted, arguing that while communities may cope, they experience recurrent asset losses, leaving communities poorer and less capable of making structural, long-term adjustments.

While less literature focuses on enhancing resilience to severe floods, some studies emphasize shifting from short-term coping mechanisms to sustainable, adaptive strategies (Shimi et al., 2010; Ferdous et al., 2019). Ferdous et al. (2019) discusses the need to move from 'hard' engineering approaches to 'soft' methods that allow communities to live with floods rather than fight them. The polders built in the 1970s iWn Bangladesh, illustrate the drawbacks of rigid flood control, as they have disrupted ecosystems and constrained socio-economic growth. Instead, researchers recommend approaches that enhance livelihoods without using engineered flood controls. For instance, Mondal et al. (2020) suggests livelihood diversification, such as livestock rearing and non-farm self-employment, to improve economic resilience. Their study also notes that temporary migration, chosen by communities over consumption reduction, has proven more effective in mitigating flood impacts. This shift aligns with Sultana et al. (2017), who finds that seasonal migration to urban centers for work is essential for floodplain households, especially char communities dependent on temporary relocation due to erosion and shifting river sediments.

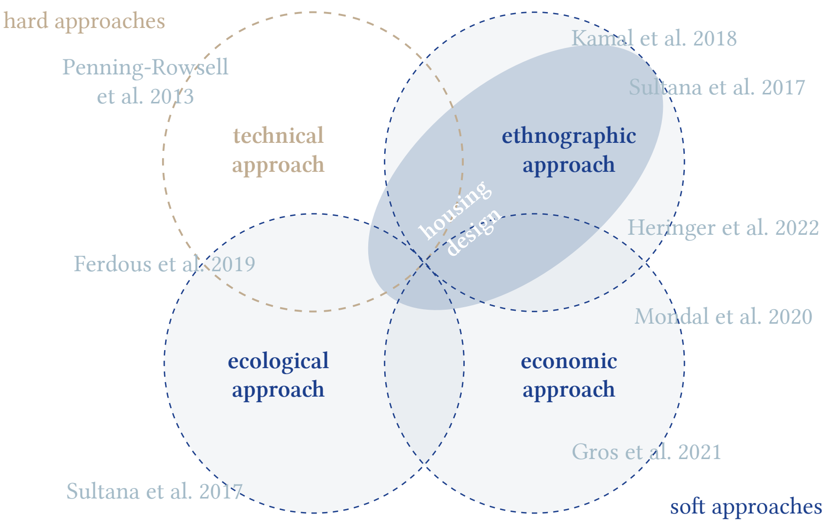
Despite some agreement in the literature on enhancing resilience, there is no unified approach to scaling these coping strategies effectively. While 'soft' approaches that support living with floods are gaining traction, there is no standardized solution yet. This study explores the scaling of existing strategies that could either result in a flood-resilient rural housing design or temporary urban housing for seasonal migrants. This research aims to propose a housing solution that aligns with 'soft' adaptation frameworks and reflect the traditional lifestyles of rural Bangladeshi communities.

Theoretical framework

Based on the literature review, flood management strategies can generally be categorized into 'hard' and 'soft' approaches. Hard approaches, such as technical solutions, use infrastructure like embankments and polders to control or prevent floods. While these engineered interventions aim to protect communities from immediate harm, they often disrupt ecosystems and limit local economic activities (Penning-Rowsell et al., 2013; Ferdous et al., 2019). In contrast, soft approaches prioritize living with floods by working with natural processes and enhancing community adaptability. These include economic, ethnographic, and ecological approaches.

The economic approach strengthens financial resilience without altering flood dynamics, focusing on strategies like livelihood diversification and forecast-based financial support. This approach mostly helps with food security, less dept and less stress (Mondal et al., 2020; Gros. et al., 2020). The ethnographic approach emphasizes adapting to floods through local practices, social networks, and migration patterns. Communities living on chars, for instance, rely on seasonal migration and flexible social networks to maintain their livelihoods amidst frequent environmental changes (Sultana et al., 2017). The ecological approach promotes sustainable coexistence with floods, using integrated floodplain management to preserve ecosystem health, which in turn supports agriculture and fisheries (Ferdous et al., 2019, Sultana et al., 2017).

This study positions itself within the soft adaptation frameworks. The proposed design should respect the natural flood dynamics and enhances community resilience by learning from local practices and migration patterns, without relying on disruptive structural measures.



Different approaches from literature on enhancing flood resilience (Author, 2024)

METHODOLOGY

As mentioned in the research question, the research will be structured into two parts.

Part I - Learning from current practices (monsoon floods)

Part I analyses communities in Bangladesh during normal floods, and takes a learning-from perspective to find out how people currently deal with flooding. It also analyses how they live, how they use their spaces and what can be learned from this.

Part II - Critical gaps and solutions (severe floods)

Part II looks at communities during severe, destructive floods. It investigates why their flood-resilient strategies do not work during these floods and what the consequences are. This part will identify critical gaps, and look at solutions from other flood-resilient solutions that have been effective in different contexts.

Scales

To structure the research, Part I and II will both be analysed through three different scales; community, cluster and dwelling.

Community	- flood patterns, agriculture
Cluster	- social cohesion, economic stability, outdoor spaces, migration patterns
Dwelling	- use of space, layout, construction, material

Fieldwork

In December, a three-week field trip to Bangladesh will include visits to Dhaka and Sylhet to study the culture, environment, and collaborate with the students from Shahjalal University of Science & Technology. Various sites will be explored, from which a suitable design location will be selected. Observations will be documented thoroughly through photographs, sketches, and interviews. Ethical considerations are essential, as homes will be visited which are private, intimate spaces that must be approached with respect (Pink et al., 2020). Consent will be obtained from residents before photographing their environment, and if individuals appear in photos, they will be shown the images and asked for permission to use them in the research.

Literature review

Since the field trip will be limited to three weeks of observation, the literature review will supplement insights gained during the visit. It will examine flood frequency and levels, as well as how local populations successfully adapt in areas such as agriculture, economic stability, migration patterns, and construction. The review will also explore the impacts on these areas when current adaptation methods prove insufficient. Research papers, local news sources, and books will be consulted to gain a deeper understanding of existing practices.

Mapping

Mapping will be used to organize observations of riverine communities coping with floods during fieldwork, inspired by How the Other Half Builds (Rybczynski et al., 1984), which provides a framework for understanding and analyzing informal urban settlements in developing countries. This mapping will explore themes of everyday life across three scales: village, community cluster, and dwelling.

Interviews

In addition to observations and documentation during fieldwork, interviews will be prepared and conducted if possible. Since the continuous flow of daily life can be difficult to capture through observation alone, interviews offer valuable context and detail (Pink et al., 2020). To explore the area through multiple scales, e Moura et al. (2023) propose a method called 'scaling stories', which investigates the social and spatial layers of an urban neighbourhood. This approach uses three scales: 1:10 (dwelling, eg., a resident), 1:100 (community cluster, eg., a local teacher) and 1:1000 (village, eg., a mayor). These scales reflect both spatial and social dimensions, as each scale represents the influence and reach of individuals within their environment.

Case studies

Part II will include case studies both from Bangladesh and globally to illustrate how similar projects address critical gaps outlined in the problem statement and expanded upon in the analysis of Part II. Specific case studies will be selected once a site is chosen during the field visit to ensure relevance to the study.

MAIN RESEARCH QUESTION

How can the existing resilience strategies of communities in Bangladesh, developed for coping with monsoon floods, be scaled up to urban housing solutions that enhance the ability to withstand more severe floods without compromising livelihoods and traditional ways of living?

Which parts work? | Which parts do not work? | Case studies solving similar issues

SUBQUESTION 1

What can be learned from the current flood-resilience strategies of communities in Bangladesh during monsoon floods regarding economic stability, social cohesion, and housing?

SUBQUESTION 2

Why do the current resilience strategies of communities in Bangladesh fail during more severe floods, and how do these events impact economic stability, social cohesion, and housing?

SUBQUESTION 3

What can be learned from other flood-resilient solutions, beyond those of communities in Bangladesh, that can be integrated into their existing practices to enhance their ability to withstand severe floods?

PART I - Monsoon floods

Learning from current practices

Scale		literature	interview*	observation	casestudies
Community scale	flood patterns	●	○	○	○
	agriculture	●	●	○	○
	migration patterns	●	●	○	○
Cluster scale	social cohesion	○	●	●	○
	economic stability	●	●	●	○
	outdoor spaces	○	○	●	○
Dwelling scale	use of space	○	○	●	○
	layout	○	○	●	○
	construction	●	○	●	○
	material	○	○	●	○

result: *Overview of* **what** *of the current practices* **should be integrated** *into the design*

PART II - Severe floods

Critical gaps and solutions

Scale		literature	interview*	observation	casestudies
Community scale	flood patterns	●	○	○	○
	agriculture	●	●	○	●
	migration patterns	●	●	○	○
Cluster scale	social cohesion	●	○	○	●
	economic stability	●	●	○	●
	outdoor spaces	○	○	○	○
Dwelling scale	use of space	○	○	○	●
	layout	○	○	○	●
	construction	●	○	●	●
	material	●	○	●	●

result: *Overview of the* **critical gaps** *in current practises and* **solutions through case studies**

* if possible, interviews are conducted to supplement the research

Community scale

Flooding analysis - part I & II

What is the impact, frequency and water height of floods in rural areas *in the specific area of research*? (both monsoon and severe)
Method = literature review, Output = Background research

Agriculture - part I & II

What is the impact of floods on agriculture in rural areas *in the specific area of research*?
Method = literature review, Output = Background research

Cluster scale

Social cohesion / outdoor spaces - part I

How and where do people interact? What do these outdoor / communal spaces look like?
Method = observing / sketching, Output = understanding of how and where people connect within their community, sketches or photos of these places

Social cohesion - part I / Migration patterns - part I & II

How do communities rebuild after (temporary) displacement? Where do people go?
Method = literature review / (interviews), Output = understanding of the way of living of communities regarding temporary and permanent migration

Economic stability - part I & II

What do people do to earn money? What spaces are used? What alternatives do people find in case flooding causes initial source of income to fail?
Method = literature review / (interviews) / observing, Output = overview of ways to earn money by rural communities

Dwelling scale

Use of space / layout / material / construction - part I

What is the current housing situation of rural residents? What characterizes their floor plan? Which spaces and what sizes are important? What materials and construction techniques are used?
Method = observing / sketches / photographs, Output = floorplans including notes, sketches of use of space, photographs of material and construction of houses

Use of space / layout / material / construction - part II
What can be learned from existing housing designs that deal with changing tides and / or floods? What are local construction techniques exist using locally available materials? How can these materials be used to create adaptable housing?
Method = literature review / observing / case studies, Output = overview of local materials and techniques, overview of existing solutions

fieldtrip

research plan writing

literature review

RESEARCH QUESTION

Learn from established flood-resilient practices of riverine communities and respectfully **build upon** these traditions to design housing solutions that align with their **existing ways of life**, while **enhancing their capacity** to withstand more destructive floods

What existing strategies do not work?

What existing strategies work?

find casest
solve critic

overvie
critical

PART II - Severe floods

Critical gaps and solutions

(see previous page for specifics)

PART I - Monsoon floods

Learning from current practices

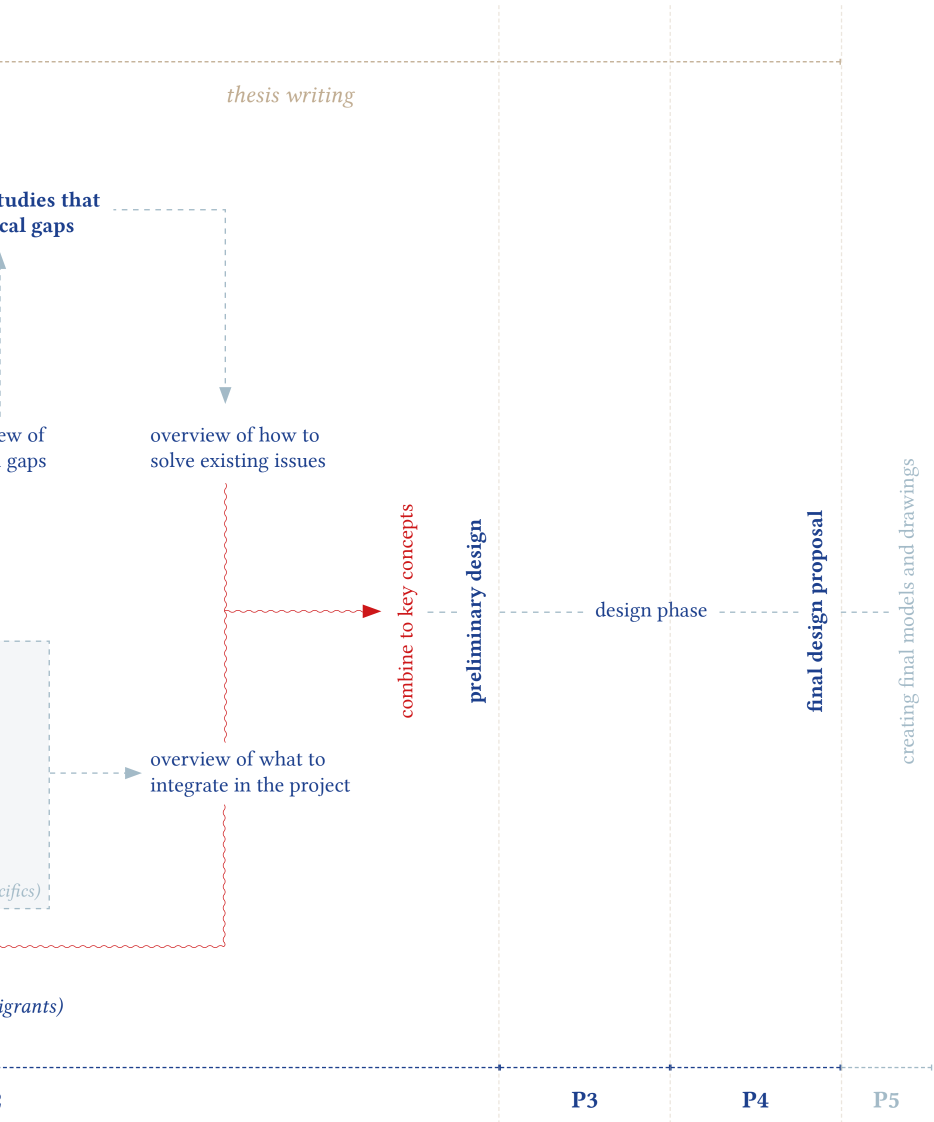
(see previous page for spe

fieldwork ▶ decide on project site

- *rural (flood resilient housing)*
- *rural-urban (for rural temporary mi*

P1

P2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preliminary design
design phase
final design proposal
creating final models and drawings
P3
P4
P5

DEFINITIONS

Riverine communities

Riverine communities are settlements located along the rivers (in Bangladesh), either in the rural areas or on chars. The riverine residents rely heavily of the river's resources, including fishing and agriculture, but are also often vulnerable to flooding, erosion and other natural changes in the river's behaviour.

Resilience

Resilience comes from the Latin verb 'resilire', which means to rebound. The theory examines the capacity of systems, whether individual, community or environment, to anticipate, adapt, recover and learn in the context of major threats, surprises, and disasters (Masten, 2014).

Seasonal / monsoon / barsha floods

The seasonal (monsoon) floods are referred to as barsha floods by Bangladeshis (Roy et al., 2016). These are normal inundation, and crucial for the production of aus and aman rice. The barsha floods rise about 8 feet above the broadcast aman fields, but do not overtop the village land (Paul, 1984).

Severe / destructive / bonna floods

The less frequent but more destructive floods that occur approximately once or twice a decade are called bonna floods (Roy et al., 2016). These abnormal floods go beyond the ability of farmers to cope and causes widespread damage (Paul, 1984).

Chars

Riverine islands, known as 'chars,' form gradually as rivers erode their banks and deposit sediment in the channel, creating shoals that slowly develop into inhabitable land. These islands are often settled by farmers but are underwater during normal floods (Roy et al., 2016).

Riverbank erosion

Riverbank erosion is the process where flowing water gradually wears away riverbanks, displacing soil and sediment, often reshaping the river's course and impacting nearby communities and landscapes (Islam et al., 2011).

Livelihood

Livelihood involves activities that sustain people's lives. Rural livelihoods largely depend on natural resources, income opportunities, asset access, and governance support (Rahman et al., 2023).

Riverine communities living close to a city
(photo by Mari Margil, 2020)

PART I

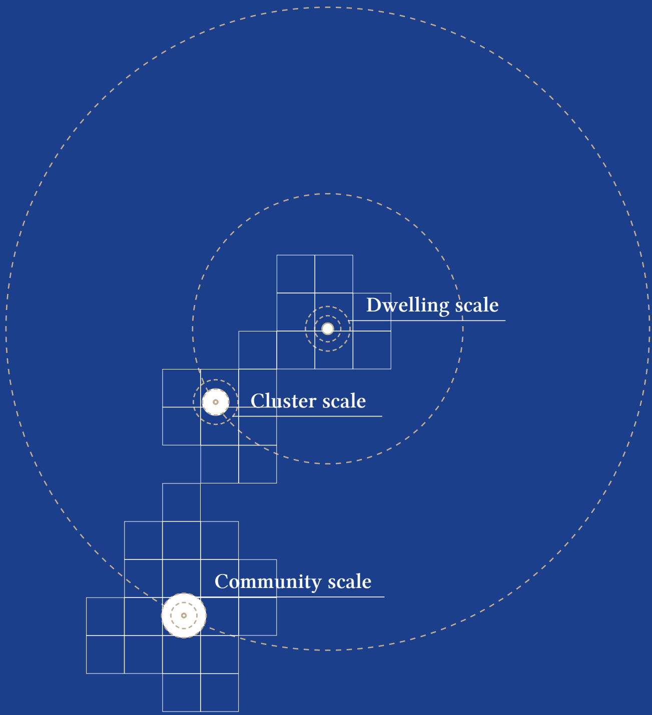
Learning from current practices

ANALYSIS THROUGH SCALES

As described in the research plan, the findings in Bangladesh are organised through three different scales; the community scale, the cluster scale and through the scale of a dwelling.

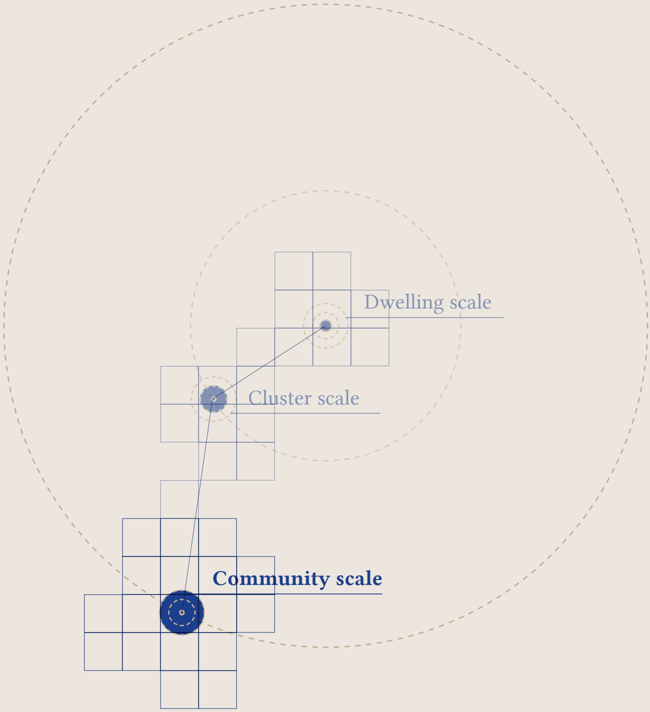
To build upon existing structures, this research maps existing ways of living based on observations and encounters during the excursion in Bangladesh.

The chapter concludes with a summary of key insights and recommendations to be integrated into the design.


Dwelling scale
Cluster scale
Community scale

learning from

COMMUNITY SCALE

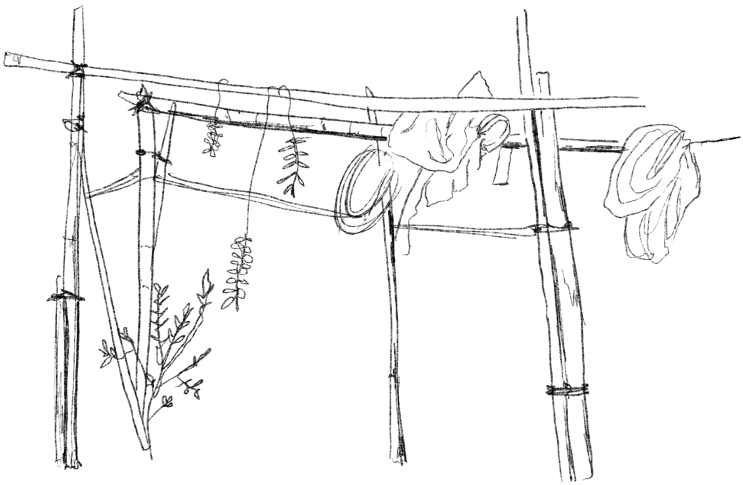

Dwelling scale
Cluster scale
Community scale

LEARNING FROM I agriculture

Agriculture is a big part of the every life in Bangladesh. In rural areas, it is one of the main sources of income. People have adapted to the monsoon by growing different types of rice (aus and aman) at the same time, so at least one harvest has a better chance of surviving the floods. They keep extra seedlings, spread their crops over different soil types, and time their planting to the flood cycle. It shows how people have developed strategies over generations to deal with flooding.

In cities, agriculture happens as well but on a much smaller scale. People use any space they can find, narrow gaps between houses and small courtyards, to grow food for their own use. But unlike the rural systems, these gardens are not designed for flooding. When the water comes, crops often do not survive.

In many small scale agriculture gardens, simple bamboo structures are built over the beds. These are mostly used to support climbing crops like gourd, beans or bitter melon. Sometimes they are also used to dry herbs or vegetables, placed on top where they catch sun and stay out of reach of animals.



Large argriculure fields in rural areas
(Author, 2025)

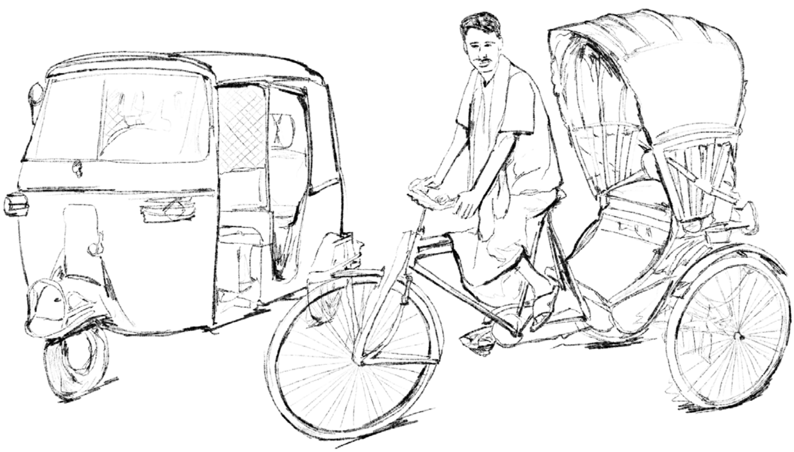
Agriculutre on a small scale in urban context
(Author, 2025)

LEARNING FROM I transport

CNGs and rickshaws are everywhere in the city. CNGs (compressed natural gas three-wheelers) are usually owned by private companies and leased to drivers. Rickshaws are often owned by individuals who rent them out for the day. The work is tough. A day's rent for a vehicle is about 9 euro, which is roughly 1,100 Taka. That means drivers need to make a lot of trips just to break even. The fare per ride is low, so the pressure to keep going is high.

Many rickshaw pullers come from the countryside. After planting their rice, they head to the city for a few months to earn extra income. It is temporary work, and for many, also a place to stay while they're between seasons. What stands out is that you almost never see women driving, it is always men.

Apart from the CNGs and rickshaws, people in the rural areas mostly use motorbikes and bicycles to move between villages. Boats are still used, but mostly in specific regions such as the haors where rivers are the only option. In the cities, traffic is constant. People get around by rickshaw, bus, CNG, or on foot. Some own cars, but the streets are mostly filled with rickshaws and CNGs.



Public transport, mainly consisting of CNGs and Ricksaws
(Author, 2025)

LEARNING FROM I market spaces

Bangladesh has a wide range of markets, both formal and informal. Formal markets usually have fixed stalls and some form of structure, but even there, things stay flexible. Informal markets are more common. Vendors set up on sidewalks, street corners, or under a roof structure. Some walk around with baskets or pushcarts, selling vegetables, snacks, clothes, or tools.

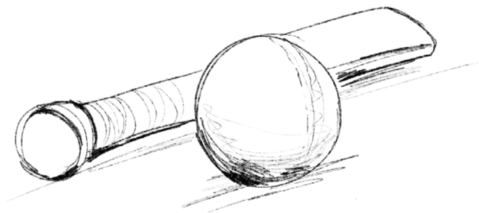
In rural areas, markets take on different forms. Early in the morning, informal labour markets form. Groups of people gather around 5 a.m. to offer themselves for day work, for example to help with the rice harvest. Others sell fish they have caught themselves, or meat from animals they have slaughtered that morning. It is not uncommon to see someone skinning a cow next to their stall, and selling the meat directly from the same spot.

These (informal) markets show how entrepreneurial people are, starting small businesses and trying to earn money wherever possible.

Markets, both in villages as well as in the city, both formal and informal (Author, 2025)

LEARNING FROM | public space

In rural areas, parts of agricultural land are used to play cricket when not in use for farming. In cities, small open spaces between buildings often serve the same purpose. A bat, a ball, and a bit of space are enough to set up a game.

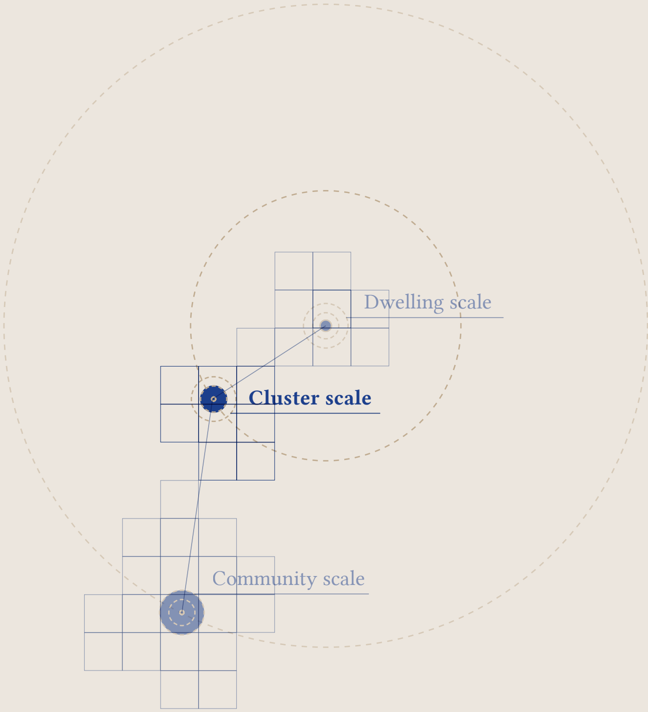


Open space a few hours outside Dhaka in village Ekduaria, where people use fields to play cricket (Author, 2025)

Open space in Dhaka, used to play cricket (Author, 2025)

learning from

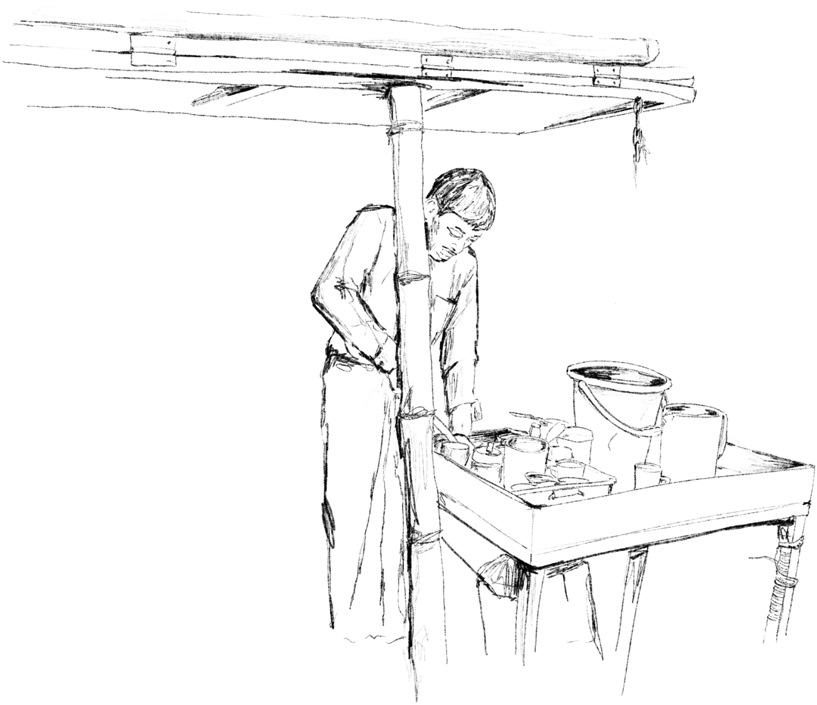
CLUSTER SCALE


Dwelling scale
Cluster scale
Community scale

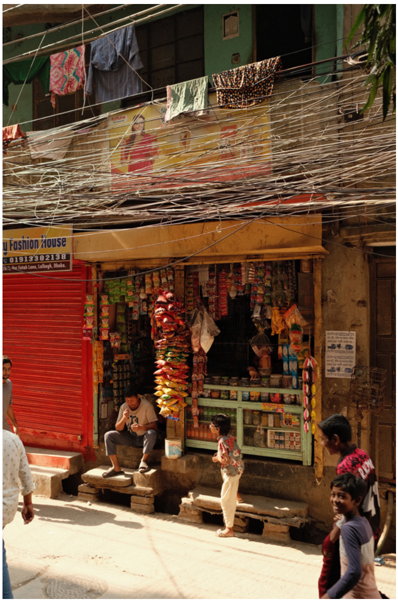
LEARNING FROM I economic spaces

Throughout the streetscape, economic activity is highly visible, from small shops to informal markets, every part of the city is used to earn a living. Shopfronts are often small, sometimes no more than a few square meters, but packed with goods. Many are open to the street, with metal shutters that close at night. Some sell groceries or snacks, others offer services like tailoring, repairs, or phone credit. The spaces behind, beside or above the shop are often used as storage or living space.

Even outside the formal shops, trade happens everywhere, on sidewalks, at intersections, or from mobile carts. The line between living and working space is often blurred. What is available, is used for earning.



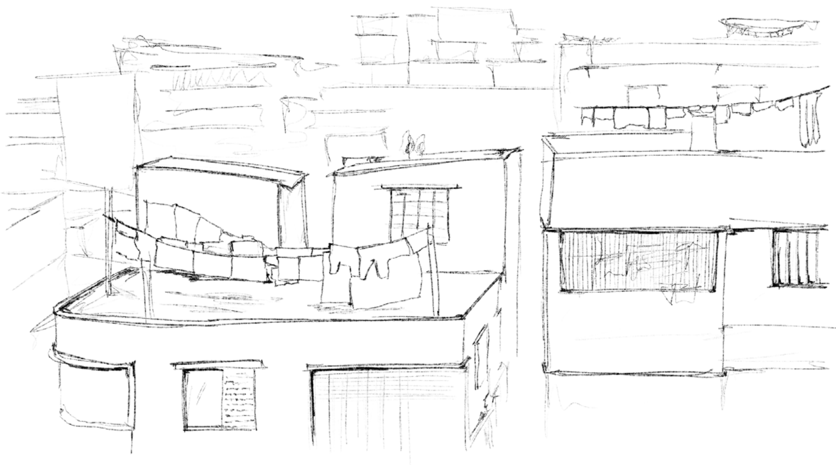
Cluster scale



Shop fronts and small entrepreneurs using a few squared meters to sell items. (Author, 2025)

LEARNING FROM I rooftops

In dense urban areas, rooftops are part of daily life. They are used to dry laundry, store materials, or sit in the evening when it cools down. Some rooftops are turned into small gardens or used for growing vegetables. In dense cities where space is limited, such as in Bangladesh, roofs become an extra liveable landscape as well. Rooftops are also used for water storage tanks, satellite dishes, or even invite people.

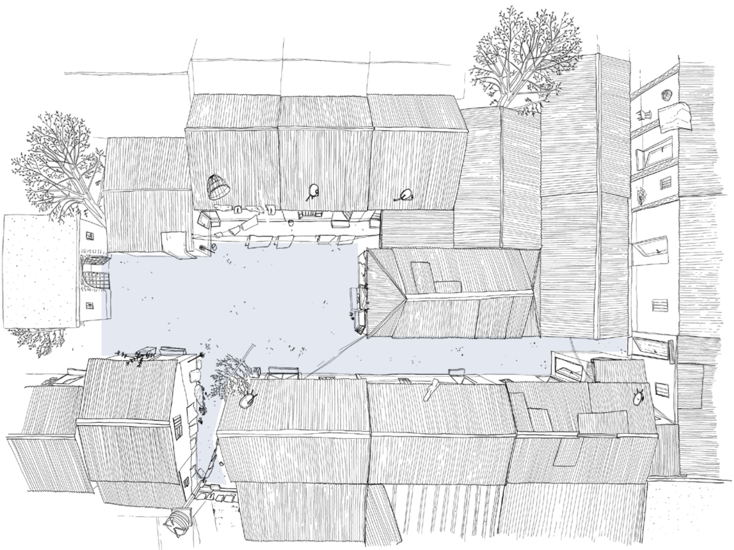


Spatial layouts of various dwelling clusters in Bangladesh (Author, 2025)

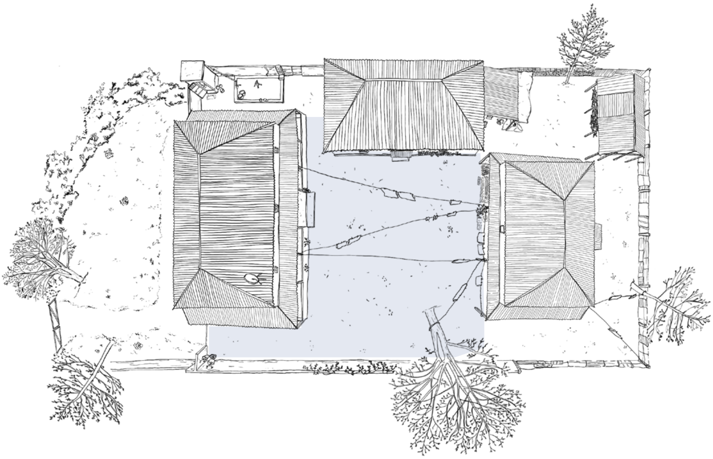
LEARNING FROM I courtyards

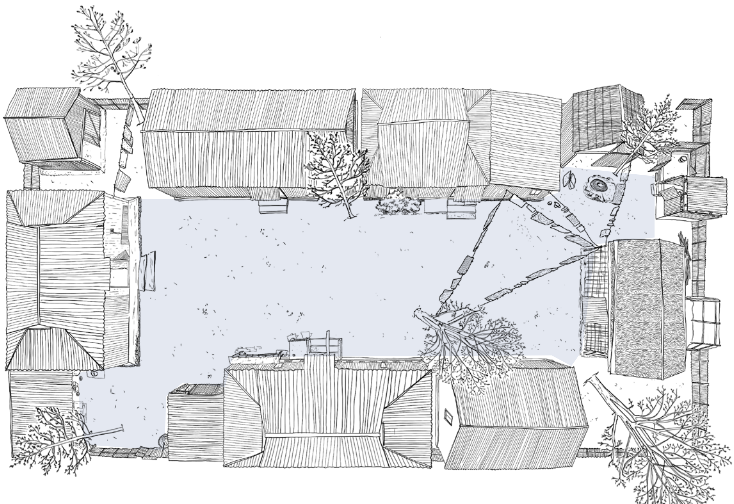
These sketches illustrate three of the places visited (see the 'home series' chapter for more details). Although located in different contexts (the sketches on the right are from rural areas, while the one on this page shows an informal settlement in the city), they all reveal a similar spatial layout; homes are built around courtyards, which serve as outdoor living areas.

These spaces are used for cooking on mud stoves, drying laundry, or simply as a place to sit and live. Sanitary facilities are not included inside the dwellings and are often shared. Access to these facilities is usually through the courtyard, with toilets and wash areas placed in the corners to maintain privacy.



Cluster scale





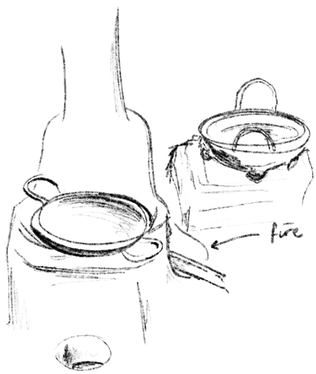
Spatial layouts of various dwelling clusters in Bangladesh (Author, 2025)

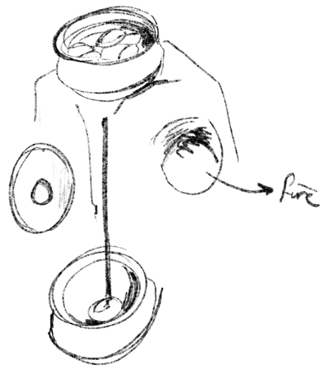
LEARNING FROM I communal facilities

As already mentioned on the previous page, the courtyard also functions as access to shared facilities. Kitchens and sanitary units are often shared by the surrounding households.

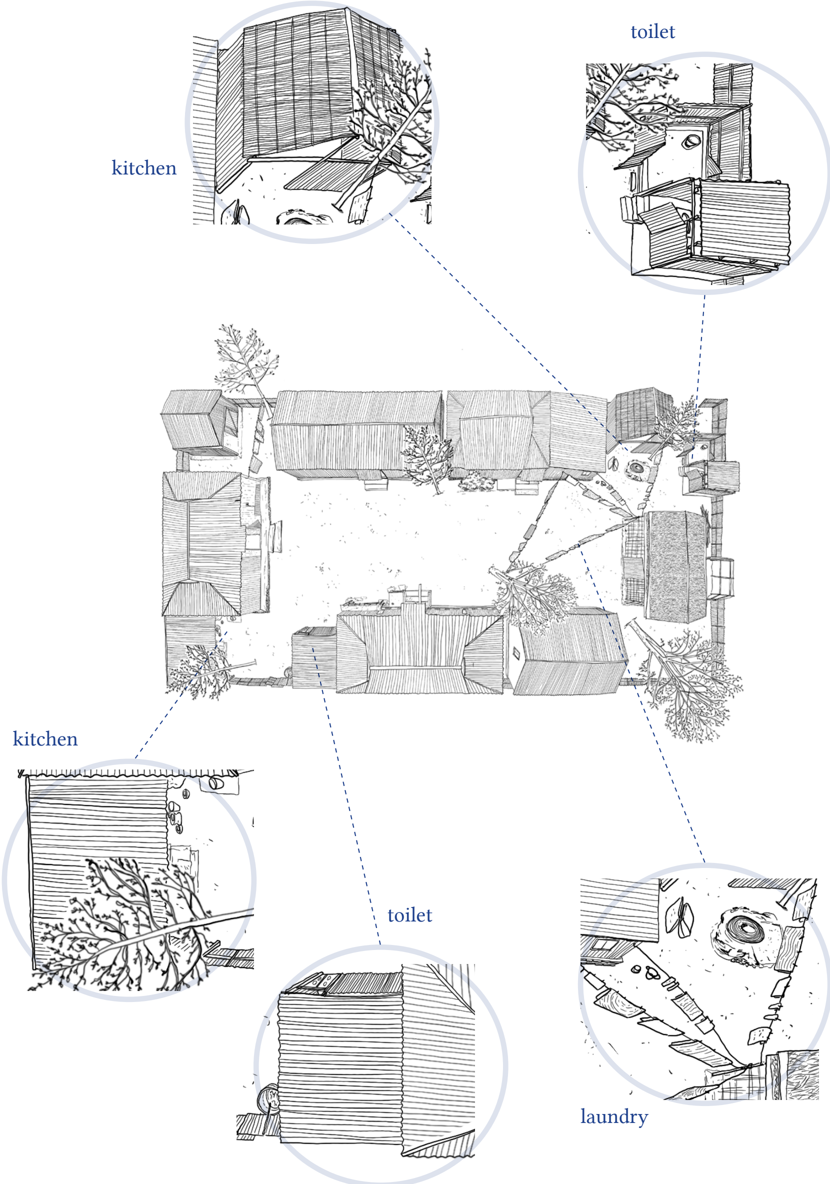
The right page shows a courtyard in a rural setting, shared by an extended family, each owning one of the houses around it. In the top right and bottom left corners, there's a simple outdoor kitchen under a roof and a shared toilet.

In Bangladesh, many people cook on mud stoves. These are usually placed outside, often under a small shelter to keep them dry. The stove is made from clay and shaped to hold one or two pots. It is fired with wood, dried leaves, or cow dung. Cooking happens close to the ground, often while seated.





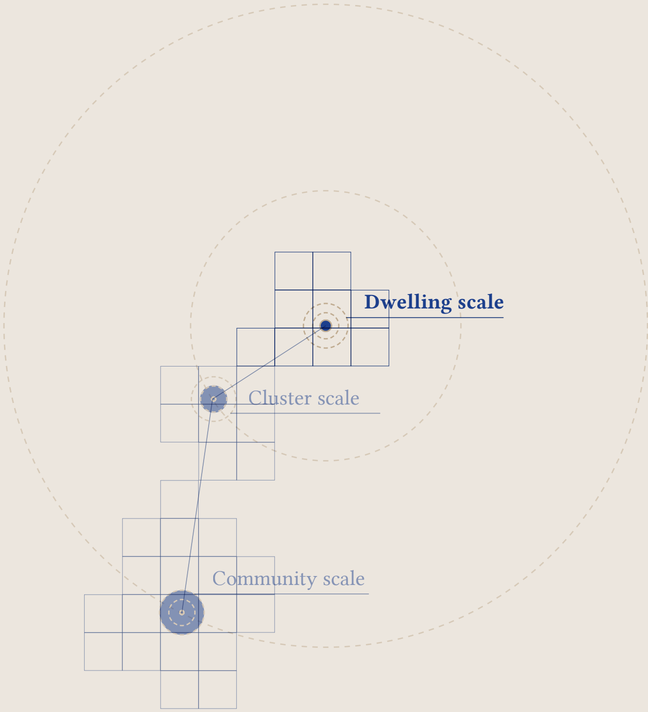
Cluster scale



Shared facilities around a courtyard (Author, 2025)

learning from

DWELLING SCALE


Dwelling scale
Cluster scale
Community scale

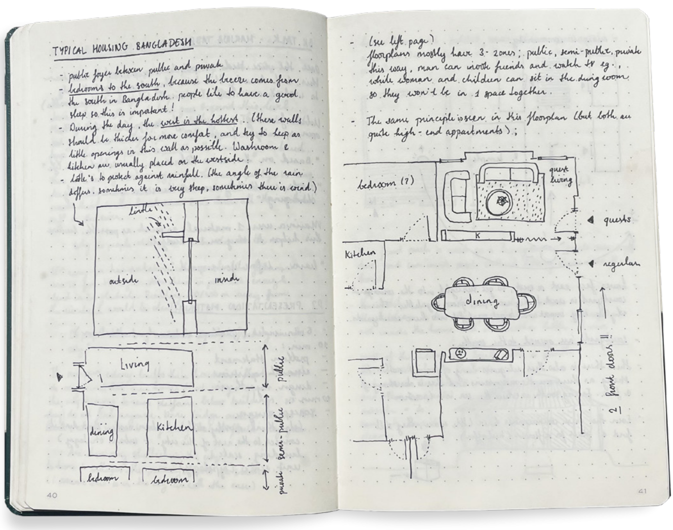
LEARNING FROM I floorplans

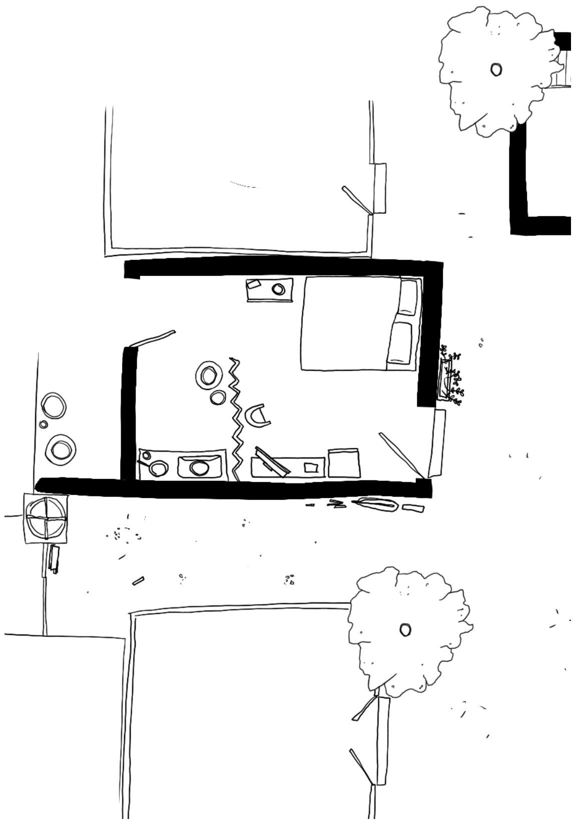
Looking at different floor plans in Bangladesh, including typical village housing as well as larger city apartments, the living room and kitchen are always separated. Cooking is considered a private activity in Bengali culture, and strong spices are often used, which makes it practical to keep the kitchen as a separate space. This also allows women and men to sit in separate spaces within the same house.

In lower-income dwellings (as shown on the right page), this separation is often created with simple, low-tech solutions, such as a partition wall made from corrugated tin sheets. In higher-income city apartments, the kitchen is still a separate space, but the dining and living areas are also clearly divided. The living room is located near the entrance, allowing guests to be received without passing through the rest of the house. Men typically sit here and watch TV, while women stay in the dining area, separated from the men. In one of the apartments visited, a double front door was used; one for guests, and a second, more private entrance for daily use.

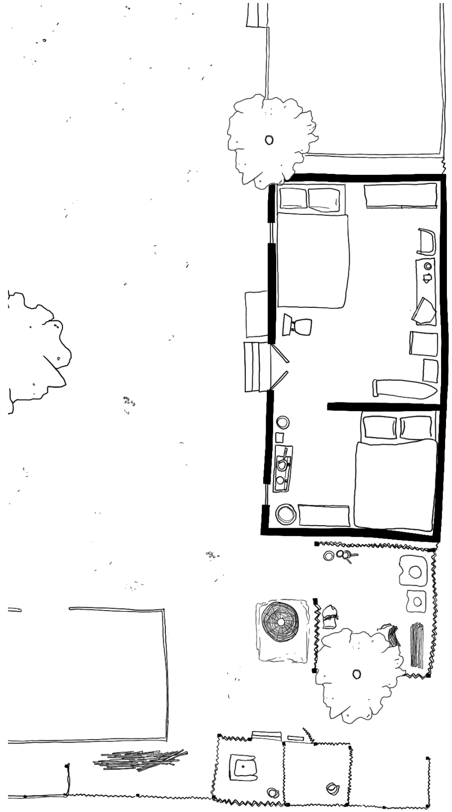
The kitchen and bathroom are always located on the facade, for natural ventilation.

In most of the visited houses, rural, low-income, city, middle-income, the living room is often also a bedroom. The bedrooms are often shared with multiple family members. Only in the high-income houses the living room is not also used as a bedroom. Also, these high-income houses often have a guest / maids room.





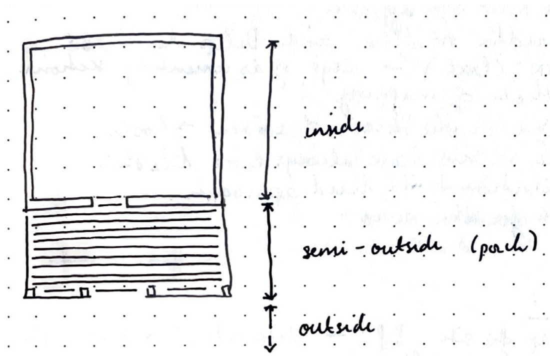
Informal settlement housing, still separating the living room/bedroom from the kitchen. (Author, 2024)

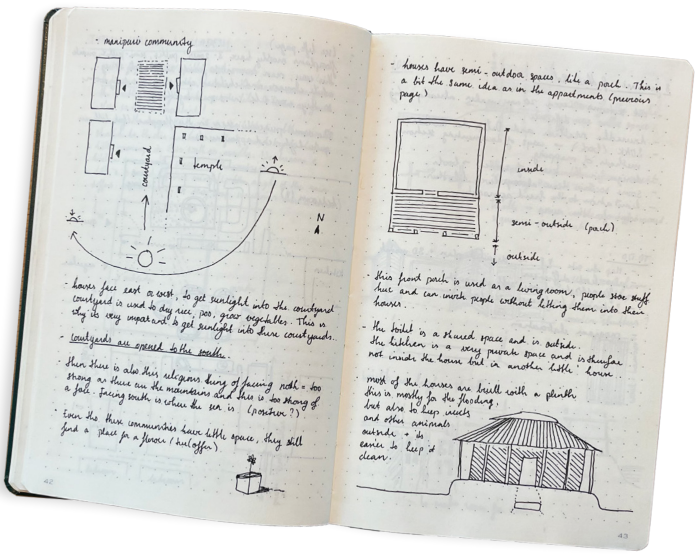


Typical village housing, showing a main living / bedroom (on the left) + a guest room / kitchen (on the right). (Author, 2024)

LEARNING FROM | use of space

What was also often seen in Bangladesh, is that people built in multiple layers; public, semi-private and private. This results in an in-between place, between the dwelling itself and the outside. This is often used to store personal belongings, but also as a place to invite people, without being inside the house itself. This layered way of building also helps to create shaded, ventilated spaces, which is beneficial in Bangladesh's hot and humid climate.



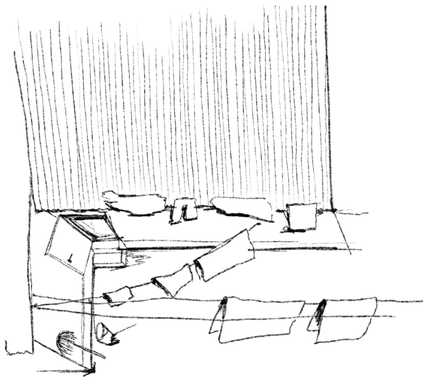


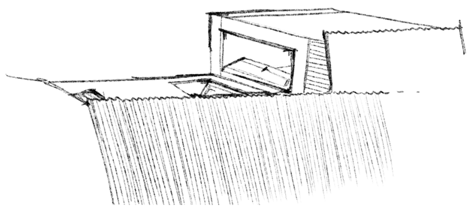
Semi outside spaces between dwelling and the outside
(Author, 2024)

LEARNING FROM I use of space

Small setbacks in the façade create valuable in-between spaces that are actively used by residents. These small adjustments in spatial layout offer opportunities for to make a home personal and unique and is practical for everyday use. People hang laundry, cook, sit, store items, or simply mark the space as their own.

Through these gestures, houses become more than standard units, they gain identity. These small setbacks support a sense of ownership, individuality, and belonging in dense neighbourhoods. These lived-in edges show how people shape space in ways that reflect daily routines and social life.





Setbacks and use of space in Bangladesh
(Author, 2024)

LEARNING FROM I materials

Materials in Bangladesh are used in ways that respond to climate, flooding, availability but also costs. They are often combined, adapted, and maintained by hand. During the fieldtrip in Bangladesh, the materials listed below were most commonly seen. In rural context, most material was locally sourced, mainly due to the costs and the ability for people to construct their own house from it. In the cities, the main material used was concrete in structures, as this allows for high-rise in the highly dense cities.

Locally sourced materials or techniques

- Brick (durable and widely used, especially for plinths and walls)
- Mud / clay (regulates indoor climate; vulnerable to erosion)
- Wattle & daub (combination of bamboo and straw mesh plastered with mud, then whitewashed for water resistance)
- Bamboo (lightweight, strong, and used for both structure and cladding)
- Wood (often combined with sheet material, as seen in systems like Bangla Baton)

Often used, not locally sourced

- Concrete (used for plinths, floors, and structural elements)
- Steel rods (for reinforcement in more permanent structures)
- Corrugated metal sheets (common for roofing and walls; fast, cheap, but thermally poor)

These materials show how building methods are shaped by function, cost, and adaptation to water. They are essential references for any design that aims to build with, not against, the local reality.

For more information on building materials in Bangladesh, this year's Global Housing Studio conducted a joint study on local materials, which is documented in detail in the book 'Global Housing – Material in Bangladesh'.

Locally sourced material
(Author, 2024)

Often seen material, not
necessarily locally sourced
(Author, 2024)

CONCLUSION I learning from

Existing ways of living that should be integrated into the design

Existing spatial practices in housing, layout, and daily routines reflect local needs, social structures, and climate conditions. To design in a unknown context, this project follows the idea of 'How the other half builds', a research by Balkrishna Doshi. Rather than replacing the existing systems, this project learns from them and creates a design that builds upon on them. The following ways of living and building, as observed in everyday housing typologies during the fieldtrip, offer important principles that can be integrated into the architectural and urban strategy.

Typology

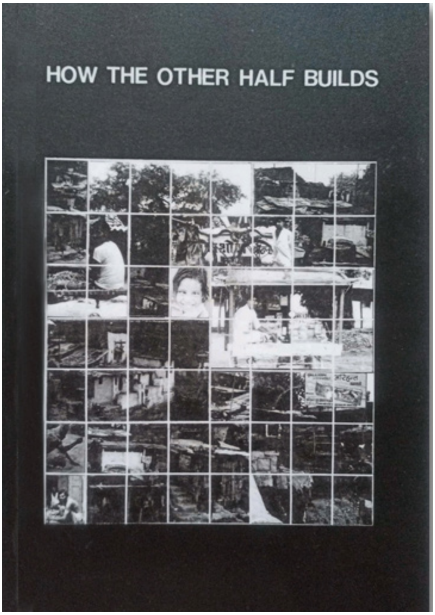
- Dwellings arranged around a courtyard
- Courtyards as a shared outdoor living area
- Small-scale
- Ground access housing
- Gallery access housing that also serves as a semi-private in-between zone
- Small nooks on the façade to create semi-private spaces connected to a shared area
- Small shops in front of housing
- Rooftop landscape

Floorplans

-Kitchen in a separate space
- Bathroom and kitchen on the façade
- Separated living and dining rooms
  (to host guests while keeping women/children or private areas separate)

Overall

- Building the masterplan in zones; different levels of privacy (public, semi-public, private)



How the other half builds, a research by Balkrishna Doshi.
(Marwaha, n.d.)

"Learn, before you respond"

PART II

Flood resilient practices

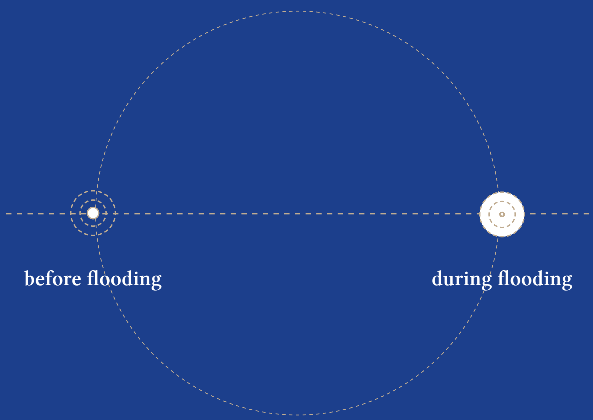
FLOOD RESILIENT PRACTICES

This second part of the research is structured in multiple sections. First, it analyses how people cope with flooding by mapping the measures they take before the flood, as well as their responses during the flood. It also maps how people live with the monsoon floods throughout the year.

Next, the chapter draws insights from current practices through expert interviews and examines case studies to learn from strategies beyond traditional Bangladeshi practices.

Finally, it concludes by identifying the key measures that should be integrated into the design.

living with the monsoon



learning from flood resilient practices

BEFORE THE FLOODING


living with the monsoon
before flooding
during flooding

LEARNING FROM I flood resilience practices

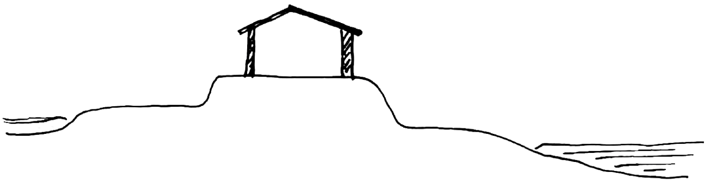
In Bangladesh, communities have developed strategies over generations to prepare for seasonal flooding. These are not emergency responses, but part of everyday construction and land use practices to live with the water.

In flood prone areas, people build their homes in ways that anticipate high water levels. One common method is to raise the house on a plinth, a compacted mound of earth that lifts the ground floor above expected flood levels. This principle is often referred to as 'dig and mound', where the excavated soil creates a raised area for the house, while the pit serves as a space to hold excess water.

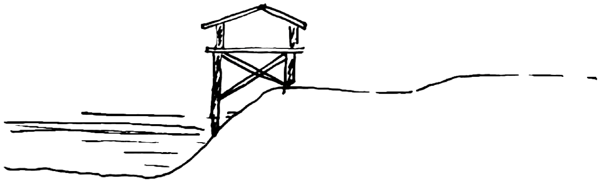
In areas where flooding is deeper or more sudden, houses are built on stilts to stay safely above the water. This is often seen along rivers.

Another strategy is to live on a second floor, while the ground floor is used for storage or animals and may flood temporarily. This allows people to stay in their homes during high water, rather than evacuating.

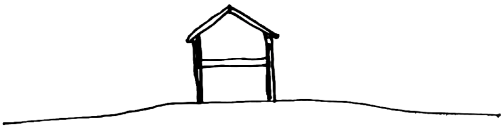
At the landscape level, people also make room for the monsoon. Agricultural fields are often located in lower-lying areas that are expected to flood seasonally. These areas act as temporary retention zones while also supporting rice cultivation or fish farming after the waters recede.



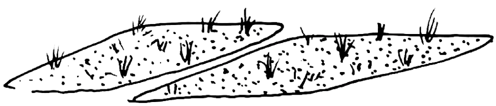
Build on a higher plinth



Built on stilts



Live on the second floor



Make room for and use of the monsoon

learning from flood resilient practices

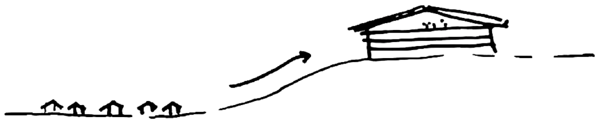
DURING THE FLOODING


living with the monsoon
before flooding
during flooding

When the flood arrives, people respond in different ways depending on the severity of the situation and the resources available. In many rural areas, one of the most common strategies is to seek shelter in public buildings, such as local schools with multiple floors. These elevated structures serve as temporary refuges for families whose homes have become uninhabitable.

In other cases, people may move their entire house, especially when it is lightweight and built in a modular way. This is most common in areas affected by riverbank erosion, where families dismantle their homes and rebuild them on safer ground nearby. If moving the house is not possible, people often rebuild it elsewhere after the flood water has receded.

A growing number of people migrate temporarily to the city, often to earn money while waiting for the land to dry. These temporary migrations are a response to both flooding and lack of income during the wet season. Many return once the water levels drop and agricultural activity can resume.



Seek shelter during flooding in schools with multiple floors

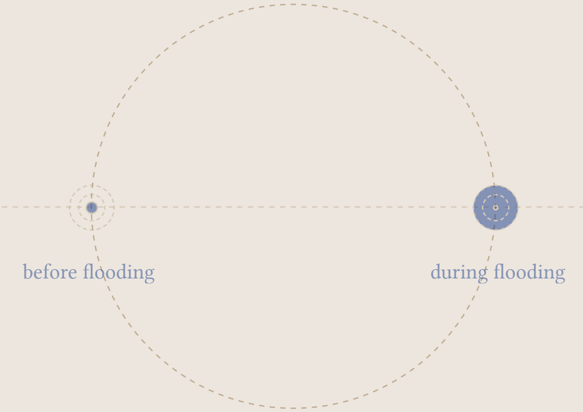
Move their house or rebuilt somewhere else

Migrate (temporary) to the city

learning from flood resilient practices

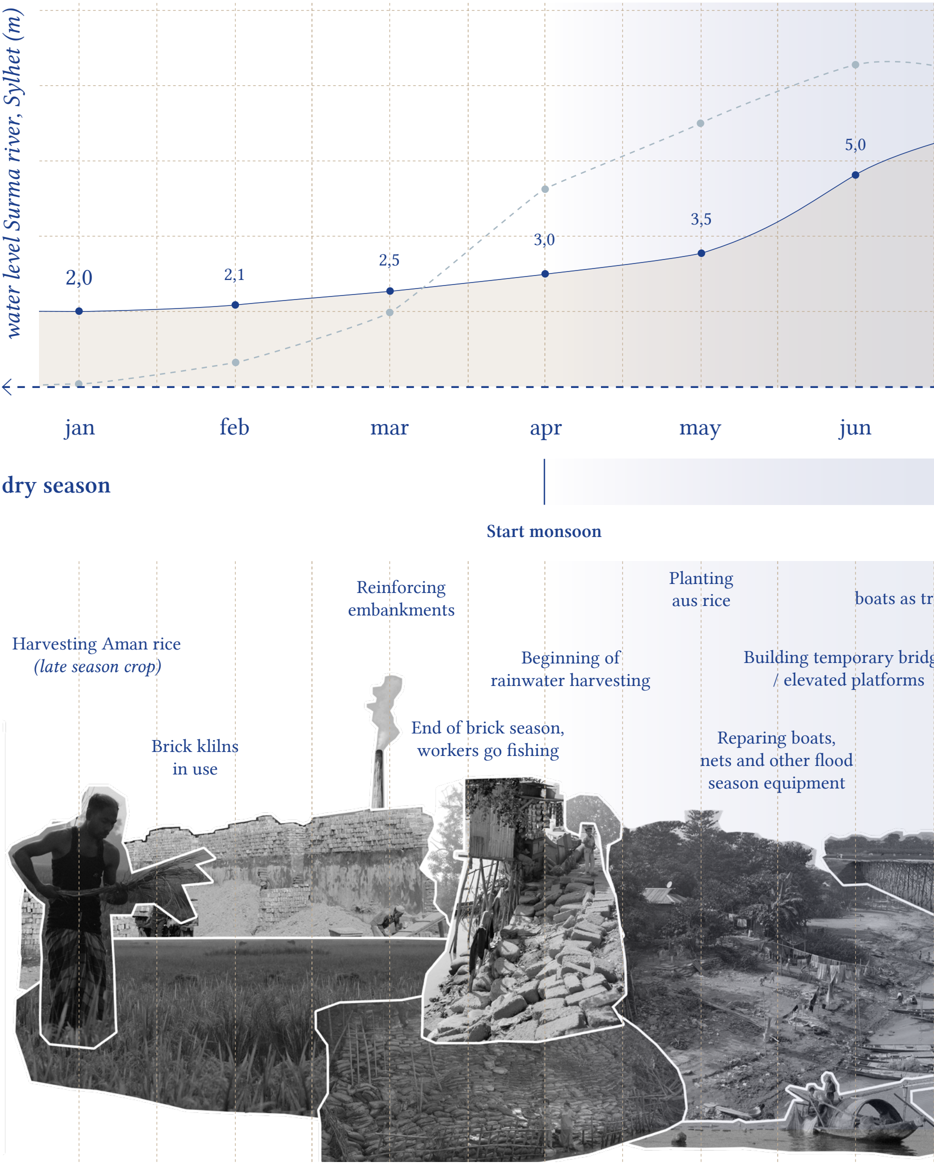
LIVING WITH THE MONSOON

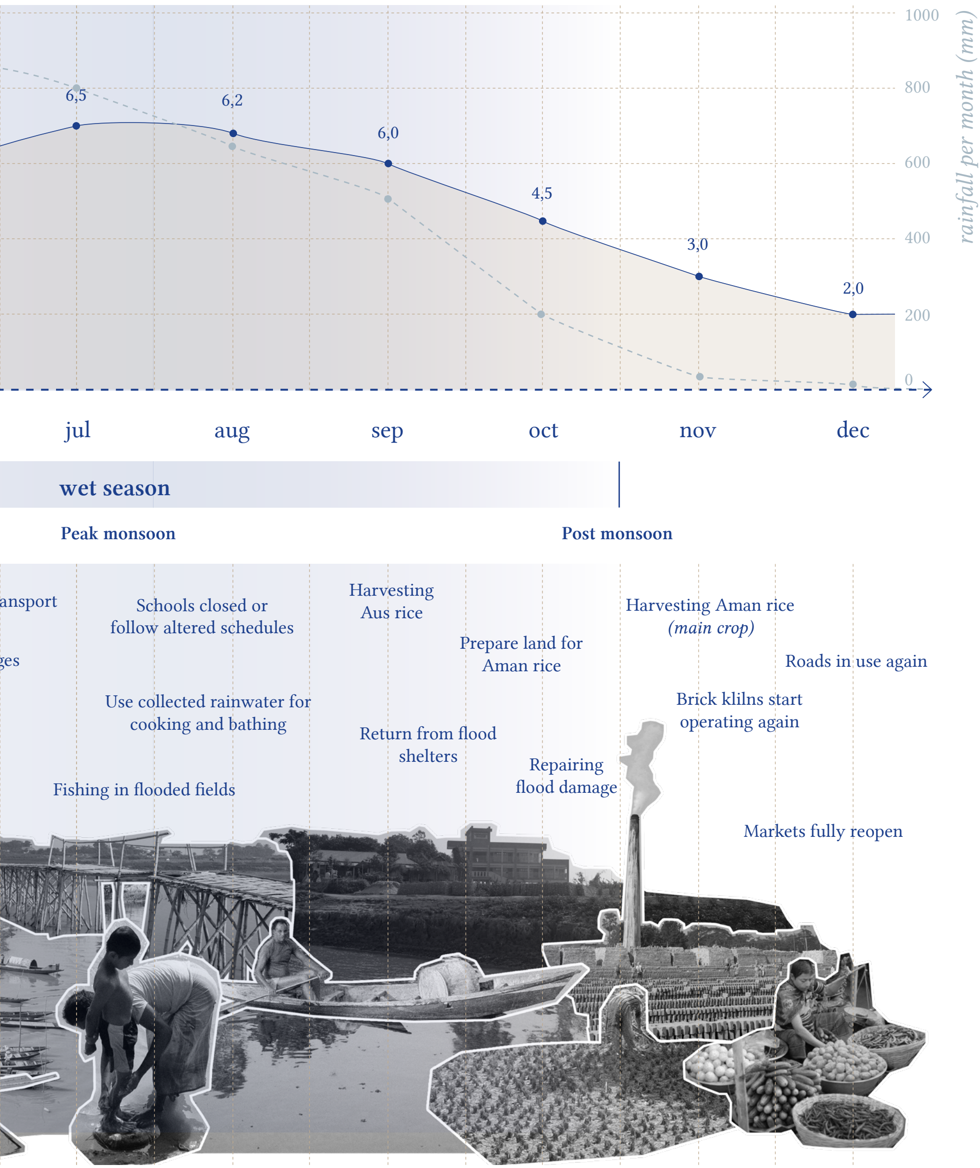
living with the monsoon



LEARNING FROM I living with the monsoon

This timeline illustrates the seasonal rhythm of life in Bangladesh in response to the monsoon. It highlights how agricultural, economic, and everyday activities shift throughout the year, adapting to periods of rain and drought.




1000
800
600
400
200
0
rainfall per month (mm)
6,5
6,2
6,0
4,5
3,0
2,0
jul
aug
sep
oct
nov
dec
wet season
Peak monsoon
Post monsoon
ansport
ges
Schools closed or follow altered schedules
Use collected rainwater for cooking and bathing
Fishing in flooded fields
Harvesting Aus rice
Return from flood shelters
Prepare land for Aman rice
Repairing flood damage
Harvesting Aman rice (main crop)
Roads in use again
Brick klilns start operating again
Markets fully reopen

learning from

INTERVIEWS + CASE STUDIES

Interview Ashutos Singha - University de Agriculture (Sylhet)
specialised in irrigation & water management

Question	*How do people prepare for flooding in terms of agriculture and what is the impact of these floods on agriculture?*
Ashutos Singha	Flash floods come without any signs, and can ruin crops just before they are ripe. In flooding areas, people can only grow one crop per year while in other areas, they can grow two or three crops per year. People take several measures regarding agriculture/ flooding: - Sometimes communities grow short duration crops, that grow quicker (January until April). - Low-cost dykes along the riverside, people built dikes that do not last ages, but do keep the crops safe. - Grow two different types of rice crops. Aman rice, which is the most typical type of rice which is planted during the monsoon in June or July, and harvested in November or December. The other type is called Boro rice, which is grown during dry season between November and May. Rainy season is from mid-June to mid-August. Now this is not really true anymore because of climate change. This also makes it harder to predict and prepare for floods.
Question	*What happens to agriculture during the more severe destructive floods? What do people do when they lose their source of income?*
Ashutos Singha	In the wet land areas, they can only grow one crop per year, but sometimes these are still ruined with the flash floods. Government takes care of these people in case their suffering is really bad from the flooding. Also, people migrate to the more dry areas (e.g. Chittagong).

They also migrate to Sylhet, but go back again after the water goes down, when they will have to fight the floods again the year after.

Question *What happens to the agriculture on the sides of the riverbank in Sylhet? (next to the new bridge) during flooding? (Does it get moved, do they temporarily have to buy more food instead of grow it?)*

Ashutos Singha Creating awareness is very important, people are now killing / damaging the rivers. They cultivate & pollute the river, but they do not really care. Creating public awareness is important.

Question *What measures in the city are taken regarding flooding?*

Ashutos Singha Schools get closed, people go and live in the schools, but this is very poor situation. Government tries to feed them, just to safe their lives. Usually it takes two to three weeks before they can get out of the shelters (sometimes 1 month) and they can get back to their houses. NGO's and social workers help them with food, just to safe them and their children. Also dry food usually helps in this situation. If the government does not help them, society helps them with food.

Question *How do flooding patterns in regions like Sylhet impact agricultural practices and rural livelihoods (particularly regarding women)?*

Ashutos Singha Flooding patterns in Sylhet, particularly in the haor areas, significantly impact agricultural practices and rural livelihoods, with rural women being among the most affected. Seasonal flash floods often occur during critical agricultural periods, such as the pre-harvest stage of boro rice, leading to widespread crop damage and financial losses. These floods disrupt planting schedules, reduce soil fertility through erosion, and damage irrigation systems, hampering subsequent agricultural activities.

For rural women, who play a key role in small-scale farming and household management, these disruptions exacerbate their challenges. They face income losses due to damaged crops and limited employment opportunities while bearing the responsibility of managing food security for their families. Additionally, floods often contaminate water sources, intensifying women's burden to secure safe drinking water and sanitation. Mobility restrictions during floods further isolate women, reducing their access to markets and resources.

Question — *What strategies are currently used in Sylhet to mitigate the effects of flooding on agriculture?*

Ashutos Singha — In Sylhet, several strategies are implemented to mitigate the effects of flooding on agriculture, aiming to reduce crop losses and sustain livelihoods. Farmers increasingly adopt flood-tolerant rice varieties, such as BRRI dhan51 and BRRI dhan52, which can survive submergence, while adjusting crop calendars to ensure harvests occur before the peak flooding season.

Raised homesteads and seedbeds are commonly used to protect nurseries and crops from submergence, and floating agriculture, utilizing water hyacinth beds, provides an alternative for growing vegetables during prolonged floods. Small-scale embankments and flood protection dikes are constructed to shield agricultural fields, while community-led initiatives, such as canal digging, improve drainage and reduce waterlogging.

Advanced irrigation methods, including solar-powered pumps and rainwater harvesting, support farming during dry periods after floods. Additionally, farmers are trained in disaster preparedness and flood forecasting, enabling them to anticipate and respond effectively to flood events.

Question *How do local communities adapt to recurring flooding in terms of water management and agricultural techniques?*

Ashutos Singha Local communities in Sylhet's haor areas have developed adaptive strategies to cope with recurring flooding, focusing on water management and agricultural practices that enhance resilience. In terms of water management, communities use raised tube wells and portable filtration systems to secure access to clean drinking water during floods. They also construct small-scale canals and improve drainage systems to manage excess water, reducing waterlogging in agricultural fields.

Rainwater harvesting is another common practice, providing a reliable water source for both domestic use and irrigation during post-flood dry periods. Agriculturally, communities adapt by cultivating flood-tolerant crop varieties, such as submergence-resistant rice, to minimize losses during inundation. Adjusting the cropping calendar is a widespread practice, ensuring that major crops like boro rice are harvested before the onset of flooding.

Farmers also engage in floating agriculture, using biodegradable rafts to grow vegetables and spices on floodwaters. Livestock rearing is adapted by constructing elevated shelters to protect animals during floods. Additionally, diversification of income sources, such as fishing or small-scale poultry farming, reduces reliance on flood-vulnerable crops.

Question *What are the key considerations for integrating water management systems into housing in flood-prone areas?*

Ashutos Singha Integrating water management systems into housing in flood-prone areas like Sylhet's haor regions requires a combination of structural, functional, and community-oriented considerations to enhance resilience and sustainability. Structurally, housing should be elevated on stilts or raised platforms to protect it from floodwaters while incorporating water storage systems, such as elevated tanks, to ensure access to clean water during inundation.

Rainwater harvesting systems should be integrated into roofing designs to provide a reliable source of water for domestic use. Drainage systems must be designed to prevent waterlogging around the house, with proper outlets to channel excess water into nearby canals or reservoirs. Functionally, homes should be equipped with flood-resistant sanitation facilities, such as raised latrines, to minimize contamination risks.

Filtration systems, either portable or built-in, are critical for ensuring safe drinking water. Solar-powered pumps can provide energy-efficient irrigation and water supply solutions during flood recovery periods.

Question *Are there specific flood-resistant water storage or irrigation systems that have proven to be effective in rural Bangladesh?*

Ashutos Singha Several flood-resistant water storage and irrigation systems have proven effective in rural Bangladesh, particularly in flood-prone regions like Sylhet's haor areas. Raised tube wells installed on elevated platforms ensure access to safe drinking water by protecting the wells from contamination and submergence during floods.

Rainwater harvesting systems, which collect water from rooftops into elevated tanks, provide a reliable source of water for domestic and agricultural use when other sources are inaccessible. Floating water storage tanks, made from lightweight materials like plastic drums, remain operational even during prolonged flooding.

Solar-powered irrigation systems, often installed on raised platforms, are gaining popularity for their ability to provide sustainable and cost-effective water solutions, especially after floods when conventional systems may be damaged. Submersible pumps are also widely used to extract water from submerged areas for irrigation or to drain flooded fields.

Additionally, community-based elevated water reservoirs serve as shared resources for irrigation and household needs, enhancing resilience in areas with limited infrastructure.

Children running on a bridge in the haors in the north of Bangladesh, during dry season. (Author, 2024)

CASE STUDIES I room for the river

The Netherlands' Room for the River programme was developed after severe floods in the 1990s made clear that higher dikes alone are not enough. The goal is simple: give rivers more room to reduce flood risk. Instead of resisting water, this approach works with it; by lowering floodplains, moving dikes, and adding overflow channels (Rijkswaterstaat, n.d.; Dutch Water Sector, 2019).

A clear example is Nijmegen, where the River Waal makes a narrow bend near the city. To reduce the risk of flooding, the northern dike was moved 350 meters inland, and a new side channel (the Spiegelwaal) was excavated. This gave the river more space and reduced high water levels by 35 cm (Stowa, n.d.).

Instead of leaving the new flood zone empty, it was turned into a public park with walking paths, cycle routes, and green space. The area floods safely during high water but is accessible and usable the rest of the year. Bridges connect both sides of the river and link the new island in between. The project also improved ecological quality and sparked development in nearby Lent.

Though the Dutch context differs from Bangladesh, the principle is transferable: design cities to work with water rather than against it. In flood-prone areas like Sylhet, spaces can be designed to hold water during the monsoon, while serving public and ecological functions in the dry season.

Room for the River, Nijmegen.
(H+N+S Landscape Architects, 2016)

CASE STUDIES I design on the terrain of water

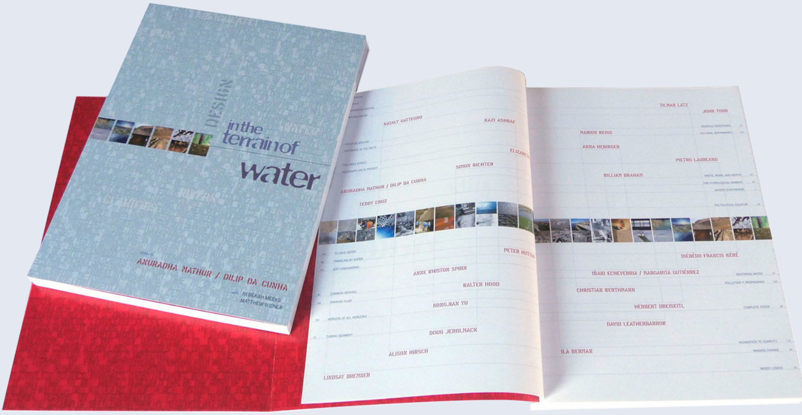
The book Design in the Terrain of Water, by Anuradha Mathur and Dilip da Cunha, argues for a different approach to design in landscapes shaped by water. Instead of treating water as a problem, the authors propose using wetness and seasonal change as the starting point for spatial thinking. This is especially relevant in monsoon and delta regions, where the boundary between wet and dry constantly shifts.

In the chapter Water as Ground, Kazi Ashraf describes how Dhaka has increasingly disconnected from its delta landscape. Where the city was once part of a fluid system of rivers, wetlands, and temporary landforms like chars, post-1960s development introduced a rigid, “dry” logic; embankments, landfills and a road-based structure that leaves no space for water. According to Ashraf, this separation is at the root of many urban challenges today, such as flooding, lack of space and the disappearance of shared public areas.

Ashraf proposes seeing water as an active part of urban systems again. Embankments do not need to be hard lines, they can be porous, layered, or even seasonal. He suggests solutions such as floating structures, elevated streets or designated flood zones. In this view, water plays multiple roles; functional, ecological, and social. As architect Saif Ul Haque puts it:

> *“Water could provide inexpensive transport solutions for the city, it could serve as reservoirs for containing monsoon rains, it could provide for valuable protein for the city dwellers by fish farming and it could help in keeping the underground water table stable by a way of percolation and other methods.” (Haque, as cited in Mathur & da Cunha, 2014, p. 97*

For flood-prone regions like Sylhet, their work suggests a reframing. Instead of treating monsoon water as something to be managed after it arrives, it should be anticipated and designed into the landscape. This means embracing temporary wetness, layering uses across time, and working with softness, porosity, and transitions.



Design in the terrain of Water.
(Mathur & da Cunha, n.d.)

CASE STUDIES I Khudi Bari

Khudi Bari is a modular, lightweight house designed by Marina Tabassum Architects for people living in flood-prone areas along rivers in Bangladesh. At first glance, it blends in with the village surroundings. The cladding (woven bamboo or corrugated metal sheets) looks just like the materials used in existing homes. Its size and proportions also match what people are used to.

However, the difference lies in what the structure enables. Most rural homes in Bangladesh are single-story, built directly on the ground. During monsoon floods, these homes become uninhabitable, forcing families to evacuate or shelter elsewhere. Khudi Bari addresses this by introducing a second floor, supported by a lightweight bamboo structure connected with steel joints. This upper level offers a dry and safe refuge during floods, allowing families to stay in place when the ground floor is submerged.

The structure is also modular and relocatable, a critical feature in regions where riverbank erosion and land tenure insecurity are common. The steel joints make it possible to dismantle and reassemble the house quickly, and most components (bamboo, cladding) are locally available and familiar to residents. This allows for community-led construction and repair, reinforcing a sense of ownership.

Khudi Bari works in local context as it does not replace what people already know, but builds upon it. It fits within the local context while also solving the lack of liveable space during flooding.

Khudi Bari in the Haors in Tahirpur, Bangladesh
(City Syntax, 2020)

CONCLUSION I flood resilient practices

Learning from existing methods

Flood resilience in Bangladesh is rooted in everyday life. Communities have developed practical strategies that do not fight the water but work with it, both before and during the flood. These local responses are spatial, seasonal, and adaptive. They show that resilience is not only about infrastructure, but also about how people build, live, and move.

Integrating existing floods resilient practices into the design:

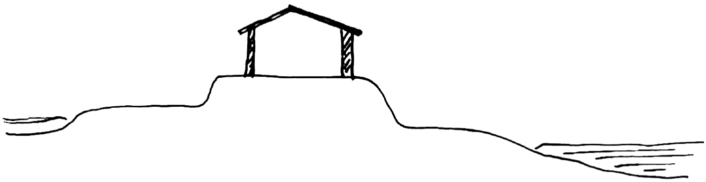
- Building on higher plinth (dig and mound)
- Have a second floor to live on for ground floor dwellings
- Make room for and use of the monsoon

Learning from case studies

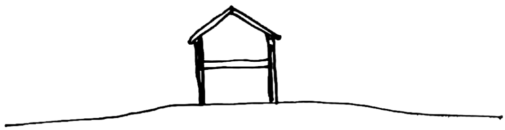
The three case studies demonstrate that flood-adaptive design is most effective when water is treated as a central design condition rather than a threat. Khudi Bari shows the value of working within existing contexts. It uses familiar materials and forms, while addressing a critical gap by introducing a second, elevated level for flood resilience. Design in the Terrain of Water advocates for anticipating seasonal wetness and integrating it directly into the spatial logic of the landscape, rather than excluding or resisting it. Room for the River illustrates how making space for water through strategic planning can reduce flood risk while also improving spatial and ecological quality.

Therefore, the design should:

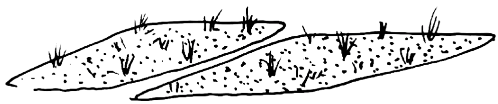
- Adapt to the monsoon rather than avoid it
- Integrate areas into the landscape that can safely flood (room for the monsoon)
- Fit within the local context
- Ground floor dwellings should have an elevated living space



Build on a higher plinth (dig and mound)



Make sure the ground floor dwellings have an extra floor



Make room for the monsoon in the landscape

HOME SERIES

how do people built and live?

BRICK FIELD WORKERS

temporary housing in the rural area


VERSE
STAR

BRICK FIELD WORKERS

Bangladesh is known for its many brick farms, one of which is located near the village of Ekduaria. Workers migrate here temporarily during the dry season, spending six months making bricks before returning to fishing during the rainy season. Since wages are based on the number of bricks produced, workers push themselves to work as many hours as possible, earning around $7 to $8 per day, which is a bit more than they make from fishing.

The brick farm owner provides basic housing: small units measuring approximately 2.5 by 3.5 meters, where entire families live together. These houses have no windows, only a single front door. The housing is arranged in a compact cluster behind a brick wall. Outside this area, communal facilities include a shared bath and toilets, while the kitchen is located in a separate space.

In addition to family housing, there are also dormitory-style bachelor accommodations for single workers or those traveling alone for work. These are large, open spaces filled with mats, where workers sleep side by side.

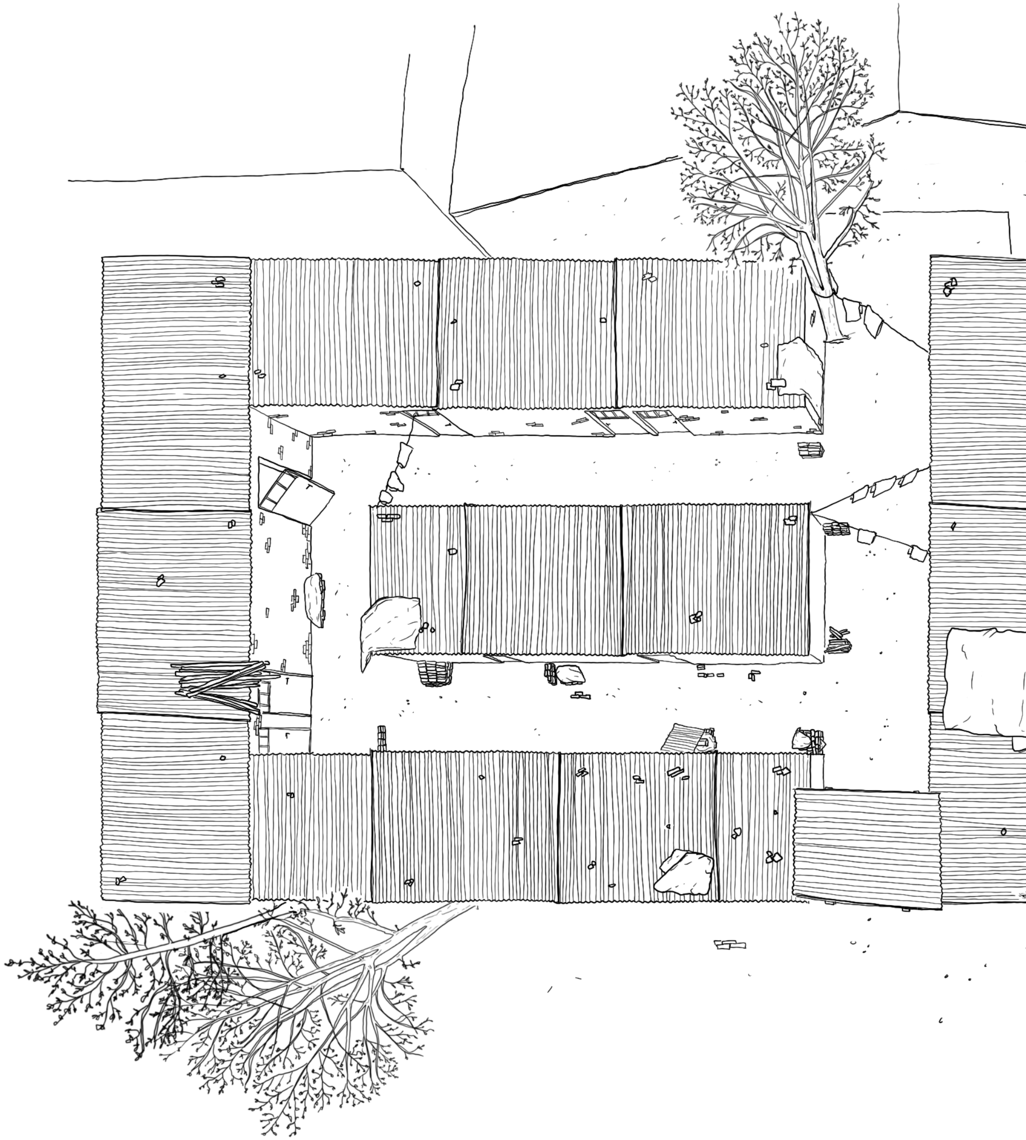
The family living in a temporary brick workers dwelling on a brick field. (Author, 2024)

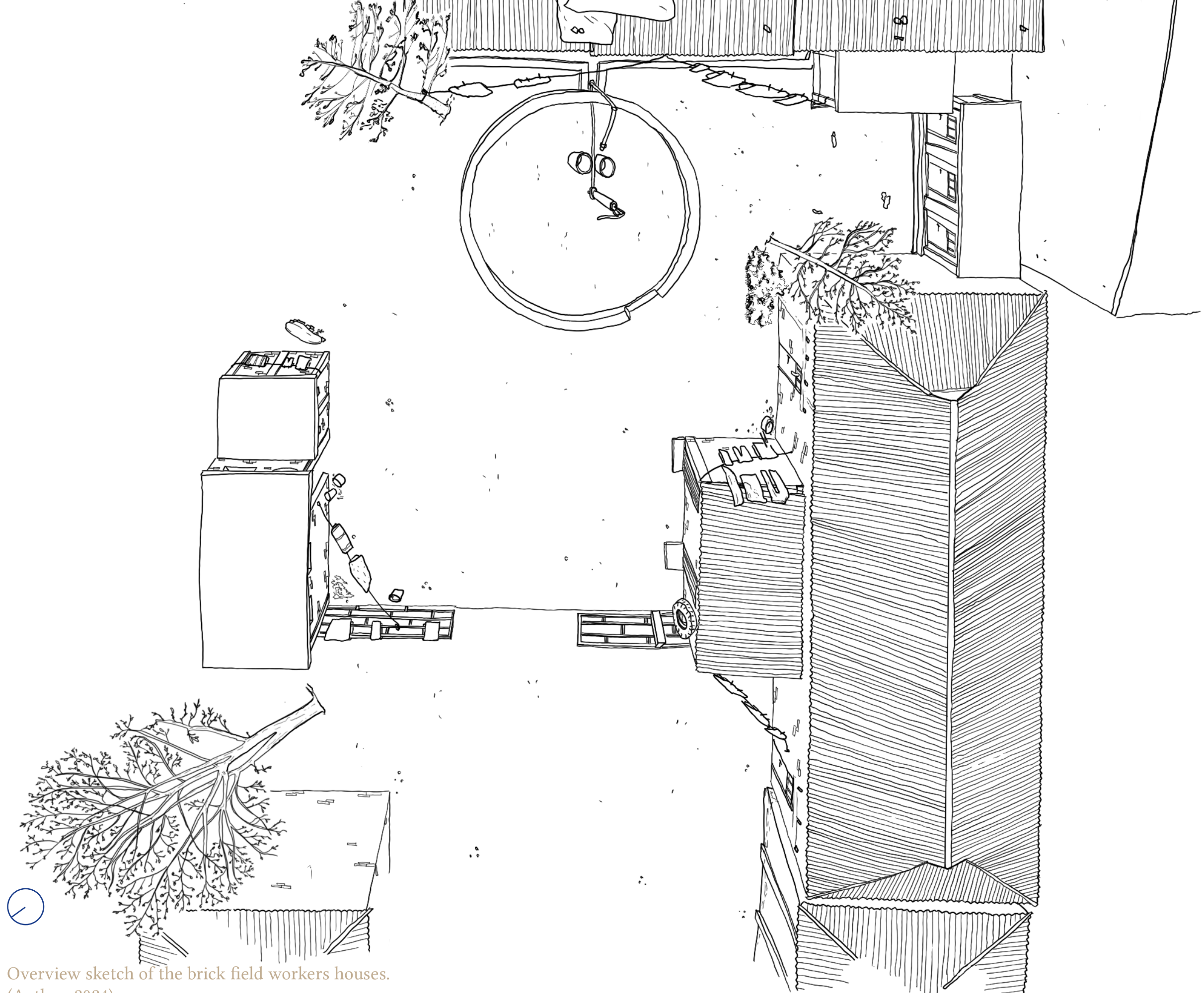
BRICK FIELD WORKERS | community

Brick field workers housing, located close to village Ekduaria (2 hours from Dhaka)

Location brick field workers houses.
(Author, 2024)

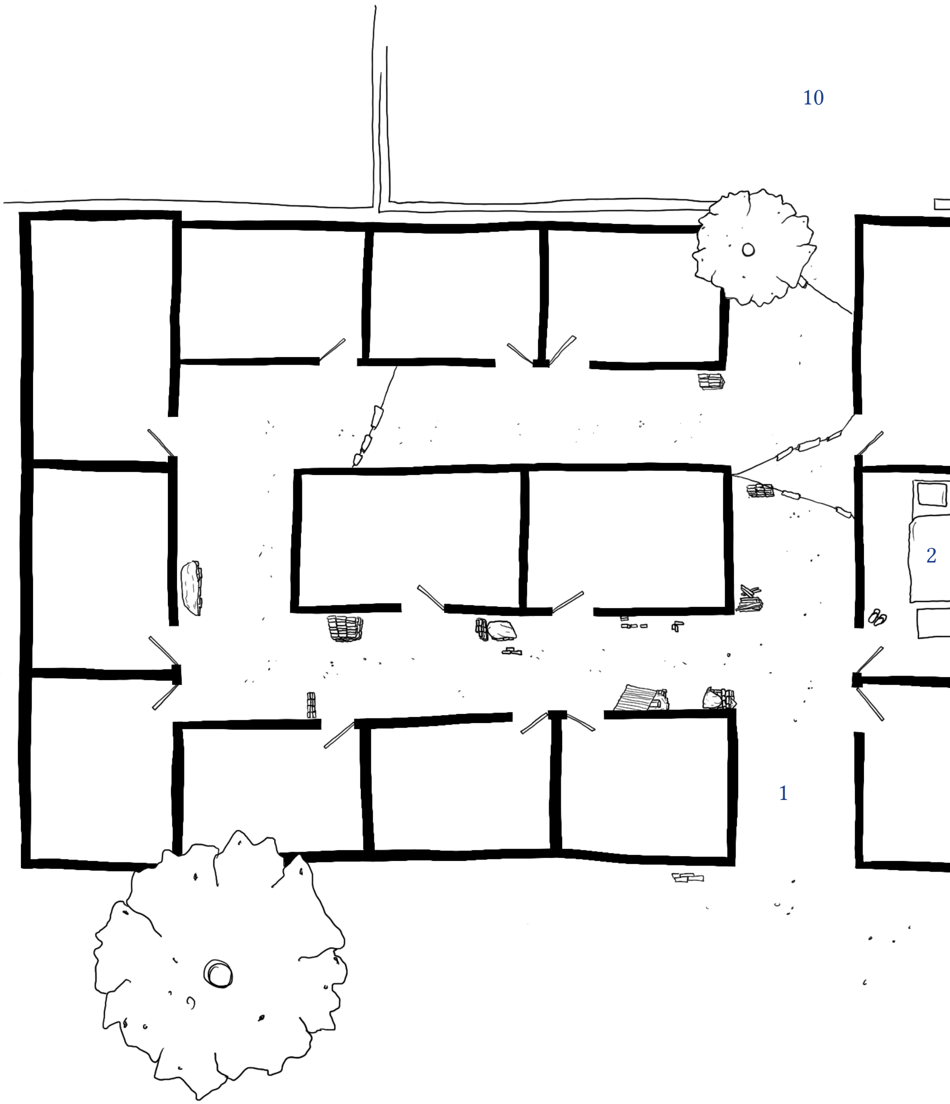
BRICK FIELD WORKERS | cluster



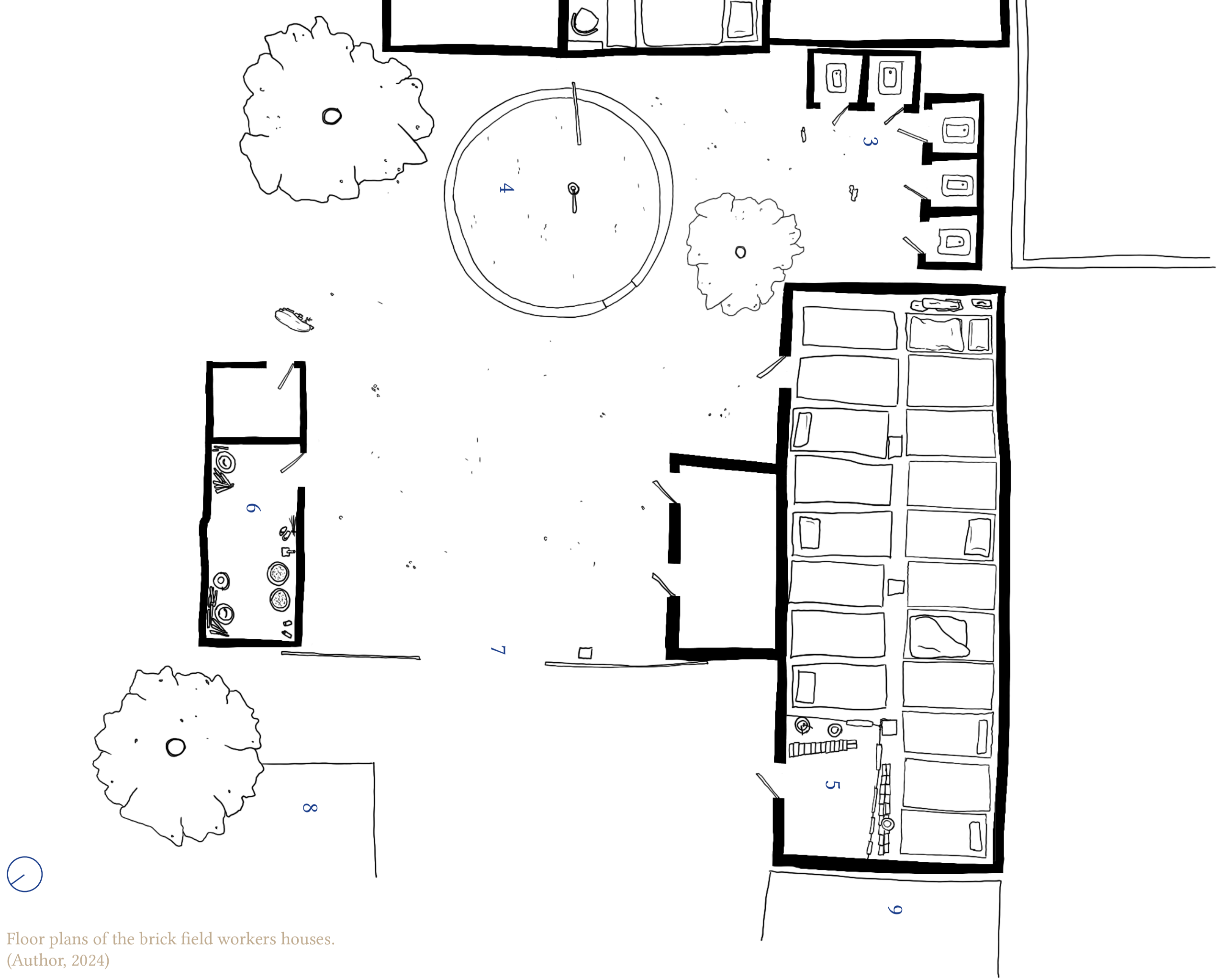


Overview sketch of the brick field workers houses.
(Author, 2024)

BRICK FIELD WORKERS I cluster + dwelling



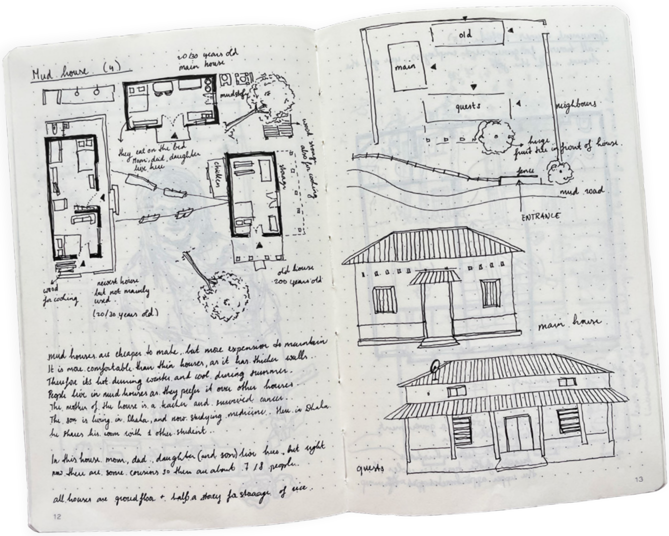
1 Entrance family houses - 2 Typical temporary family house - 3 Shared toilets - 4 Shared bathing - 5 Bachelor houses - 6 Shared kitchen - 7 Fence - 8 Bachelor houses - 9 Office brickfield owner - 10 Indoor factory



Floor plans of the brick field workers houses.
(Author, 2024)

MUD HOUSES

materiality in the rural area



MUD HOUSES

A few hours outside Dhaka, near the village of Ekduaria, a family of four lives in traditional mud houses. Their plot consists of three structures: the main house (the middle house), a guest house, and an old house that is rarely used. The homes, built 20 to 30 years ago, are single-story with an additional half-story used for storing rice. The "old" house, however, dates back approximately 200 years.

The mother explains that while mud houses are cheaper to construct compared to other materials, they are more expensive to maintain. Despite this, the family prefers them over tin houses, as the thicker mud walls provide better insulation, making them more comfortable in Bangladesh's climate.

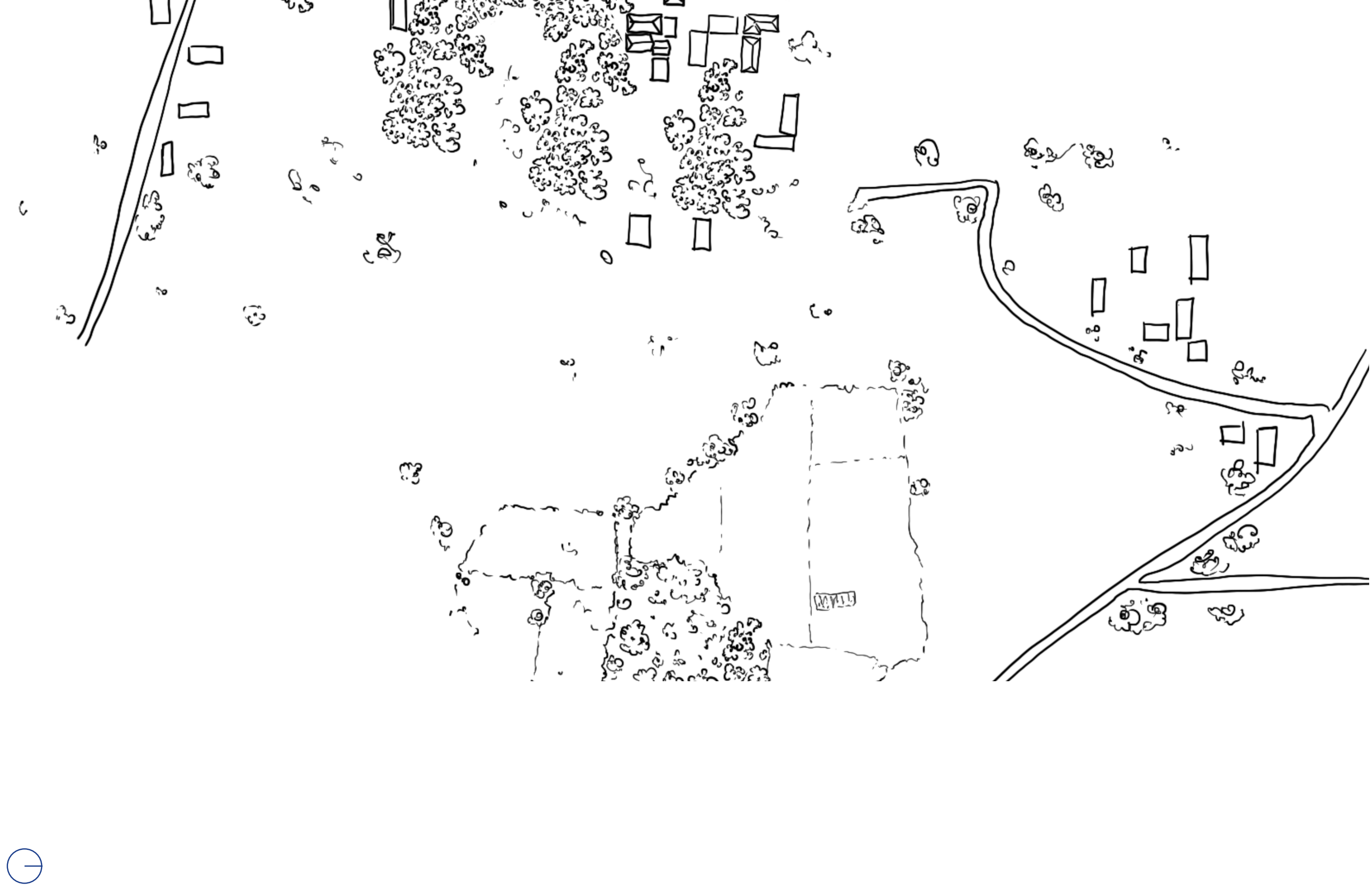
The household typically includes the mother, father, and daughter, with the son studying medicine in Dhaka. At the time of the visit, four cousins were also staying there temporarily.

As for the future, the son plans to live on the family land but has different ideas about the homes;

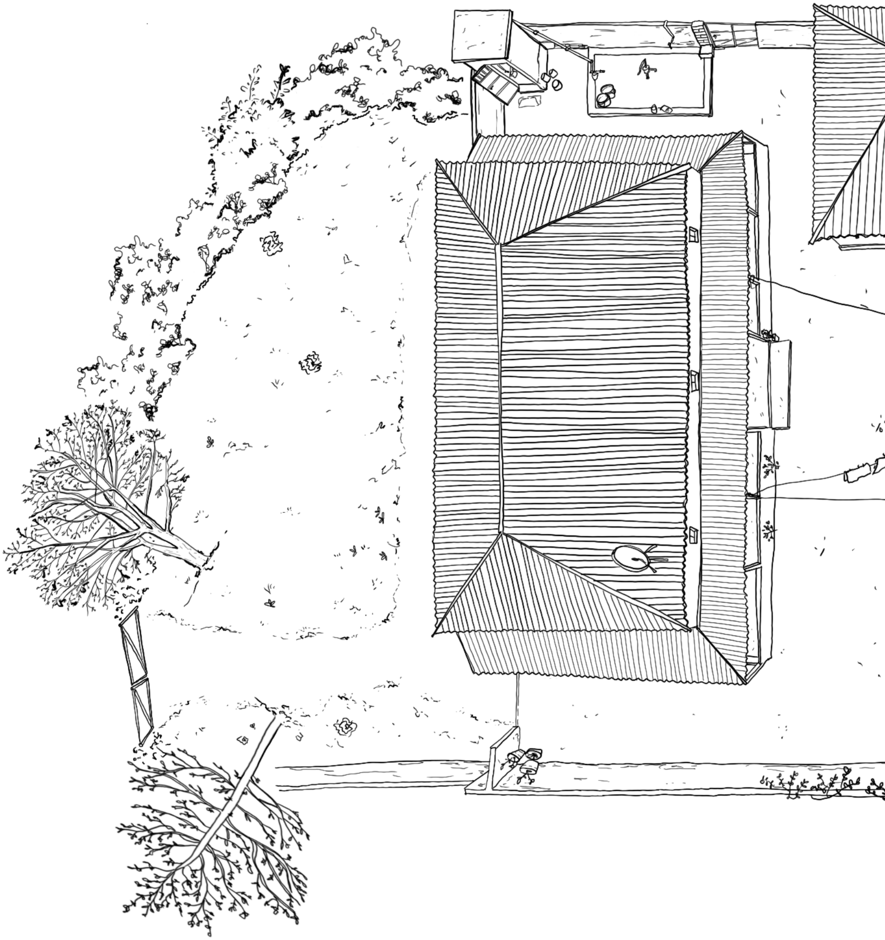
"I will keep one mud house for tradition, but I will demolish the other two to built one really big house"

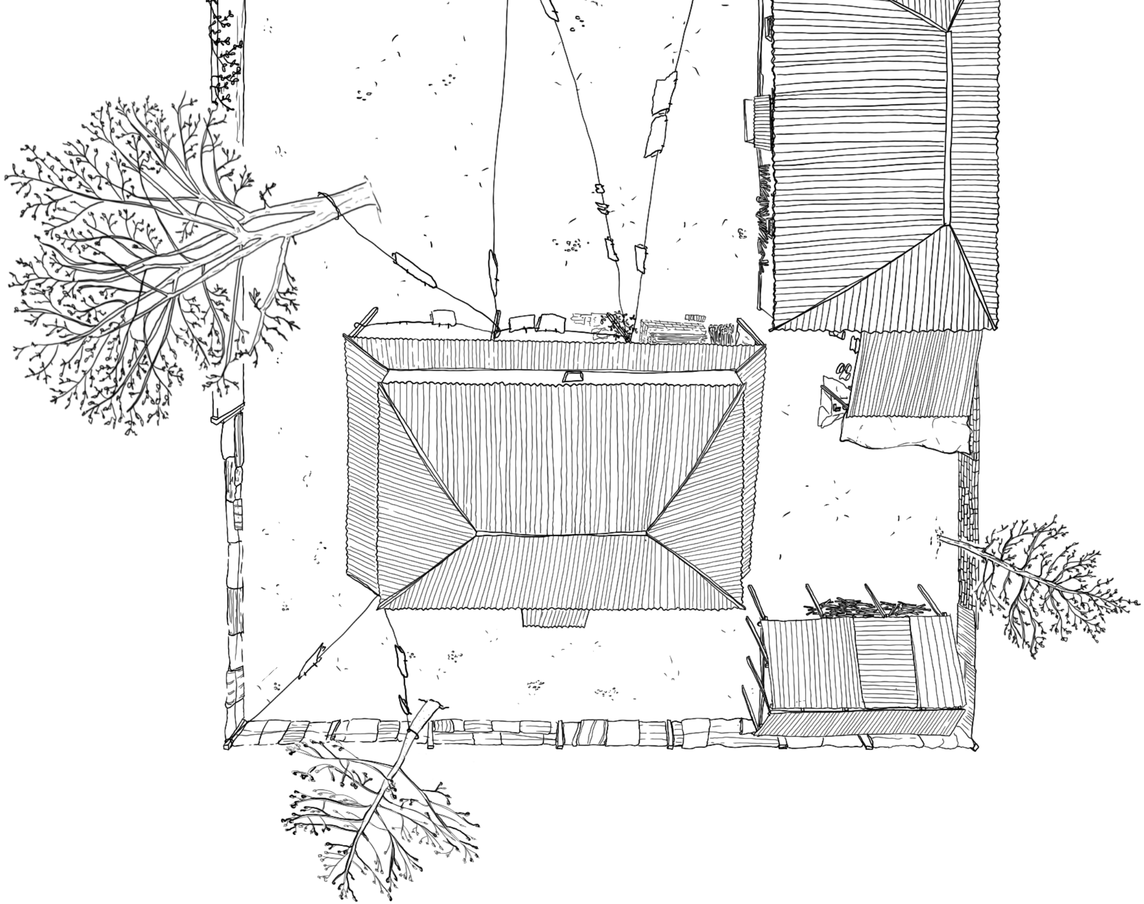
The fanily living in three mud houses
in the rural areas close to Ekduaria.
(Author, 2024)

Mud houses, all three owned by one family, located close to village Ekduaria



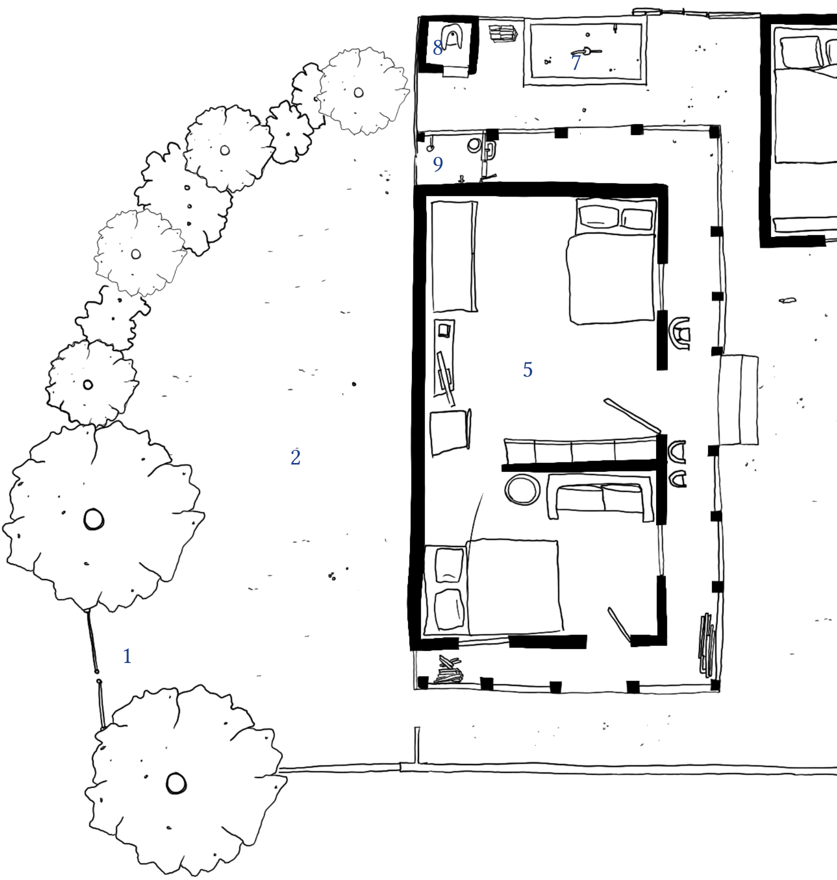
Location mud houses.
(Author, 2024)



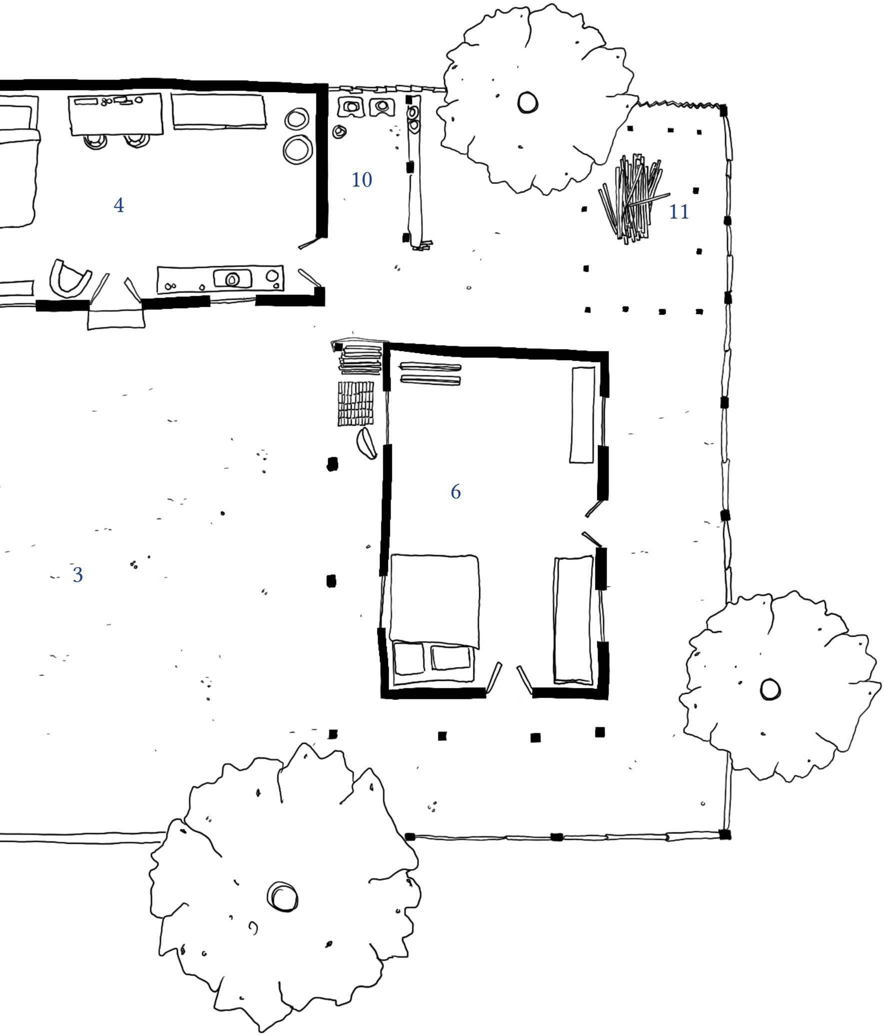


Overview sketch of the mud houses.
(Author, 2024)

MUD HOUSES | cluster + dwelling



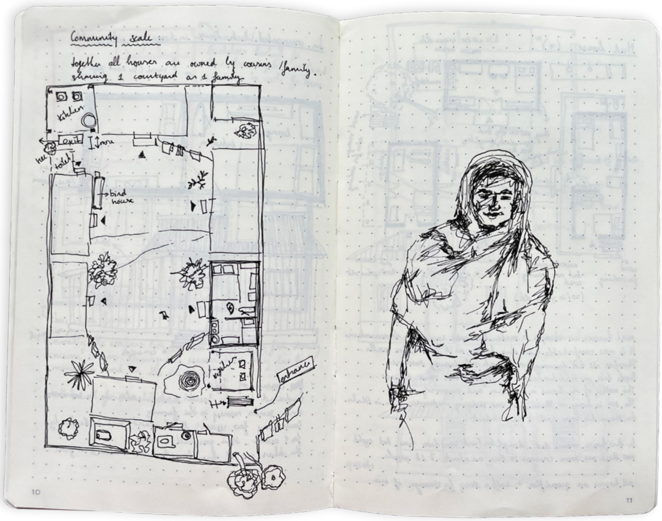
1 Entrance gate - 2 front yard - 3 courtyard - 4 main house - 5 extra house for son - 6 old house (not in use) -7 outside water tap - 8 toilet - 9 bathroom - 10 mud kitchen - 11 wood storage



Floor plan of the mud houses.
(Author, 2024)

TYPICAL VILLAGE HOUSING

layout in the rural area



TYPICAL VILLAGE HOUSING

The village of Ekduaria offers a glimpse into the typical organization of rural communities in Bangladesh. Homes are built in clusters with relatives, primarily using corrugated tin sheets as building material.

In one of these houses, a woman lives with her children while her husband works as a salesman in Saudi Arabia. She cares for the children at home, while he returns only once every few years, staying for a month before leaving again for work.

The house consists of a main room, where the woman and her children sleep, and a guest room. The main room also serves as a living space, furnished with a closet, TV, fridge, and chairs. Additionally, the family shares an outdoor courtyard with their relatives, which functions as an extended living area.

The guest room includes a small kitchen, but cooking is primarily done outside in a separate space with a mud-stove kitchen, which is shared among the households in the cluster.

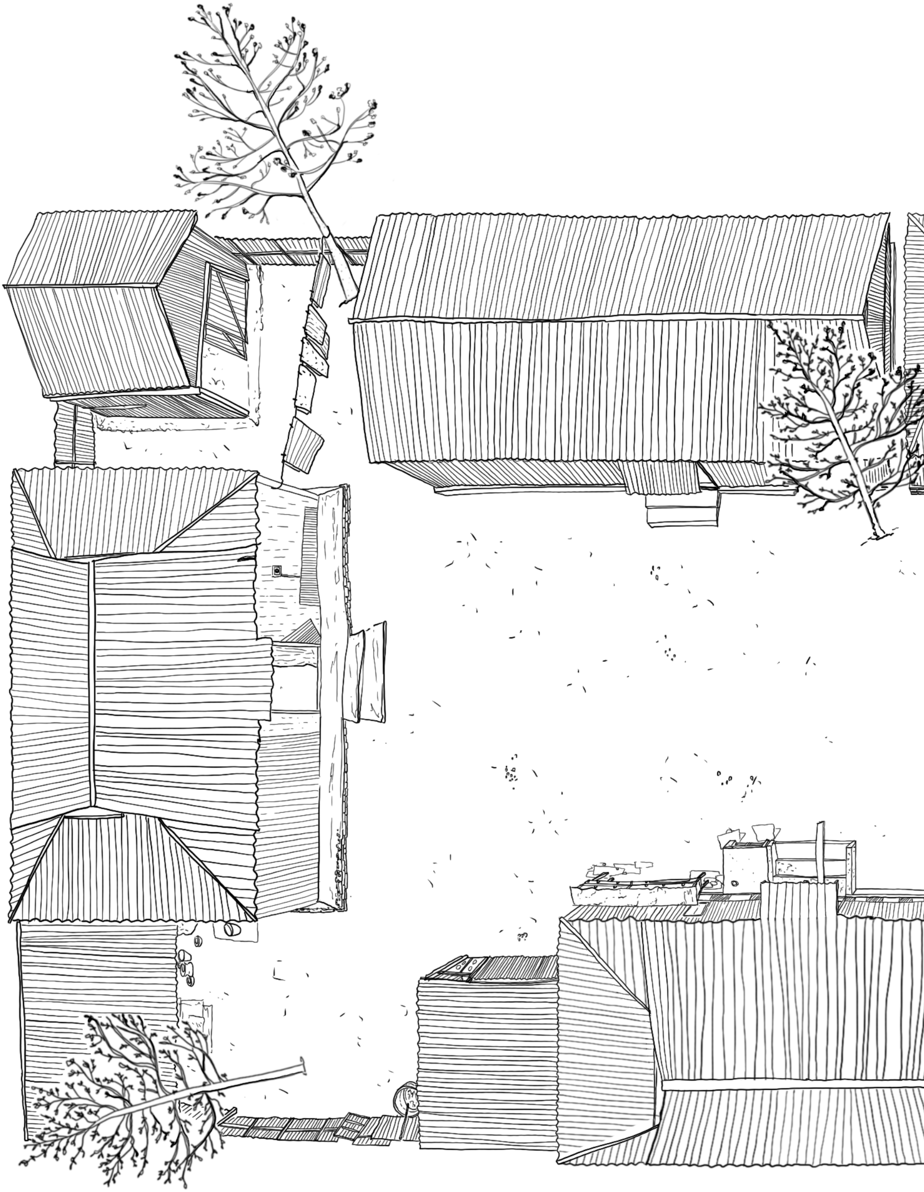
The resident of a typical village dwelling in Ekduaria, a village close to Dhaka. (Author, 2024)

TYPICAL VILLAGE HOUSING I community

Typical rural housing in the village Ekduaria

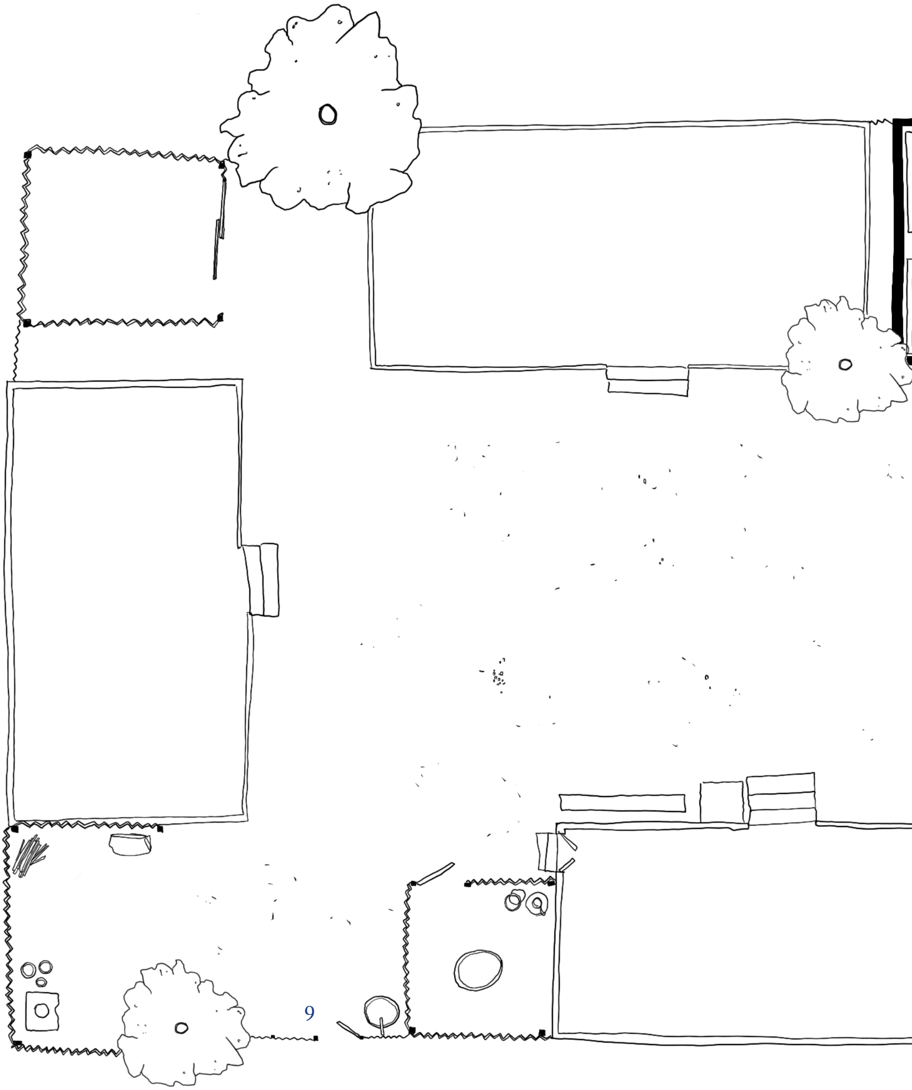
Location typical village housing in Ekduaria.
(Author, 2024)

TYPICAL VILLAGE HOUSING I cluster

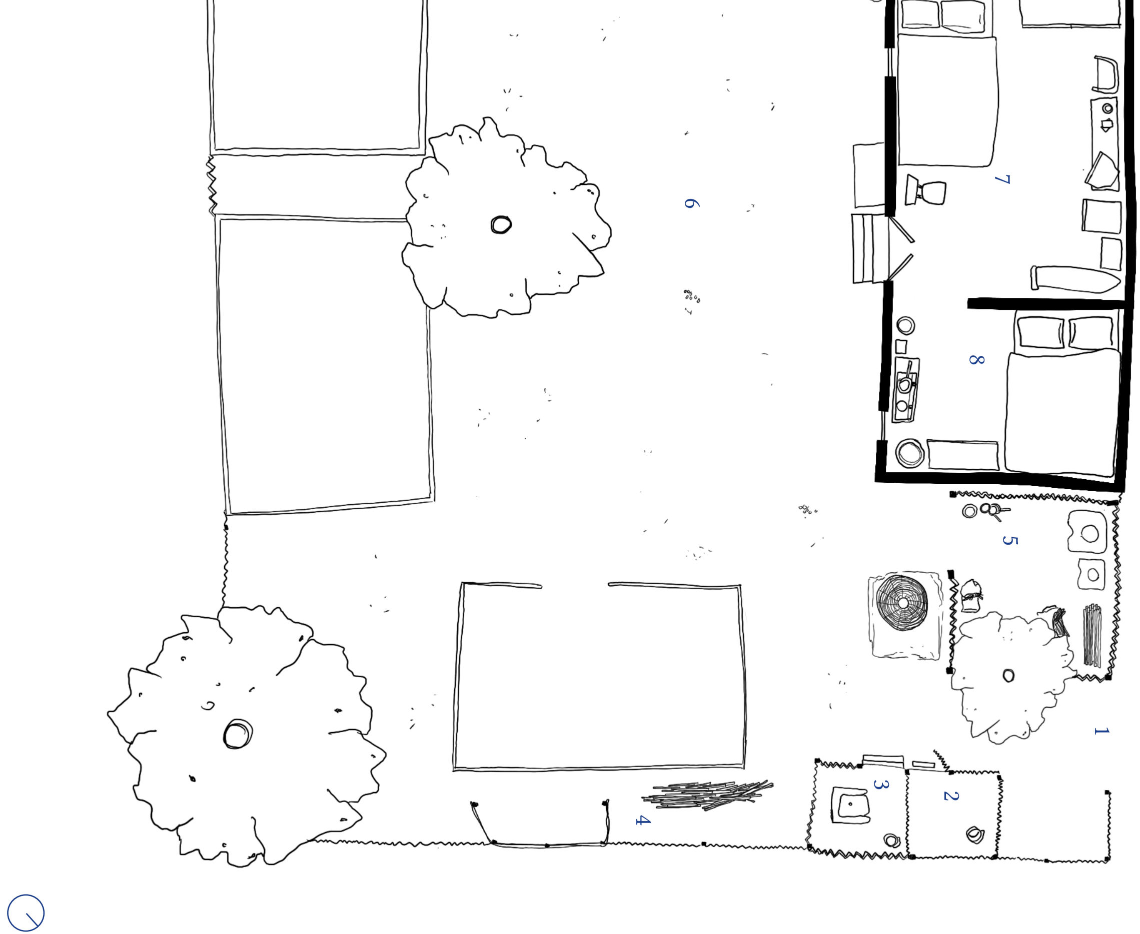


Overview sketch of a cluster in the village Ekduaria.
(Author, 2024)

TYPICAL VILLAGE HOUSING I cluster + dwelling



1 Entrance - 2 bathroom - 3 toilet - 4 wood storage - 5 communal mud kitchen - 6 communal courtyard - 7 main living / bedroom - 8 guestroom - 9 exit



Floor plan of a cluster in the village Ekduaria.
(Author, 2024)

URBAN INFORMAL SETTLEMENT

keane bridge, Sylhet

INFORMAL SETTLEMENT

In the heart of Sylhet, a city in northern Bangladesh, an informal settlement is situated along the Surma River, next to Keane Bridge.

The community is home to both Hindu and Muslim residents. The land is government-owned, but the Hindu families were provided with funding to build their homes as a reward for their work as sweepers. Their houses, constructed from brick with plastered walls, are painted in bright colors and arranged around small courtyards. Despite their poverty, nearly every home has a satellite TV dish on the roof.

In contrast, the Muslim residents live in houses made of corrugated tin sheets, which are in noticeably poorer condition than the brick homes of the Hindu community.

The river plays a central role in daily life, serving as a means of transport, a place for washing, and a source for growing vegetables. However, it also poses a significant threat. Several times a year, flooding causes water to rise inside the homes, forcing families to live on the streets until the water recedes.

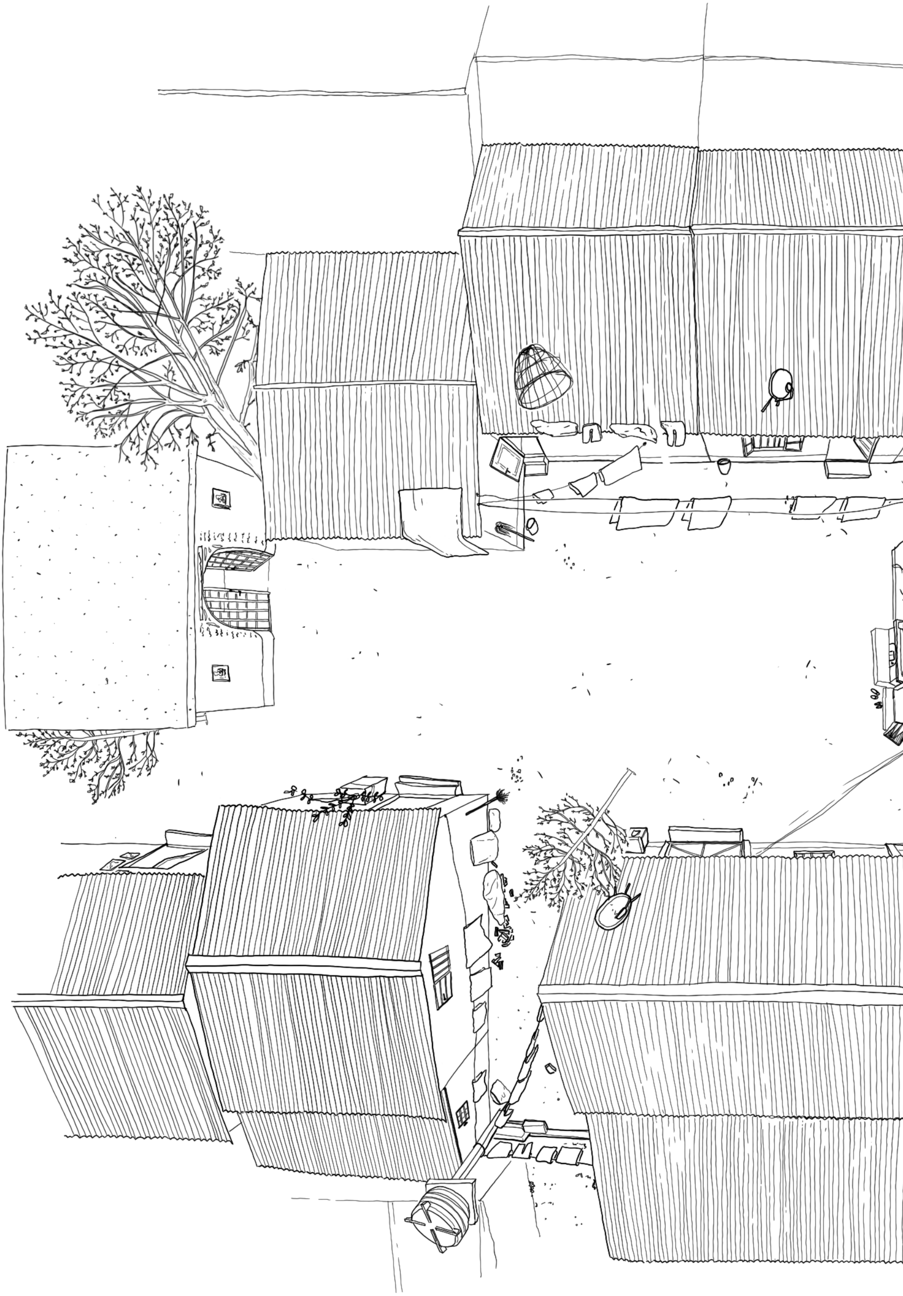
The residents of a dwelling in the informal settlement in Sylhet, next to Keane bridge. (Author, 2024)

INFORMAL SETTLEMENT | community

Urban informal settlement along the Surma River, next to Keane Bridge, Sylhet

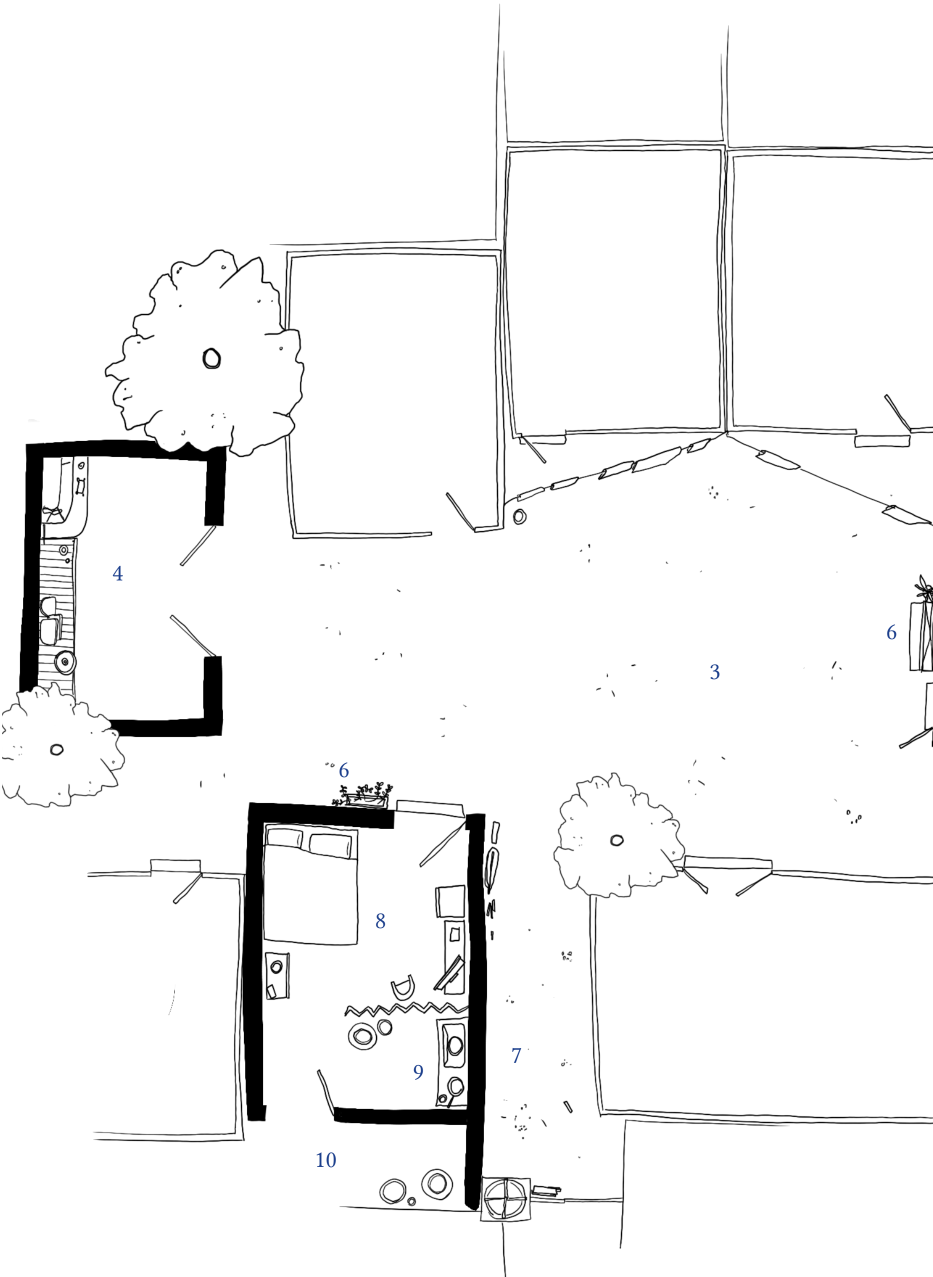
Location informal settlement Keane Bridge, Sylhet.
(Author, 2024)

INFORMAL SETTLEMENT | cluster

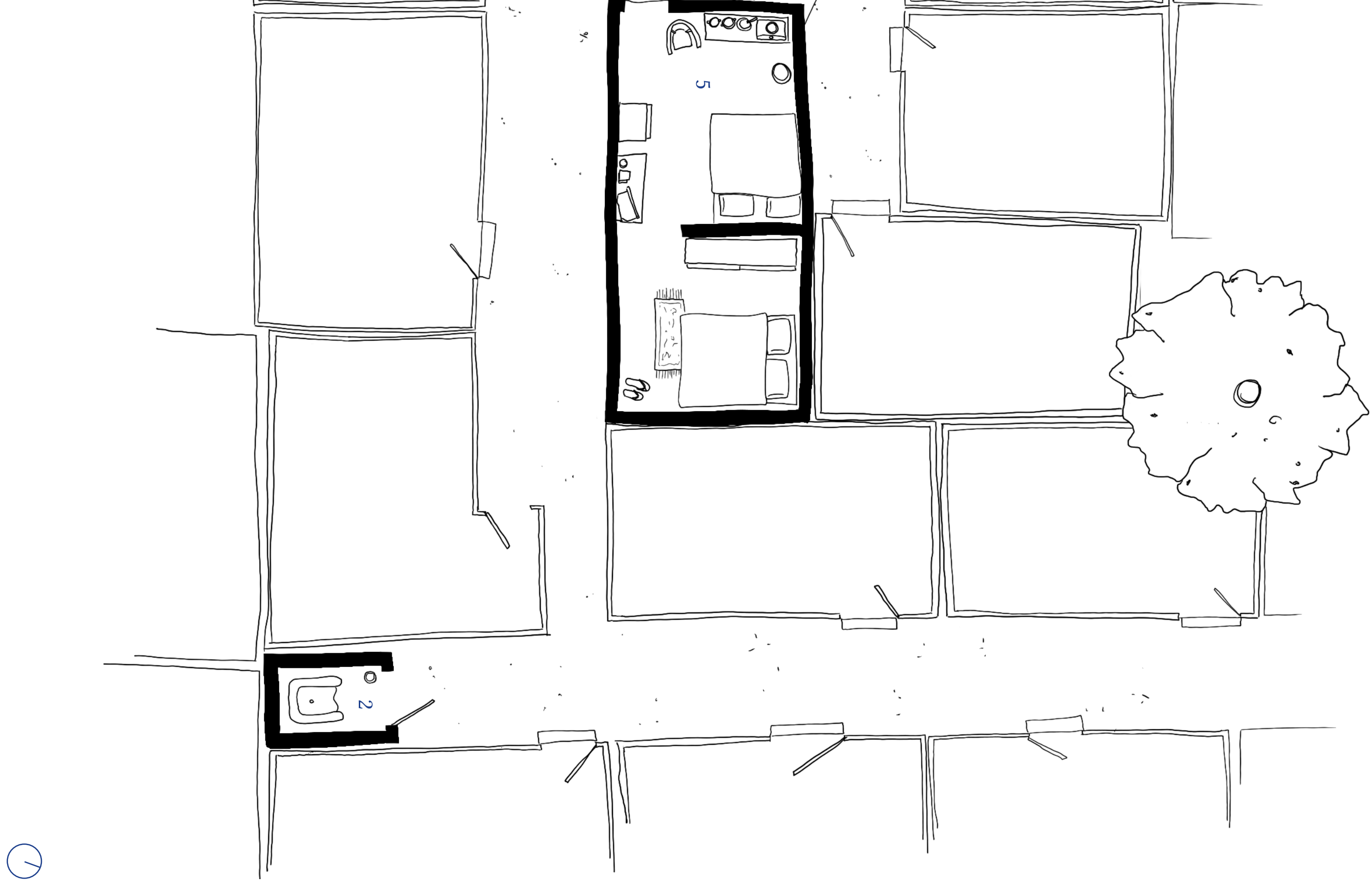


Overview sketch of the hindu community living in the informal settlement next to Keane Bridge, Sylhet. (Author, 2024)

INFORMAL SETTLEMENT I cluster + dwelling



1 Entrance to hindu community - 2 communal toilet - 3 communal courtyard - 4 community temple - 5 typical hindu dwelling in this community - 6 small temple in front of house - 7 inbetween space, used for water collection - 8 living/bedroom - 9 kitchen - 10 shared back space behind house for sanitary



Floor plans of the hindu community living in the informal settlement next to Keane Bridge, Sylhet. (Author, 2024)

SITE ANALYSIS

Keane bridge, Sylhet

SYLHET

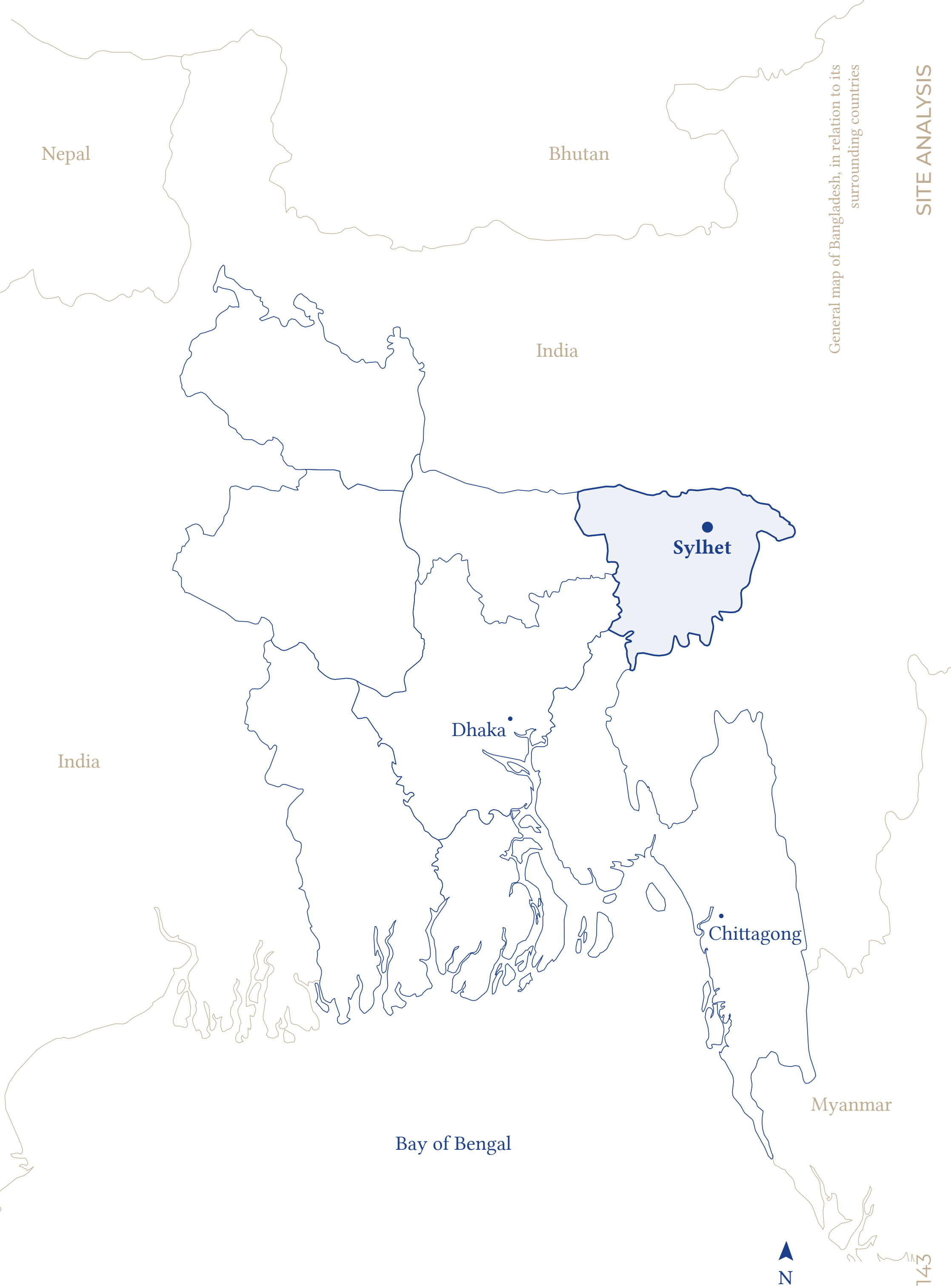
The project is located in the north of Bangladesh, along the Surma river in Sylhet, a city surrounded by hills, wetlands, and tea plantations. The region is part of a larger floodplain, with low-lying land that fills with water during the monsoon. This geographical setting shapes both the landscape and the way people build and live (Khan et al., 2024; Bhuiyan et al., 2024).

The city is growing rapidly and presents a mix of formal and informal development. Planned neighbourhoods with apartment buildings and wide roads exist alongside dense, self-built settlements, often located on lower or flood-prone ground (Khan et al., 2024; Islam, 2001).

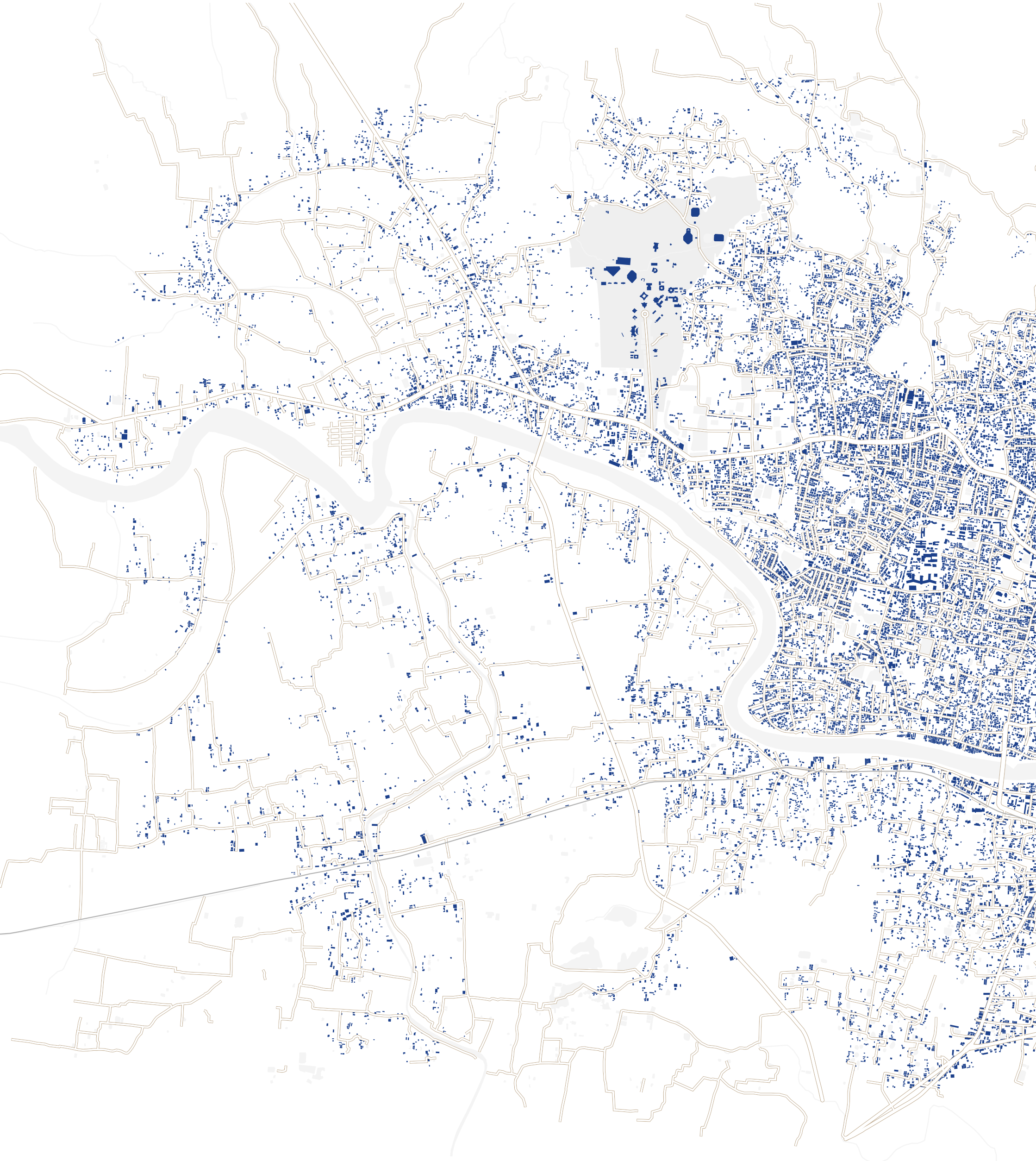
The population is diverse. There is a large student presence due to several universities and colleges. Some residents work in public services, healthcare, or education. Many others are employed in the informal sector as day labourers, street vendors, rickshaw drivers, domestic workers, or in small-scale production and repair. In surrounding areas, employment in tea gardens and agriculture is common (Sarker et al., 2020). The local economy is mostly small-scale and informal. Trade and services take place in street markets, roadside stalls, or directly from homes. At the same time, parts of the city are changing, with growing private investment, commercial development, and ongoing construction (Sarker et al., 2020).

Sylhet is exposed to seasonal flooding during the monsoon. The Surma River rises and regularly inundates parts of the city, especially low-lying informal areas. Streets become impassable, houses flood, and daily life is disrupted. Residents adapt to the yearly monsoon by raising floors, building walkways, or adjusting routines, integrate it as part of their lifestyle (Islam, 2001).

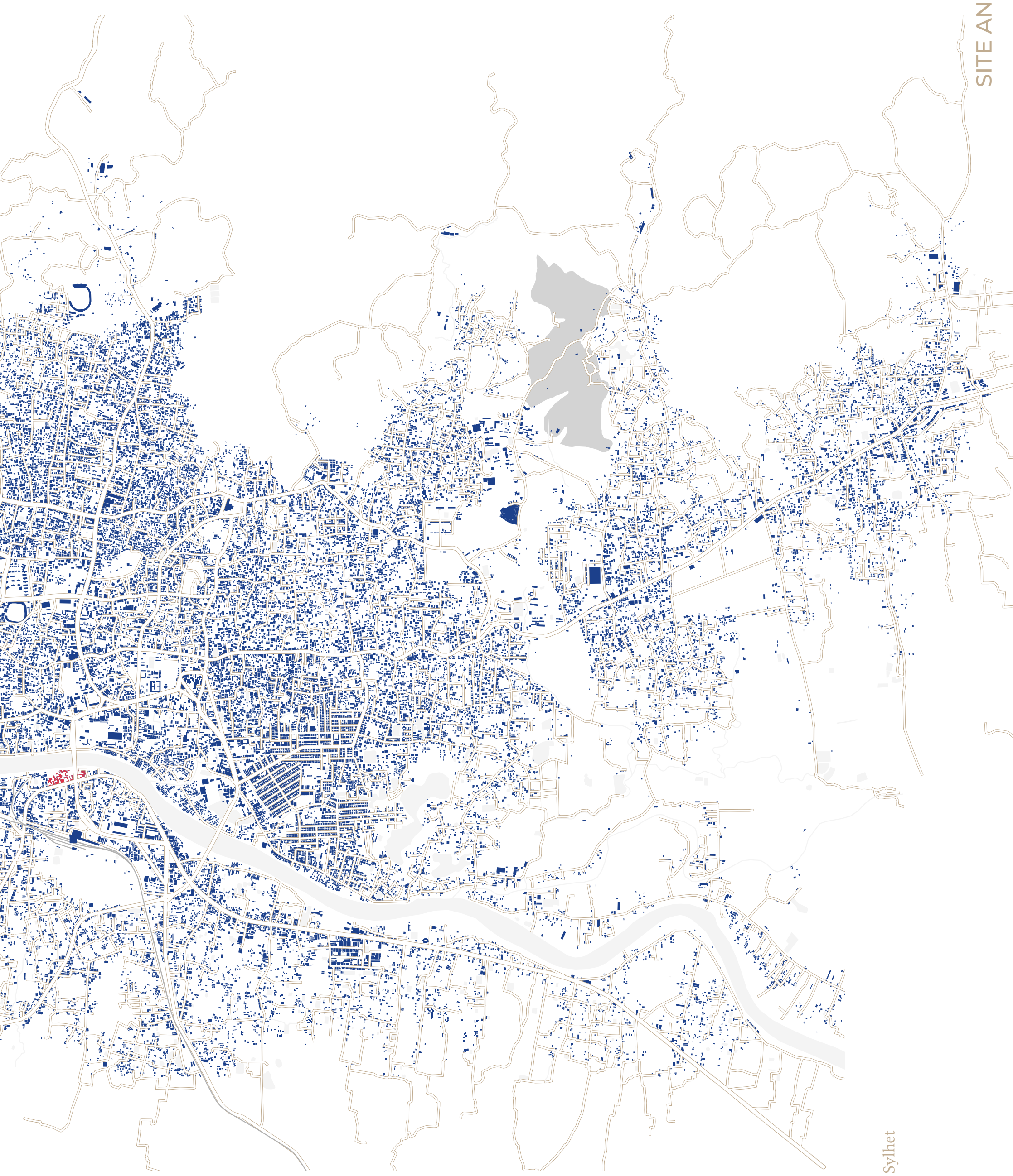
General map of Bangladesh, in relation to its surrounding countries



SYLHET | overview

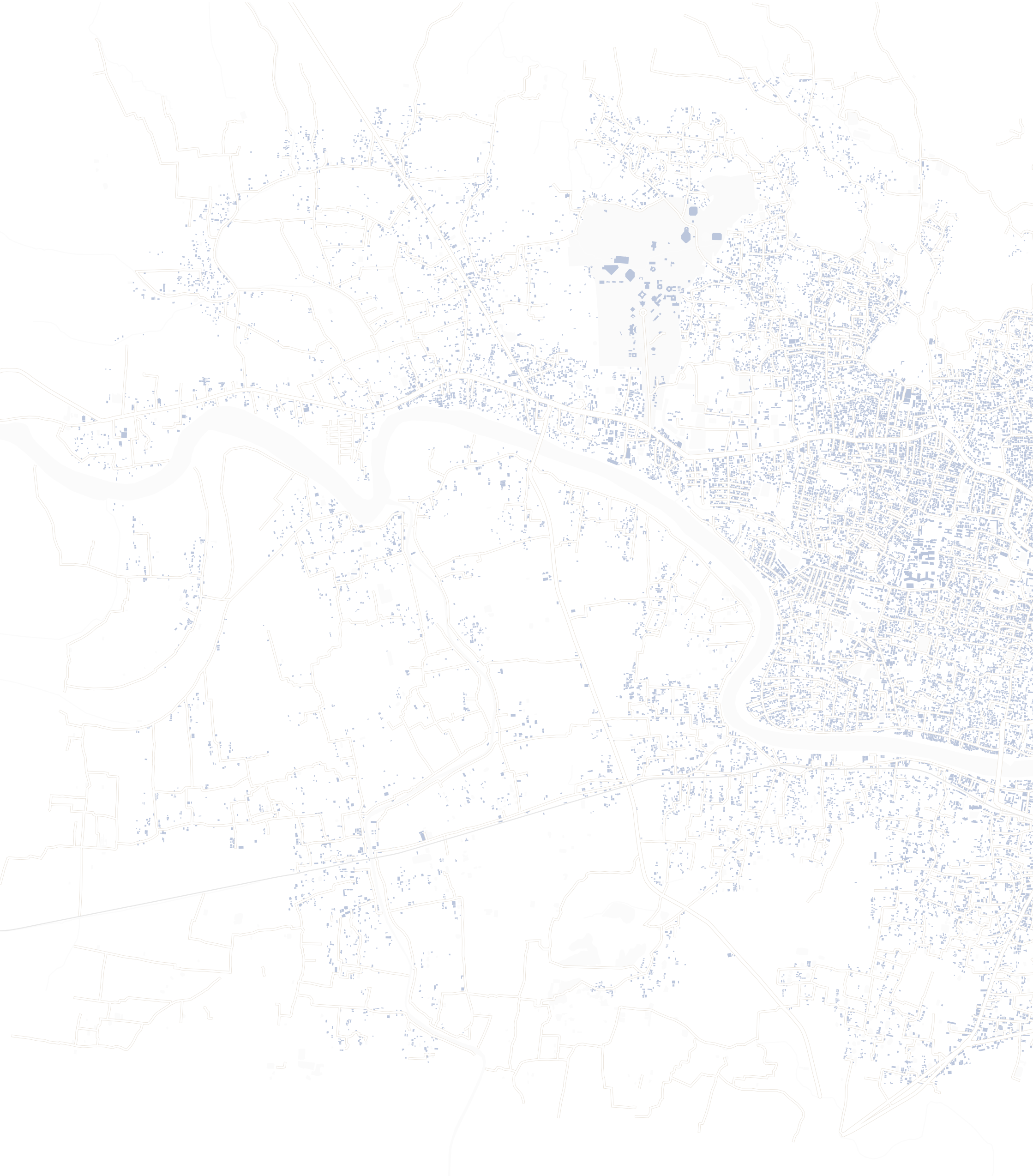


Population 659.138 people
Area 26,50 km²

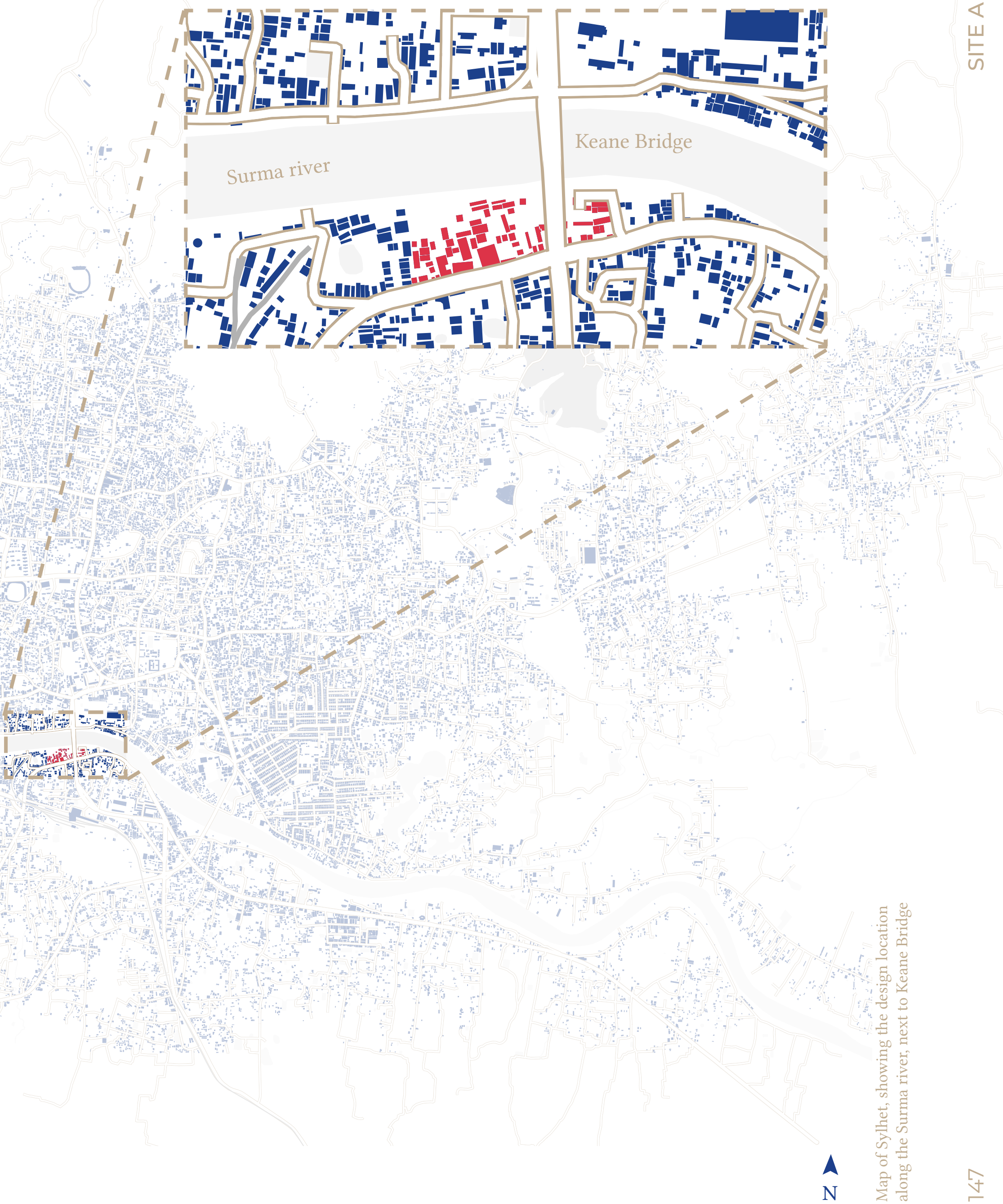


Map of Sylhet

SYLHET I site location within city

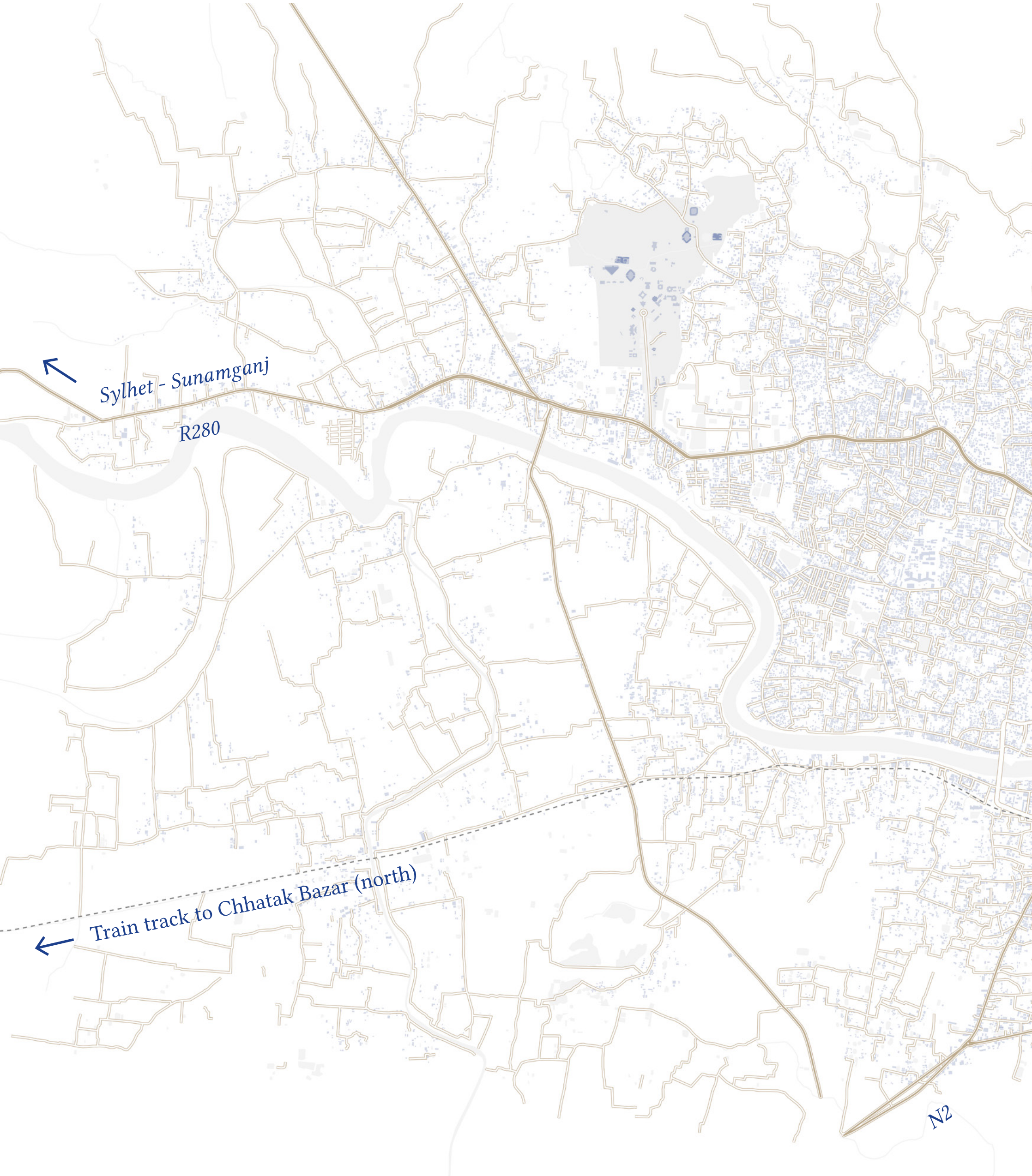


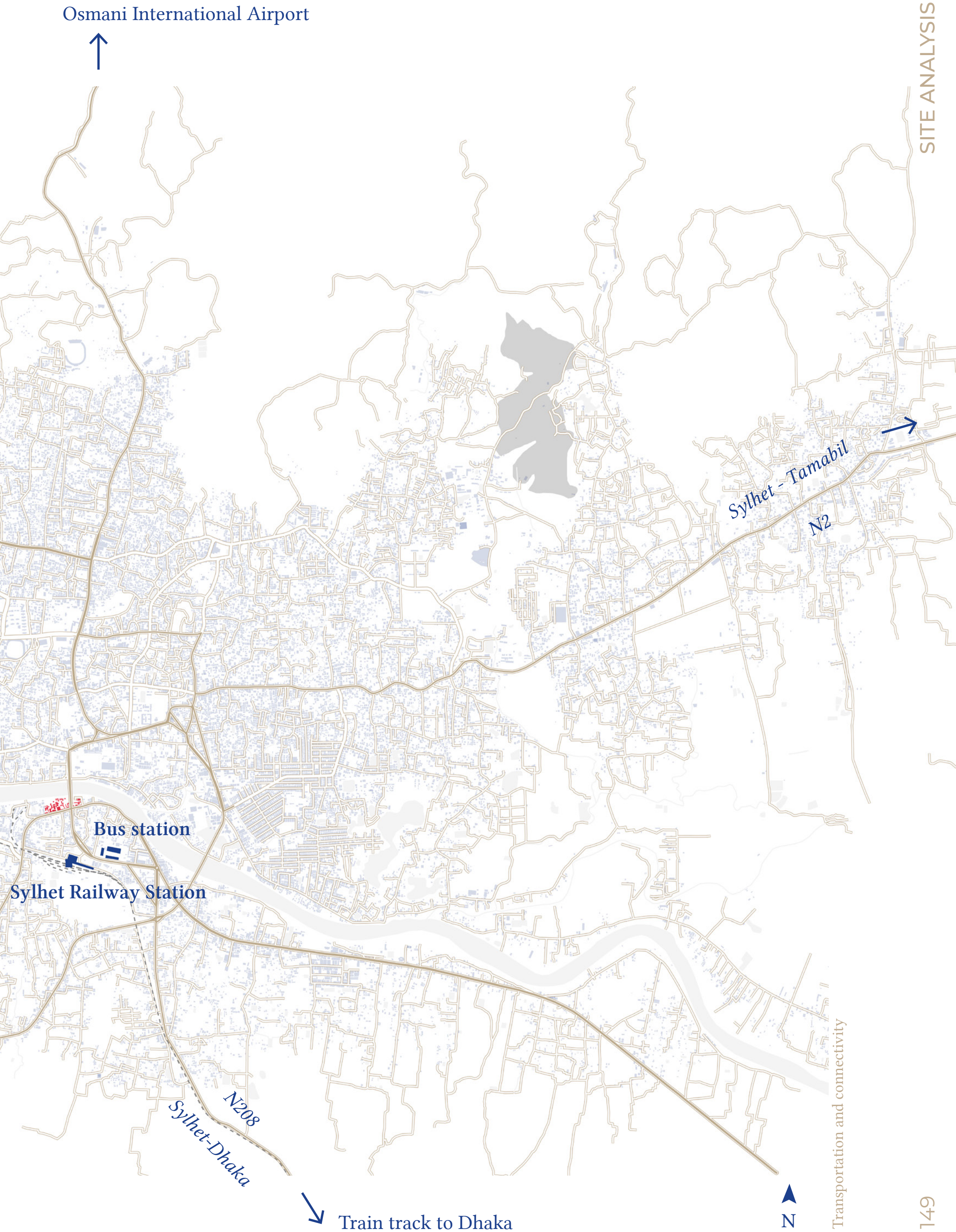
Location in the city



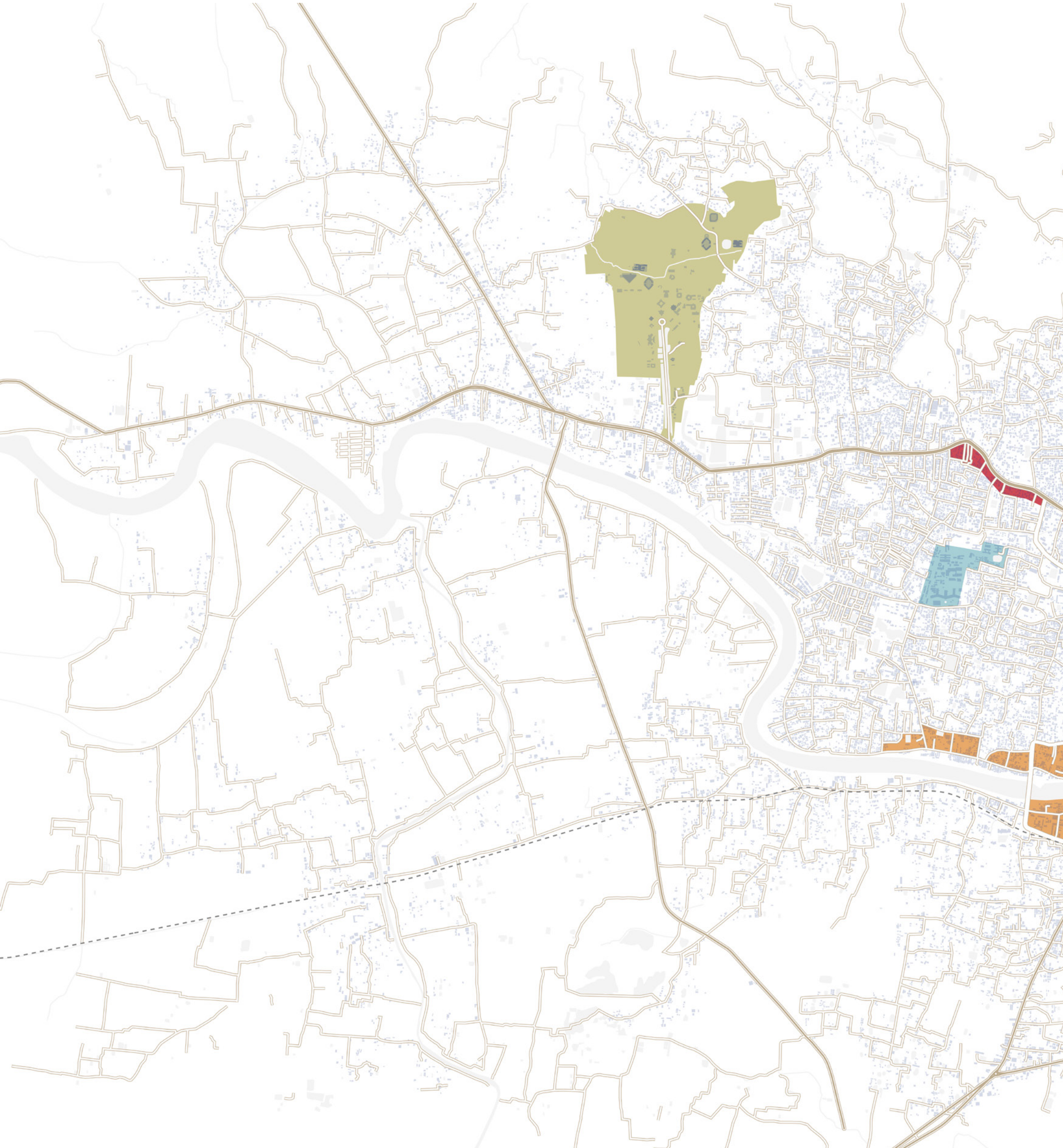
Map of Sylhet, showing the design location along the Surma river, next to Keane Bridge

SYLHET | connectivity

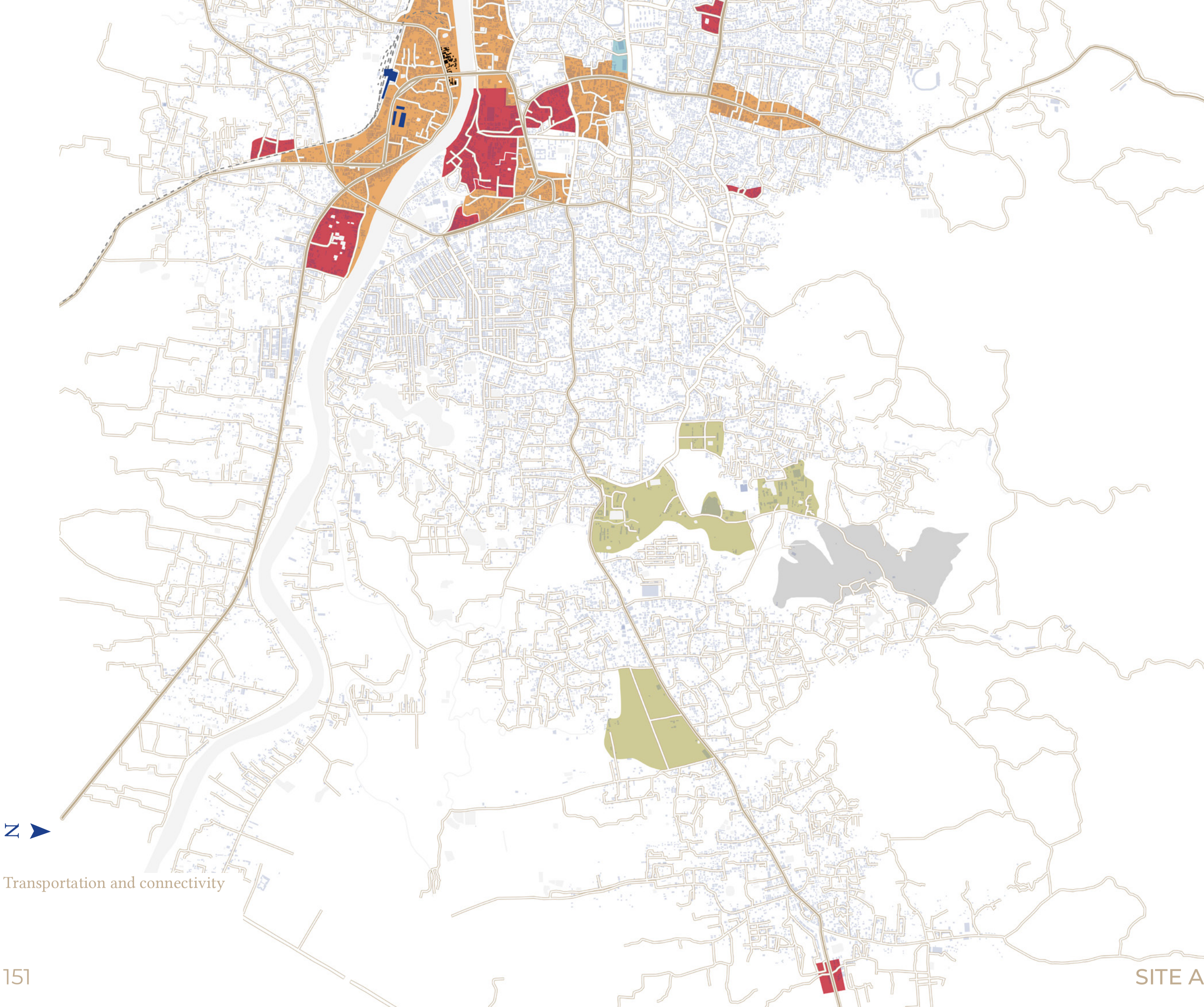



Osmani International Airport
Sylhet - Tamabil
N2
Bus station
Sylhet Railway Station
N208
Sylhet-Dhaka
Train track to Dhaka
N

SYLHET | facilities

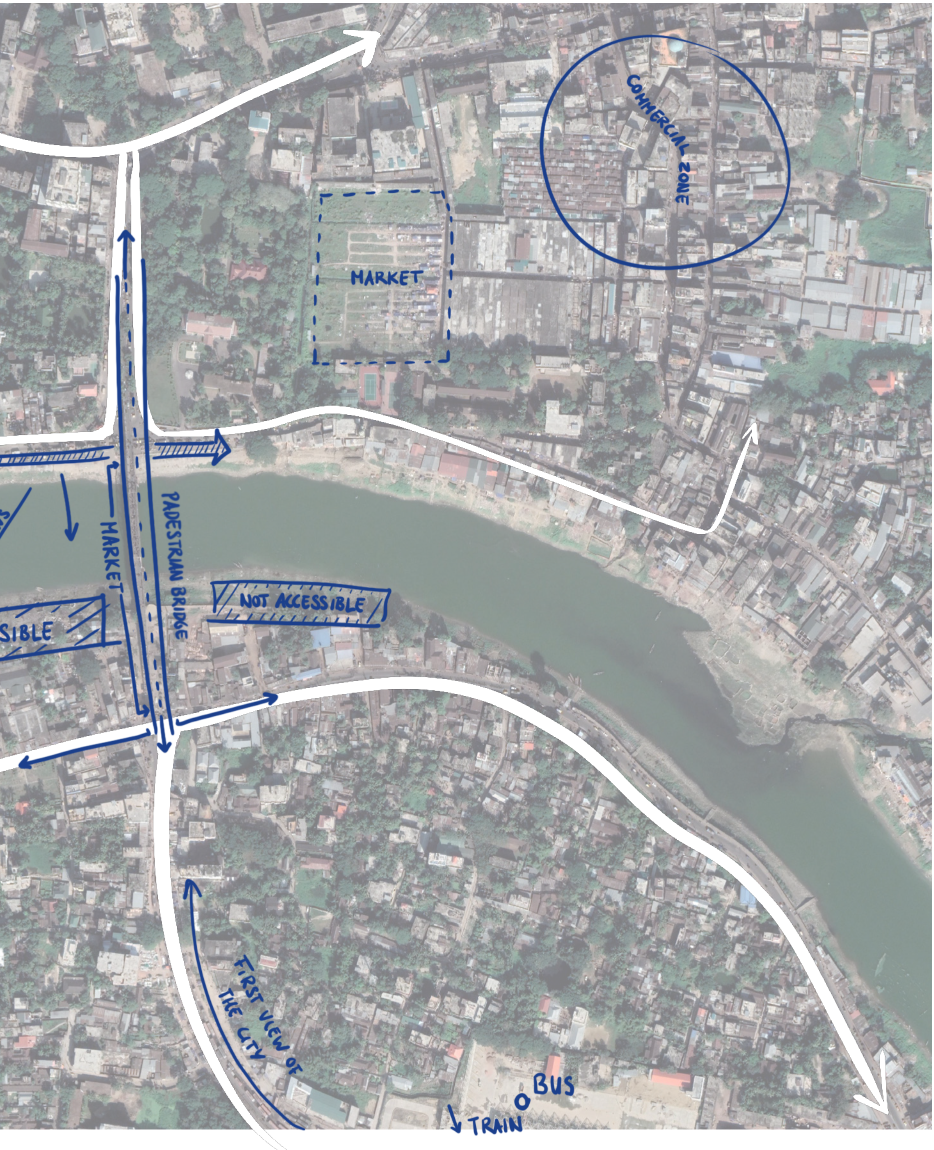


Commercial
Mixed use
Medical
Education



Transportation and connectivity

SYLHET I relation site and city



Relation between site and urban fabric

N

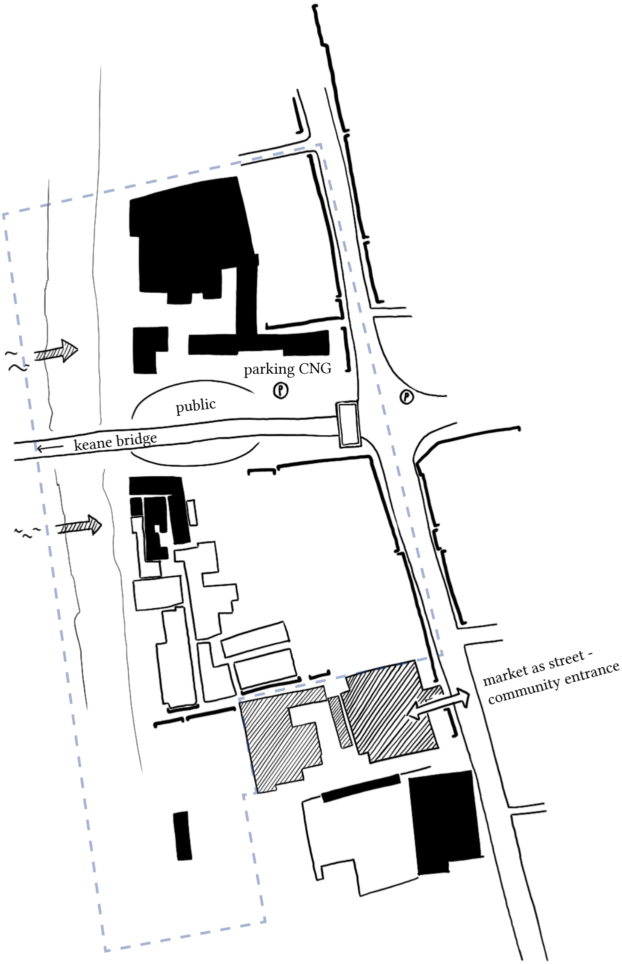
SITE I existing built area

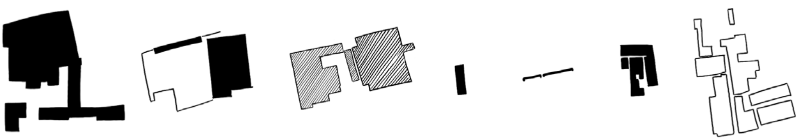
Design location along the Surma river, next to Keane Bridge. The exact location is indicated in red.

N

design location

Important places on location

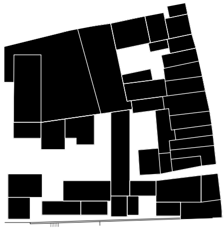




wood workshop | mosque | market | madresa (school) | shops | hindu houses | muslim houses

SITE I existing built area

Design location along the Surma river, next to Keane Bridge. The exact location is indicated in red.



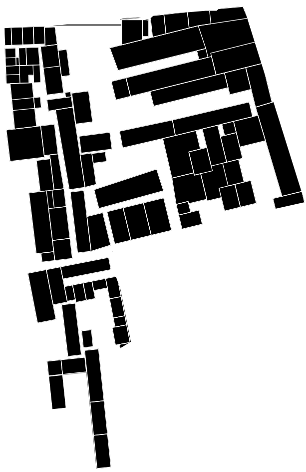
Wood workshop

2.780 m² built on ground floor
670 m² built on second floor
50 m² built on third floor
50 m² built on fourth floor
50 m² built on fifth floor

total of **3.600 m²**

Estimated m² per category

1650 m² wood workshop
1050 m² shops
900 m² housing



Hindu and Muslim housing

6.190 m² built on ground floor
520 m² built on second floor
150 m² built on third floor

total of **6.860 m²**

Estimated m² per category

90 m² school
1800 m² Shops
4970 m² Housing

SITE I existing dwellings

Hindu housing

The existing Hindu houses are constructed from brick and finished with a concrete layer of plaster. The residents all personalised their houses by painting it in various colourful colours. Compared to the Muslim houses, these are in better condition as the government helped providing these as a reward for their work as sweepers.

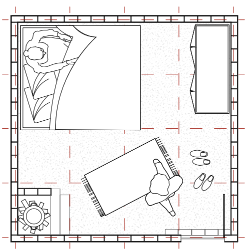
Two different types of spaces were found, each appearing in different layouts and sizes[1]:

- Bedroom + living room + kitchen
- Bedroom

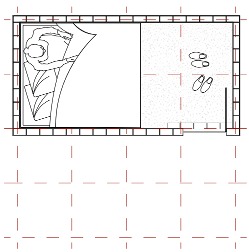
The cooking area is part of the house's structure, with the fireplace doubling as the kitchen.

Typically, one family of 6 people live in one house.

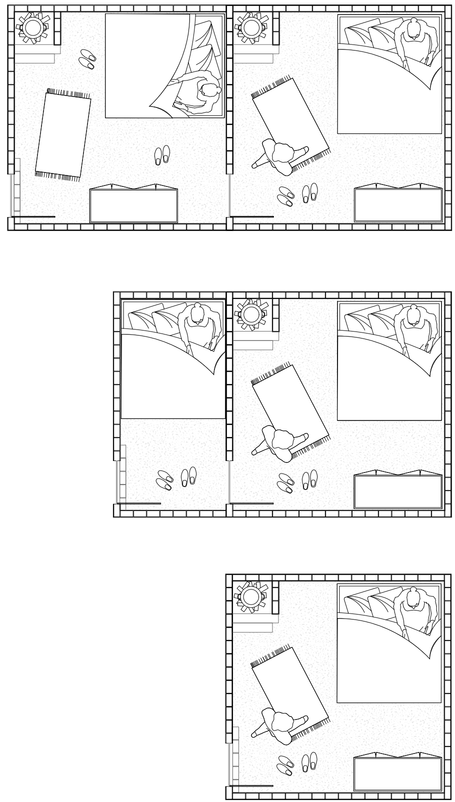
[1] As we were not able to visit many houses, these were the main types we were able to identify. There is a possibility of more types of spaces.



Bedroom / living / kitchen



Bedroom



Configurations Hindu housing
(drawings created by Youri Doorn, 2025)

SITE | existing dwellings

Muslim housing

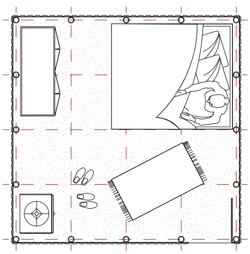
The drawings in this section are based on photographs and video material collected during the field trip. Since the layouts did not follow a consistent or recognizable grid, estimations were made to document the spatial arrangements as accurately as possible. A grid of 0.9 by 0.9 meters was used in the drawings, based on approximate dimensions observed on site.

Five types of spaces were identified, appearing in different combinations and sizes:

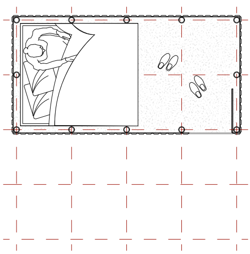
- A space used for both sleeping and living
- A separate bedroom
- A kitchen located in an enclosed area
- An open or outdoor kitchen
- A small shop

Typically, two to three families (10–15 individuals) share a single house.

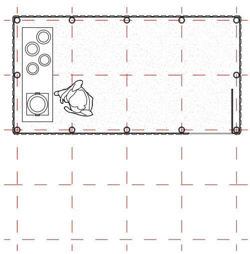
The houses are constructed using bamboo columns, wooden slats, and corrugated metal sheets.



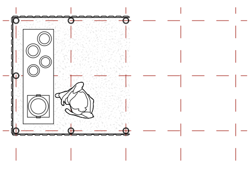
bedroom / living



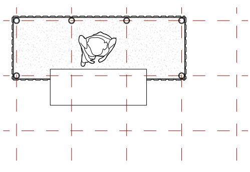
bedroom



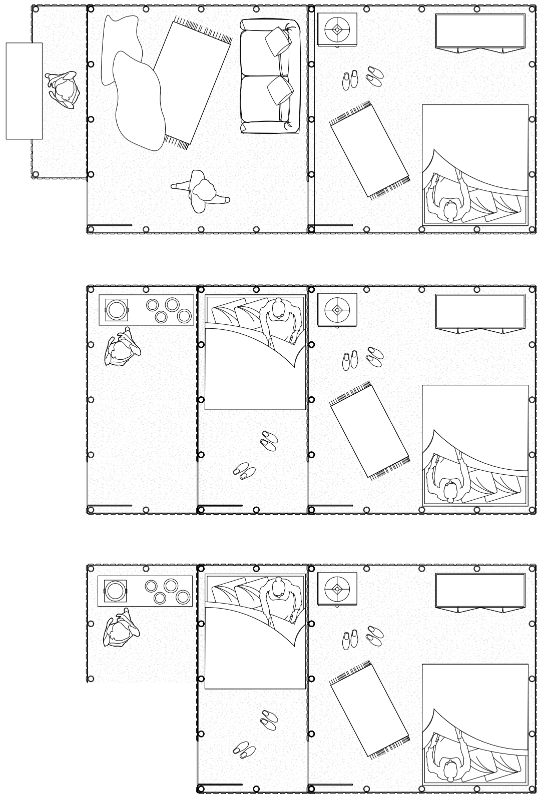
kitchen in closed space



kitchen in open space



shop



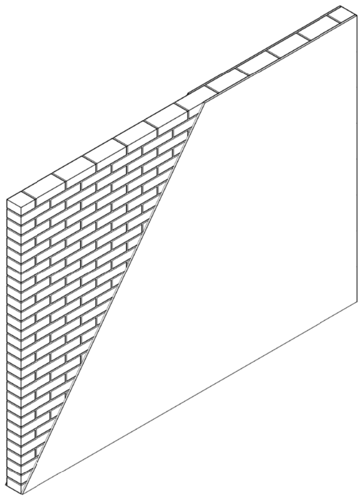
Configurations Hindu housing
(drawings created by Youri Doorn, 2025)

SITE | existing dwellings

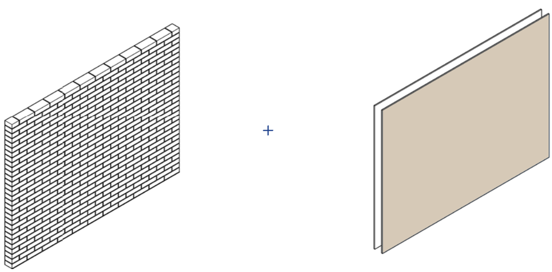
Materials

The materials used in the Hindu community differ from those used in the Muslim community. The Hindu homes are built with brick and finished with plaster and paint, made possible by a government subsidy they received to build on the land, (as a reward for their government-related jobs as street sweepers).

In contrast, the Muslim community's homes are constructed with bamboo or wooden frames and finished with corrugated metal sheets. As a result, these houses tend to be in poorer condition.



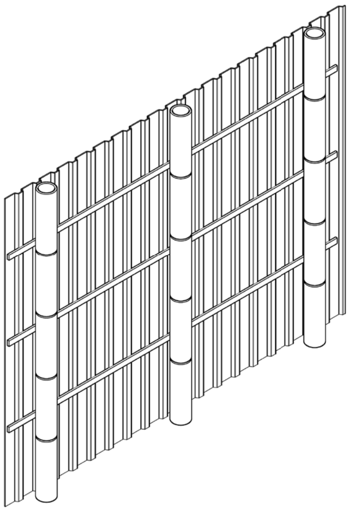
Hindu housing

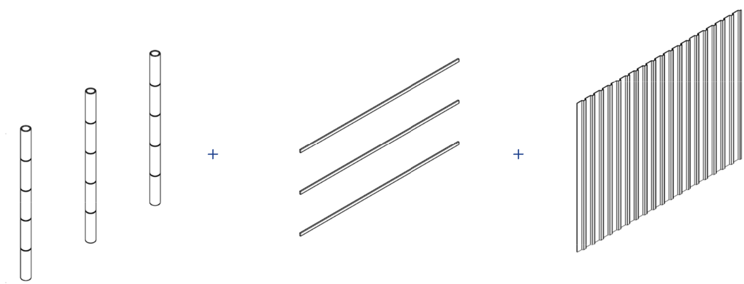


brick wall

plaster finish + paint

Material walls Hindu housing
(drawings created by Youri Doorn, 2025)





Materials Muslim housing
(drawings created by Youri Doorn, 2025)

Interview with a resident from the Keane Bridge community
translated by one of the students from the Shahjalal University of Science and Technology

Question — *What do people who live in this community do for a living?*

resident *(translated)* — Most people here work on the streets. Some clean houses, especially the Hindu families, and they earn about 400 to 500 taka a day. Others, mostly Muslims, collect plastic bottles and sell them to recycling factories. They usually make around 700 to 900 taka a day, depending on how much they collect. Some run small tea stalls and make about the same, 400 to 500 taka a day. A few work in the fish market, which connects to the main street and the slum. There are also two rickshaw drivers, but they have to hire the rickshaws themselves for around 1000 taka a day.

Question — *How often does the flooding happen?*

resident *(translated)* — It is mostly during the rainy season. The water comes right up to the houses, and when that happens, people have to move out and live on the streets with their families. The houses usually don't get too damaged, but the toilets and sanitation stuff do.

Question — *Have there been really bad floods before?*

resident *(translated)* — Yeah, two years ago in 2022 was bad. And even worse about 20 years ago, in 2004. That time, the water came up to chest height inside the houses here in the colony.

Question — *How do floods affect life in the settlement?*

resident *(translated)* — People end up living on the street. Sometimes they build small makeshift houses right there. For about half the year, the water goes up and down, so they have to move back and forth a lot—like three to six times a year. And because the sweeper jobs don't pay much, even the kids have to go out and stay on the streets too.

Question *Do people do anything to protect their homes from flooding?*

resident *(translated)* Not really. What they really want is a better house with an upper floor so they don't have to leave every time it floods. But no one is helping them, and money is tight.

Question *What kind of materials would they like to use for their houses?*

resident *(translated)* They usually build with brick, concrete, and thin sheet metal.

Question *Do they experience earthquakes?*

resident *(translated)* Yes, sometimes, but only small ones.

Question *What are the most important things people want in their homes?*

resident *(translated)* People don't talk much about that. What matters most to them is raising their kids in a better way. Education and having a shared space for the community, that's what they really care about.

Question *Is the land they live on their own?*

resident *(translated)* No, it belongs to the railway. It's not community land, and it's not officially theirs. They just live on it. But they do it because they want a better future for their kids.

Question	*Would they be willing to move if there was a better place to live?*
resident *(translated)*	Yes, they would. If they could go somewhere else and get a better life for their children, they'd go.
Question	*What would they need in a new place?*
resident *(translated)*	They love the land they're on now. They've made their lives here and have a strong emotional connection to it. If they moved somewhere else, they'd still want to bring their temple, their culture. They'd still need a way to earn a living, and they'd want to live in a way that feels right to them.
Question	*Do they face riverbank erosion?*
resident *(translated)*	Yes, a few times. The houses break and they have to rebuild. It's happened multiple times already because they're living right by the river.
Question	*Have any people here come from rural villages to join this community?*
resident *(translated)*	*laughs* This is their village, they've always lived here.
Question	*Are they one big community?*
resident *(translated)*	Yes, they all came at the same time. What keeps them going is sticking together. Their community means everything to them.
Question	*Do they have any connection with the nearby Muslim community?*
resident *(translated)*	The land is shared, but it's kind of like two villages using the same space. They're one big family and follow the same religion.

The colourful streets of the Hindu community.
(Author, 2024)

SITE I community

During the second site visit, together with Hyosik Kim, Youri van Doorn, Kaspar ter Glane, and Mascha Gerrits, Hyosik brought materials for the children to draw what their dream house would look like.

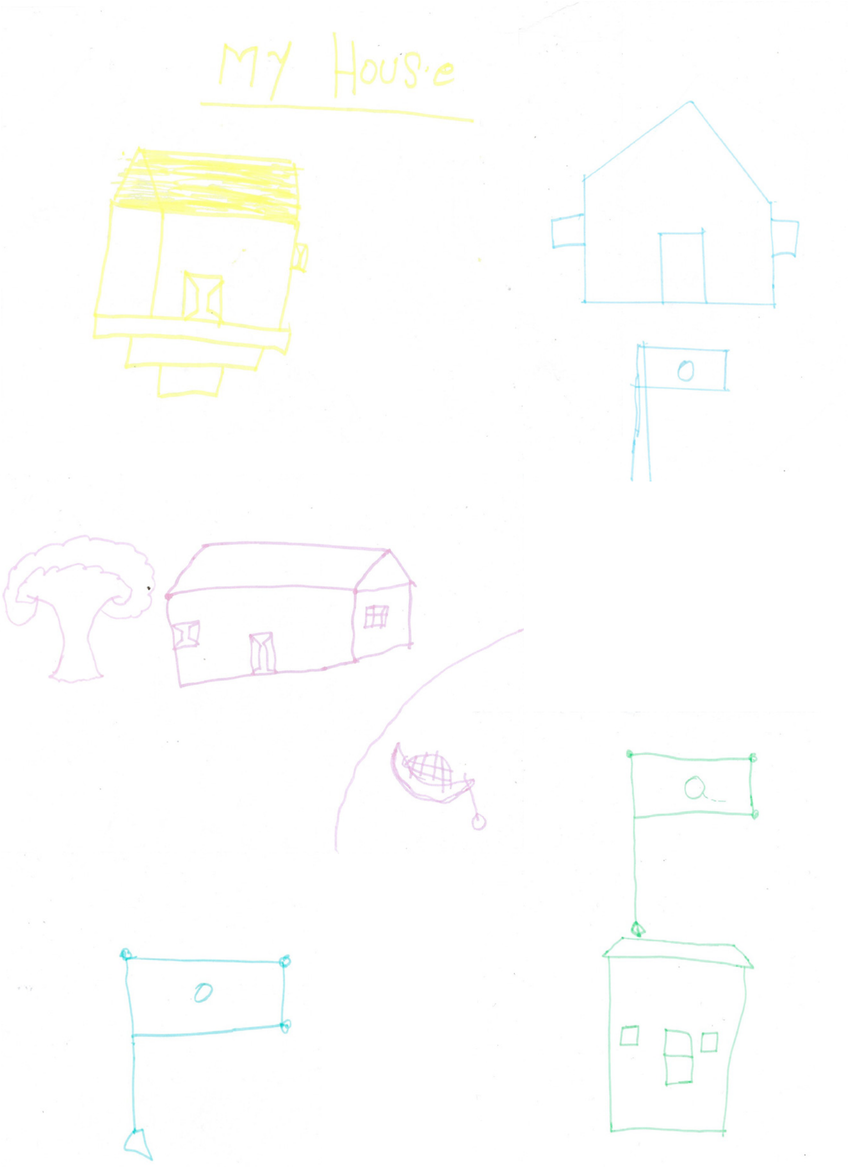
What stood out was that many of them drew a house that closely resembled the one they currently live in. Almost all of the drawings included something that referred to the site they live on now, a Bangladeshi flag on or next to the house or a river. The most important thing for them is being able to stay in their own place, and live in a house that feels familiar.

Hyosik handing out the material to draw at the Hindu community. (Author, 2024)

Drawings in progress. (Author, 2024)

One of the children of the Keane Bridge community showing his drawing of his dream house.
(Author, 2024)

A collection of the drawings created by the children of the Keane Bridge site.



Collection of drawings created by the Keane Bridge community, representing their dream houses

KEANE BRIDGE COMMUNITY

A photographic journey through the design location

SITE

Overview of community living next to Keane Bridge, along the river.


hindu
houses

Housing
The hindu part of the community consists of colourful brick houses, plastered and painted.

SITE

hindu
houses

Temples in Hindu part of the community


নদীর পাড়,২৬নং ওয়ার্ড,সিলেট সিটি কর্পোরেশন,দ:সুরমা,সিলেট।
হরিজন সংঘ

hindu
houses

In-between spaces

SITE

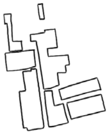
hindu
houses

Cooking

SITE

hindu
houses

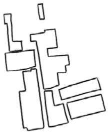
Job
The hindu part of the community mostly works as sweepers, that is why this colony is also referred to as the Sweepers Colony.



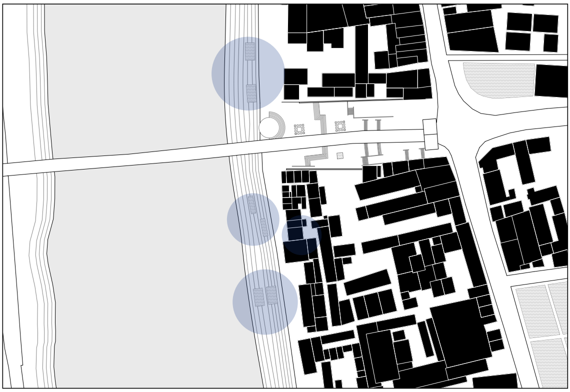
muslim
houses

Housing
The Muslim houses are in a worse state compared to the Hindu houses. They are mostly built from corrugated sheets.

SITE

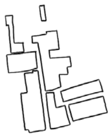


muslim
houses



Small scale agriculture

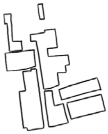
SITE



muslim
houses

In-between space, not always functional

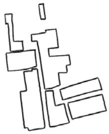
SITE



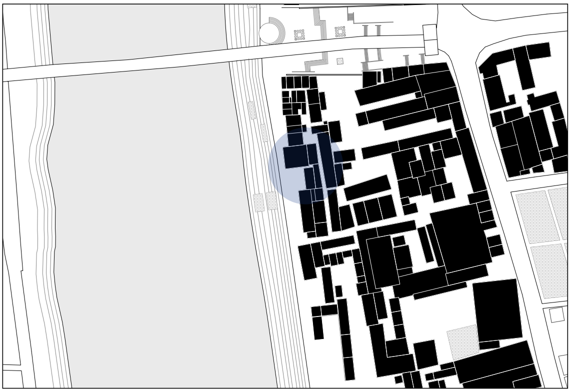
muslim
houses

Meeting place and having fun

SITE

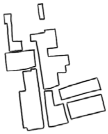


muslim
houses

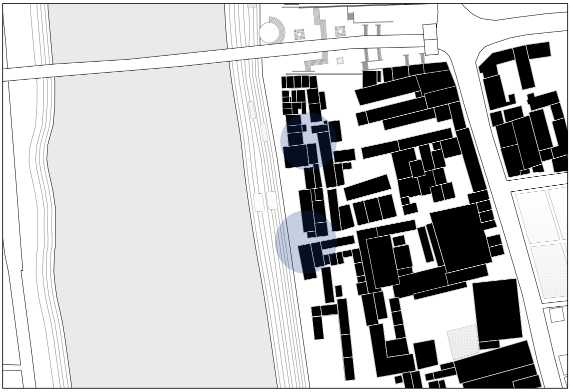


An separate space indoor is created for cooking.
This is a shared facility

SITE



muslim
houses



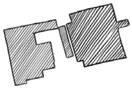
Places where people from the community work;
small-shop owner, tea-stall owner, garbage collector

SITE

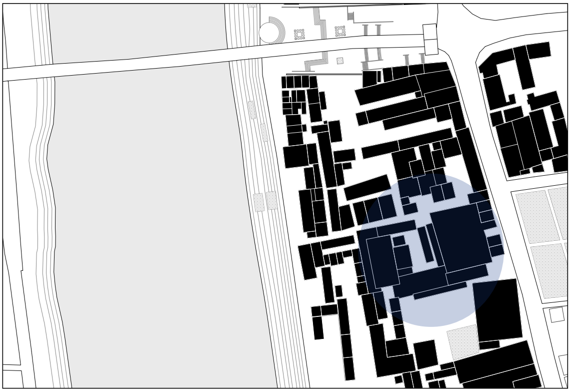
muslim
school

Madresa, the muslim school

SITE



market



The fish-market, connecting the community to the public


পুষ্টি

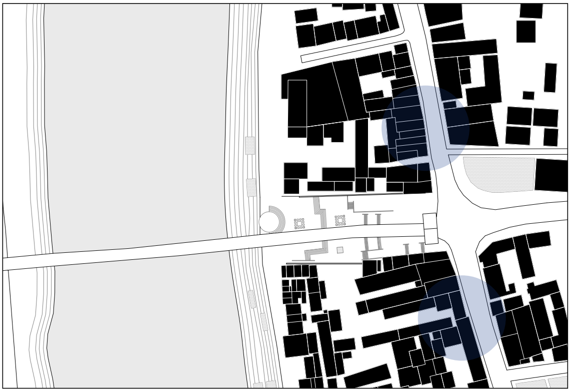

পুষ্টি

SITE

wood
workshop

Woodworkshop, above the Keane bridge

shops



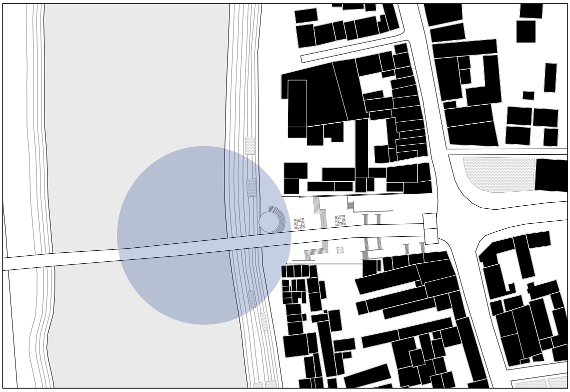
Shops along the road


DHL


UCB

SITE

bridge

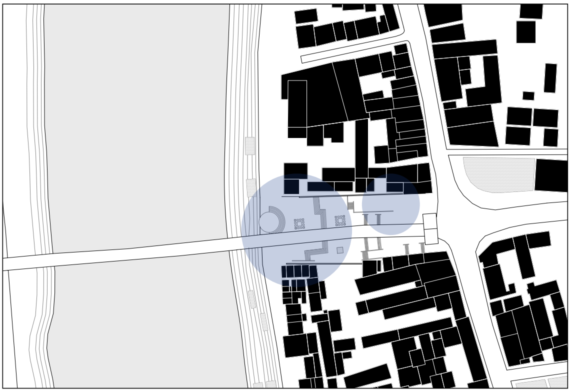


The bridge itself is used as an informal market, where people sit without having to pay for their spot

Informal market on Keane Bridge
(photos by Mascha Gerrits, 2024)

SITE

bridge



The space below the bridge is used as public space, the space right next to it as a CNG parking spot


01712 317 119

DESIGN

concept and context

PROBLEM

Overall national problem

Climate change is amplifying the frequency and severity of floods, overwhelming the current strategies of communities living in Bangladesh in withstanding these floods, leading to loss of houses, loss of livelihood, displacement and migration (particularly to urban areas).

Keane Bridge community (local problem)

A close-knit Hindu and Muslim community, living in an informal settlement next to Keane Bridge, experiences flooding annually. Every year, the water reaches inside their houses, to the extent that they have to live on the streets with their family until the water recedes again. This happens about three times a year.

'How can the existing resilience strategies of communities in Bangladesh, developed for coping with monsoon floods, be scaled up to urban housing solutions that enhance the ability to withstand more severe floods without compromising livelihoods and traditional ways of living?'

CONCEPT DIRECTION

'Soft approach' // living with the floods

Research showed two directions of dealing with the flooding, either hard approaches (technical solutions such as dams, trying to control the floods) or a soft approaches (allow for people to live with the floods). This design will work and find design solutions within the soft approaches.

--> allow for the water to rise (either a temporary infill on the ground floor, built in a way that the water can go below the buildings, or have space between the buildings for the monsoon)
--> built in a way to use the monsoon as an opportunity (eg. rainwater harvesting)

Built upon existing working structures

The people living in the community next to Keane Bridge, but also in the rural areas in Bangladesh have their own unique structure of building small courtyards, used as an outdoor living space. The buildings around these courtyards are often all family members.

--> keep the courtyards, but in a different form (either in blocks or between buildings)
--> built in a way people are still able to live on ground floor (max. 4/5 floors)
--> families / communities living together with houses facing each other
--> keep opportunity for people to make houses unique and colourful
--> design spaces with multiple layers; outside, semi-outside, inside (places to invite people other than inside their private space)

Use of local material / techniques

Based on the idea of Anna Heringer, make as much use as possible of local material and local techniques, so most of the money can go to the (local) people building it, instead of to imported material. This way, local practices remain intact.

--> invest project resources directly into the community (craftsmanship)
--> use locally sourced material

REFERENCE I SOAK by Mathur & Da Cunha

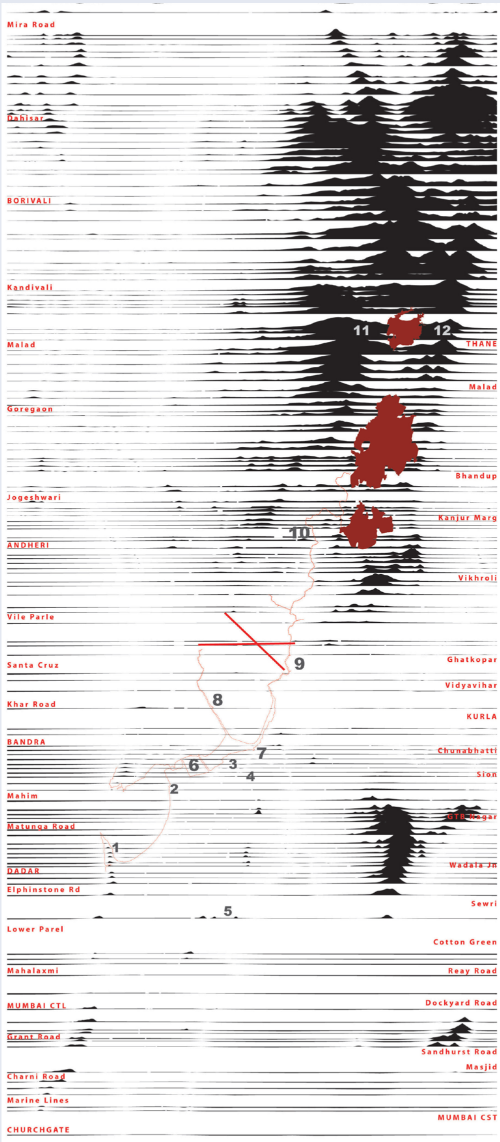
Anuradha Mathur and Dilip da Cunha are the founders and principles of design firm Mathur/da Cunha, based in Philadelphia and Bangalore, India.

In their book SOAK, they argue for water as a spectrum of wetness, rather than land and river as fixed, separate categories.

Maps are usually drawn as stills from above. Mathur and Da Cunha their criticism (Bremner, 2018);

"In our work on Mumbai, the idea of the estuary was a way of critiquing the colonising idea of an island city dividing land and water as drawn by lines on maps. Section as a technique became a way to move away from that. Not one section but multiple sections became a way to subvert the view from above."

In the book of Bremner, MONSOON [+ other] WATERS, she writes about Arjun Appadurai and Carol Breckenridge who build on this idea with "wet theory". The wet theory emphasizes change, motion, and fluidity as fundamental aspects of reality. It suggests that instead of treating flux, migration, and boundary-blurring phenomena as exceptions, these should be recognized as central to how the world functions. The flow of water, the migration of people, and the reshaping of landscapes by environmental forces are not anomalies, but essential elements of historical and geographical processes. Their theory also challenges the idea that territory is stable and permanent, but rather sees it as dynamic, shaped by constant flux and interactions between land, water and other forces (Bremner, 2018), which aligns with the ideas of Mathur and Da Cunha.



Multiple sections of Mumbai on top of a map
(Mathur & da Cunha, n.d.)

RETHINK THE SITE PLAN

If the water next to the site is a spectrum of wetness, where is the line?
The plan is not a permanent situation, it is a moment in time. The design should fit within this spectrum.

dry season

the monsoon as a s

wet season

pectrum of wetness

Rethinking Rivers

"Water as a spectrum of wetness, where boundaries between land and water are fluid and constantly shifting"

-

Anuradha Mathur and Dilip da Cunha

How to design with the temporality of the monsoon in mind?

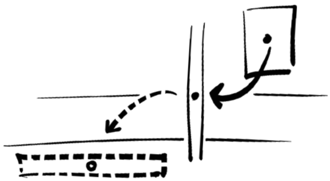
URBAN | strategy

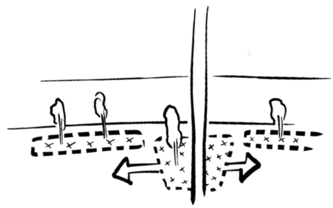
Based on the conclusions from the 'Site Analysis' chapter, the following strategy will be used in the design process.

Make south more attractive

Right now, there is a contrast between the north side of the Surma river and the south side. The north is more developed, has large commercial zones to attract people and has a recreational zone along the river.

But the first place people will pass, when arriving in Sylhet, is the south side of the river, as this is where the roads from Dhaka arrive, the train- and bus station are located.





Extend commercial / market zone from north to south

One of the strategies to make the south side of the river more attractive is to connect north and south through an extension of the commercial zone.

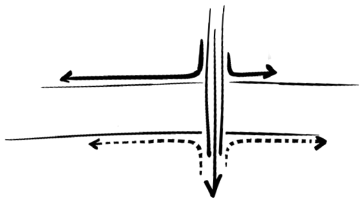
Along the riverside promenade, a market street will continue which will attract citizens to this part of Sylhet as well. The market is visible from the north side of the river, and will give this neighbourhood a lively view.

Continue pedestrian street along river

Pedestrians are walking from north to south via Keane Bridge, but end up in a chaotic traffic crossover, where they are mixed again between cars and CNG's.

There is no place yet on the south side just for pedestrians.

The flow of pedestrians will be guided along the riverside, where the market and separate pedestrian pathway from Keane Bridge continues.



Add green and recreational space

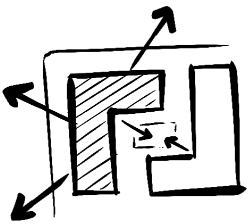
One of the only public spaces is below Keane Bridge, but is fully built in concrete and is mostly used by homeless people at the moment.

As this area is in such a public place, along the riverside, it should not only be redeveloped for its future residents but also for the rest of the city.

The riverside will be a public and green place, offering not only a new hotspot in the city, but also a green view from the other side of the river.

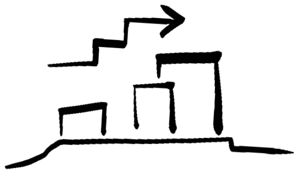
SITE I strategy

The masterplan will consist mainly of clusters. These clusters are designed based on the strategy below.



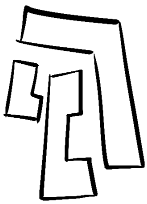
Public on outside, residential on inside

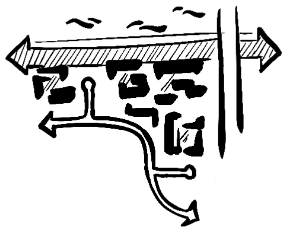
Create a 50% 50% combination between living on ground floor and public functions on groundfloor.



Riverside view

Buildings will gradually rise in building height, with the lowest buildings along the river side, and the highest towards the street side.





Keep buildings of cultural value

The site along the riverbank includes buildings of cultural or religious value, such as the Hindu community, or the mosque. These buildings must be kept in order to

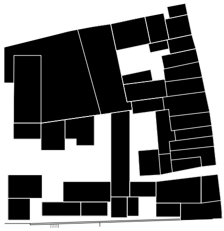
Public, semi-public, private

The site will contain multiple layers, from *public* (park, commercial zone, riverside), to *semi-public* (the courtyards between buildings), to *private* (residential houses).

The cars will also be separated from the pedestrians and courtyards.

SITE | overview

Design location along the Surma river, next to Keane Bridge. The exact location is indicated in red.



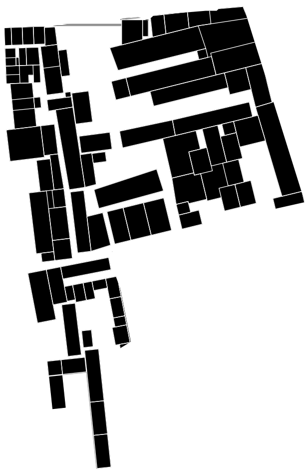
Wood workshop

2.780 m² built on ground floor
670 m² built on second floor
50 m² built on third floor
50 m² built on fourth floor
50 m² built on fifth floor

total of **3.600 m²**

Estimated m² per category

1650 m² wood workshop
1050 m² shops
900 m² housing



Hindu and Muslim housing

6.190 m² built on ground floor
520 m² built on second floor
150 m² built on third floor

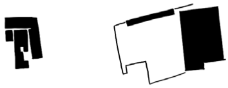
total of **6.860 m²**

Estimated m² per category

90 m² school
1800 m² Shops
4970 m² Housing

SITE I demolition

keep



hindu houses

mosque

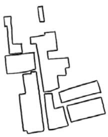
Hindu houses

580 m²

Mosque

2440 m² (total of three floors)

demolish

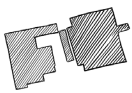


muslim houses

Muslim houses / shops

9880 m²

demolish in later phase



market

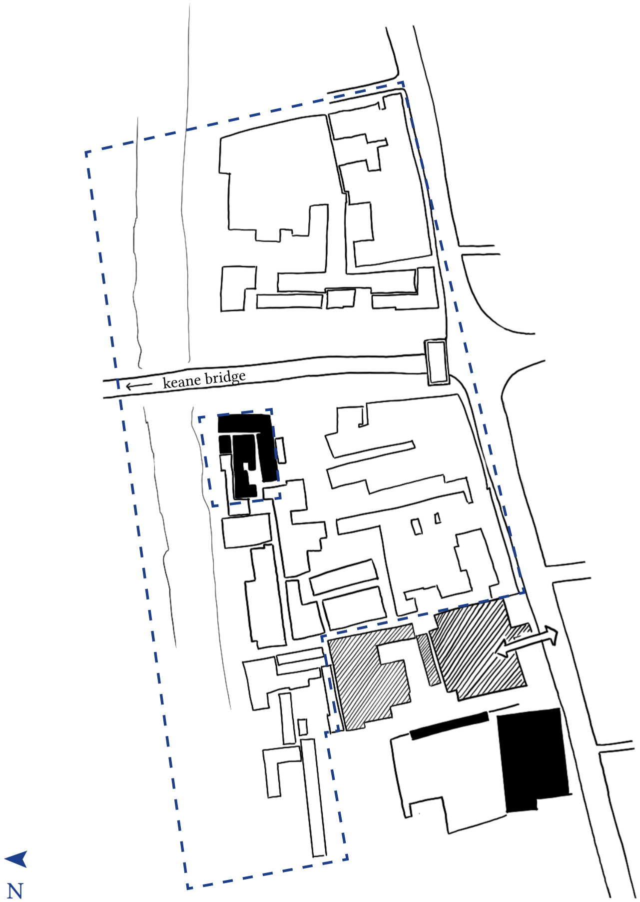
market

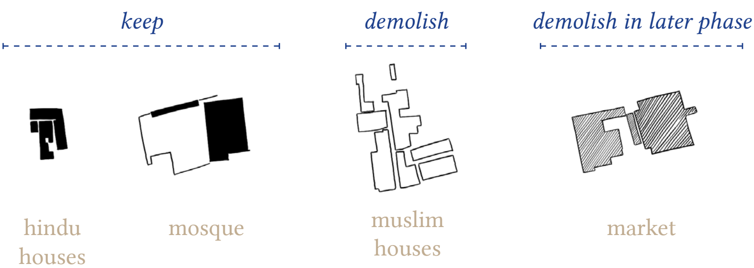
1680 m²

In order to built new, flood resilient housing, a total of 9880 m² of the informal Muslim settlement, the shops and the wood workshop will be demolished.

In return, at least the communities and businesses that are already on this location will get a new place back. To justify the demolition and add something new to the city, the aim is to return at least 4 m² for every 1 m² that is demolished.

This amounts to a total of about **40.000 m²**.


keane bridge
N


keep
demolish
demolish in later phase
hindu houses
mosque
muslim houses
market

SITE | program

Existing

10.460 m^2 built area on **2,1 Ha**.
FSI = **0,5**.
GSI = **0,5**.

Proposal

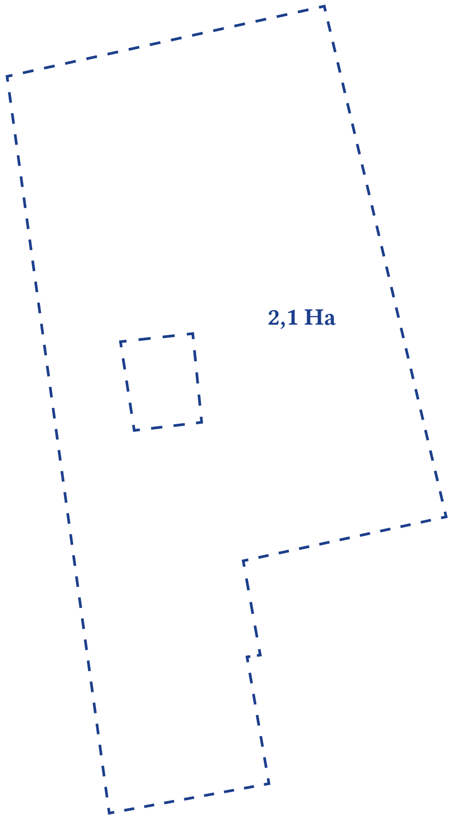
40.000 m^2 on a site of **2,1 Ha**.
FSI = +- **2,0**.
GSI = **0,4**.
150 - 200 dwellings / Ha

Different types of units will be realised

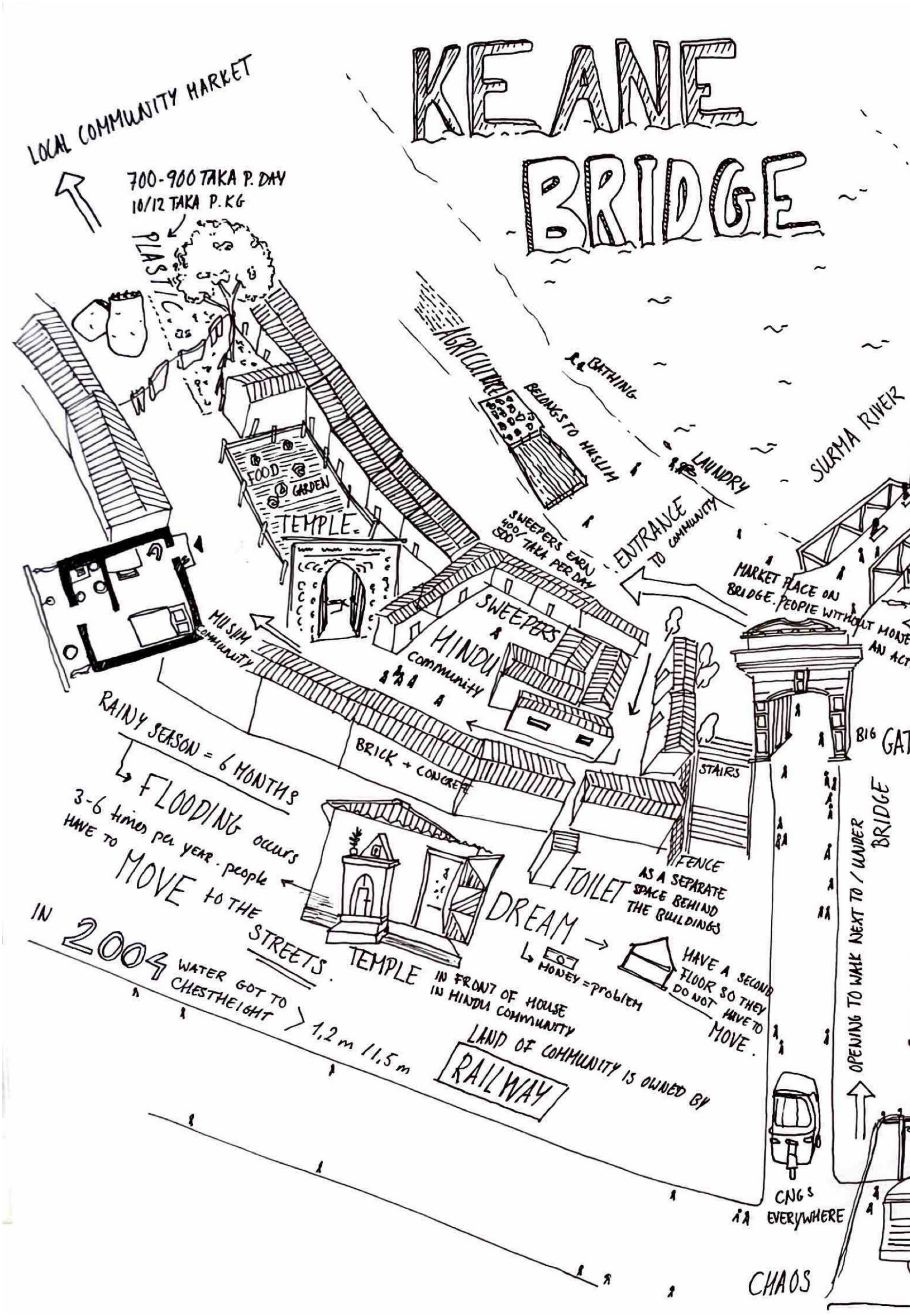
Low-income	*(50% of dwelling m^2)*
Middle-income	*(25% of dwelling m^2)*
High-income	*(25% of dwelling m^2)*

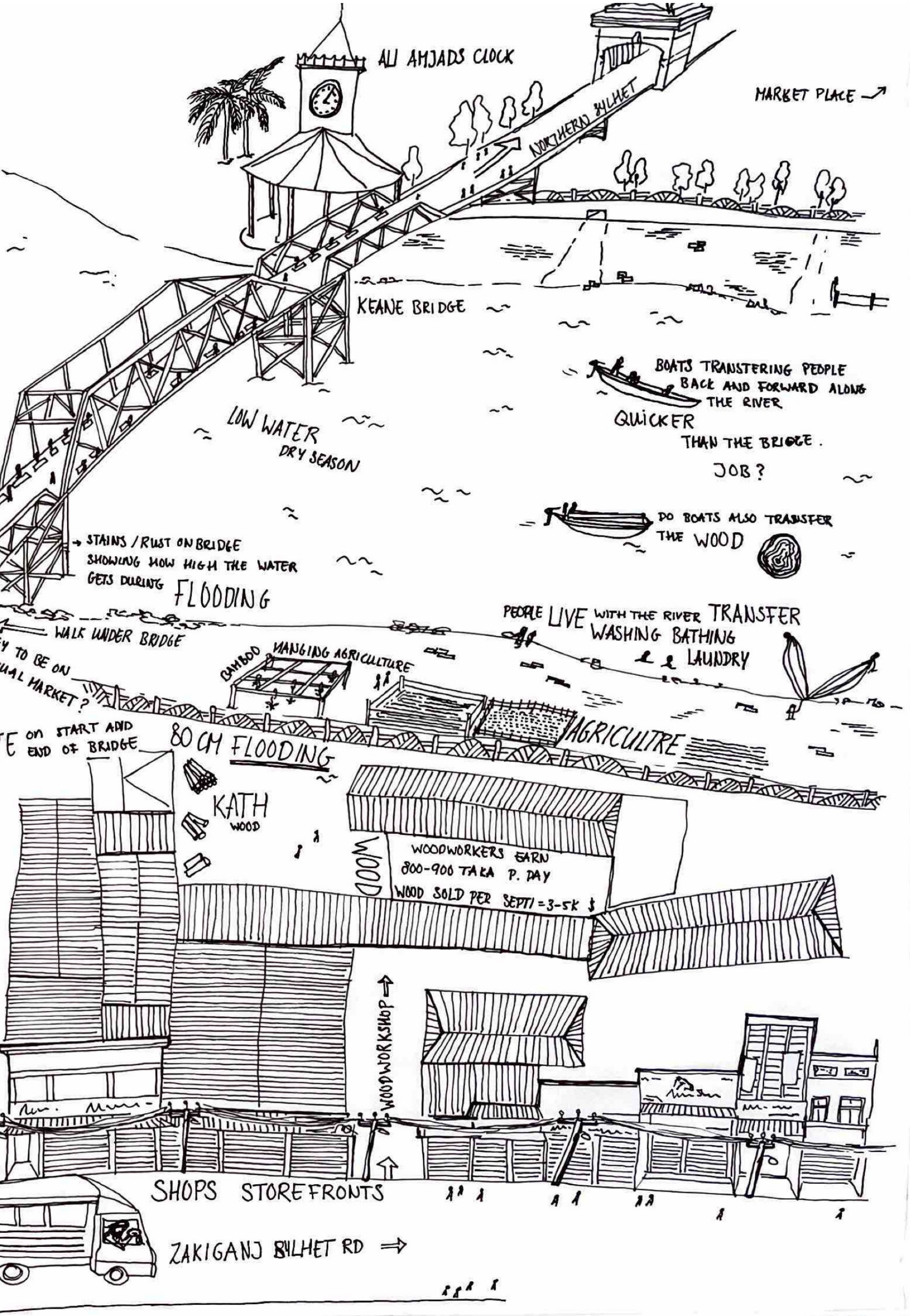
places for small business *(as they will be partly removed)*
school

market along the river
recreational pedestrian street + sit places along river
park as connection between public space on top of bridge and below bridge


2,1 Ha

DESIGN PROCESS


KEANE BRIDGE
LOCAL COMMUNITY MARKET
700-900 TAKA P. DAY
10/12 TAKA P. KG
PLASTIC
AGRICULTURE
BELONGS TO MUSLIM
BATHING
LAUNDRY
SURMA RIVER
FOOD GARDEN
TEMPLE
SWEEPERS EARN 400/500 TAKA PER DAY
ENTRANCE TO COMMUNITY
MARKET PLACE ON BRIDGE. PEOPLE WITHOUT MONE
AN ACT
MUSLIM COMMUNITY
SWEEPERS
HINDU Community
BIG GAT
STAIRS
BRIDGE
RAINY SEASON = 6 MONTHS
↳ FLOODING occurs
3-6 times per year. people HAVE TO MOVE to THE STREETS.
BRICK + CONCRETE
FENCE
TOILET AS A SEPARATE SPACE BEHIND THE BUILDINGS
DREAM →
↳ MONEY = problem
HAVE A SECOND FLOOR SO THEY DO NOT HAVE TO MOVE.
IN 2004 WATER GOT TO CHESTHEIGHT > 1,2 m / 1,5 m
TEMPLE IN FRONT OF HOUSE IN HINDU COMMUNITY
LAND OF COMMUNITY IS OWNED BY
RAILWAY
OPENING TO WALK NEXT TO / UNDER
CNGS EVERYWHERE
CHAOS

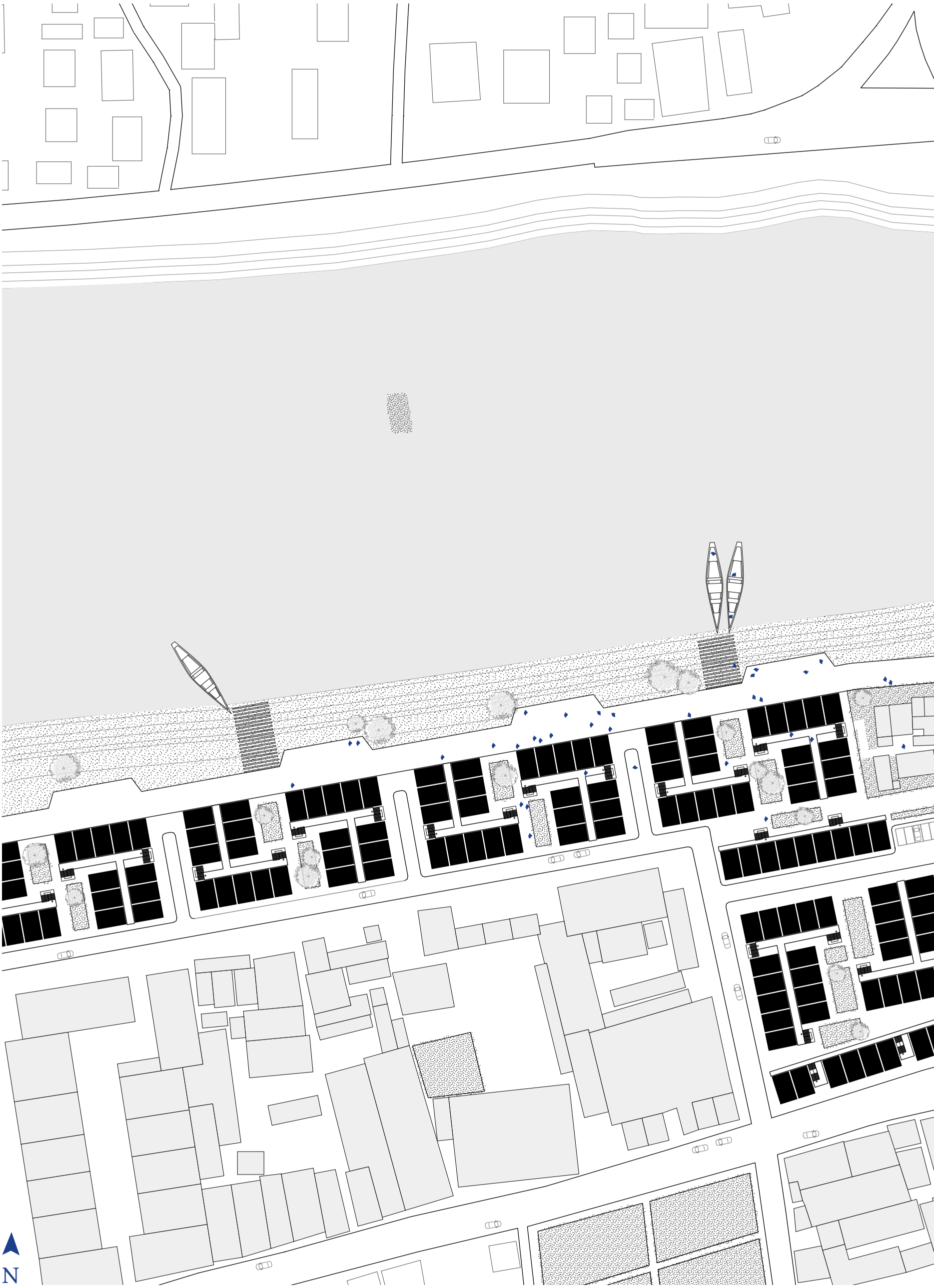


Jan Rothuizen style analysis of the first findings on the project location


N

Current situation

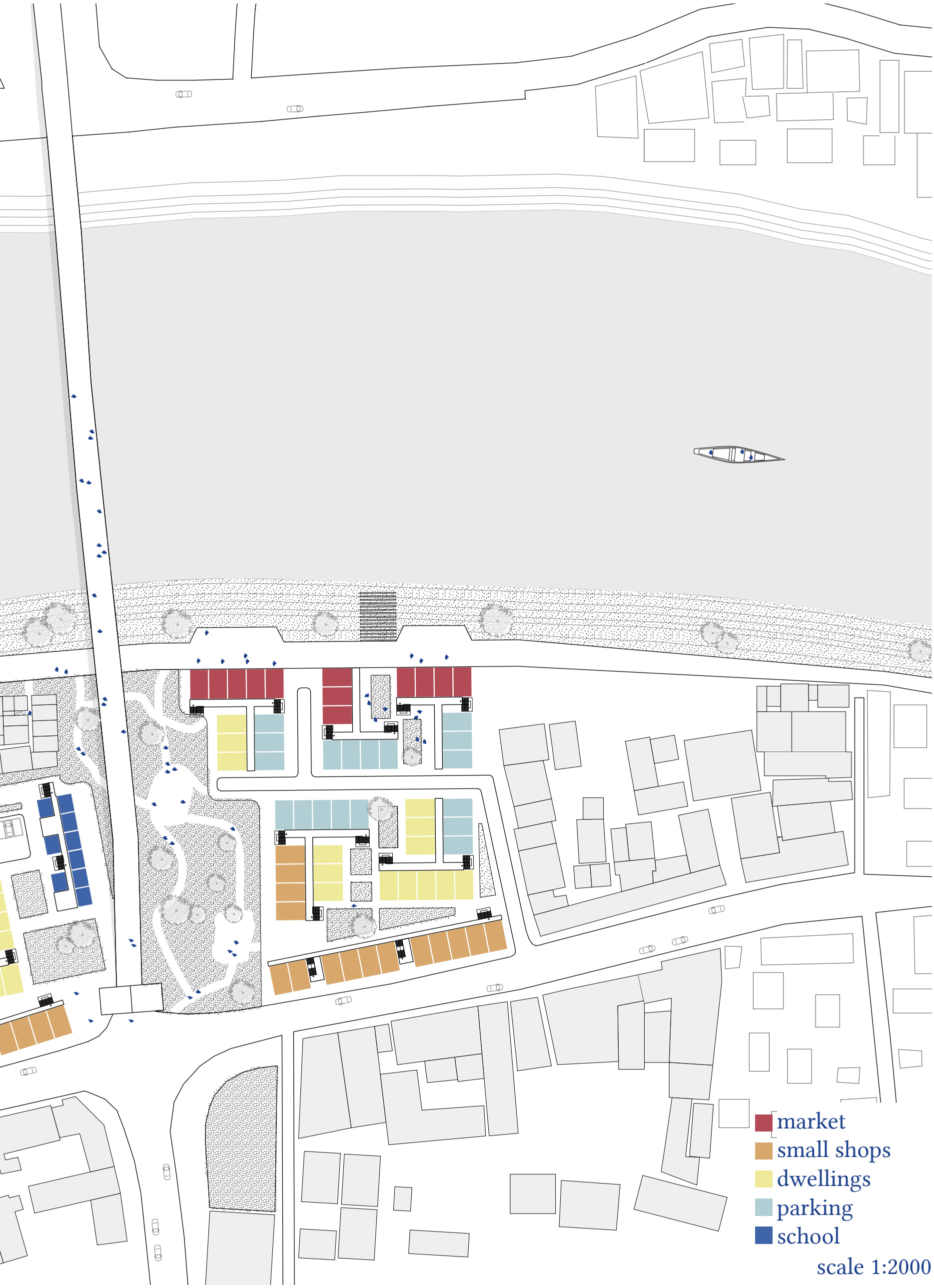
P2 DESIGN | masterplan proposal



scale 1:2000

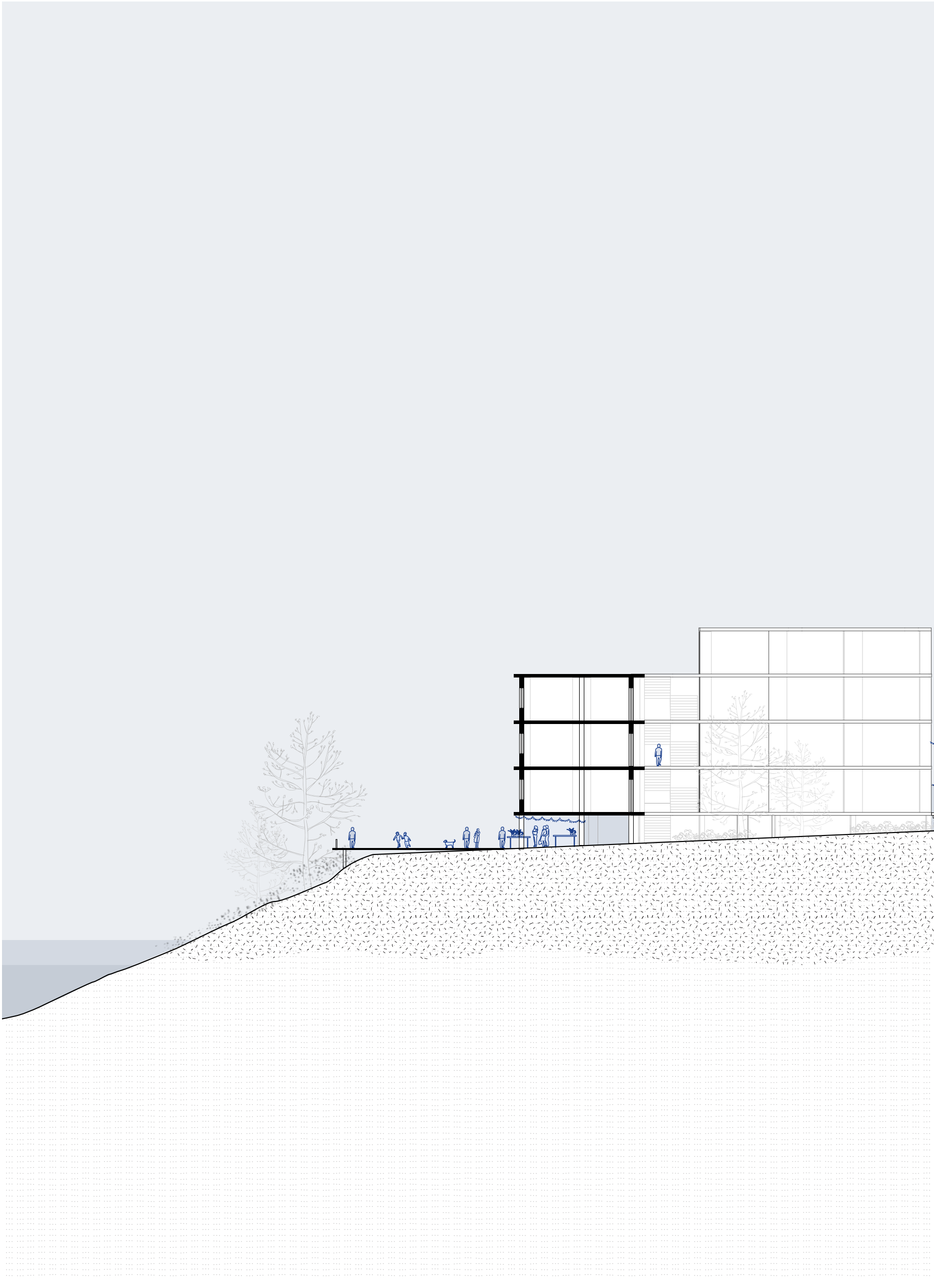
Masterplan

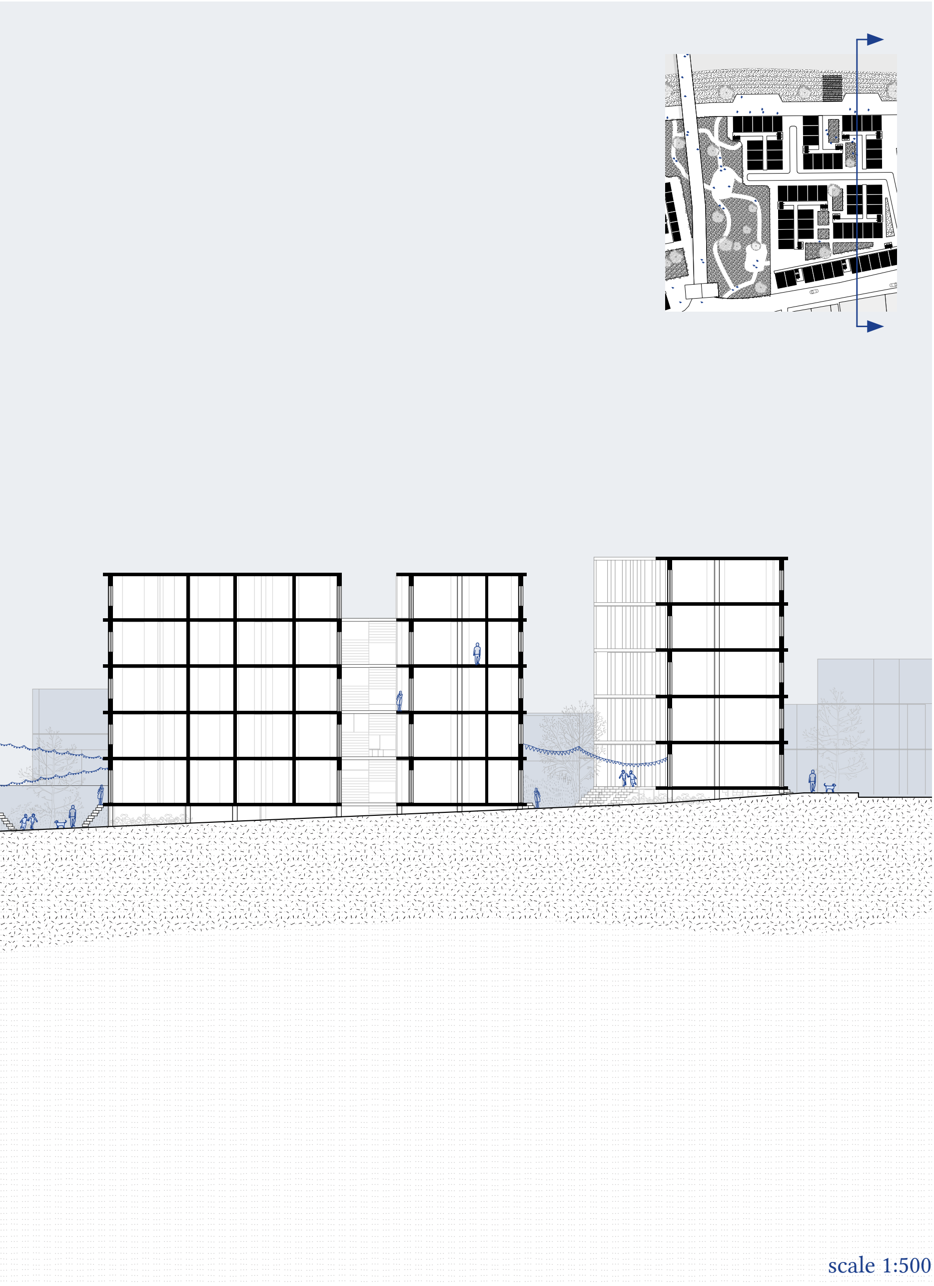
P2 DESIGN | masterplan functions



Masterplan program

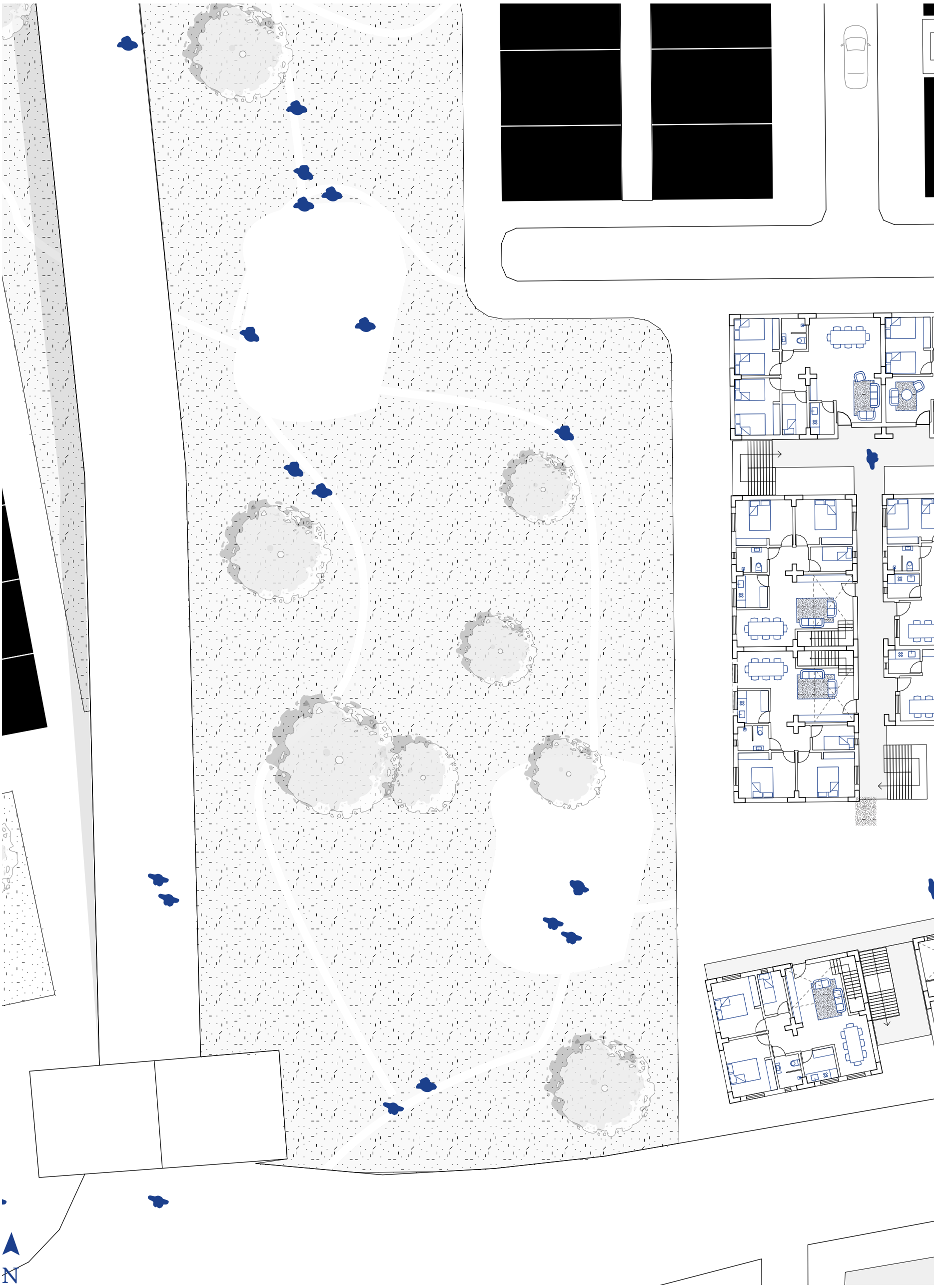
P2 DESIGN | section





Section through multiple clusters, showing public riverside promenade and semi-private courtyards

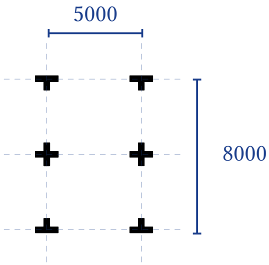
P2 DESIGN I cluster



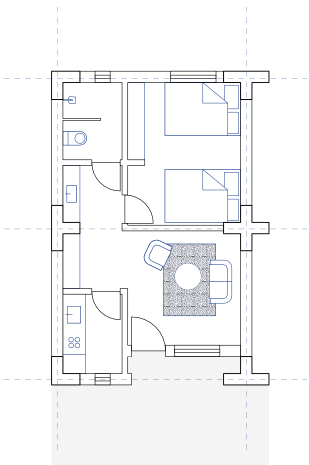
Groundfloor plan of cluster

P2 DESIGN | floorplans dwellings

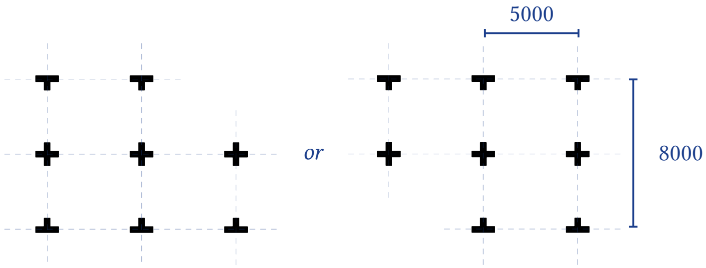
Low-income *family apartments*



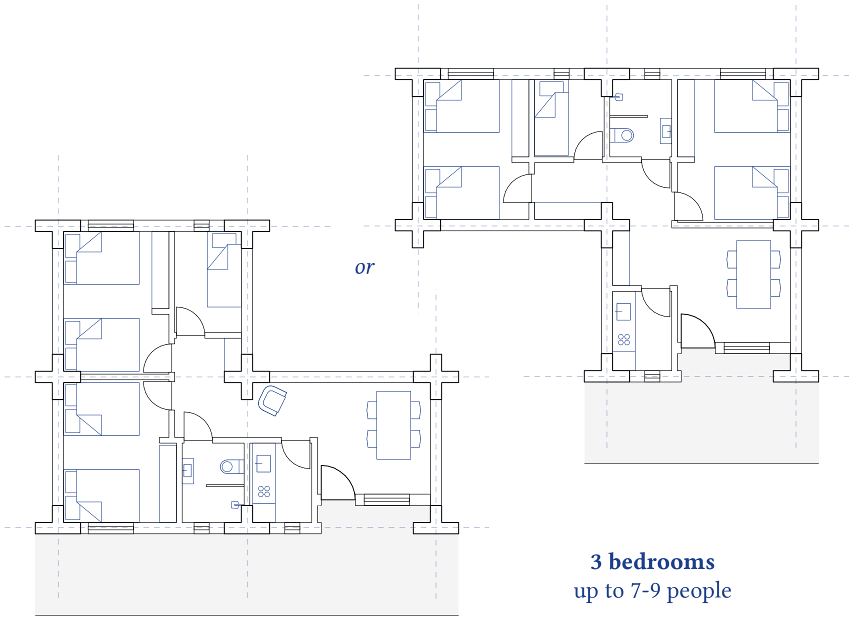
1 unit
34 m²



1 bedroom
up to 4 people



1,5 unit
52 m²

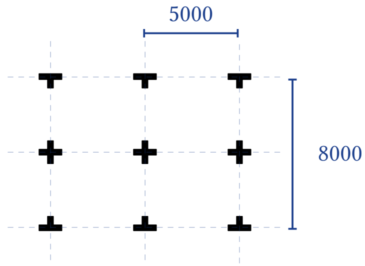


3 bedrooms
up to 7-9 people

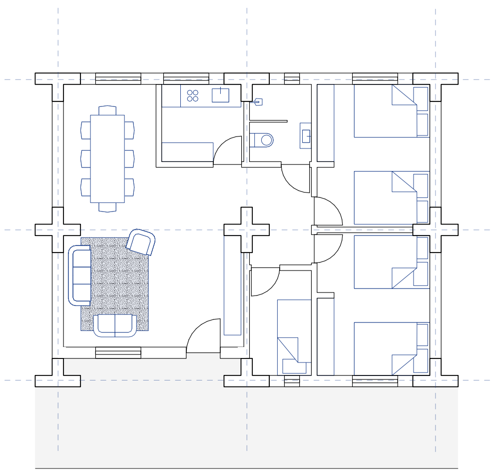
scale 1:200

P2 DESIGN | floorplans dwellings

Middle-income *family apartments*

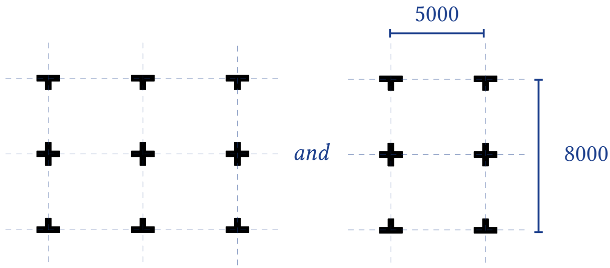


2 units
72 m²

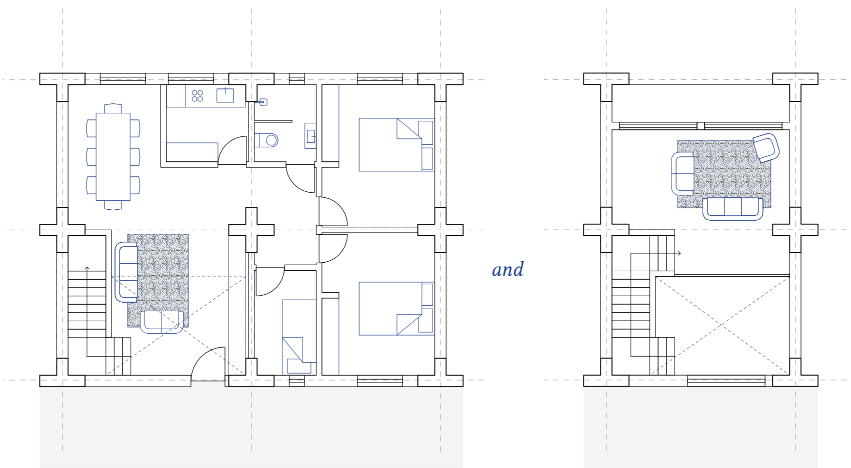


3 bedrooms
up to 7-9 people

High-income *family apartments*



3 units
105 m^2

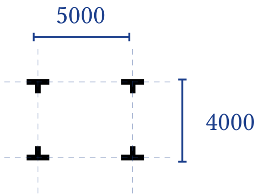


3 bedrooms
up to 7-9 people

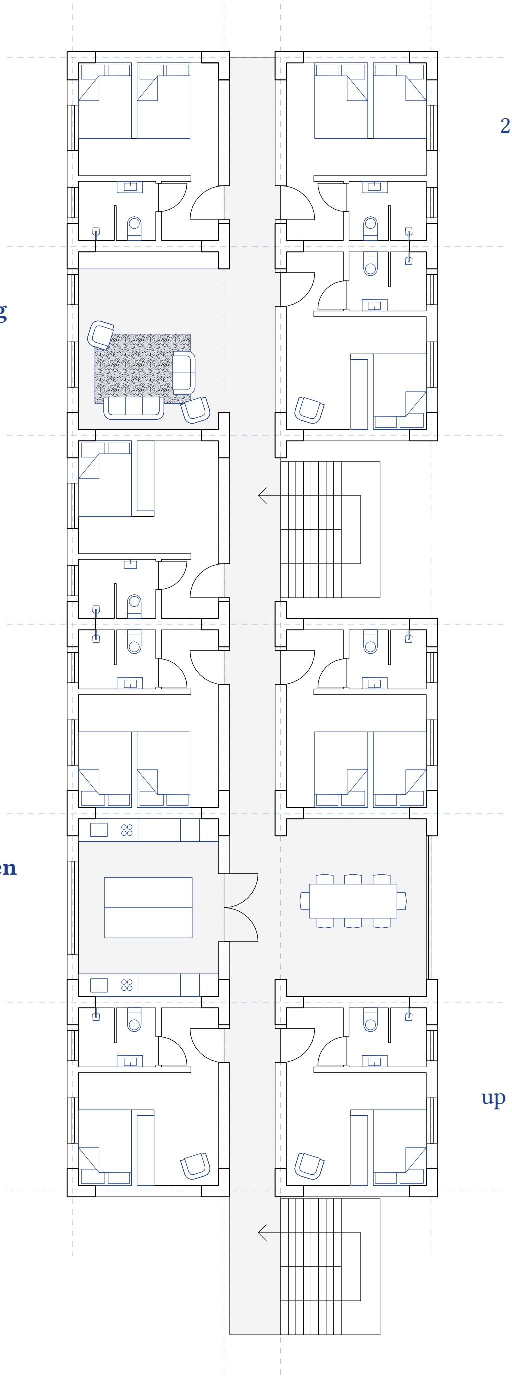
scale 1:200

P2 DESIGN | floorplans dwellings

Temporary migrants *bachelor and family rooms, shared facilities*



1 units
17 m²



2 beds
2-4 people

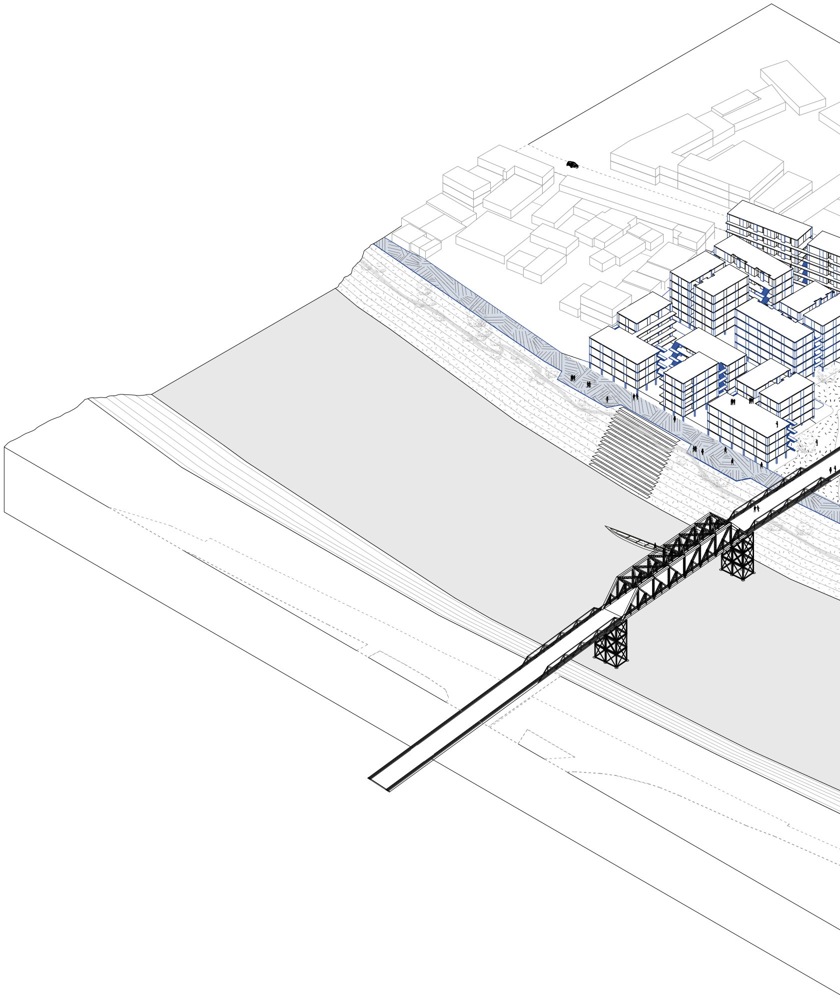
shared living
1 per floor

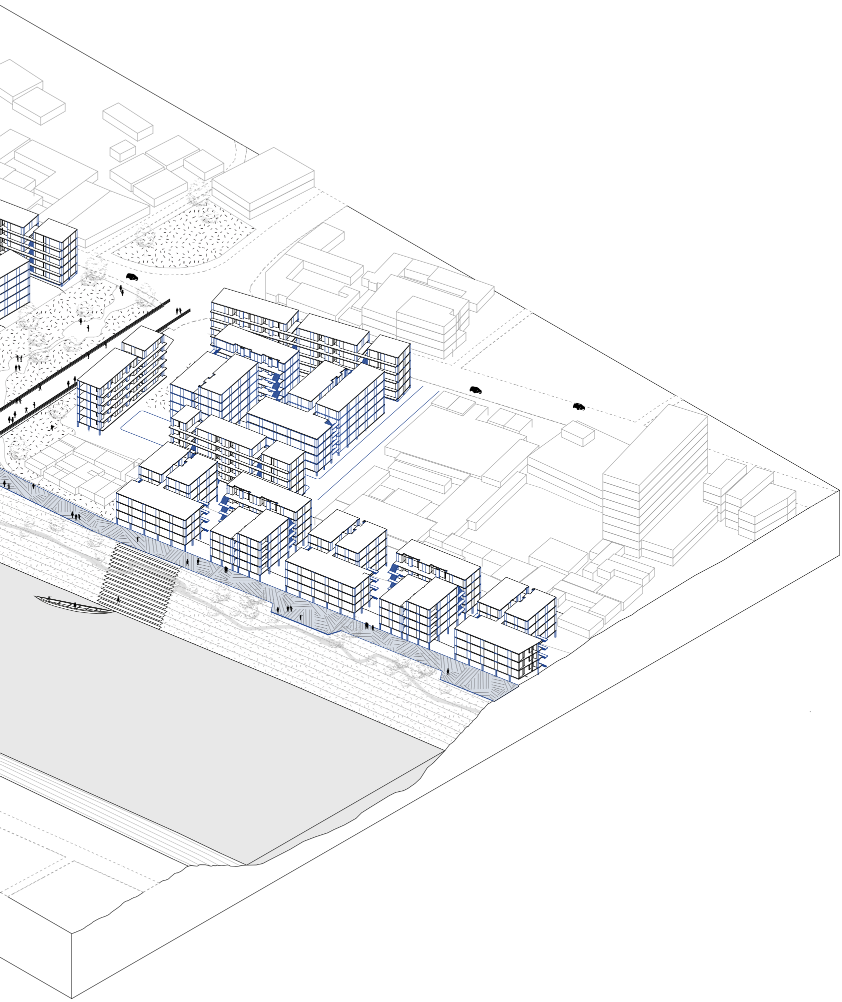
shared kitchen
1 per floor

1 bed
up to 2 people

scale 1:200

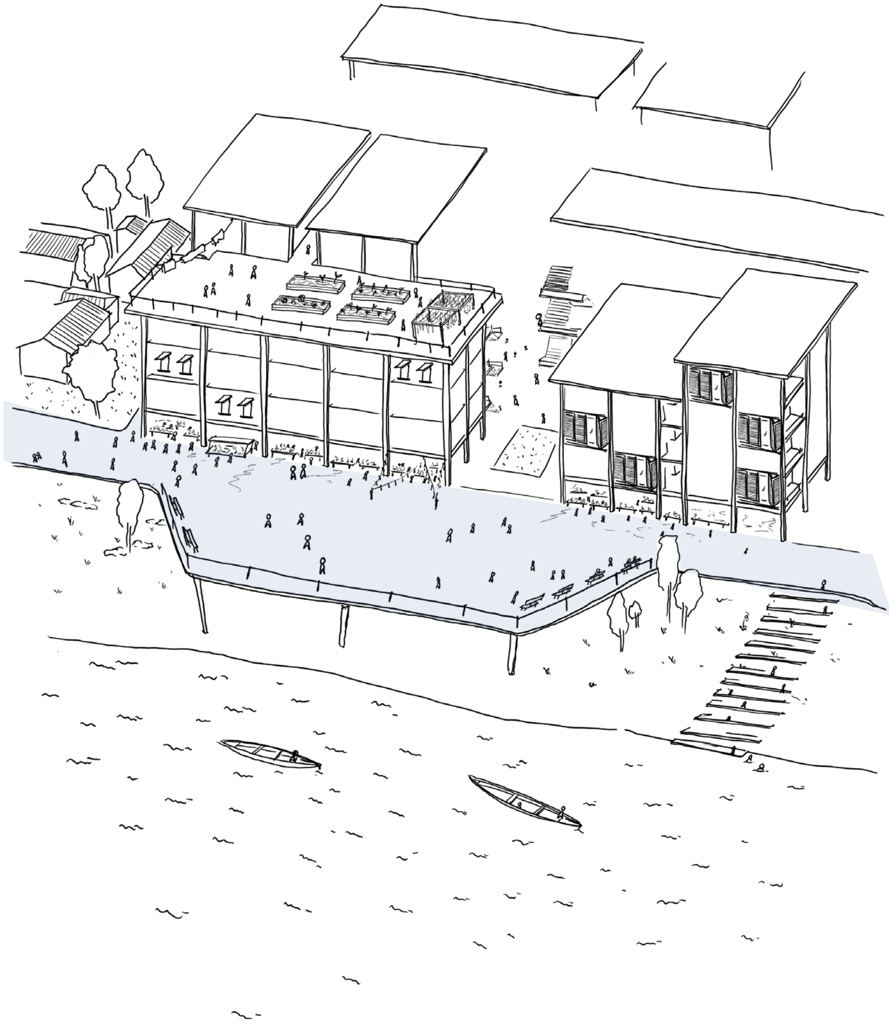
P2 DESIGN | axonometric impression



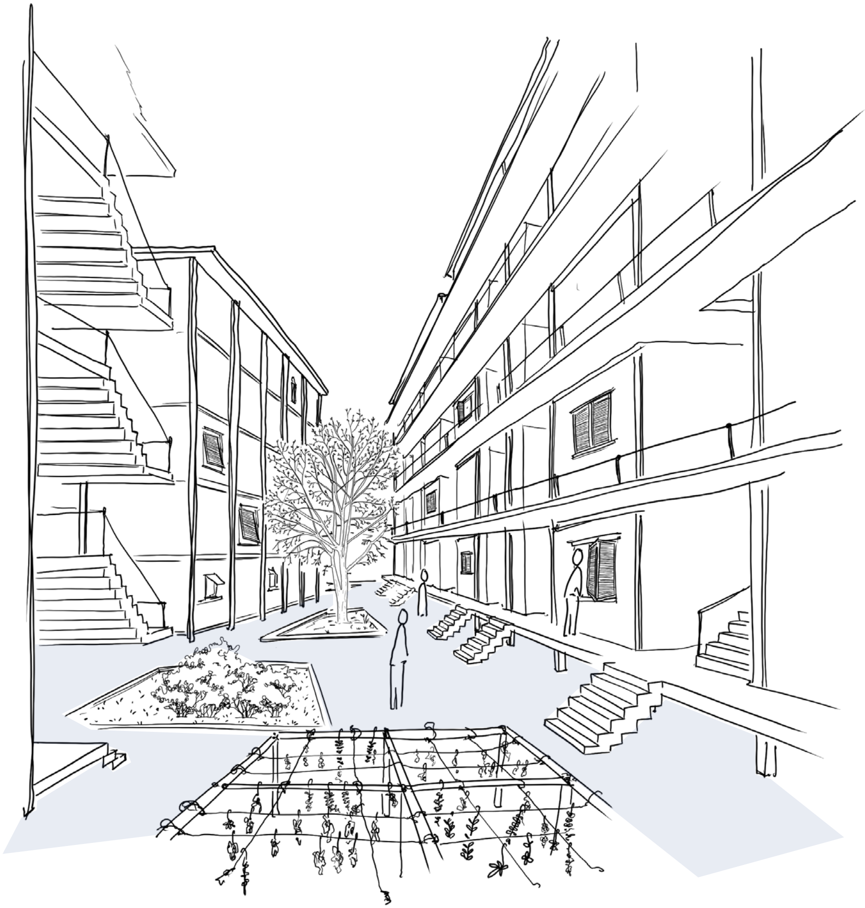


Axonometric impression of design on site

P2 DESIGN I sketch impressions



public market along riverside



semi-private courtyard

Impression sketches of public outside versus semi-private inside

P2 DESIGN I feedback and redesign

The feedback on P2 was clear. Right now, the steps from research to proposal are too quick to draw conclusions on. This also applies to the reasoning for FSI. Apart from that, the design needs a better connection between the design itself and the river. Referring to the project as riverine communities does not fit to the location site. Although this is along a river, it rather suggests communities in rural areas instead of in the middle of the city centre. Building for flood resilience is an important part of the project, but building many buildings next to each other on stilts, in Asia, will cause the site to become very dirty and the spaces underneath the buildings to be filled with trash.

Overall, I agree with the feedback. The aim was to scale-up existing ways of living and building, yet the outcome has scaled up too much and does not connect well enough anymore to the scale of the existing communities. While the masterplan visually aligns with the existing urban fabric, the axonometric impression shows that the design deviates too much from the existing building style. The design looks more like large-scale apartment blocks densely packed together, rather than an extension of the existing built environment.

Therefore, the following design steps will be taken to improve the current design;

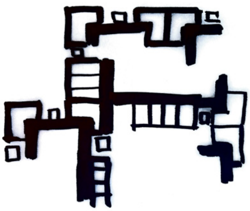
Cluster
- Redesign the cluster layout (which also works in 3D), based on the scale of the analysis sketches of existing clusters. Add galleries as a connection between the dwellings, so people still live around courtyards, but also on higher grounds.

Building
- Keep the 'simple structure' but change columns to a linear structure (since flexibility is unnecessary and the height is limited to four floors, reducing concrete use)
- Separate income-based circulation systems
- Develop a better flood-resilient plinth solution

Unit
- Also use bricks for floors (Catalan vaults)

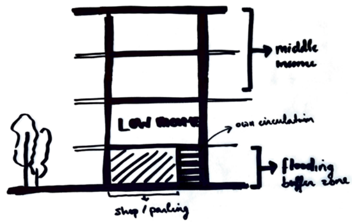
The new concept ideas are shown on the right page.

Concept



Building in organic clusters,
but with elevated circulation

Organisation



Shops / parking on GF, low income below,
middle on top, separate circulation systems

Buildings

Gallery units

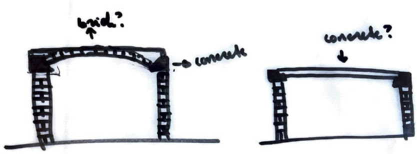
Corner pieces

Temporary houses

Combine with school for extra shelter during floording?

Ground floor plan

Flooring



REFERENCE | Rhizome in Addis Ababa

Government buildings have high production costs because of the imported building materials, a building configuration that does not fit in the existing social and cultural context and offer no flexibility to adjust the houses to people's needs.

The project offers clusters that work independently and can be organised the existing surrounding urban fabric. The clusters consist of incremental housing blocks with circulation systems, which can be composed in a hierarchical sequence going from main streets, to more intimate courtyards, to private dwellings (Divisare, n.d.).

Rihzome in Addis Ababa (Divisare, n.d.)

REFERENCE I El Salitre Community Center

The community centre in Mexico is made from local materials, available in the area; handmade clay brick, produced in the same town, concrete, steel and finishes with pigmented concrete and the land of the region.

The walls are made from double mud brick walls for thermal comfort and handmade Catalan vault slabs that are typical of the region (Divisare, n.d.).

Omar Vergara Taller, Centro Comunitario El Salitre
(Divisare, n.d.)

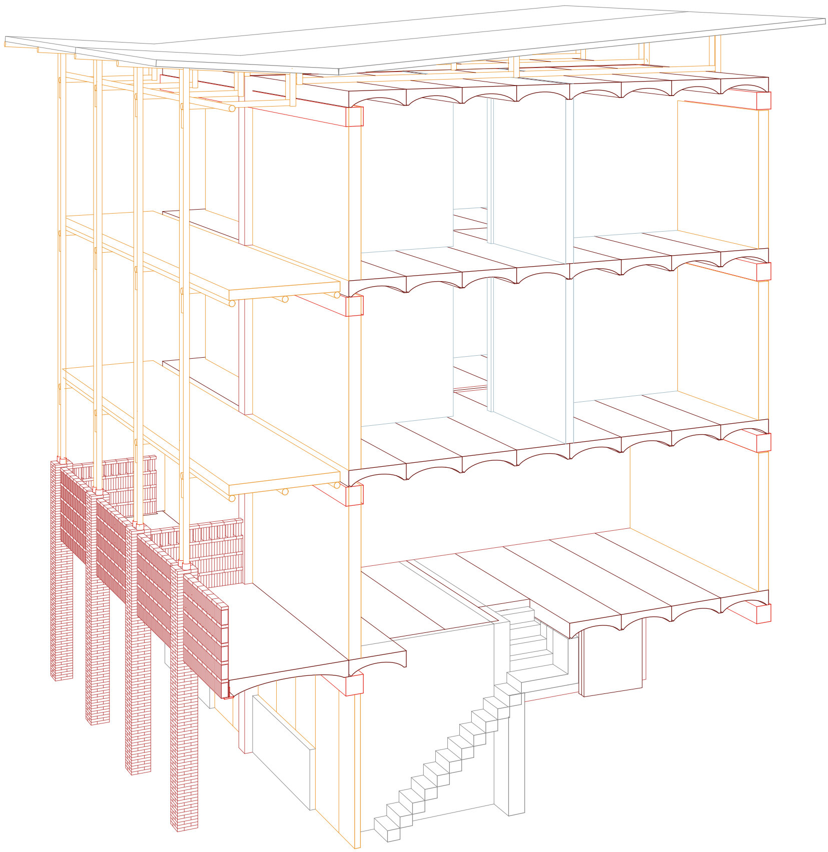
P3 DESIGN | section

Based on the feedback of P2, a new design was created during the P3 phase. Still working with the same concept principles, but better fitting in the context.

The section gives an impression of what the building will look like, showing the load bearing brick walls, as well as the brick balcony and Catalan slabs. On the ground floor, there is a public side of the building facing the courtyard with small shops. On the outside of the cluster, there are parking spaces connected to the road.

The ground floor and first floor are connected, where the low-income dwellings will have their own entrance to separate low and middle-income groups.

The gallery gives access to all the middle-income houses.

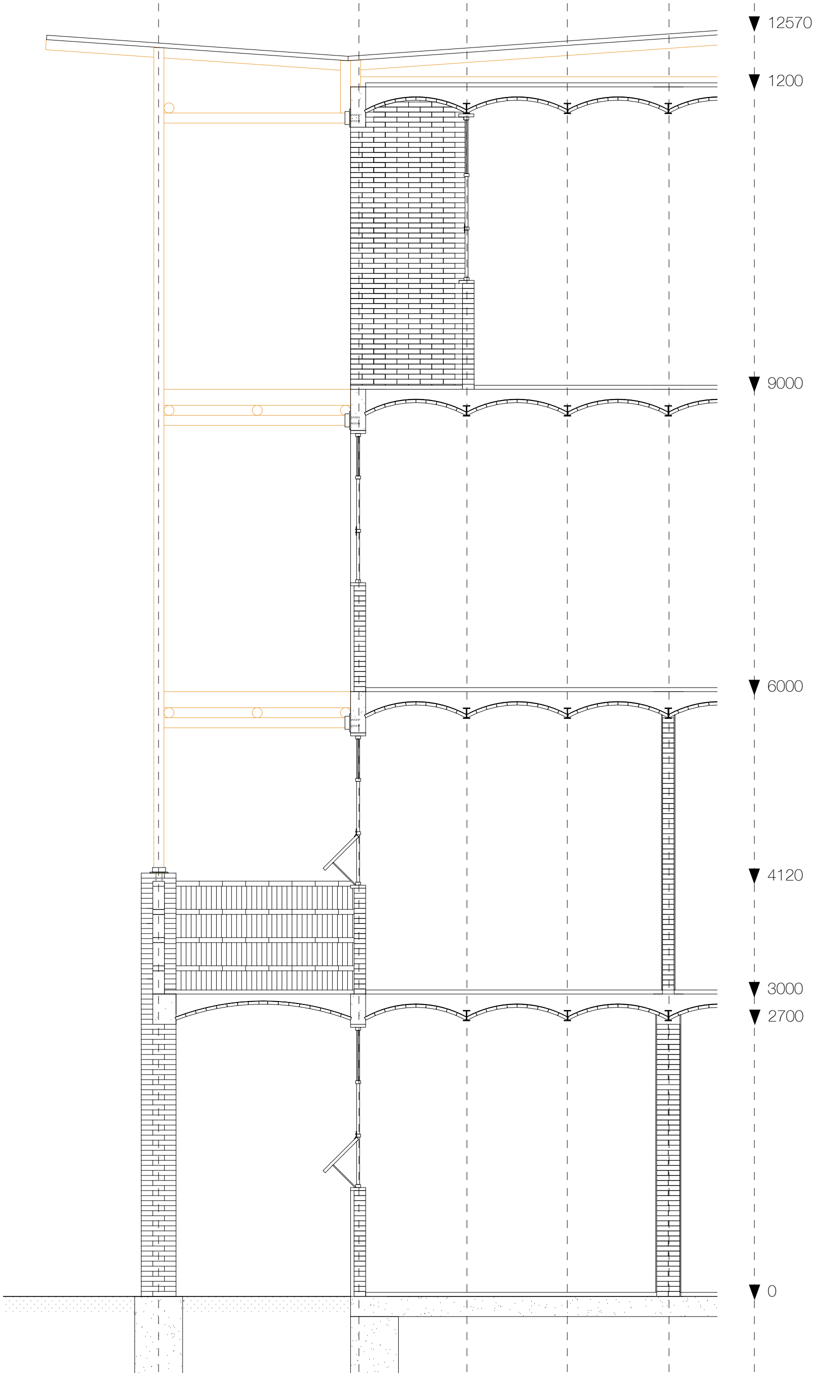


3D section through design, showing the maisonette dwelling
on groundfoor / first floor + middle income apartments on top

P3 DESIGN I section

The idea is to use mainly local material and minimize the need to use concrete. This way, the money put into the project will mostly go to the people in Bangladesh putting in effort and labour into building the houses, instead of spending the money on imported materials.

The section on the right shows how different material is used throughout the building.



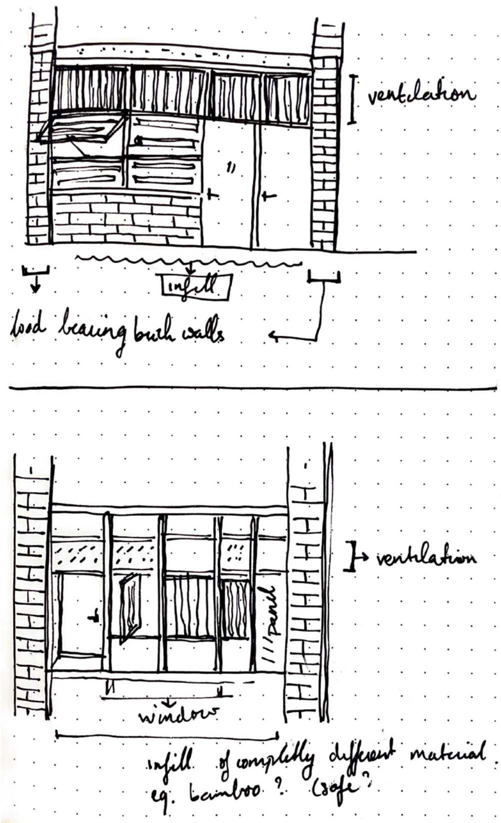
scale 1:75

P3 DESIGN I working model

The model on the right shows the ground floor (shop + entrance low-income housing + bit of parking on the back), the first floor (low-income housing + private balcony) and the first bit of the middle-income housing along the bamboo gallery.

The engraved wall on the left side is the load bearing brick wall, on which the Catalan vault floors rest. As the facade is a part that still needs to be designed, they are left blank for now. However, this model works well as a test model to try different types of façades.

The idea for the facade is to either work with a brick wall that has a little set-back compared to the load bearing walls, or a lighter infill for the facade from different material than brick. Important to keep in mind while designing the facade is that this should include ventilation possibilities and integrate a panel for the shafts.



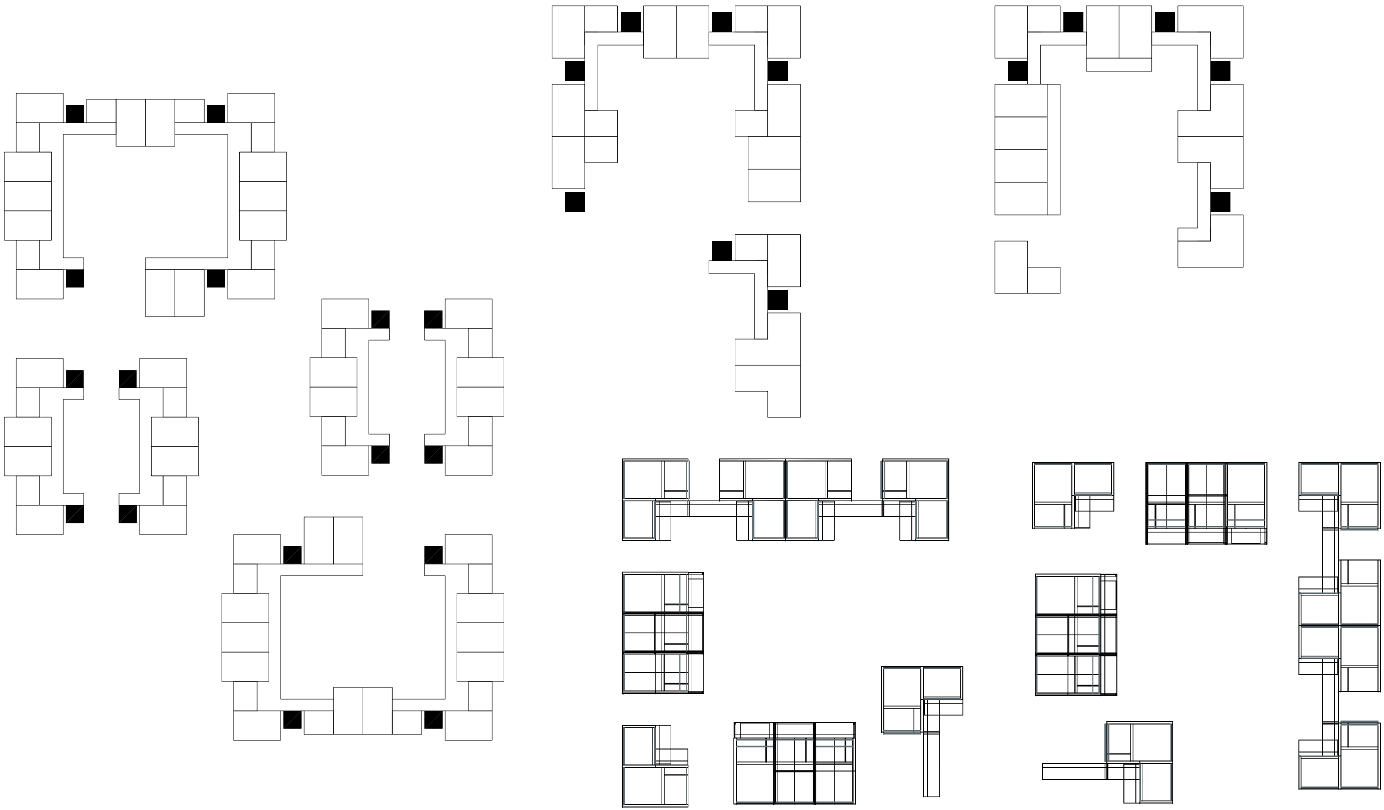
First sketch ideas for facade infill between the load bearing brick walls.

Working model scale 1:20 of the first 2 floors of a unit

P3 DESIGN | cluster idea

As the cluster / masterplan concept in P2 was too dense, and not at the scale of the existing way of building in courtyard clusters, a new concept was created before the P3. Although it is not fully worked out yet, it does show the idea of how the different building 'pieces' can be connected to clusters.

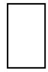
Looking at this concept critically, this will never reach a high density, an aspect that is necessary when designing in Bangladesh, especially in the city centre. Therefore, this concept will be used but designed to a more dense version.



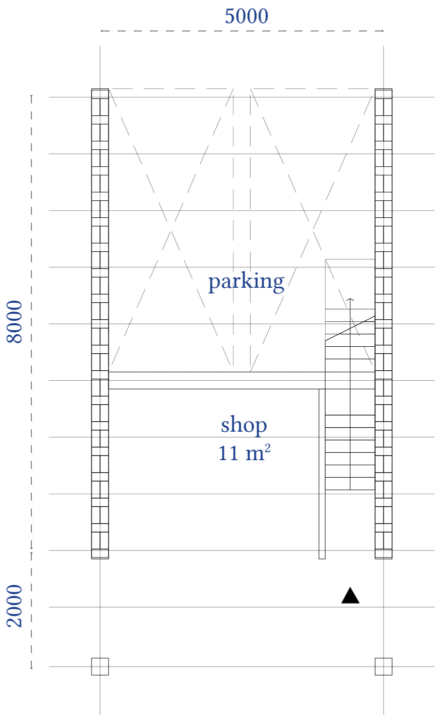
Ideas on what the modular clusters could look like, based on corner 'pieces' and straight 'pieces'

P3 DESIGN I floorplans

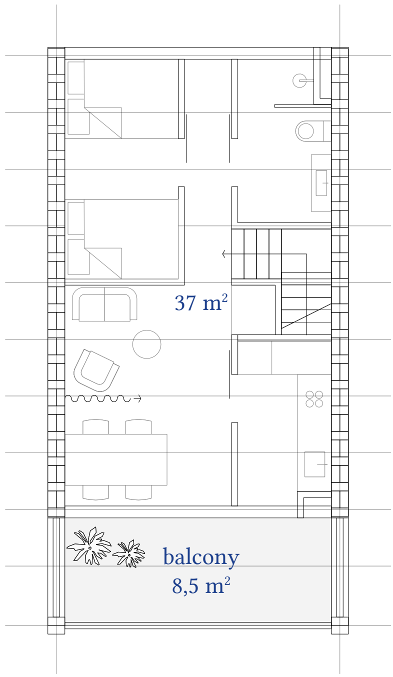
The plan consists of a linear structure, between which various apartment sizes and layouts are possible. The low-income groups are in the first two floors of the unit, with middle-income apartments in the third and fourth floor.



1 unit



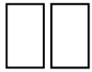
ground floor



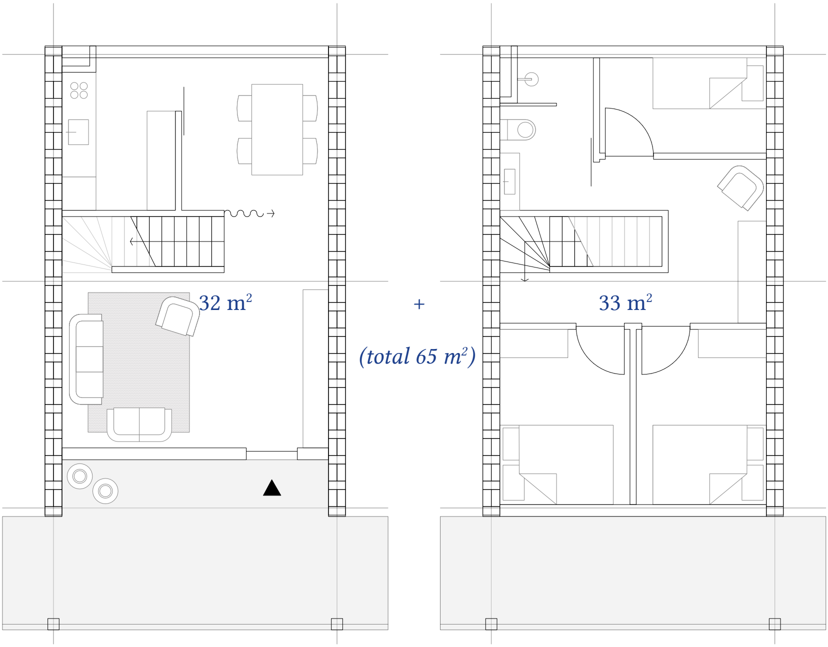
low income housing
1st floor

scale 1:100

P3 DESIGN | floorplans

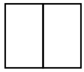


2 units

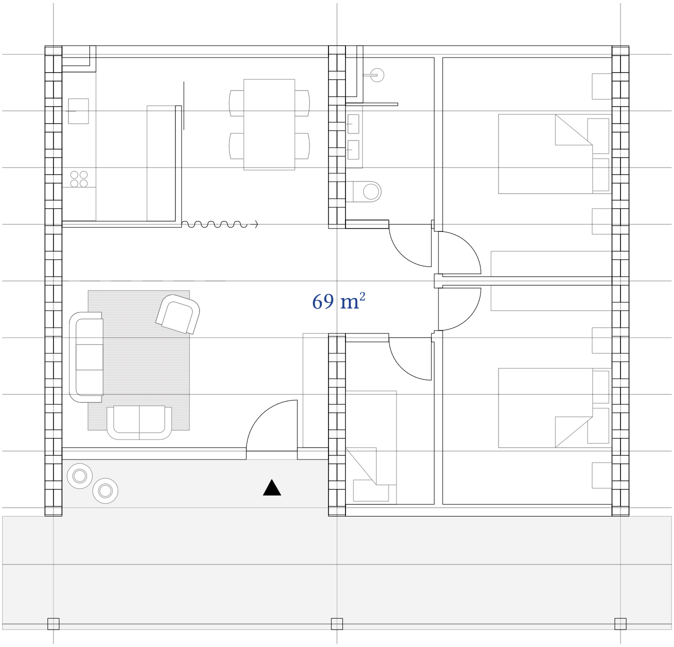


middle income housing
2nd floor

middle income housing
3rd floor



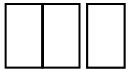
2 units



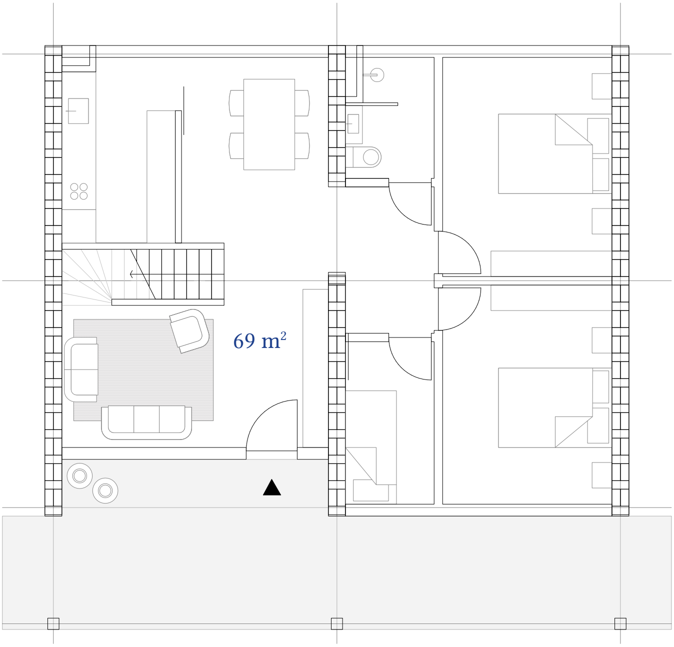
middle income housing
2nd / 3rd floor

scale 1:100

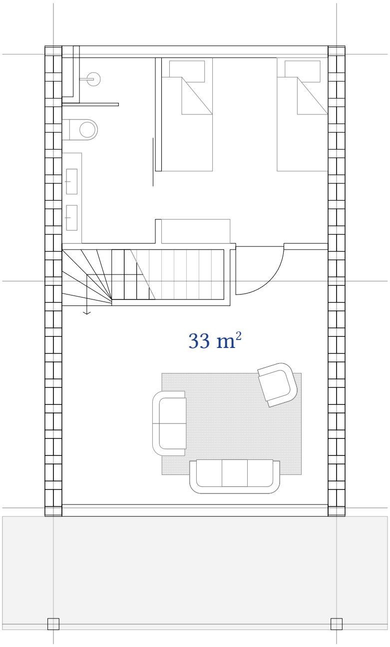
P3 DESIGN | floorplans



3 units



middle income housing
2nd floor



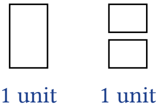
+

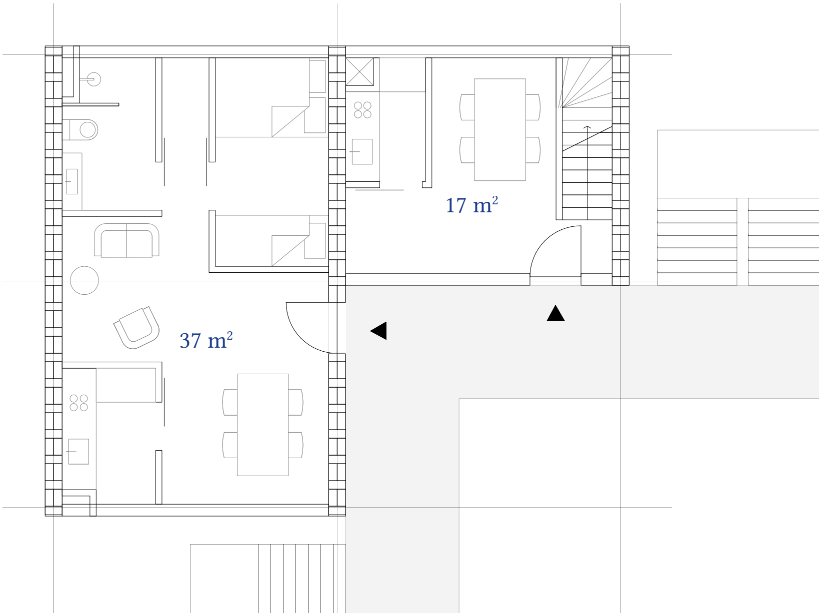
(total 102 m²)

middle income housing
3rd floor

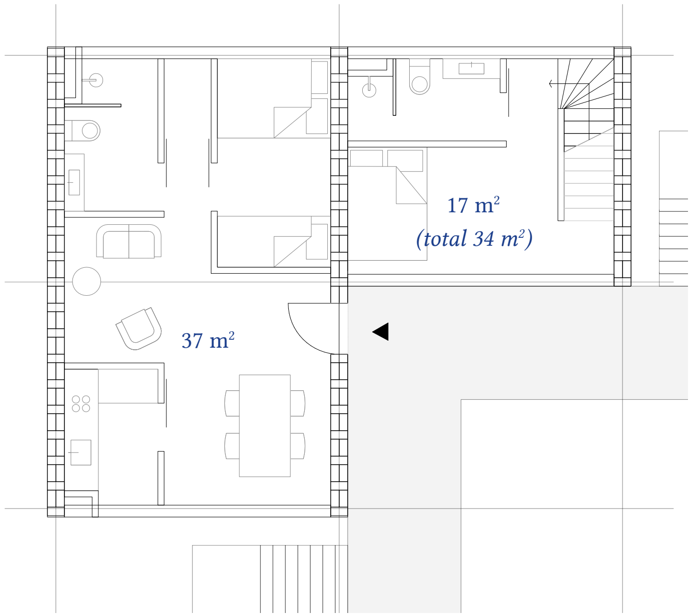
scale 1:100

P3 DESIGN | floorplans





low income housing
1st / 2nd floor

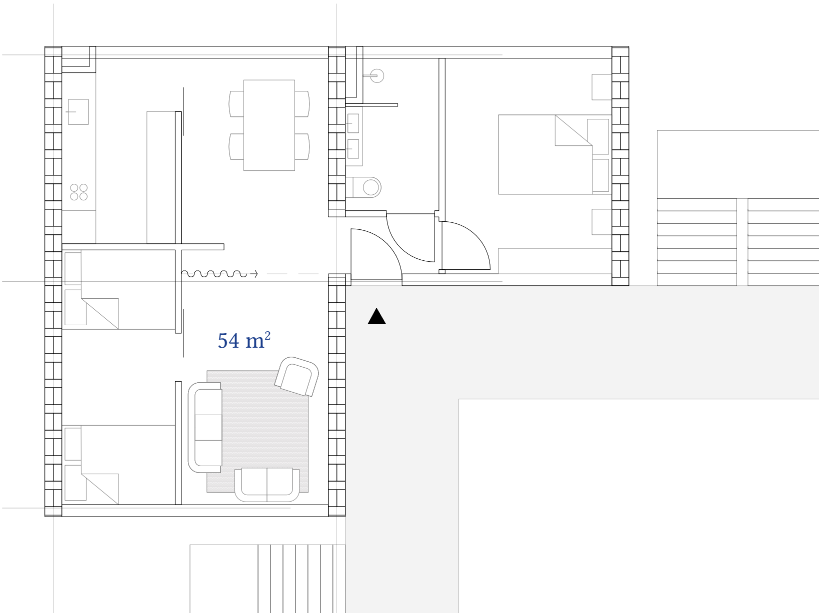


low income housing
1st / 2nd floor

scale 1:100

P3 DESIGN | floorplans

1 unit 1 unit



middle income housing

1st / 2nd / 3rd floor

scale 1:100

P3 DESIGN | feedback

During the P3 feedback session, Marina was there to see all the projects in their current status and react on these.

Based on the material I showed her, the low-income floor plans still need some work. It it important that the layout of the apartments follow the structure of the construction (with stairs going into the same direction and the floors).

When working on the cluster design, it is important to keep in mind that building a maximum of four storeys is not going to result in a very dense plan. Therefore, the cluster should be designed in a way that will still intensify the density.

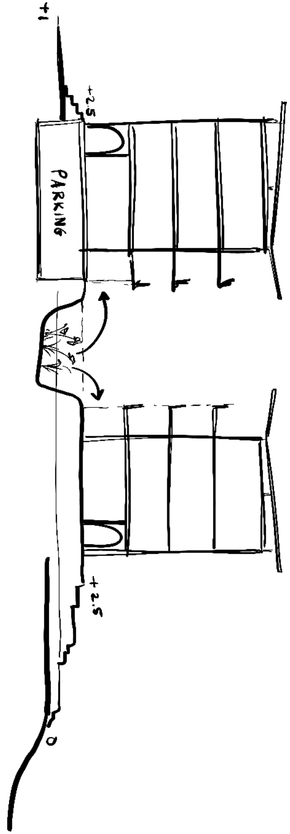
DESIGN PROCESS I masterplan

Based on the feedback of P3, a first new masterplan was created. The most important design aspects are building like people already built (in clusters), and making room for the monsoon, as this is an natural element people have to live with.

The clustering is yet too chaotic, but the principle of having a public zone along the river, a middle semi-private zone, and a public zone at the street again works well. Inside the clusters, there will be water ponds, which can be used for agriculture in dry season, but also store water during the monsoon.

To deal with the height difference at the site, a principle of 'dig and mound' will be used; the ground for parking and water storage is used to elevate the buildings.

First masterplan + sketch to organise and improve the masterplan



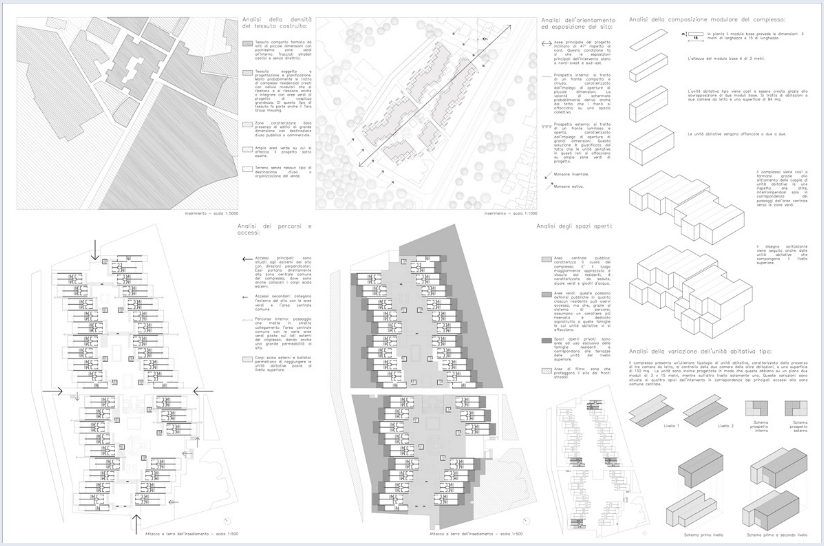
Principle sketch, dig and mound

REFERENCE I tara apartments

Tara Apartments in New Dehli by Charles Correa also integrates water tanks in the masterplan that can collect and store water, in the courtyards of a cluster.

Another interesting element in this plan are the points of access to the houses. These are from within the courtyard, which create quite noticeable elements in the plan. This way, no galleries are needed to access the houses.

Tara apartments by Charles Correa (photo from Mehendra Rah consultants private limited, n.d.)



situation and ground floor plan

circulation in elevation and section

Tara apartments by Charles Correa
(drawings by Briccolani, 2009)

REFERENCE I Asian games village

The Asian games village in New Delhi, India, by Raw Rewal in 1982 is an example of a context sensitive, low-rise high-densitty housing project. The project is based on traditional Indian urban forms like the courtyard clusters which creates a neighbourhood that promotes both shared open community spaces, as well as privacy.

The way the courtyards connect to each other would also work well in the design for the keane bridge community, with a clear public outside space, and a semi private inner courtyard spine, which opens up and gets more narrow just like this reference.

Masterplan Asian games village by Raj Rewal (Raj Rewal Associates, 2020).

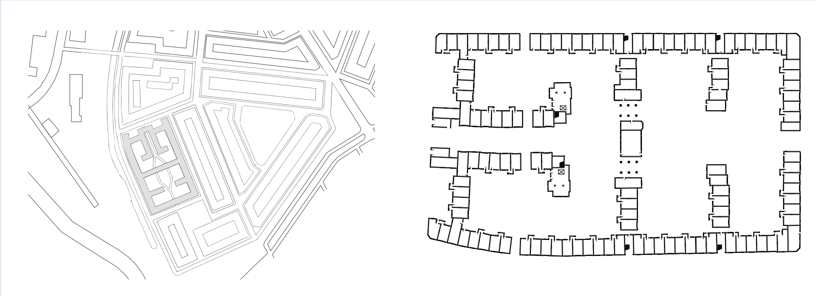
Asian games village by Raj Rewal (Raj Rewal Associates, 2020).

REFERENCE | Justus van Effen complex

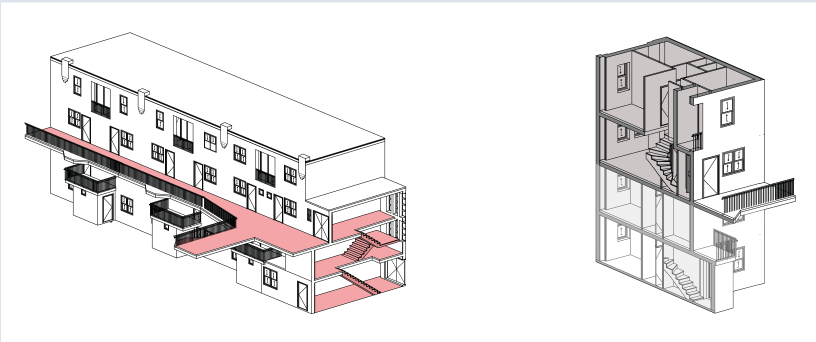
The Justus van Effen complex in Spangen, Rotterdam, is a well fitting reference for the idea of building in clusters, with a maximum height of four floors, while still building high density.

The circulation within the cluster is an innovative system with an elevated gallery street through the middle of the housing block. This minimizes the vertical circulation and encourages social interaction in the outside spaces.

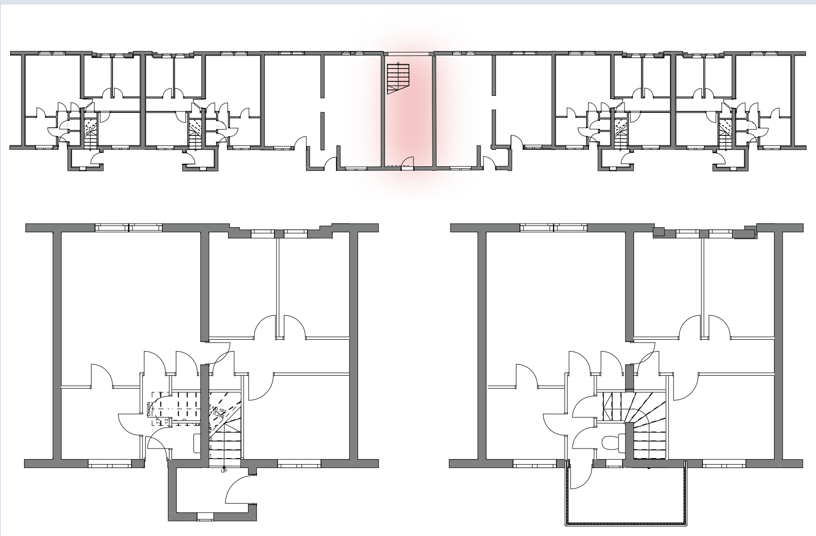
Justus van Effen complex in 1922
(photo from Architectuurwijzer, 2019)



cluster



circulation



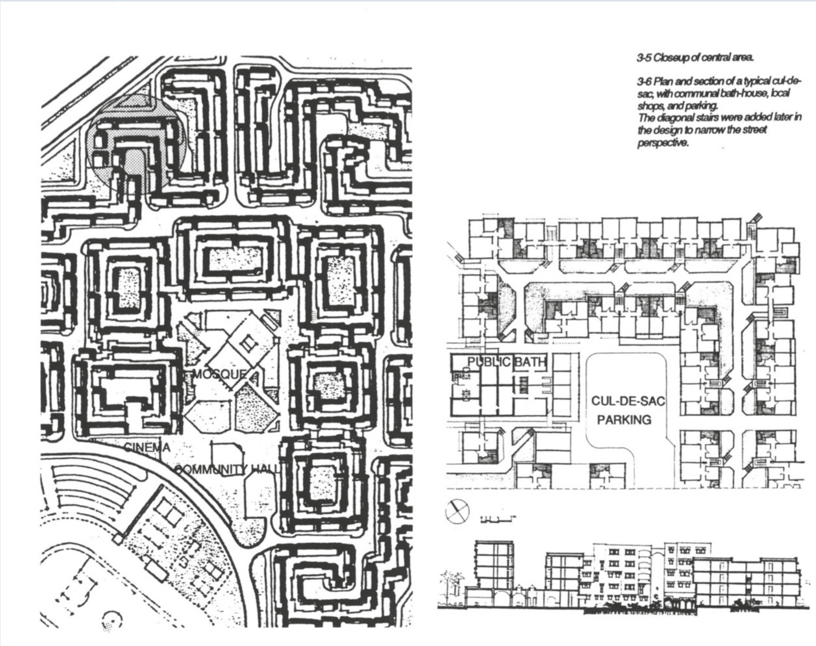
access floor plans

Justus van Effen block (drawings by Coco de bok, 2024)

REFERENCE I Dar Lamane housing

Dar Lamane housing in Casablanca, Morocco, is a large scale social housing project designed to address urban overcrowding and improve the living conditions for low-income families. The masterplan clearly defines public, semi-public and private spaces, which promote community interaction but also preserve privacy.

The design includes pedestrian-friendly streets, central courtyards and modular housing units that can be adapted or expanded over time.



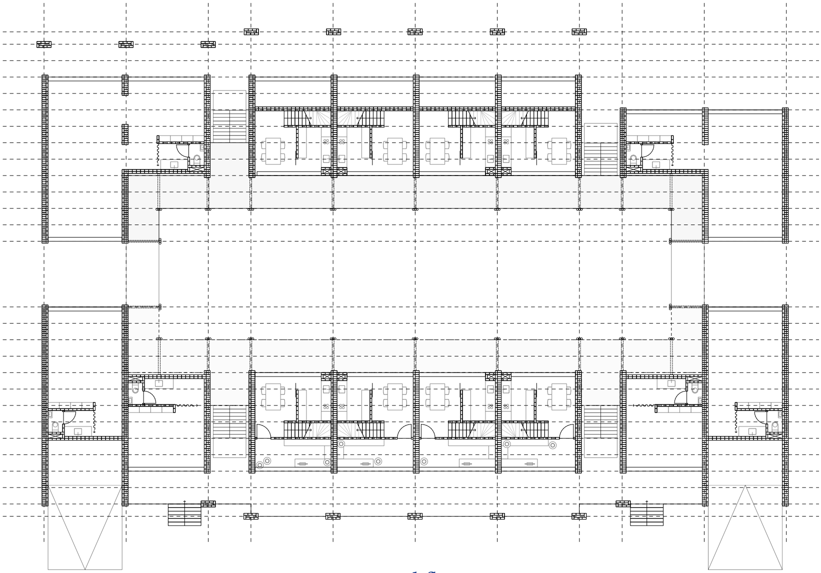
Masterplan and cluster of Dar Lamane housing (photo from Archdaily, 2022)

Public edge between the roads and Dar Lamane housing (photo from Archdaily, 2022)

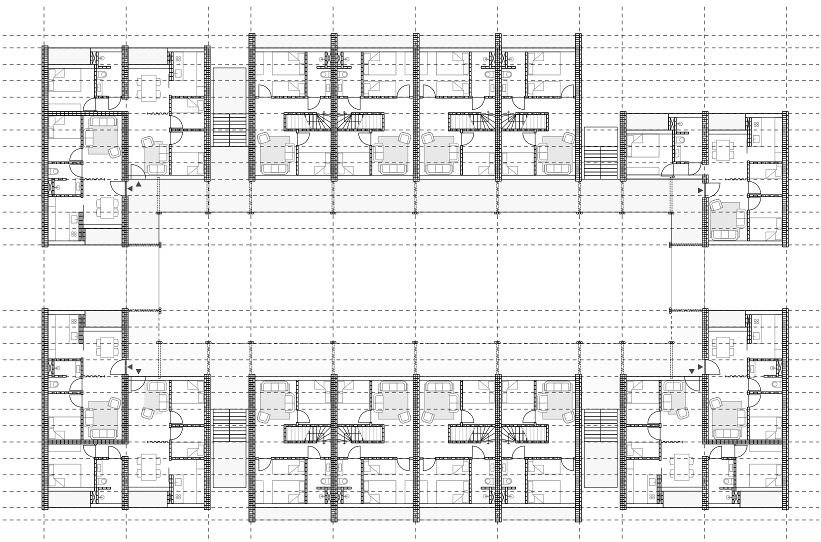
DESIGN PROCESS I new masterplan

Improved masterplan

DESIGN PROCESS I cluster



ground floor

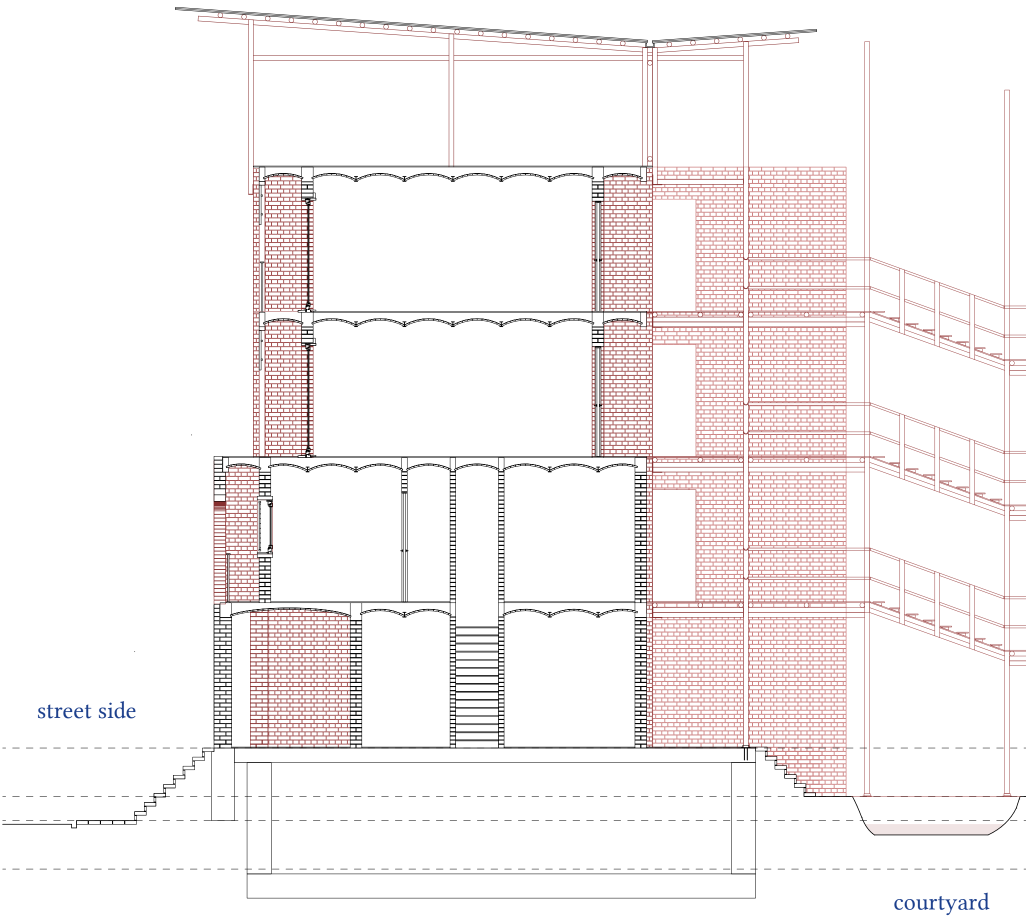


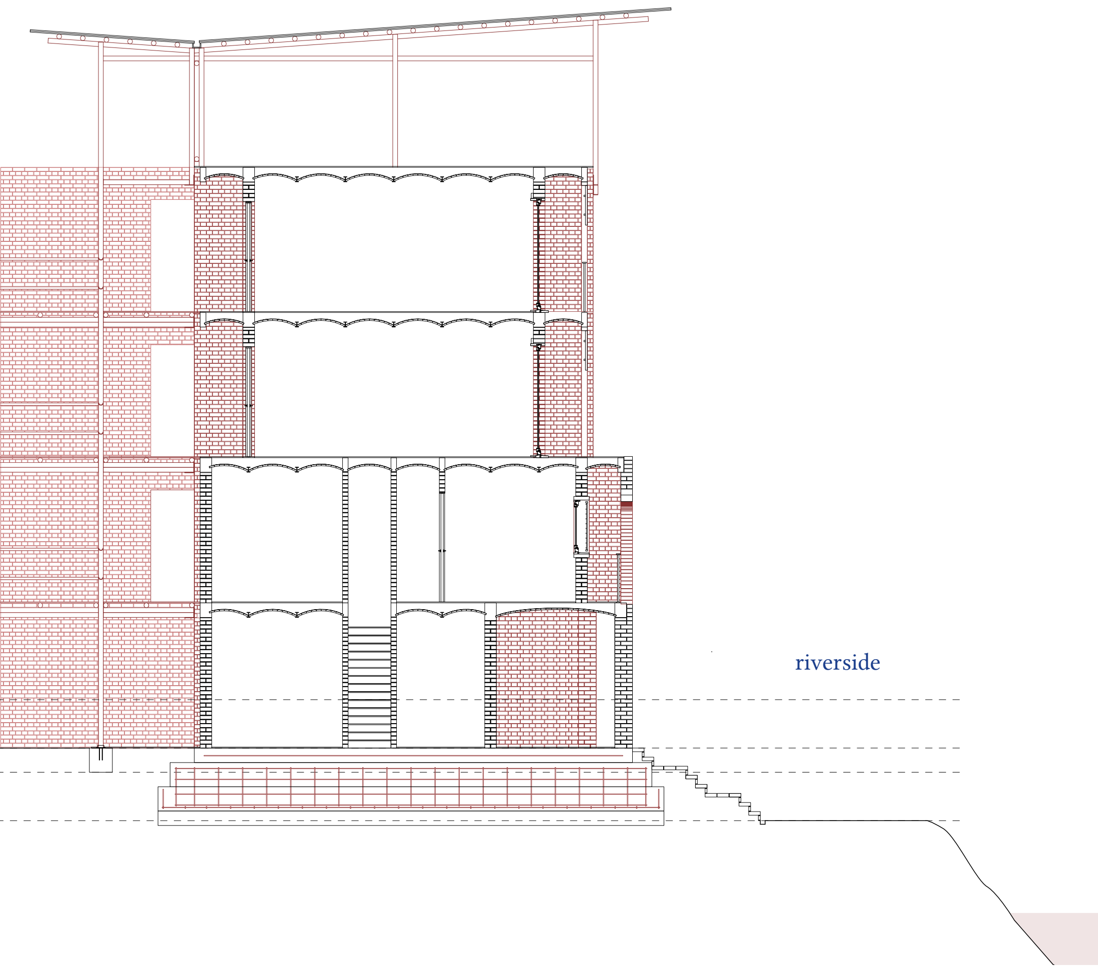
first floor

second floor

third floor

DESIGN PROCESS I section

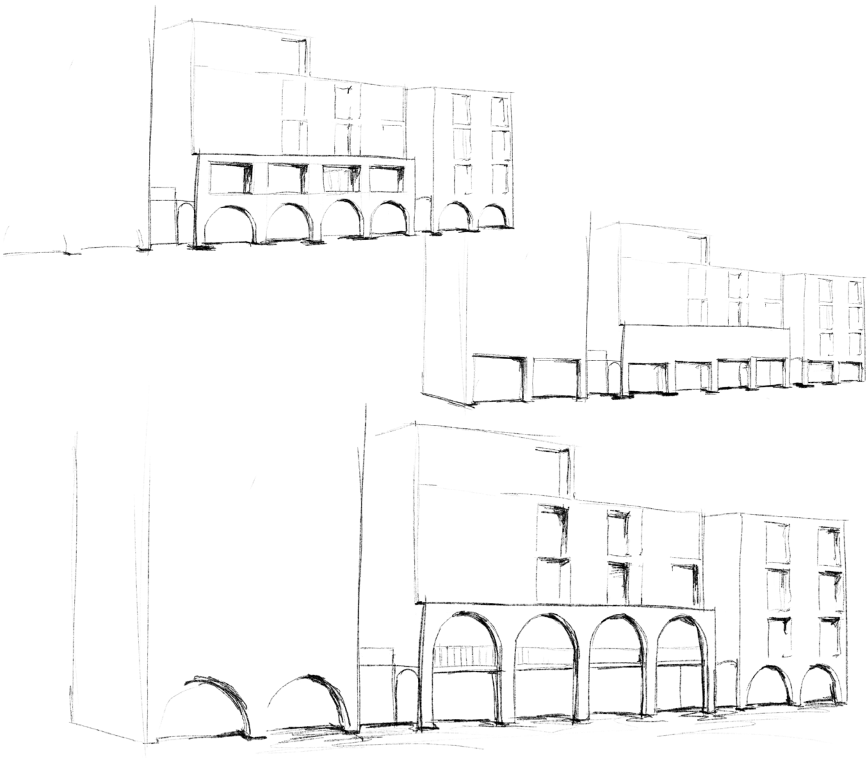


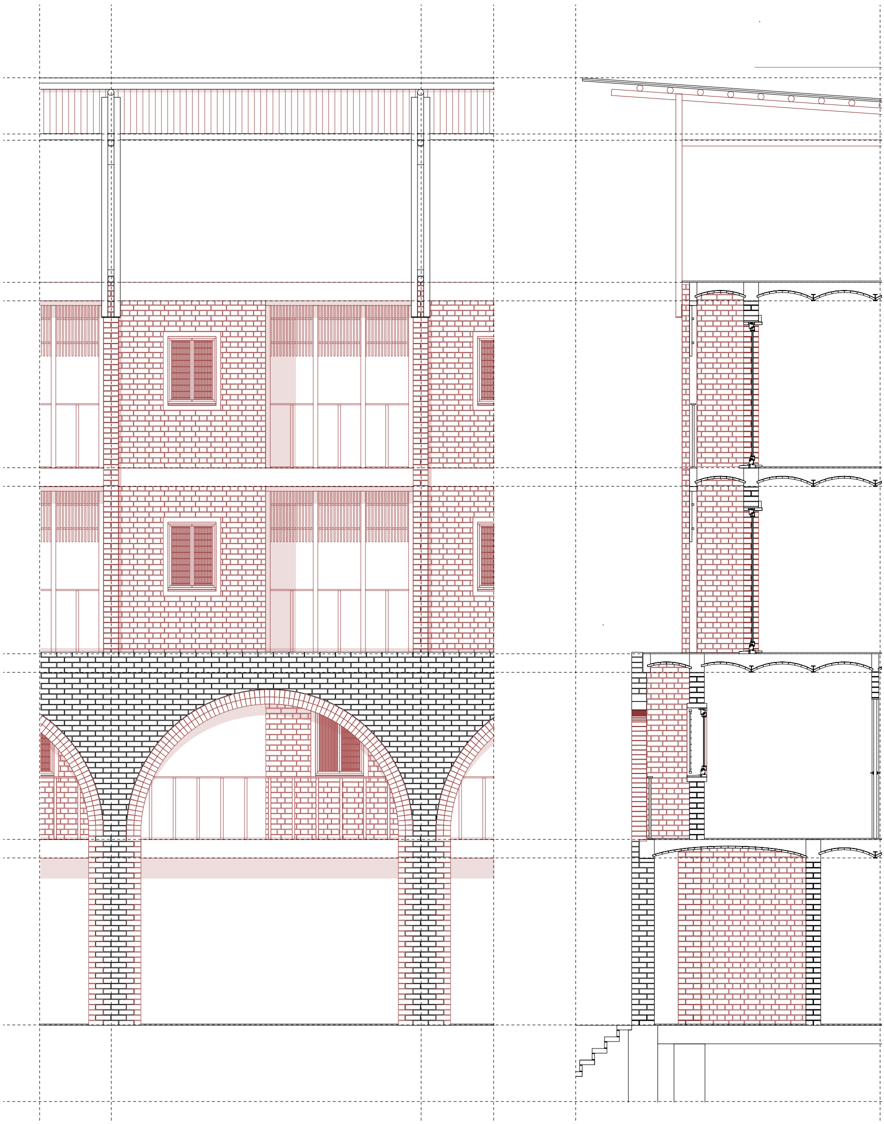

riverside

DESIGN PROCESS I facade design

In the process of designing the facade, the building needs a clear public edge. As the first two storeys are shop houses, this could also expressed in the facade, showing these two floors are connected.

Through arches, this public side of the building is emphasized, creating a semi-outdoor corridor between the street side and the shop houses.





Facade elevation + section

DESIGN PROCESS I BC architects

In April we went on a fieldtrip to Brussels, to visit BC Architects and receive feedback on the current state of our designs. BC Architects is known for working with local, natural building materials and for integrating architecture, craftsmanship, and sustainability into one practice. Their work emphasizes circular construction and local material sourcing, often resulting in buildings strongly related to their context, both culturally and ecologically.

Apart from architectural design, the office also includes BC Materials, a spin-off that reclaims earth from construction sites in Brussels and transforms it into new building materials such as clay plasters, compressed earth blocks, and earth screed.

Earth screed, a kind of earthen floor finish, is one of their innovative applications as shown in the photo on the right. It combines raw earth with stabilizers to create a smooth, warm, and durable flooring solution. Using earth screed reduces the carbon footprint of conventional screed systems, which could also work well as a screed in the Catalan vault floors in the design. The material could well be made from local earth close by the project site.

Earth at BC architects, used in building material
(Author, 2025)

Earth screed applied in a 1:1 floor construction model
(Author, 2025)

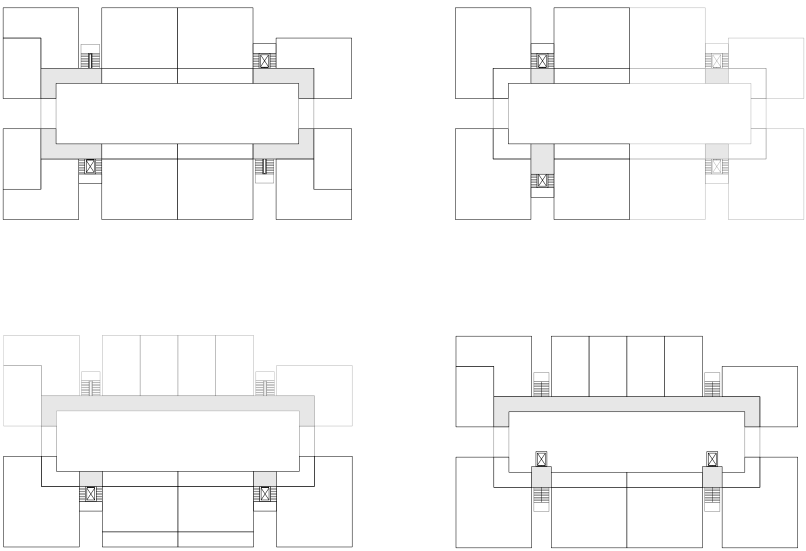
DESIGN PROCESS I high income housing

Based on the feedback of Marina, the plan was going into the right direction but because of its prominent position within the city, it needs a higher density as well as high-income housing and an elevator.

Trying some quick ideas on how high-income housing could become part of the cluster as well. The low and middle income units are accessed through a gallery. Although this works well, the high income apartments should have a more private entrance. Therefore, the staircase will function as a portico apartment, from which on every floor only two high income apartments can be accessed. The bamboo gallery in front will function as a private balcony.

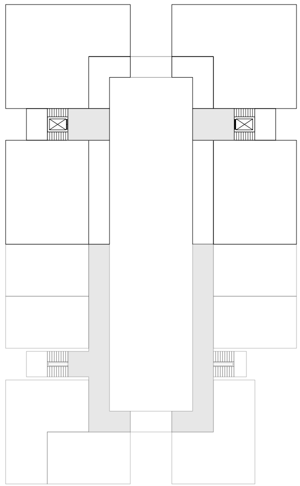
To built as efficient as possible but also isolate the high income apartments from the other and not built an elevator at every staircase, the building is raised locally in accordance with the master plan, instead of per cluster.

On the right, the masterplan shows how the clusters will get a 5th (and 6th) floor either between two clusters or that a cluster is raising the bottom building. This will also help in height variation between all clusters.

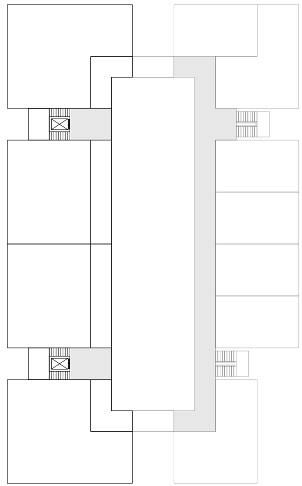


Quick ideas on how to integrate high-income apartments in the existing cluster

Masterplan showing where the high-income top-ups will be located



Idea 2; raising either the left or right side of the building of a cluster with high-income apartments

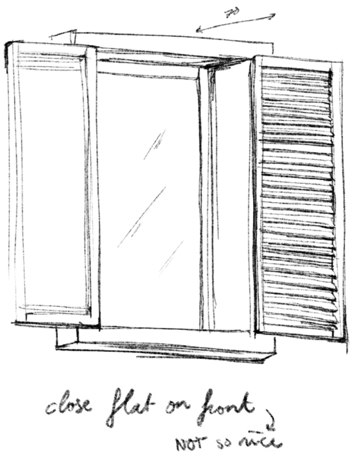


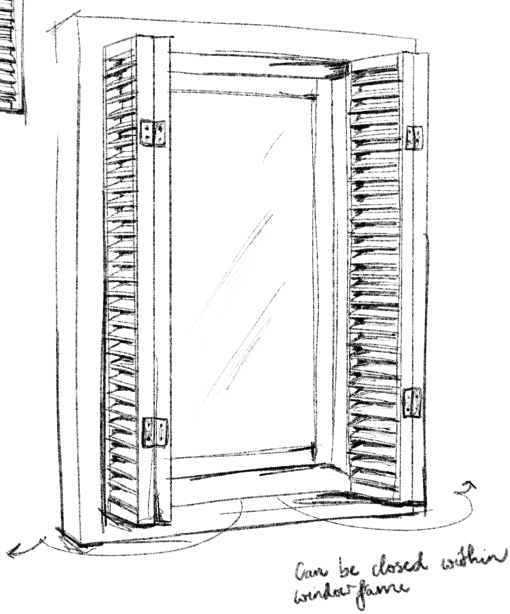
Idea 1; raising the bottom building of a cluster with high-income apartments

DESIGN PROCESS I facade development

In the process of developing the facade, a first facade model was made to get a feeling of what the facade will look like. Based on this model, the balcony on the third floor is changed, as it is a bit of a weird area now. Also the distances between the metal railing need to change to a maximum of 100mm, and the building could use a bit of a finishing edge (whether this should be a roof or not is tested in the next model).

The smaller windows will have wooden shutters, that will give privacy but still ventilation during cooking and showering.



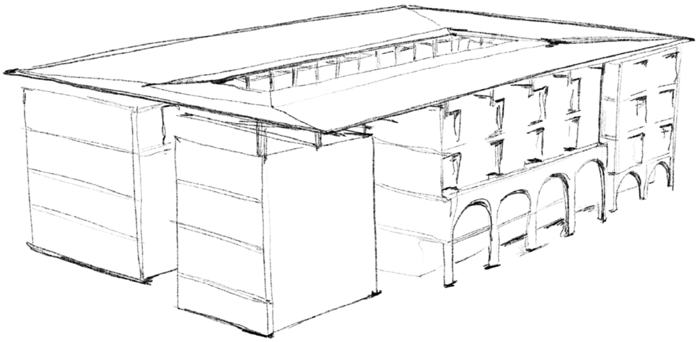


Facade model scale 1:50

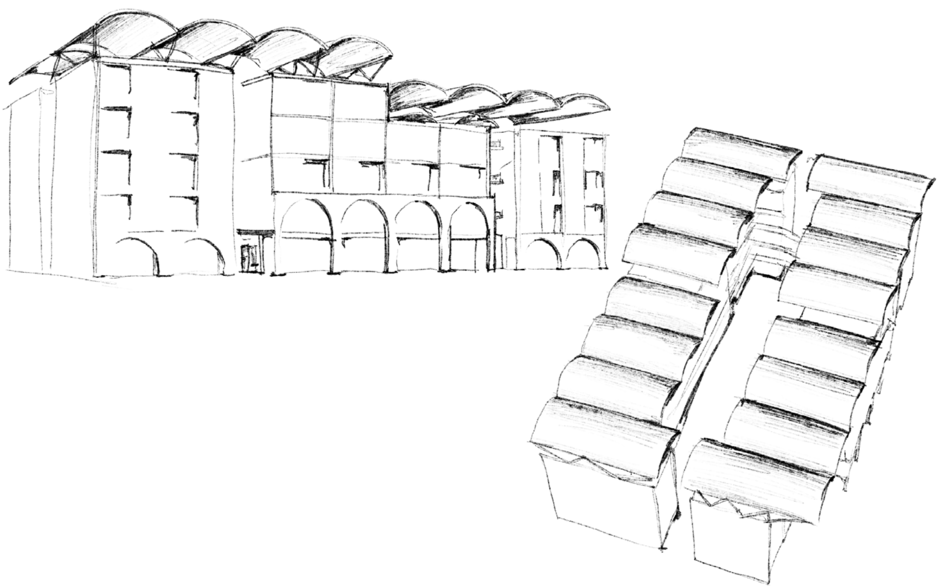
DESIGN PROCESS I roof development

The roof covers the structure and helps to control the climate. It acts as an insulating layer and reduces the heat from the sun to reach the interior spaces. It also offers an extra outdoor space to the community, which is still in the shadow. Apart from this, it also helps to collect rainwater.

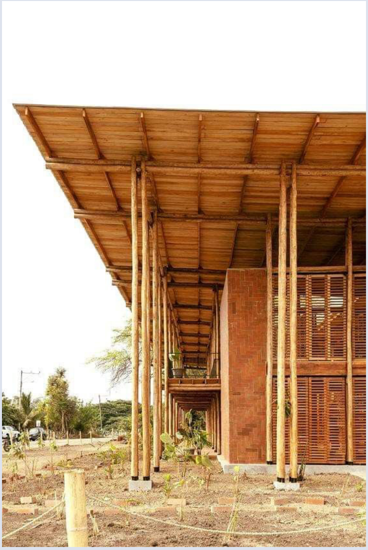
Some sketches to test whether it should be one big roof covering the full cluster, or separated into multiple parts.



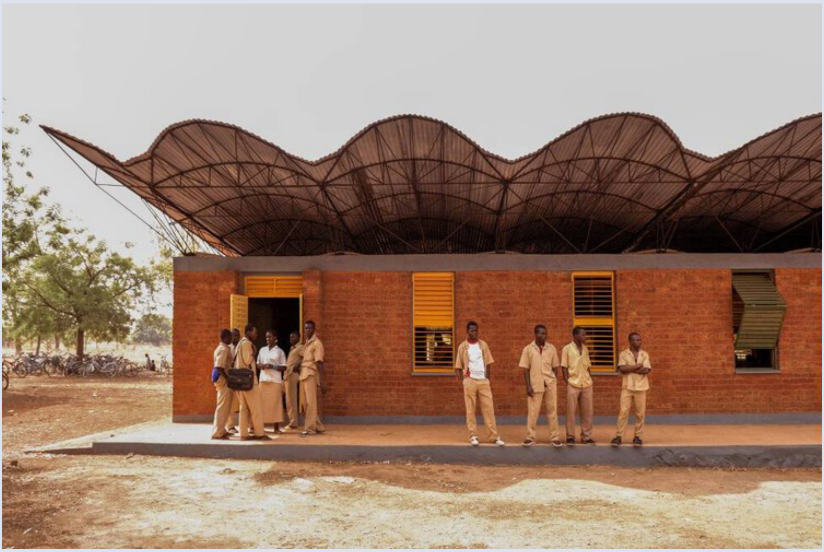
Original idea, sloped bamboo roof with corrugated sheets



Alternative idea, continuing with the arches on the roof as well



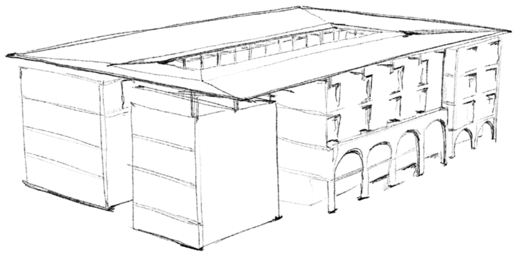
Reference for original roof, combination of material (brick, bamboo) with a big flat roof (STIRworld, n.d.)



Reference for a wavy roof

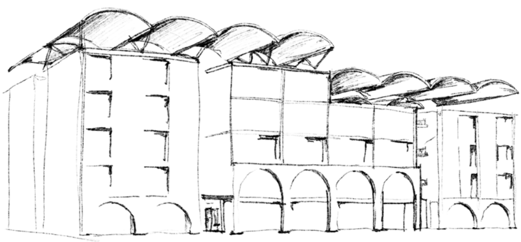
DESIGN PROCESS I roof development

The two different roofs were tested in a quick cardboard model as three separate ideas; the wavy roof as separate elements and the sloped roof both as a one-piece element as well as two separate ones.



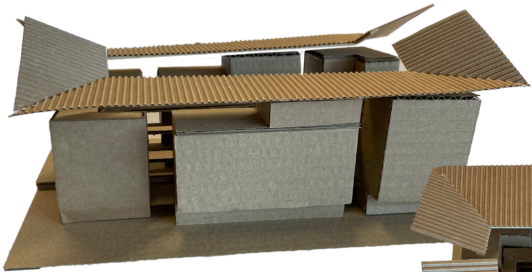
Test 1 & 2

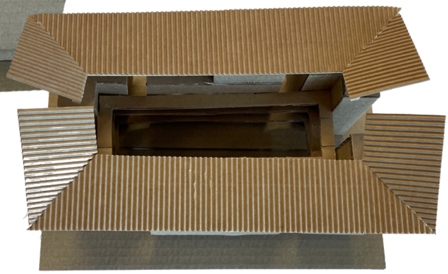
Original idea, sloped roof, either as one piece, or separate pieces following the structure of the building

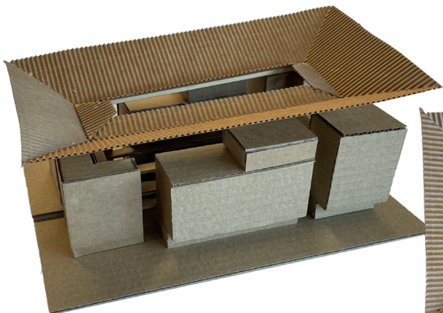


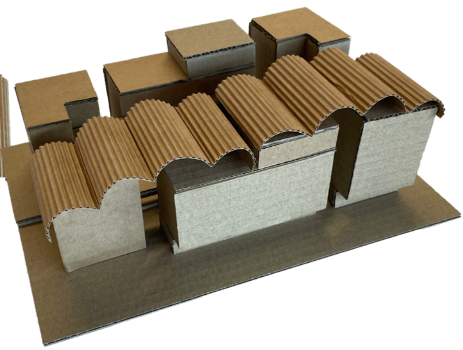
Test 3

Alternative idea, wavy roof with steel structure









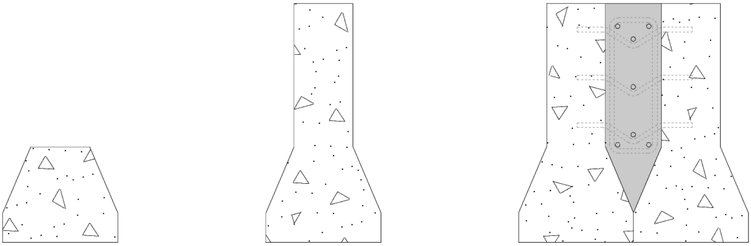
Test models to see what the roof could look like
scale 1:200

DESIGN PROCESS I detailing

To integrate the Catalan vault floors as a system into the design, as well as making the building process more efficient, the building system was further developed.

In Bangladesh, prefab building is not common yet. However, this floor system asks for a repeated pattern throughout the building. The brick vaults are kept in place by concrete beams. This could be produced prefab on site, as a first step towards prefab building. This will give a much more efficient building process, and therefore contribute to affordable housing. The downside is that this will need space for the elements to be built, as well as a crane to lift the elements in place. Although this could be considered quite expensive, this evens out with the time saved while building. The prefab beams are placed and could be casted with concrete to fit the exact connection (see right page for examples how this would be applied).

After discussing this during a building technology feedback session with Rocio, the final details have been changed to the point where extra on site casting on the prefab elements is not needed anymore. The final details can be found in the next chapter.

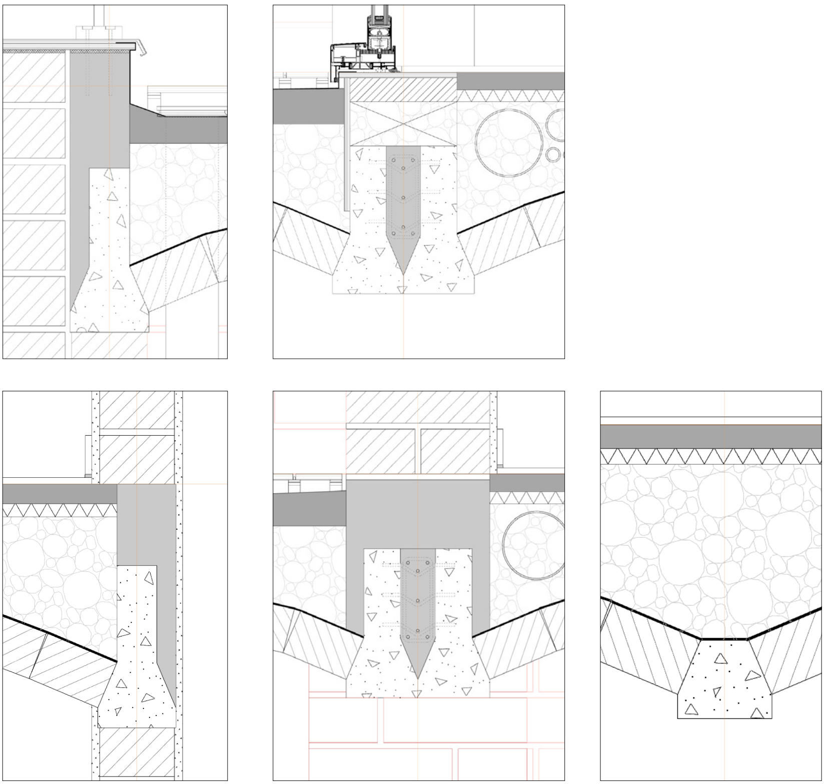


basic form

basic form + rib

double, reinforced + concrete

First detailing idea to simplify the system



First detailing idea to simplify the system

DESIGN PROCESS I pre-p4 feedback

2 weeks before the p4, there was a last feedback session with Marina. This was a very helpful session, in which all last concerns with the design were discussed.

Roof

First of all, the roof idea was discussed. I was already in doubt whether a roof would be a good idea. I think for a single building it would work, but since the design consists of multiple buildings in a master plan, this will become a lot, in not a nice way. Fortunately, Both Marina and Rohan agreed that the building does not need a double roof while looking at the master plan model, but that a flat roof would work better. This will also allow urban farming on the roof.

Third floor balcony zone

As can be seen in the 1:50 facade model, there is a bit of a setback on the third floor, which is now not part of the balconies on that floor. Considering whether this should be a green zone with vegetation, or bigger balconies, Marina suggested to do both. The balconies are extended towards the edge and between the balconies will be planters.

Water-buffer zones inside courtyard

Another point of discussion were the 'water-buffer zones' between the courtyards. The idea is to use this space for small scale agriculture, however, as Rocio mentioned rightly, this impacts the way these courtyards are experienced. Agriculture stays really close to the ground, while there could also be larger trees. Marina suggested an in between solution and use this space for fruit trees, which are quite common in Bangladesh. The space will become more green, while also having something to grow and eat.

Prefab elements

The prefab elements, as shown on the previous page, were discussed whether prefab is an option, as this is not really common yet in Bangladesh. Since many of the same parts are needed, this could be done, even on site (but space is required to store this) and a crane must be rented which adds to the costs. On the other hand, building will be more efficient which will also save money so it is possible.

Bamboo gallery

The starting point of the building technology strategy, was to design the building in such a way that most money will go to the people building it, instead of to imported material. This is why the building was mostly brick with a bamboo structure since the beginning. Now the building will not have a roof anymore, the inner bamboo structure is also not protected by the roof. As Rohan also already earlier on suggested that a steel structure would be a better fit, now without a roof steel just makes more sense. Marina explained that Bangladesh recycles a lot of steel so this way, it will still fit to the idea of designing in a way that people will benefit from it.

Masterplan model scale 1:500

Sketch of semi-private courtyard
(Author, 2025)

Sketch of public riverside promenade
(Author, 2025)

DESIGN

Proposal

design

BUILDING TECHNOLOGY

BUILDING TECHNOLOGY | strategy

"Money should go to the people, not to cement"

-

Anna Heringer

The construction methods and material choices at the core of this design are inspired by the work of Anna Heringer. Her approach to building in countries like Bangladesh is based on working *with* local materials, skills, and traditions, rather than against them. By investing the project's resources into the community instead of imported materials or external contractors, construction can help strengthen local economies. Through the use of working with what is already available, whether that's mud, bamboo, or brick, Heringer shows that sustainable design is not only about technology, but also about social impact.

Following this philosophy, this project tries to work as much as possible with local materials and to rely on local labour and craftsmanship throughout the building process, so most of the money invested in the project go to the people working on it.

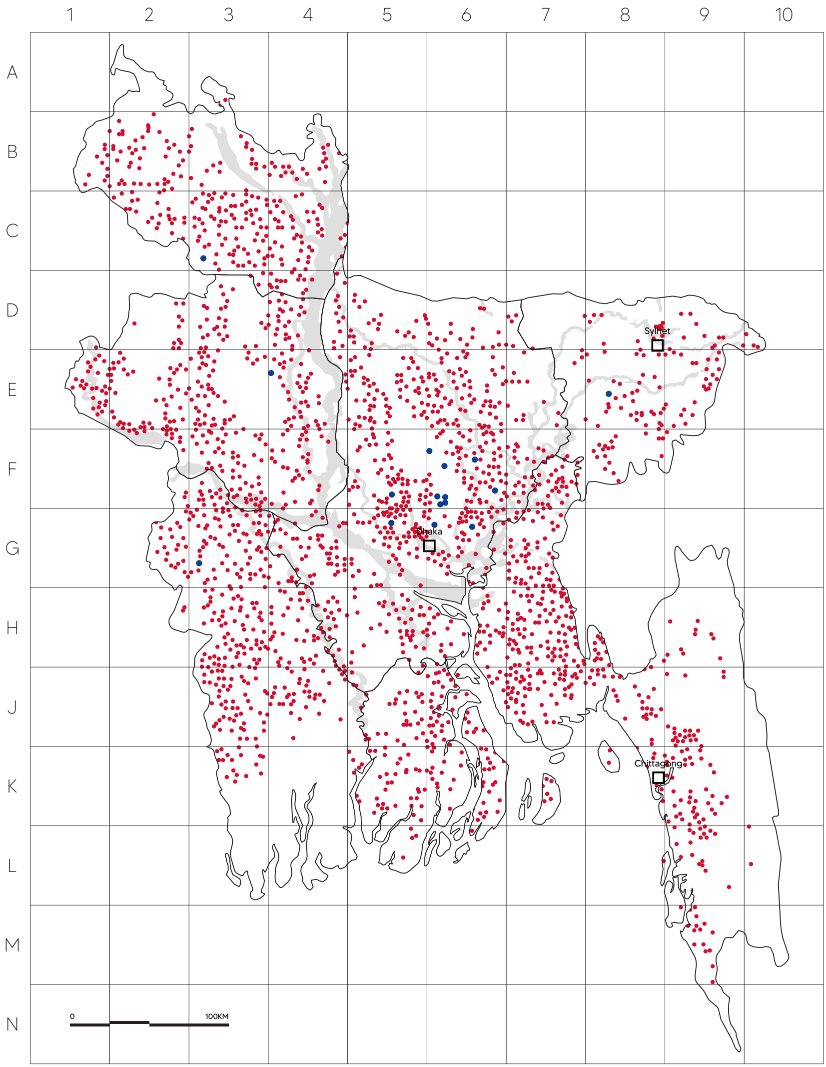
Brick Kiln visited during the field trip,
two hours outside of Dhaka
(Author, 2025)

Bricks are one of the most important building materials in Bangladesh, playing a large role in the Bengali construction sector. Due to the widespread availability of clay along riverbanks, brick-making has been a long-standing industry, supporting both urban expansion and rural development. The process involves extracting clay, moulding, drying, and firing bricks in kilns. Various types of bricks are produced, including handmade and machine-made bricks, used in structures ranging from rural housing, historic mosques to modern high-rises.

There are about 7.000 brick kilns across the country, but their informal nature make monitoring and regulation difficult. Lee et al. (2021) addressed this by developing a satellite-imagery model to identify kiln locations. Expanding on that, Mondal et al. (2024) manually labelled 26.000 satellite images to map these sites. The resulting map highlights a heavy concentration of kilns around Dhaka, while Sylhet, due to its hilly, forested terrain and lower population density, has one of the country's lowest kiln counts. The figure on the right shows the location of the brick kilns across Bangladesh.

The majority of Bangladesh's approximately 7.000 brick kilns are either fixed chimney or zig-zag kilns. These kilns typically produce low-grade, third-class bricks. Their output is often inconsistent, partly due to variations in the clay mixture and the manual nature of the process. In contrast, tunnel kilns, of which there are around 80 in the country, offer a fully automated system that produces higher-quality ceramic bricks. These kilns are not only more efficient but also emit significantly less CO_2 compared to traditional kilns. However, bricks from tunnel kilns are more expensive and therefore less accessible to the general population. Additionally, the traditional brick industry employs a large number of workers, making the shift toward automation a complex social and economic dilemma.

Given its local availability, familiarity, and reliance on local labour, brick is a highly relevant material for this project, fitting to the philosophy described on the previous page. For load-bearing elements, ceramic bricks are required due to their strength and consistency. However, lower-grade bricks from traditional kilns can still be meaningfully integrated into non-structural parts of the building.



● Fixed chimney / zig-zag kilns
(3rd grade bricks)

● Tunnel kiln
(ceramic bricks)

Overview of Brick Kilns in Bangladesh, created as part of the '*Materials in Bangladesh*' booklet (Author, 2025)

BUILDING TECHNOLOGY I material

Brick is used in various parts of the building. The diagram below shows the use of ceramic bricks, which are required for load-bearing walls, both as structural walls and as Catalan vault floors. In addition, brick waste or third-grade bricks, coming from brick kilns, are used as infill and ballast above the Catalan vaults, and as a finishing layer in the cocciopesto brick terrazzo floors.

cocciopesto brick terrazzo (1)

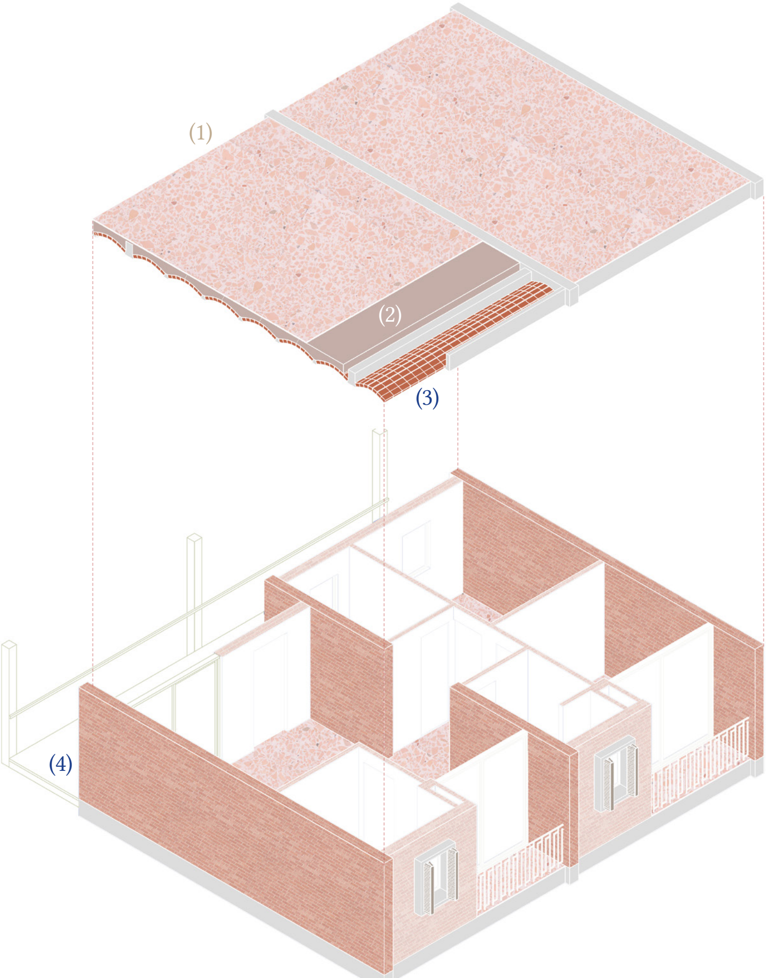
brick aggregate (+sand) (2)

Brick waste
(/ 3rd grade bricks)

brick Catalan vaults (3)

Ceramic bricks

load-bearing ceramicbrick walls (4)



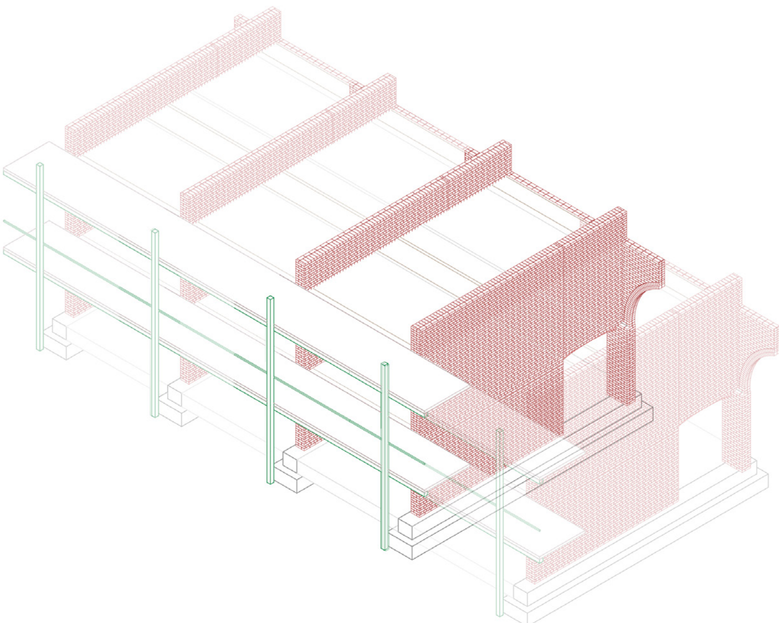
Different appliances of brick in the design
(Author, 2025)

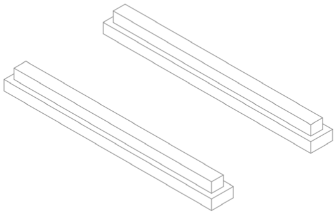
BUILDING TECHNOLOGY | construction

Ceramic brick is used as the primary construction material and used as load bearing walls. Although this limits the design to a maximum of around four to five floors, it actually aligns well with the concept of building in a way that reflects how people live today. Since most residents use the courtyard as their living room, it is important that the dwellings maintain a sense of being ground-related.

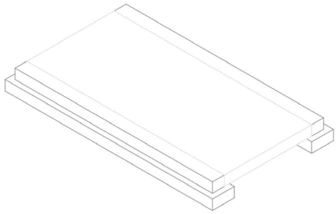
The design is based on a linear system of load-bearing brick walls, supported by concrete tie-beams at each floor level. These beams improve structural stability and enhance earthquake resistance. The floors consist of Catalan vaults, also constructed from ceramic brick and held in place by concrete beams. Concrete is used only where necessary to enable the brick structure.

The gallery within the courtyard is constructed using a steel frame. While this may seem at odds with the project's aim to use local materials, it aligns with regional realities: Bangladesh has a large ship-breaking industry in Chittagong, where steel is recovered and recycled for construction use.

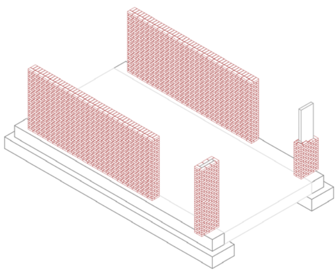




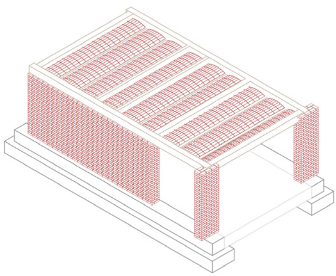
1. Strip foundation



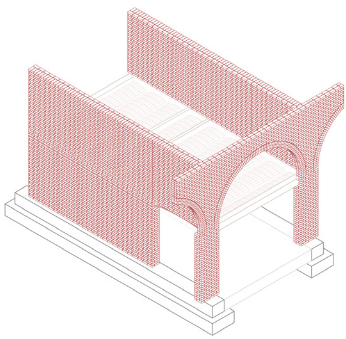
.2. Concrete ground floor



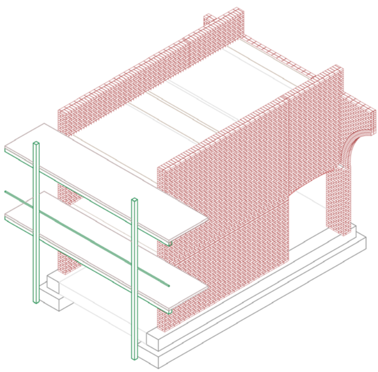
3. Load bearing brick walls



4. Catalan vault floor between concrete beams



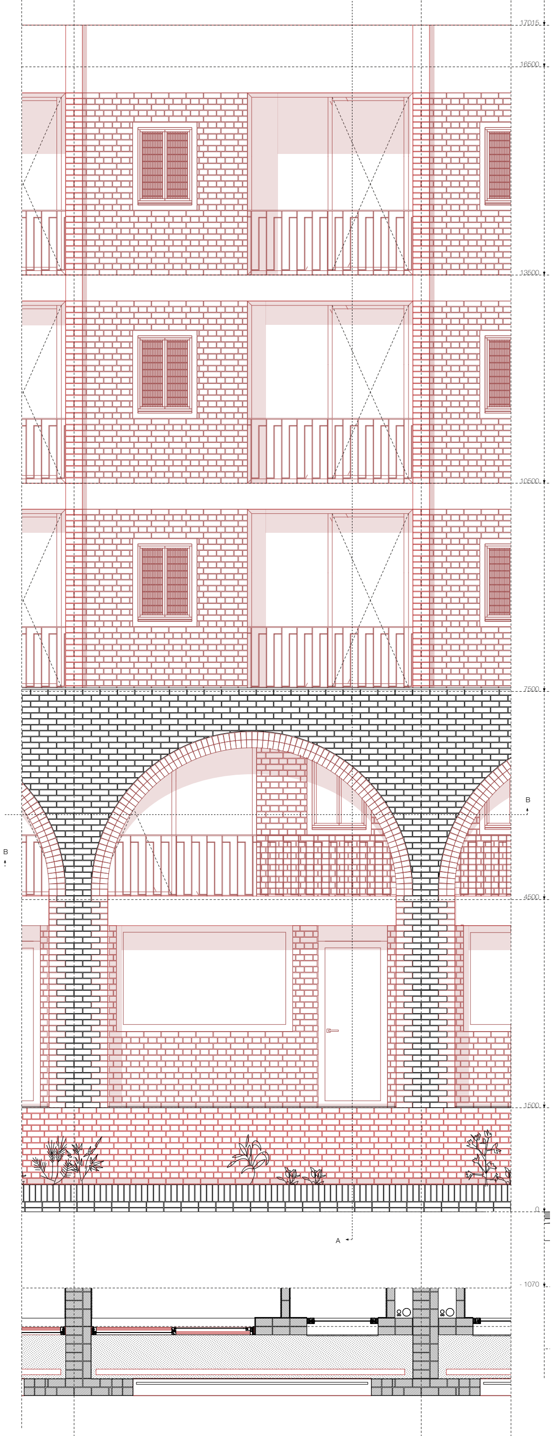
5. Brick arches as second facade



6. Steel gallery

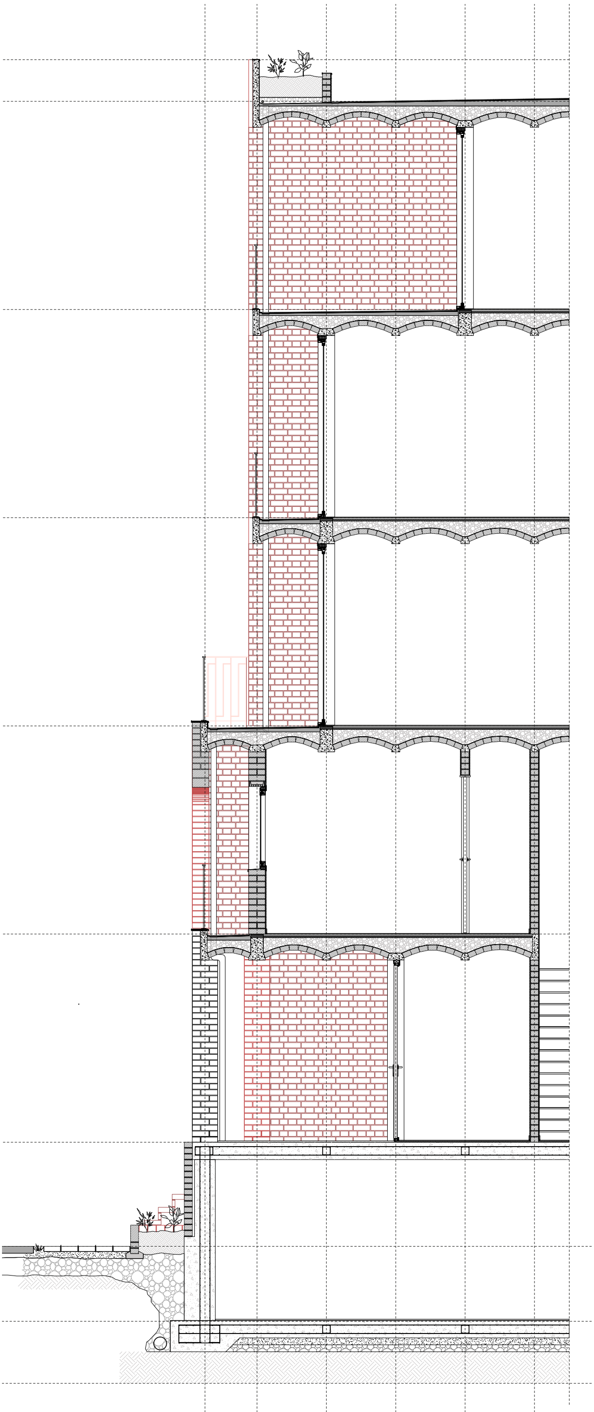
Construction system
(Author, 2025)

BUILDING TECHNOLOGY I section



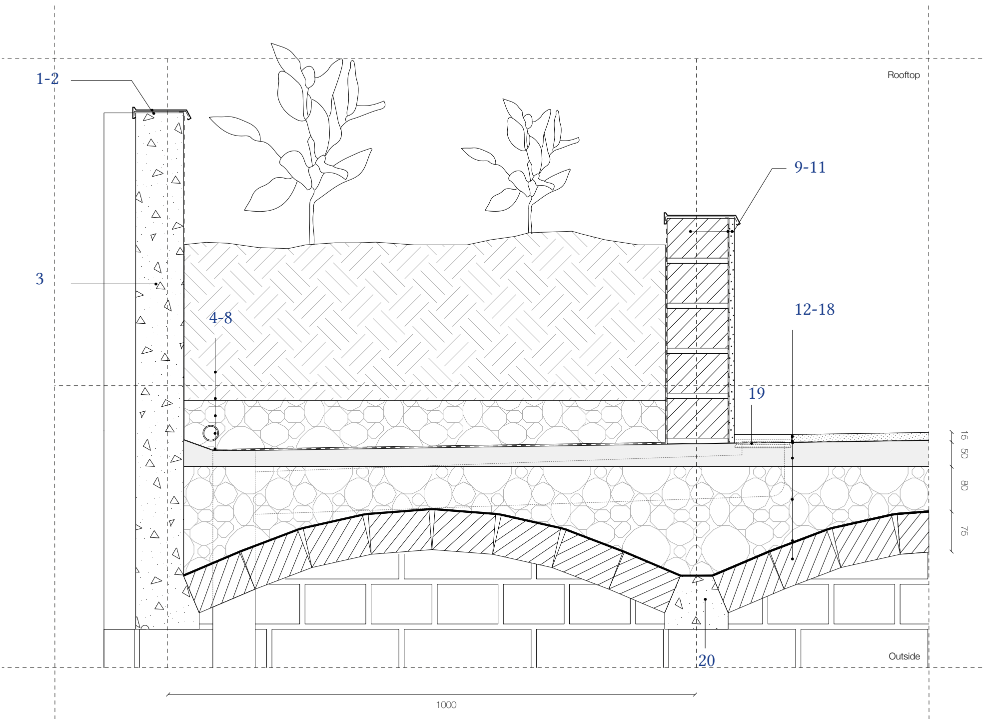
Facade elevation

Horizontal section BB'



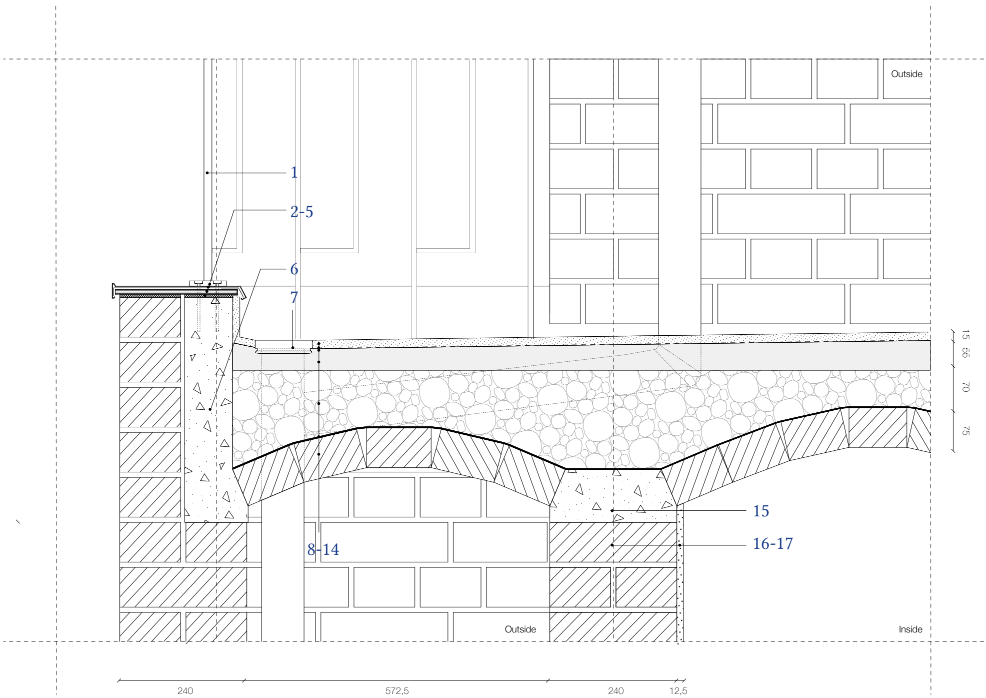
Vertical section AA'

Roof



1 Aluminium wall capping
2 Packing layer
3 Reinforced concrete
4 Topsoil 300mm
5 Filter fabric (geotextile)
6 Drainage layer brick aggregate 50mm
7 Drainage-permeable rubber inner box
8 Waterproofing
9 Brick 115mm
10 Waterproofing
11 Plaster 10mm
12 Cocciopesto brick terrazzo 15mm
13 Bonding coat (lime / sand)
14 Waterproofing
15 Sloped sand-cement screed 40-60mm
16 Brick aggregate with sand 70-187,5mm
17 Thin lime mortar layer (water-repellent, vapour-permeable)
18 Ceramic brick vault 75mm
19 Rainwater drainage
20 Prefab reinforced concrete beam

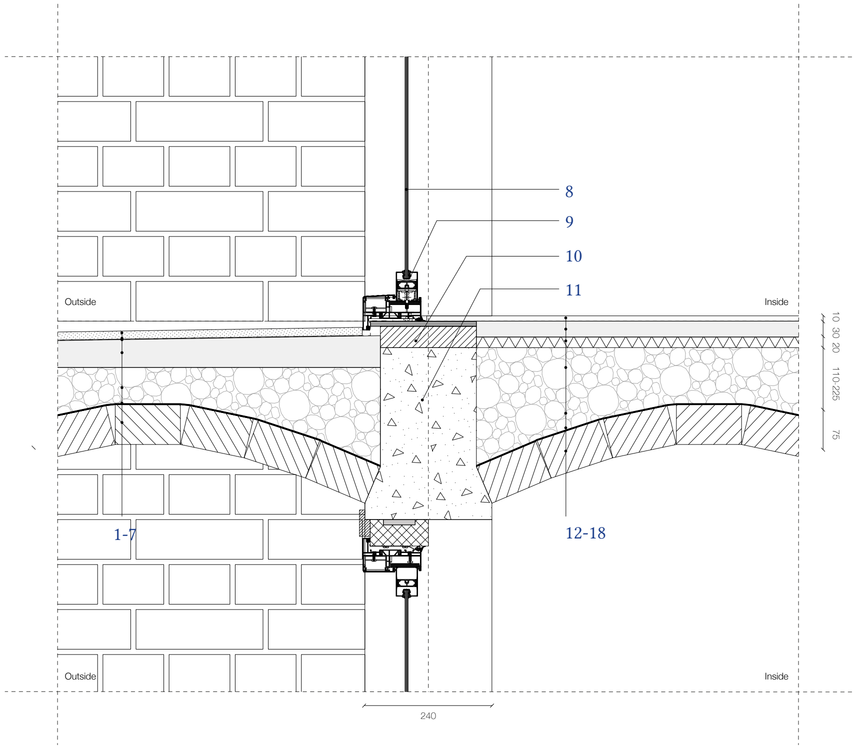
Balcony



1 Mild steel railing
2 Aluminium wall capping
3 Packing layer
4 Plywood 10 mm
5 Polyurethane sealant
6 Prefab reinforced concrete beam
7 Rainwater drainage
8 Cocciopesto brick aggregate terrazzo 15mm
9 Bonding coat (lime / sand)
10 Waterproofing
11 Sloped sand-cement screed 40-60mm
12 Brick aggregate with sand 70-187,5mm
13 Thin lime mortar layer (water-repellent, vapour-permeable)
14 Ceramic brick vault 75mm
15 Prefab reinforced concrete beam
16 Brick wall 240mm
17 Gypsum fibre board 12,5mm

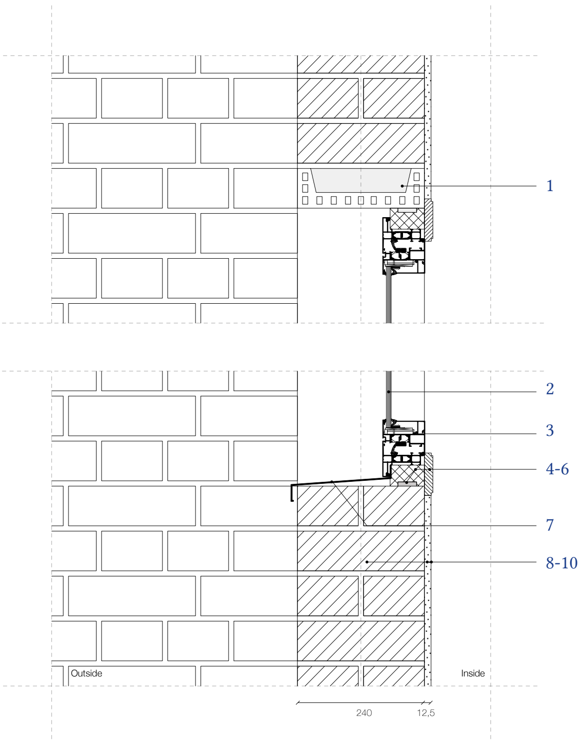
scale 1:5 (scaled 35%)

Loggia



1	Cocciopesto brick aggregate terrazzo 15mm	11	Prefab reinforced concrete beam
2	Bonding coat (lime / sand)	12	Cocciopesto brick aggregate terrazzo 10mm
3	Waterproofing	13	Bonding coat (lime / sand)
4	Sloped sand-cement screed 40-60mm	14	Earth screed 30 mm
5	Brick aggregate with sand 70-187,5mm	15	Insulation board 20 mm
6	Thin lime mortar layer (water-repellent, vapour-permeable)	16	Brick aggregate with sand 110-225mm
7	Ceramic brick vault 75mm	17	Thin lime mortar layer (water-repellent, vapour-permeable)
8	Single glass unit	18	Ceramic brick vault 75mm
9	Aluminium window frame		
10	Timber sole plate		

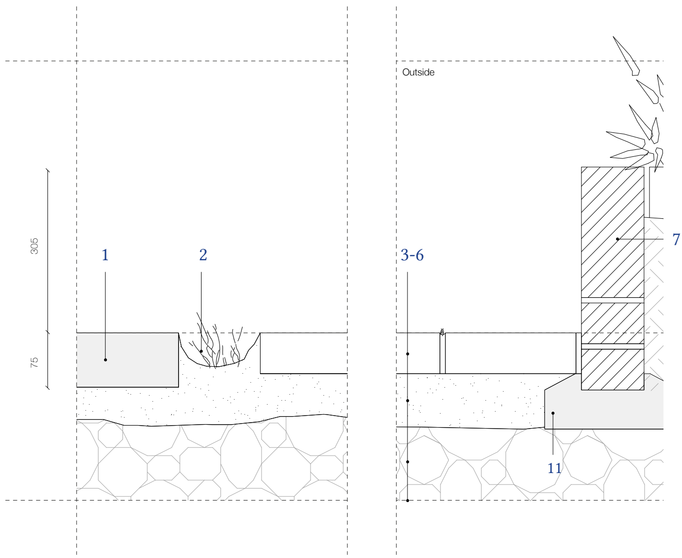
Window



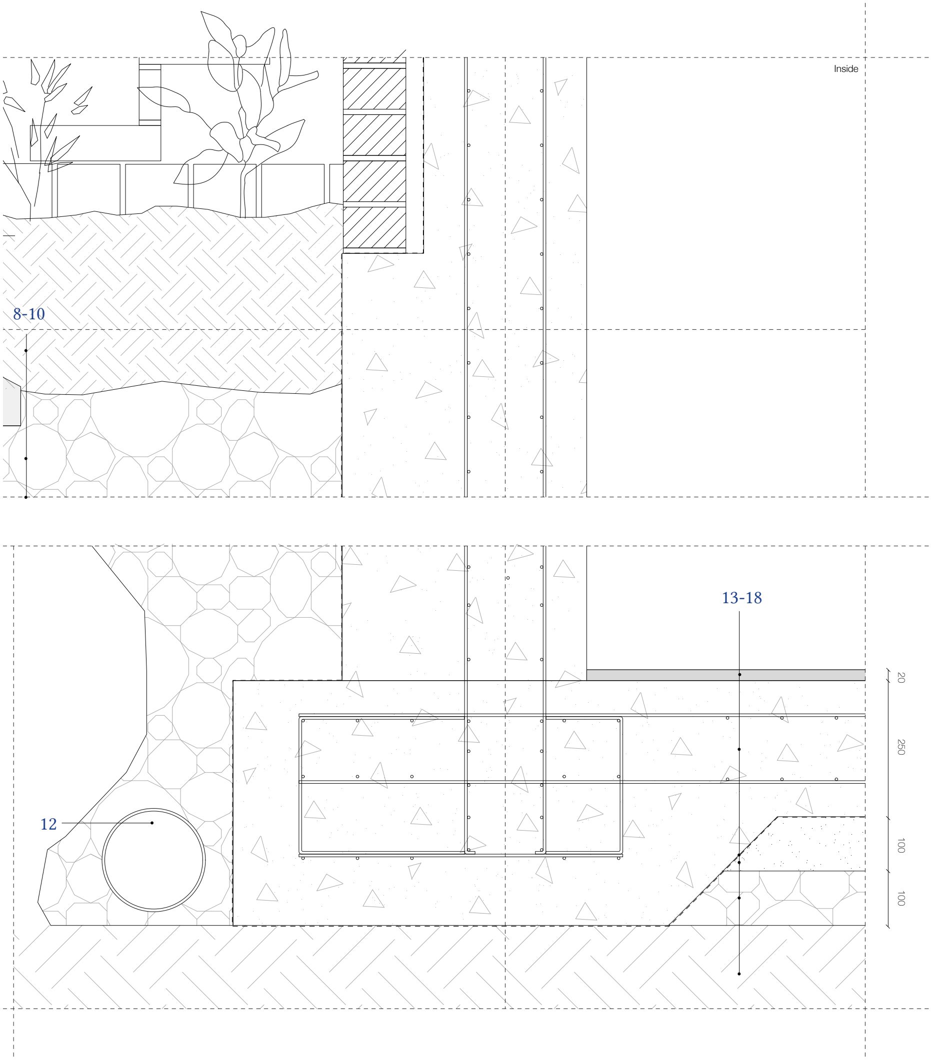
1 Terracotta brick lintel
2 Single glass unit
3 Aluminium sill flashing
4 Polyethylene foam tape
5 Hardwood subframe
6 Finishing cladding
7 Aluminium sill flashing
8 Brick wall 240mm
9 Plaster cement 12,5mm
10 Paint

scale 1:5 (scaled 35%)

Ground floor / parking



1 Car road
2 Swale
3 Permeable paving 75mm
4 Sylhet sand 100mm
5 Crushed aggregate 250mm
6 Soil
7 Brick
8 Topsoil 325mm
9 Crushed aggregate 300mm
10 Soil
11 Reinforced cement concrete
12 Drainage
13 Cement floor finish 20mm
14 Reinforced concrete floor slab 300mm
15 Waterproof membrane
16 Sand 100mm
17 Crushed aggregate 100mm
18 Soil

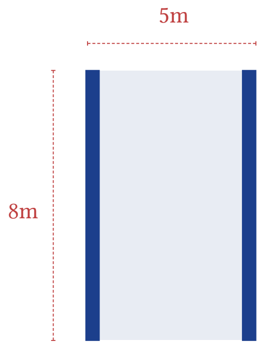


scale 1:5 (scaled 35%)

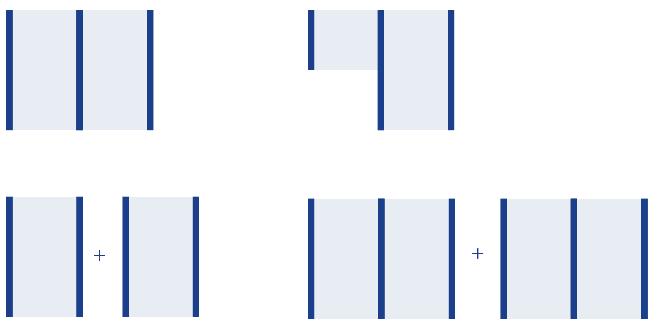
design

UNITS

DESIGN I unit concept



Basic form
40 m^2

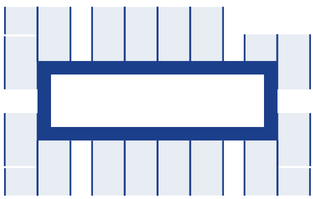


The fixed grid enables flexible variations within the housing blocks

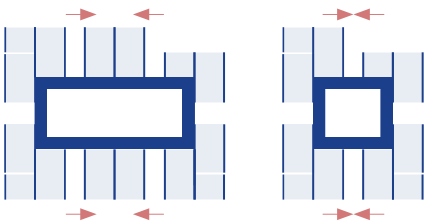
+

Gallery units

Corner pieces

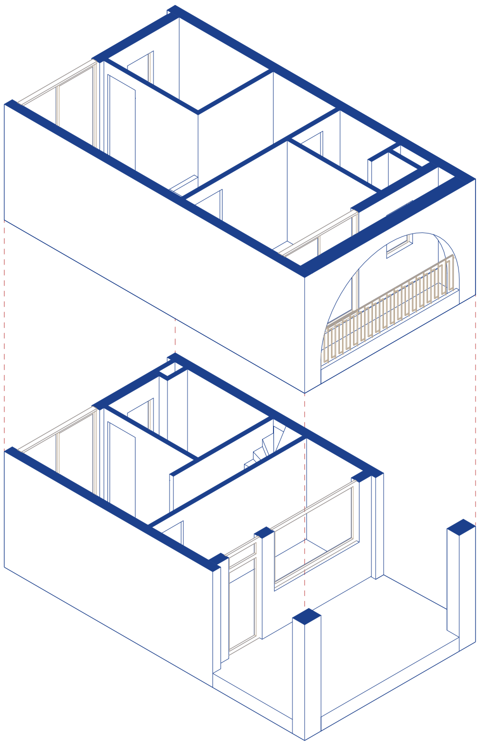


Basic form

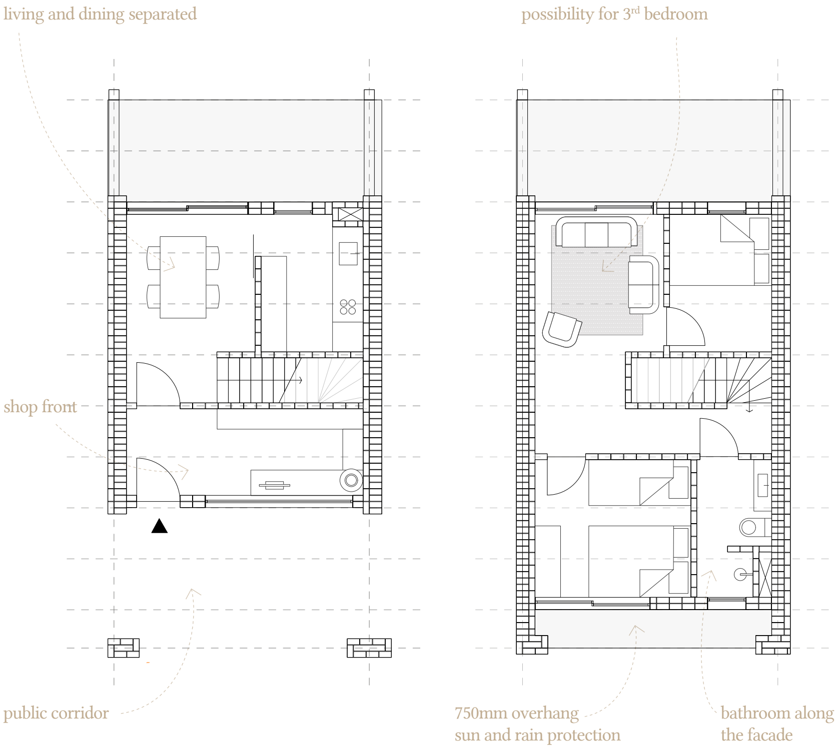


Variations possible to fit the site

DESIGN | units

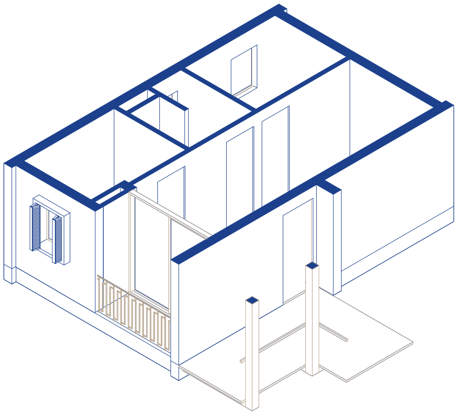


60 m²
+- 5-6 people
10-12 m² per person

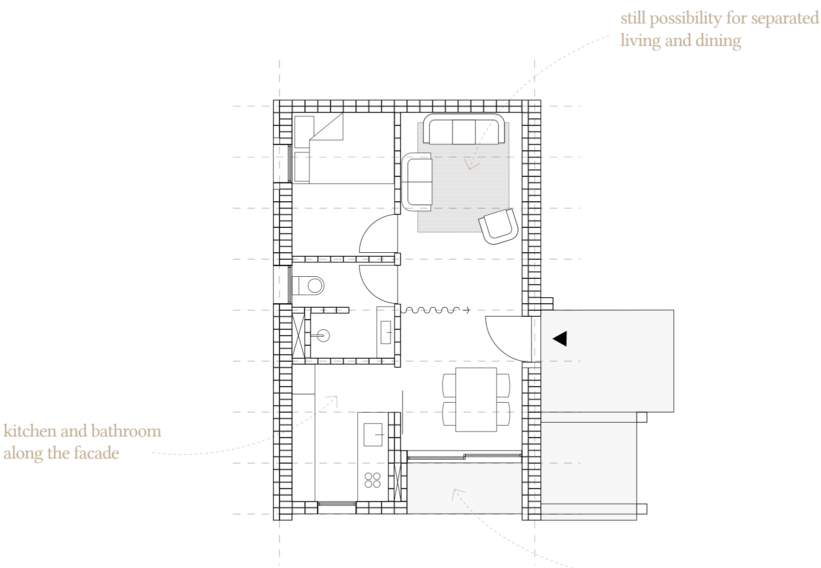


shop house
low income

DESIGN | units

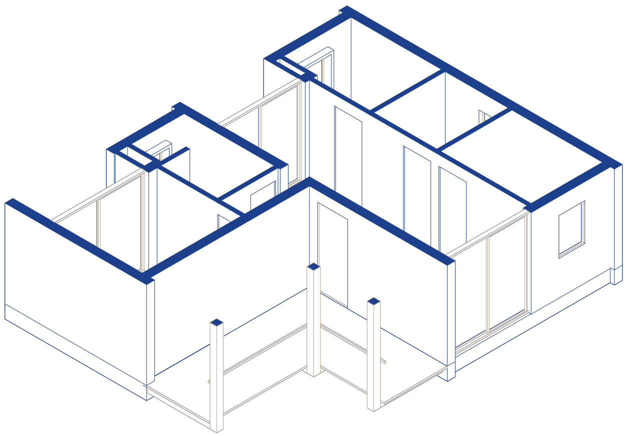


31 m²
+- 2-3 people
10-15 m² per person

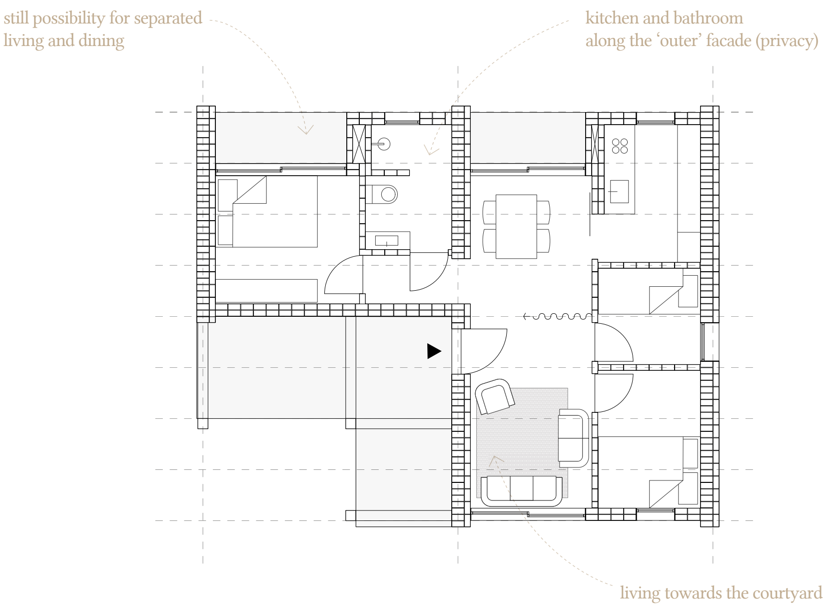


1-bedroom apartment
low income

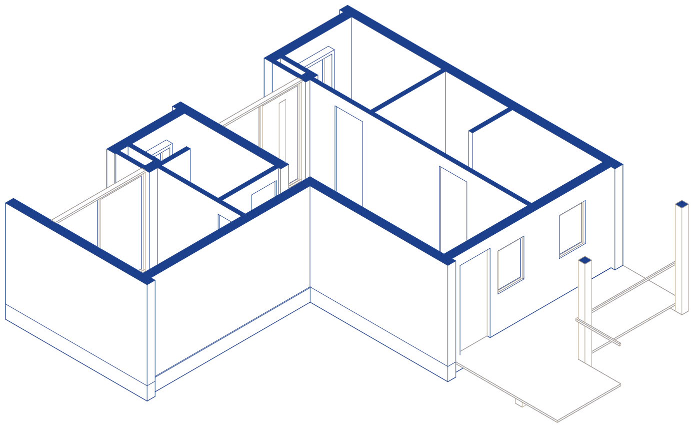
DESIGN | units



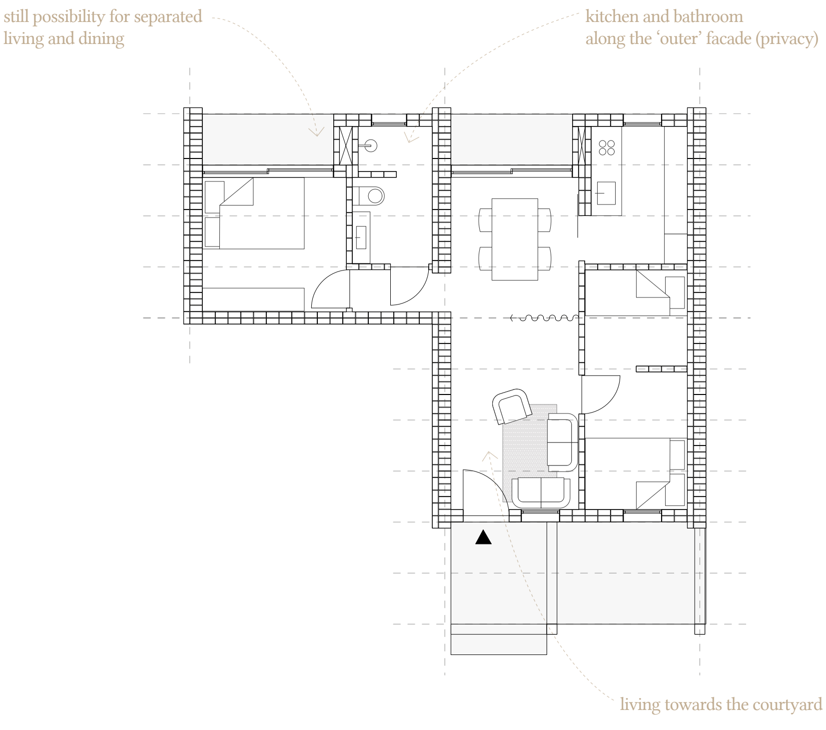
50 m²
+- 5 people
10 m² per person



3-bedroom apartment
low income

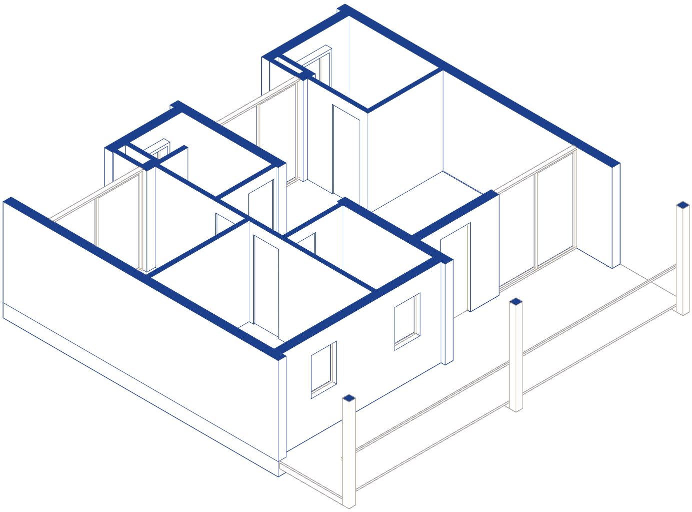


50 m²
+- 5 people
10 m² per person

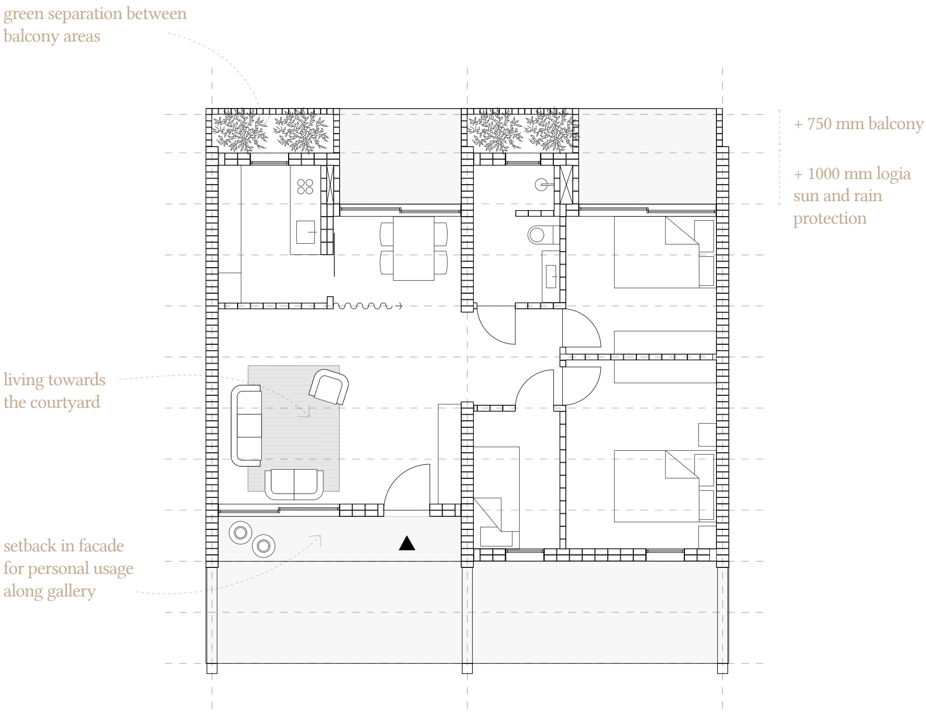


2-bedroom apartment
low income

DESIGN | units

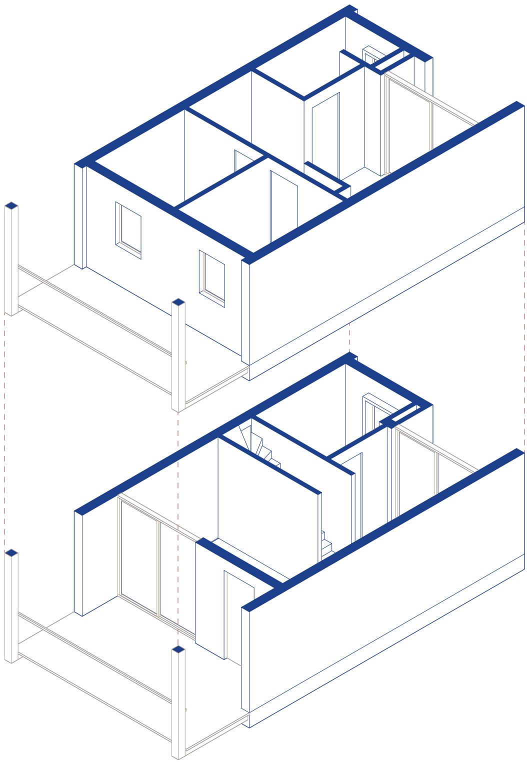


64 m²
+- 4-5 people
13-16 m² per person



3-bedroom apartment
middle income

DESIGN | units

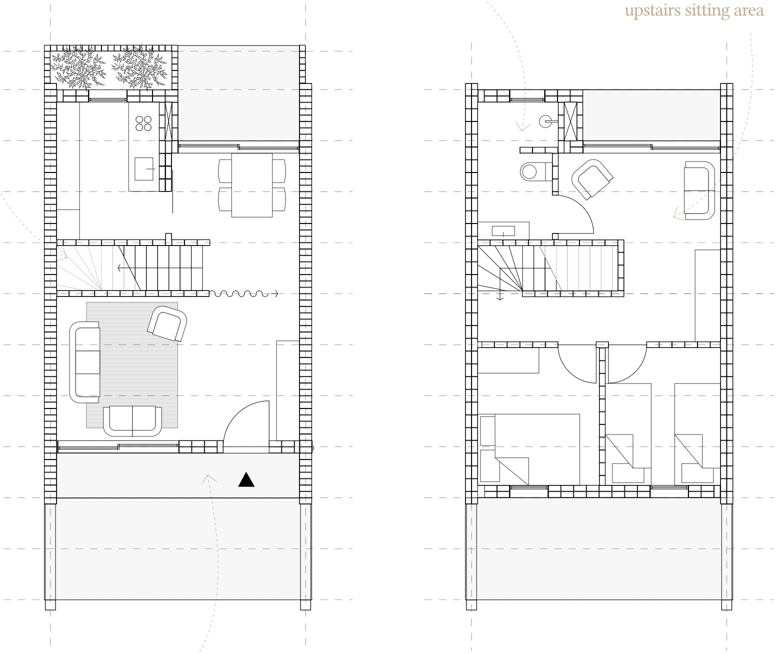


64 m²
+- 4 people
16 m² per person

stairs as a separator between
living and dining

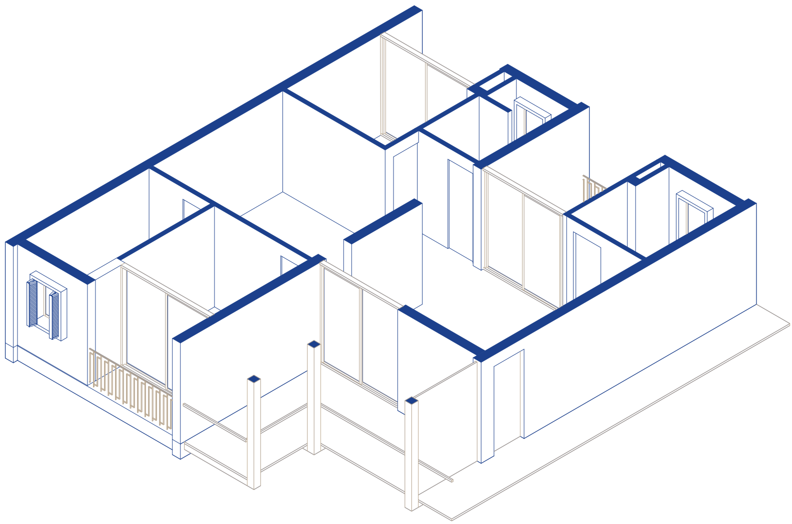
kitchen and bathroom
along the 'outer' facade

upstairs sitting area

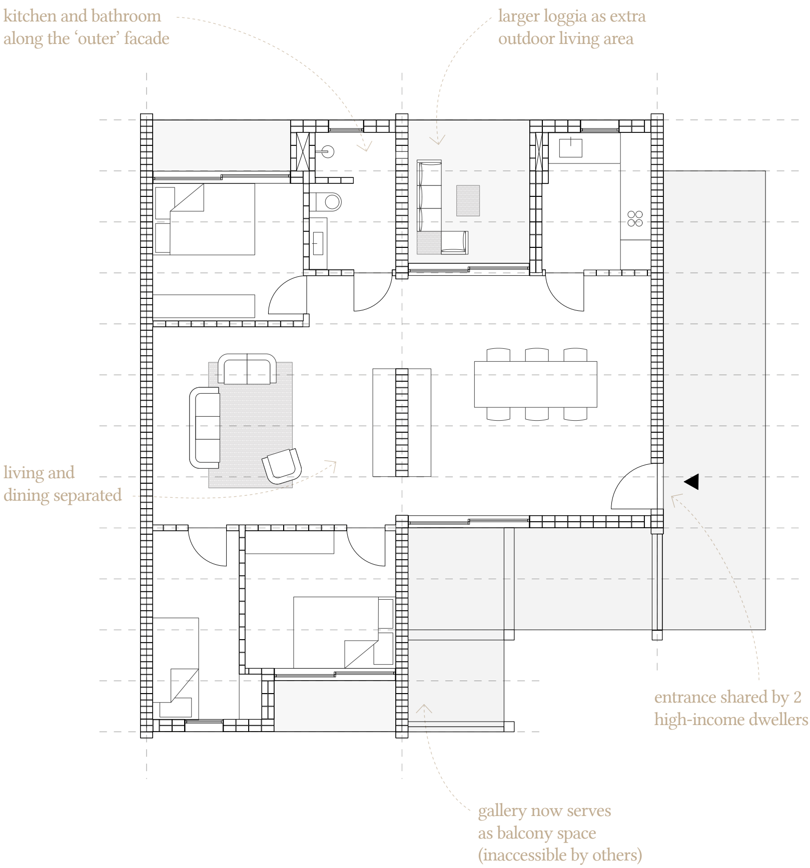


setback in facade for personal
usage along gallery

2-bedroom maisonette
middle income

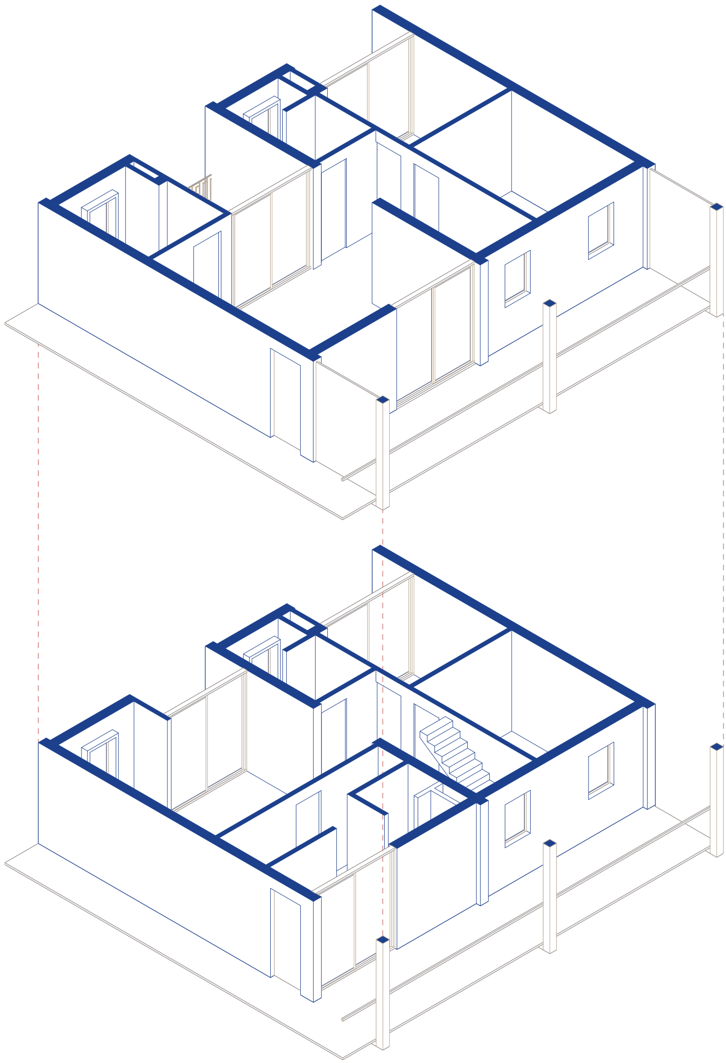


80 m² *(+ 25 m² private outdoor space)*
+- 4 people
20 m² per person

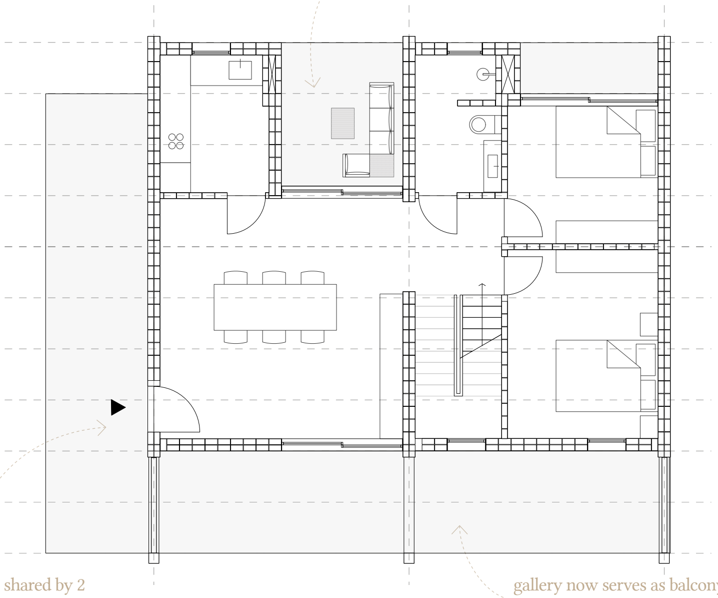


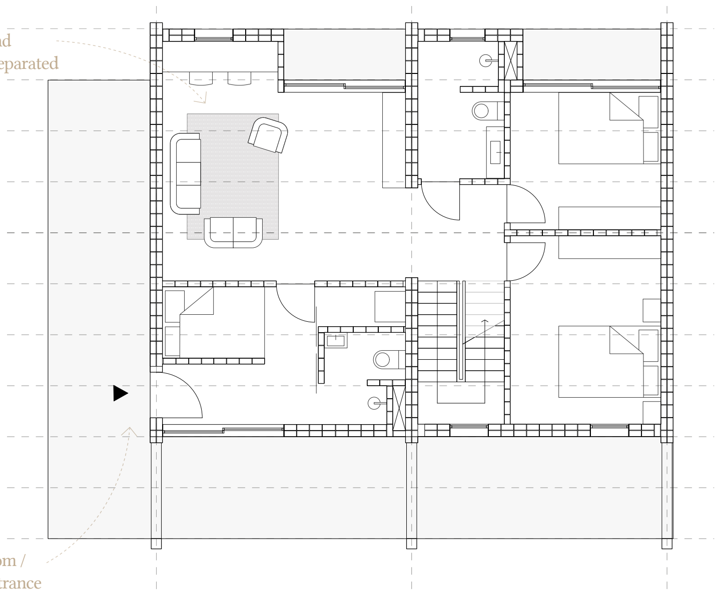
3-bedroom apartment
high income

DESIGN | units



140 m² *(+ 34 m² private outdoor space)*
+- 6 people
23 m² per person





4-bedroom maisonette
high income

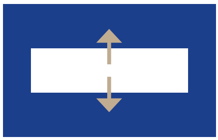
Interior

design

CLUSTER

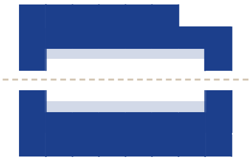
DESIGN I cluster concept

Basic block

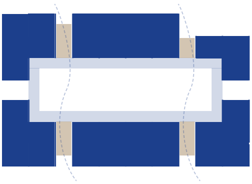


Live around courtyard

Create public space

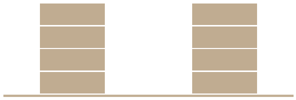


Connect courtyards

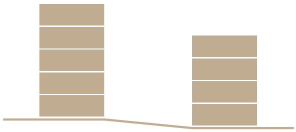


Vertical and horizontal circulation /
ventilation courtyard

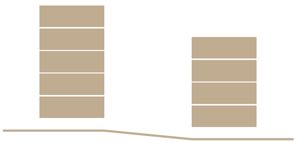
Provide living as people live right now



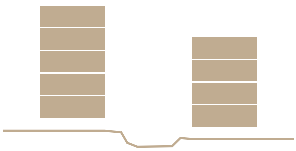
Max. 4 / 5 floors, live on groundfloor



Adjust to existing landscape

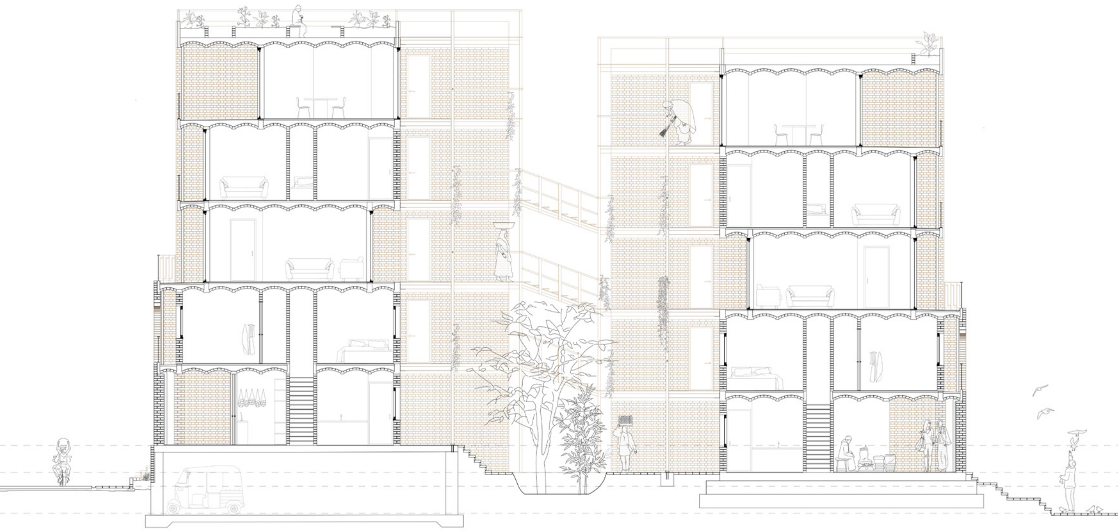


Raise 1,5 meter for parking and flooding

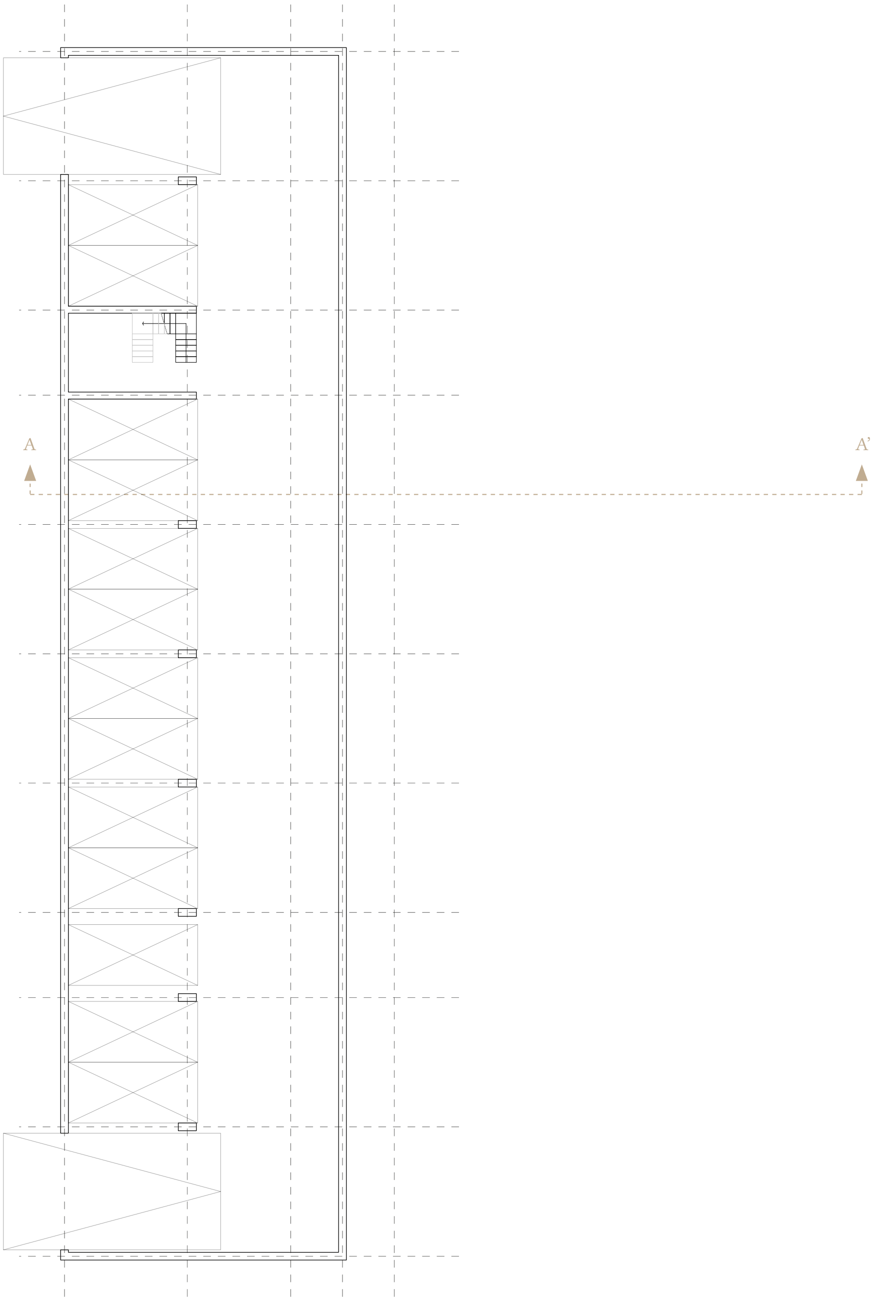


Create room for the monsoon water

Allow living with the monsoon



Section AA' through full cluster

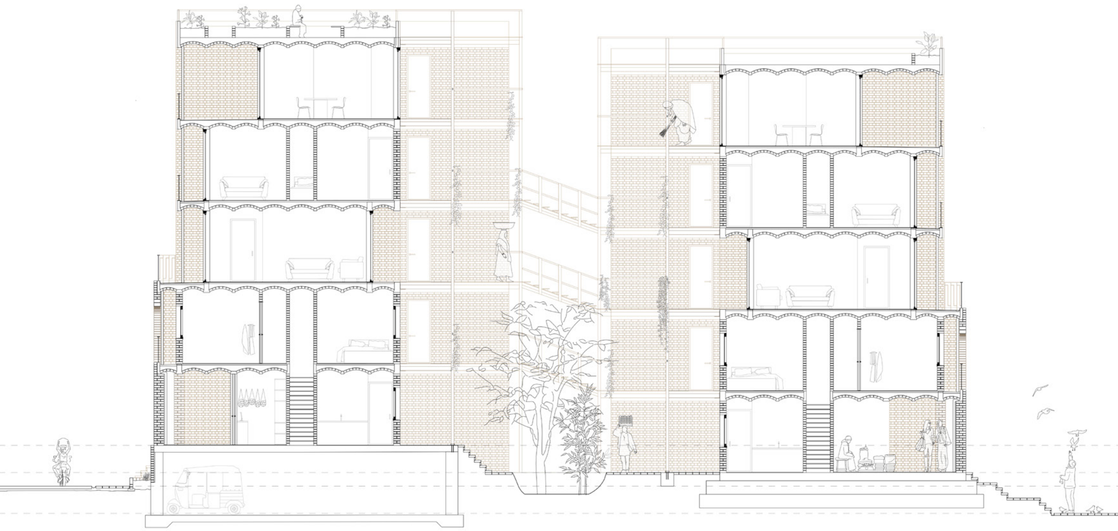


parking
-1

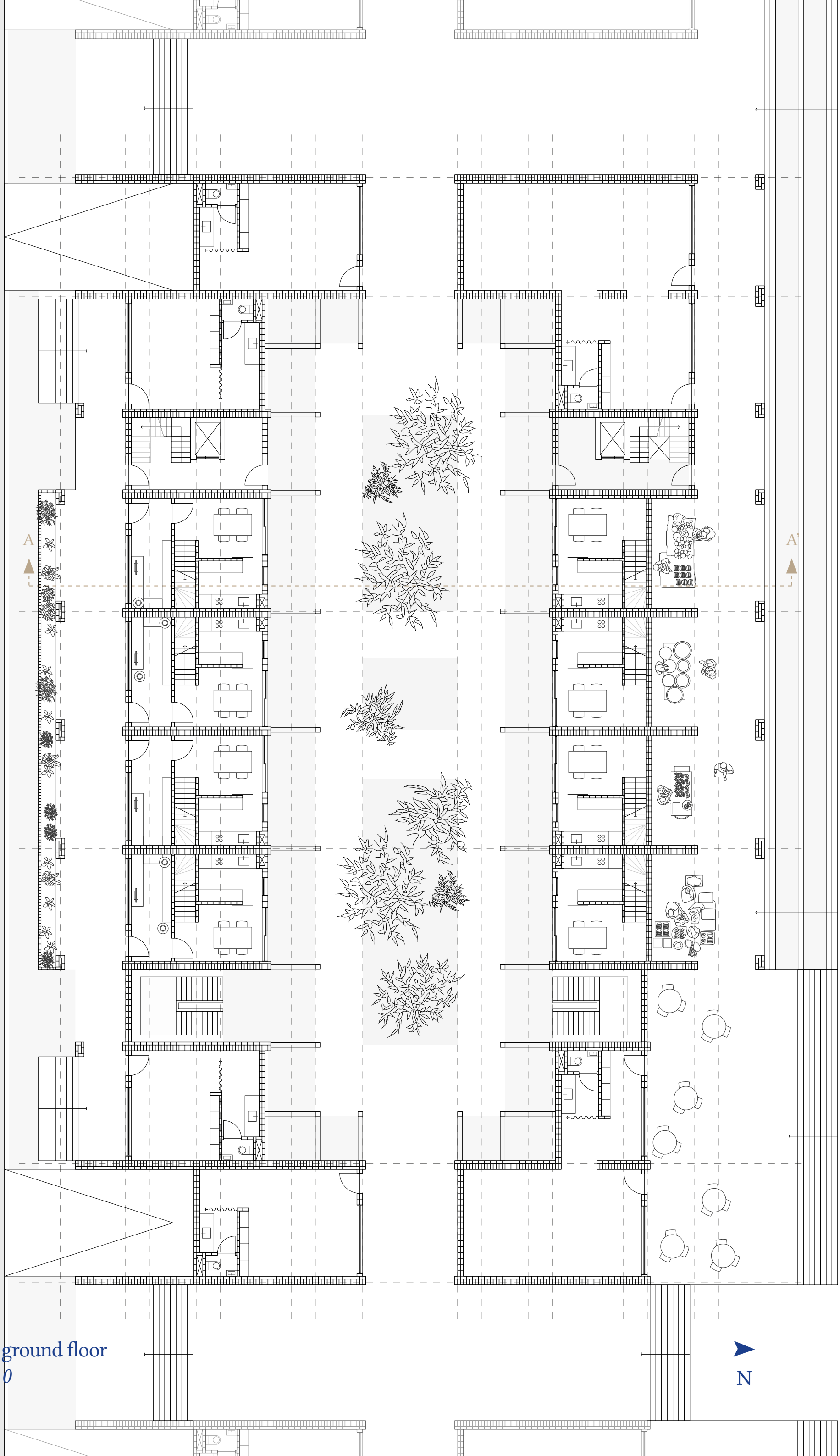
N

DESIGN I cluster

The ground floor of the cluster consists of public functions and small shop-front dwellings designed as maisonettes. The use of the ground floor aligns with the soft approach of the design: enabling life with the monsoon, rather than trying to resist it. This is realised by elevating both sides of the cluster by 1,5 meter above ground level, while leaving room between the building as a buffer for the monsoon to infiltrate into the ground. In addition, the ground floor primarily houses public functions, and the dwellings on ground floor are maisonettes, meaning each unit includes a second living floor above ground level.



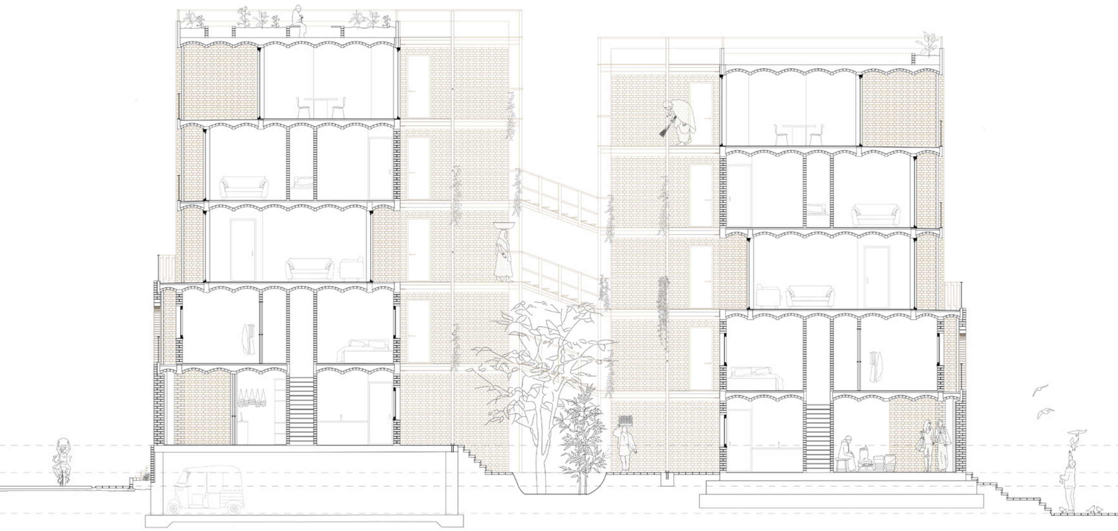
Section AA' through full cluster



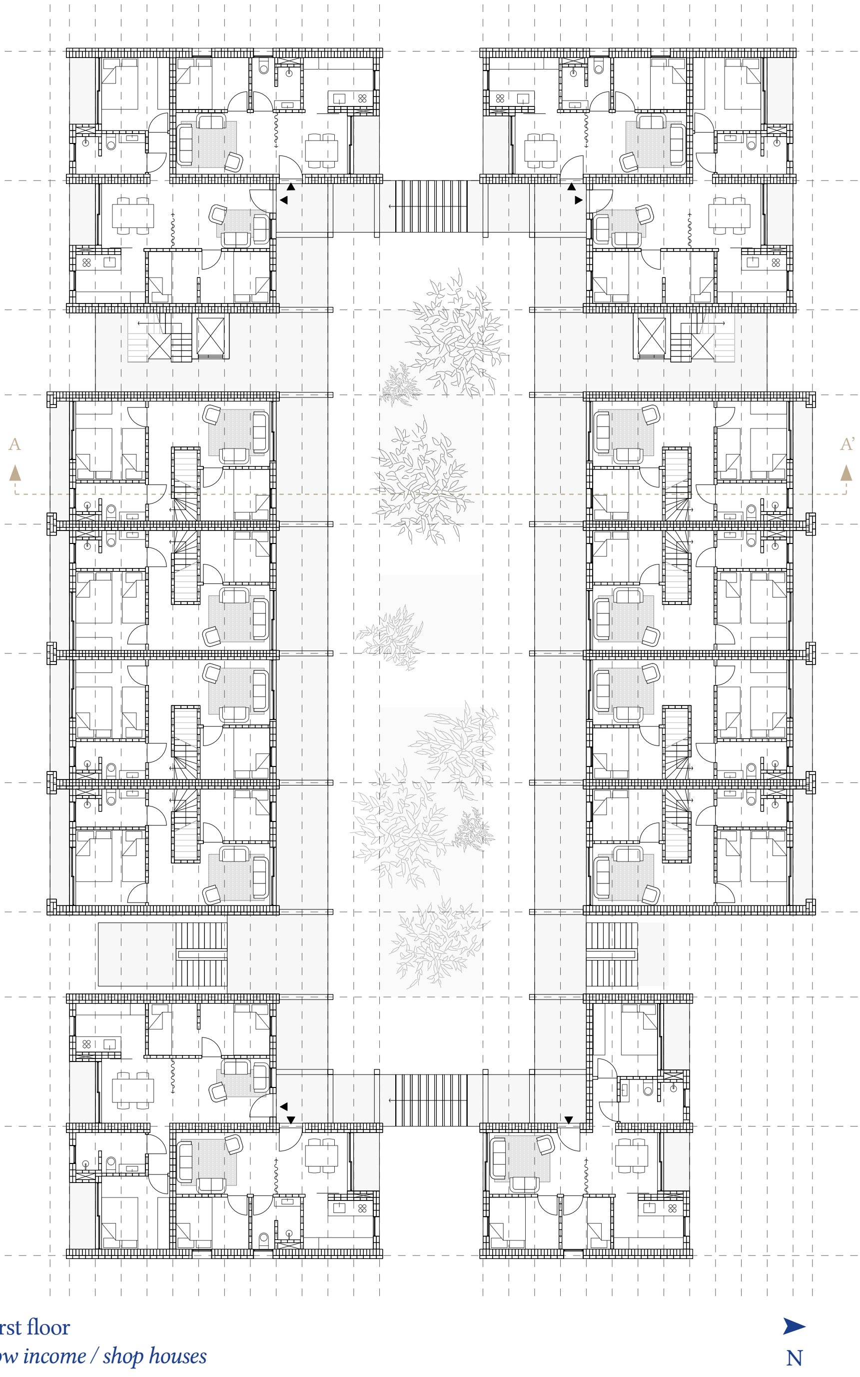
street side

riverside promenade

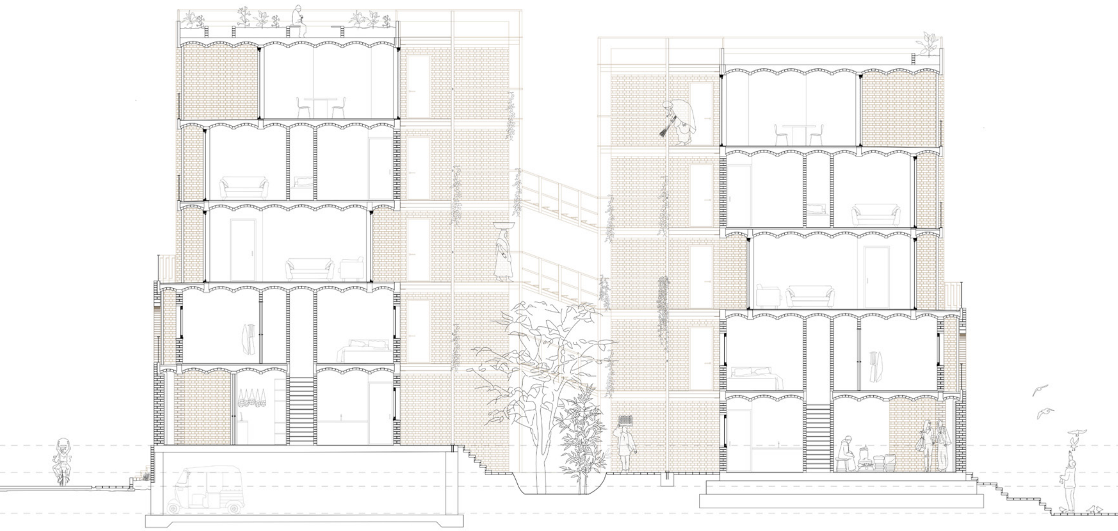
ground floor
0



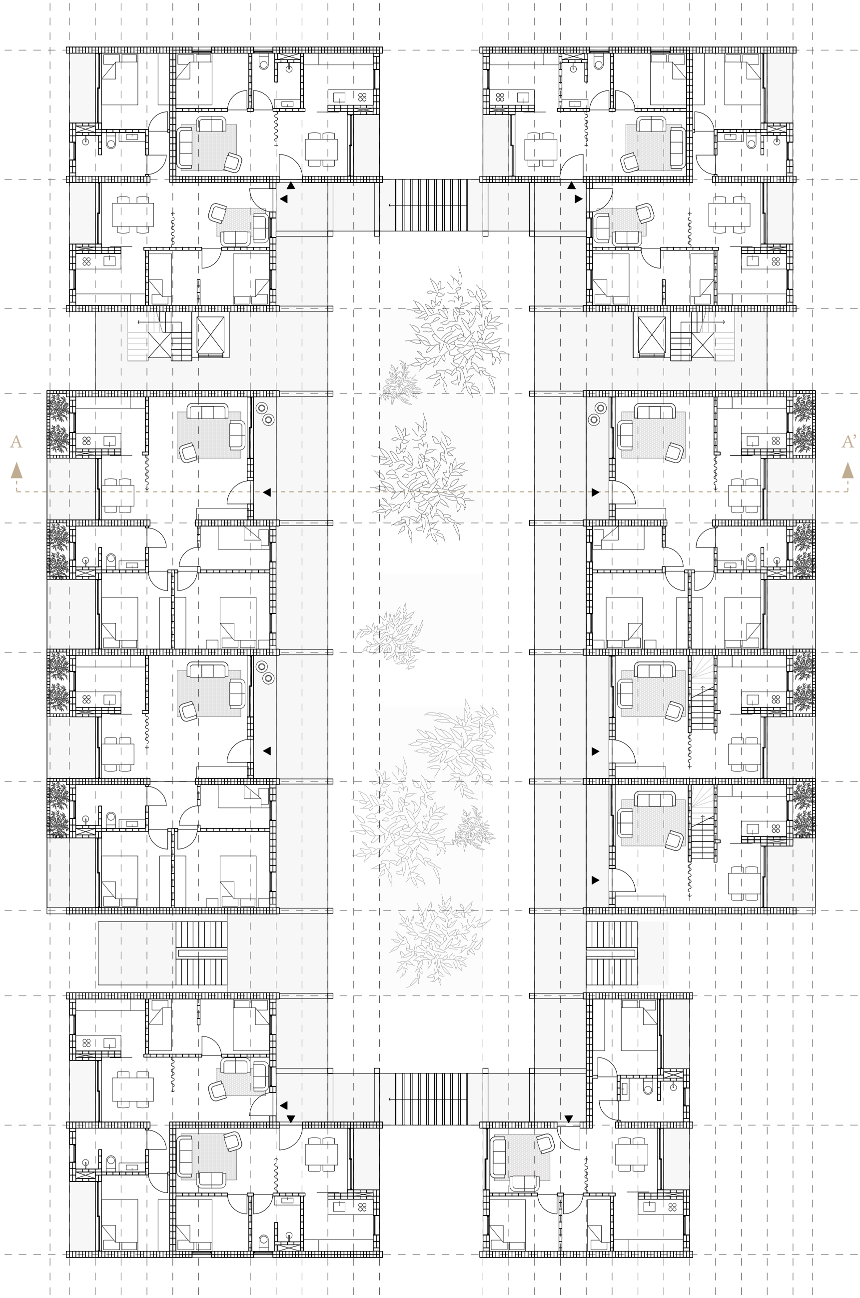
Section AA' through full cluster



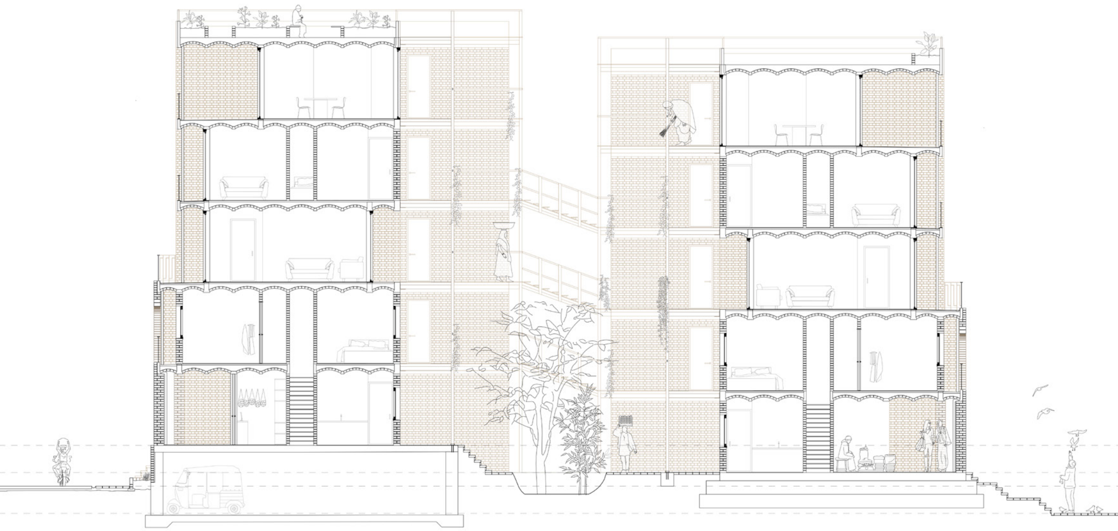
first floor
low income / shop houses



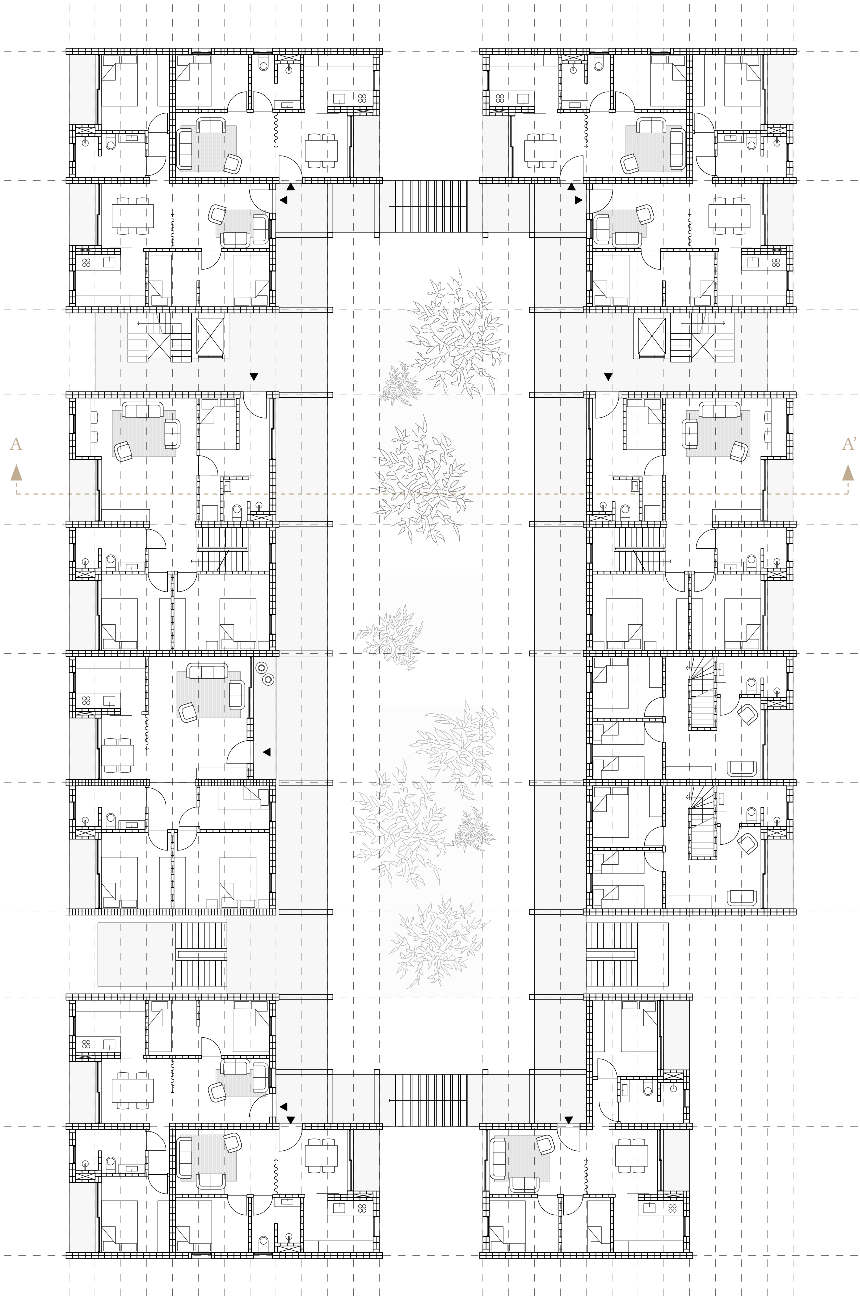
Section AA' through full cluster



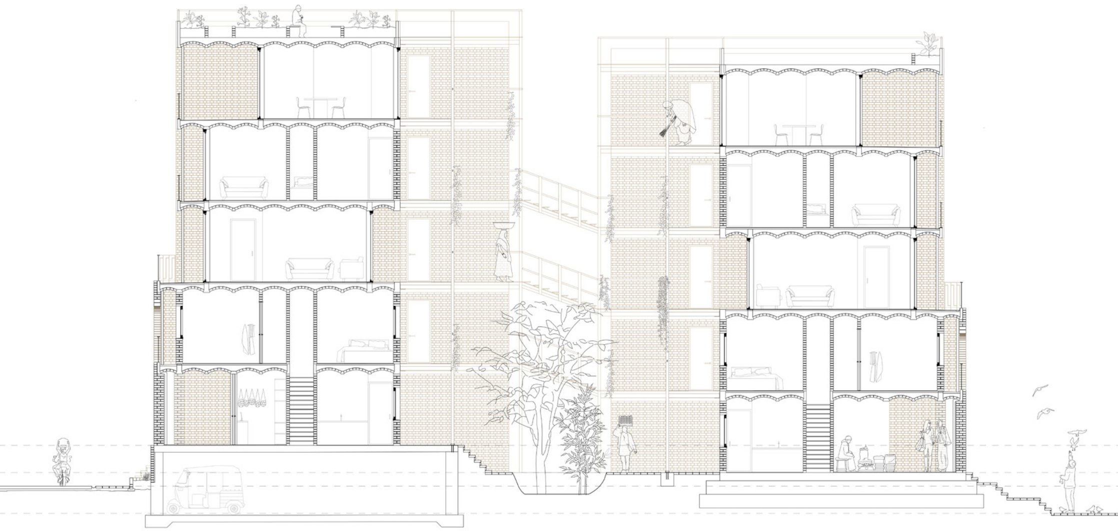
second floor
middle income



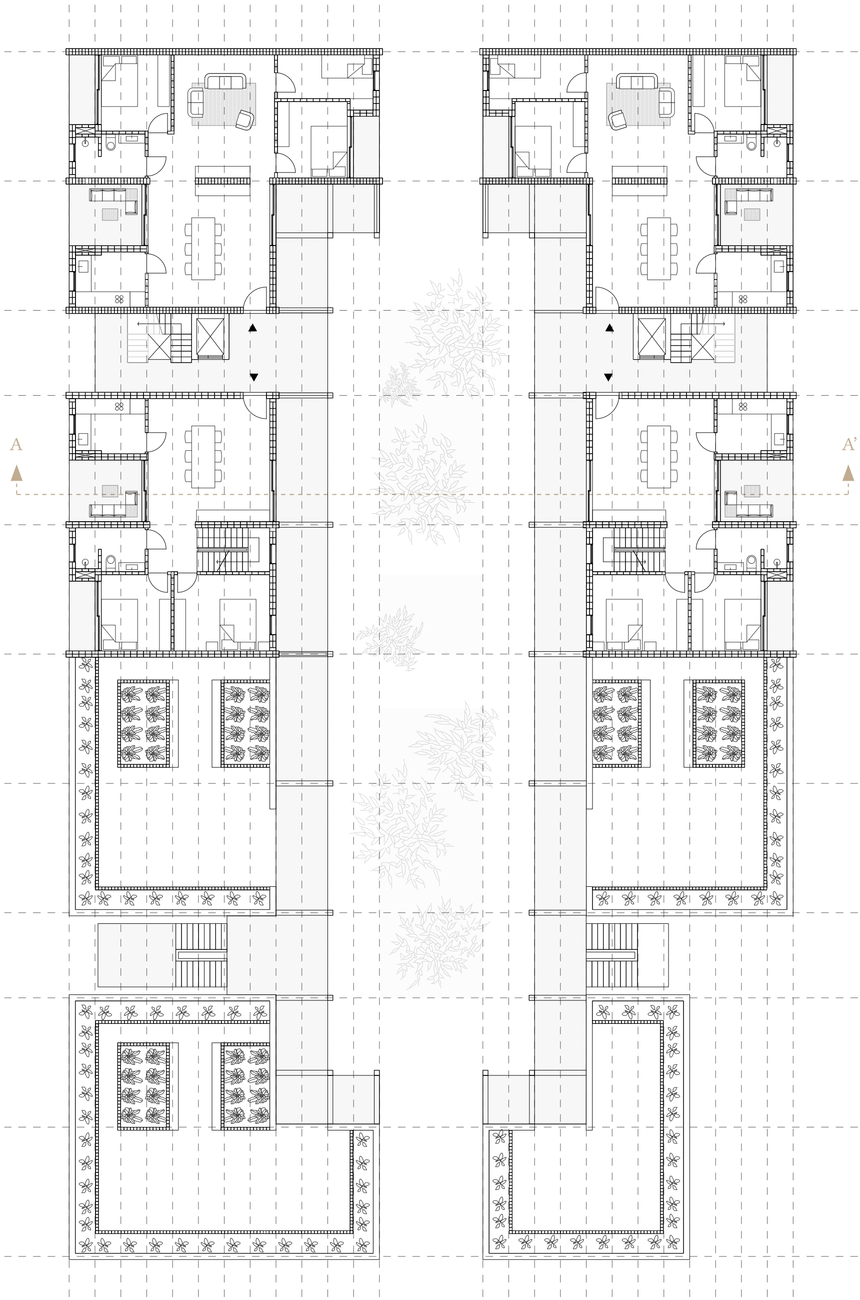
Section AA' through full cluster



third floor
middle income



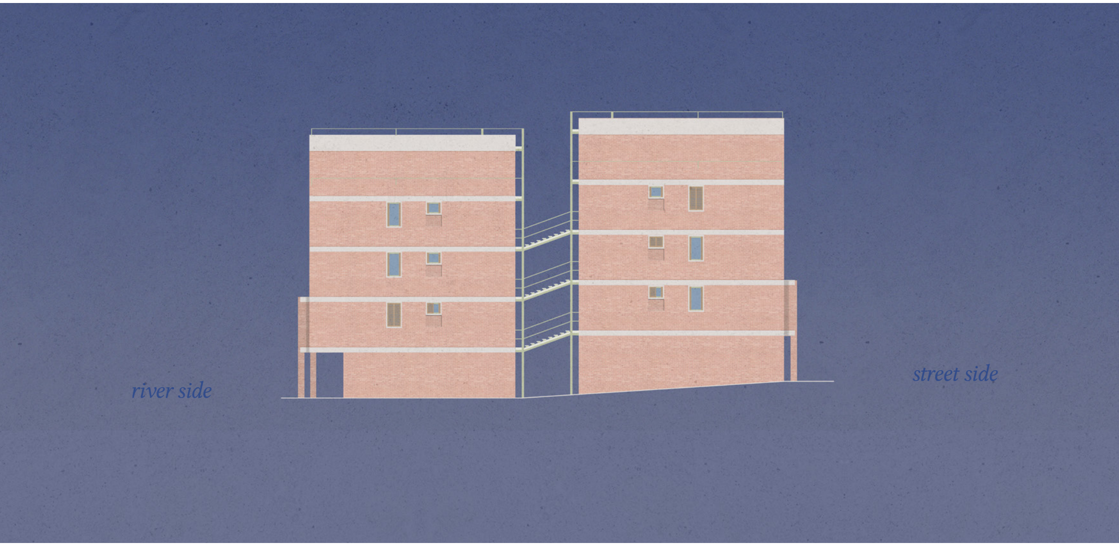
Section AA' through full cluster



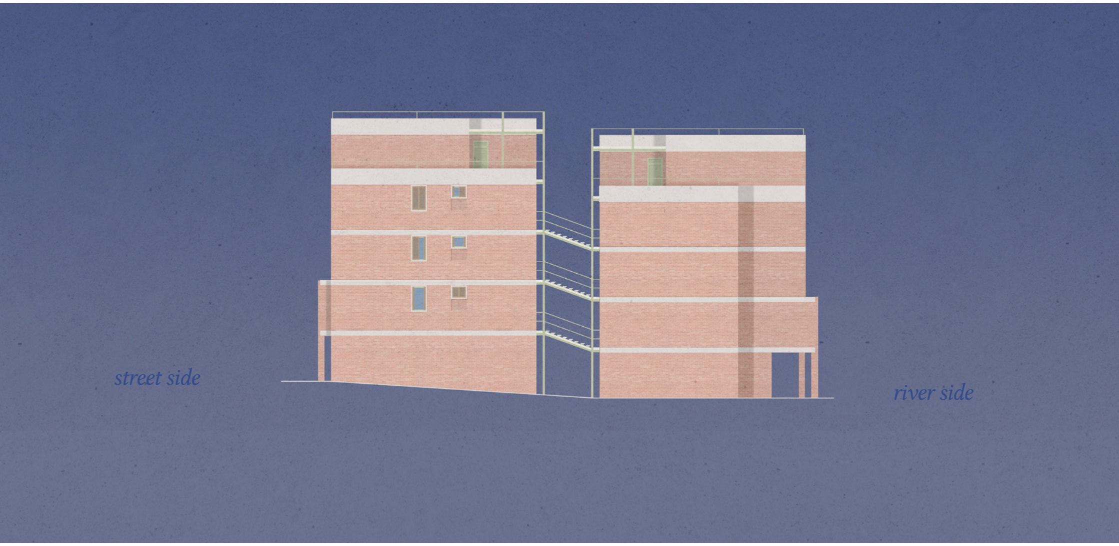
fourth floor
high income / rooftop

DESIGN I elevations

North
river side



West
alley



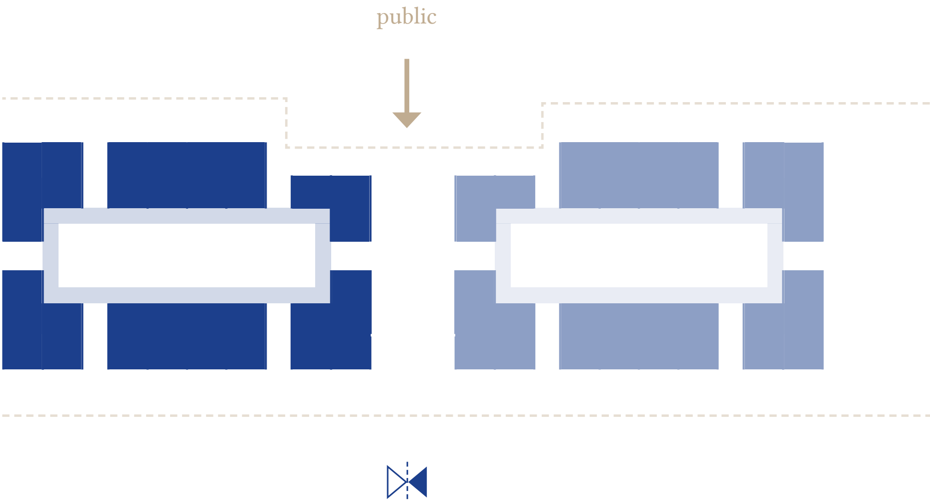
East
alley

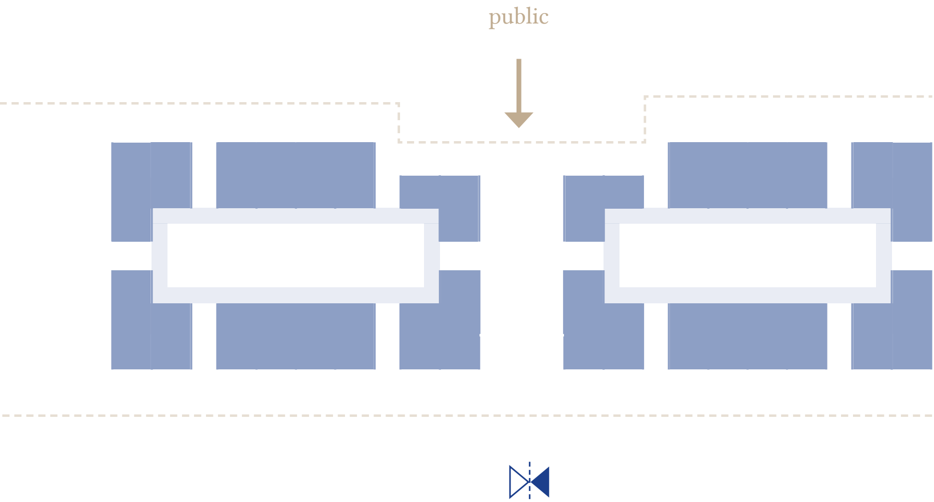
South
street side

design

MASTERPLAN

DESIGN I masterplan concept

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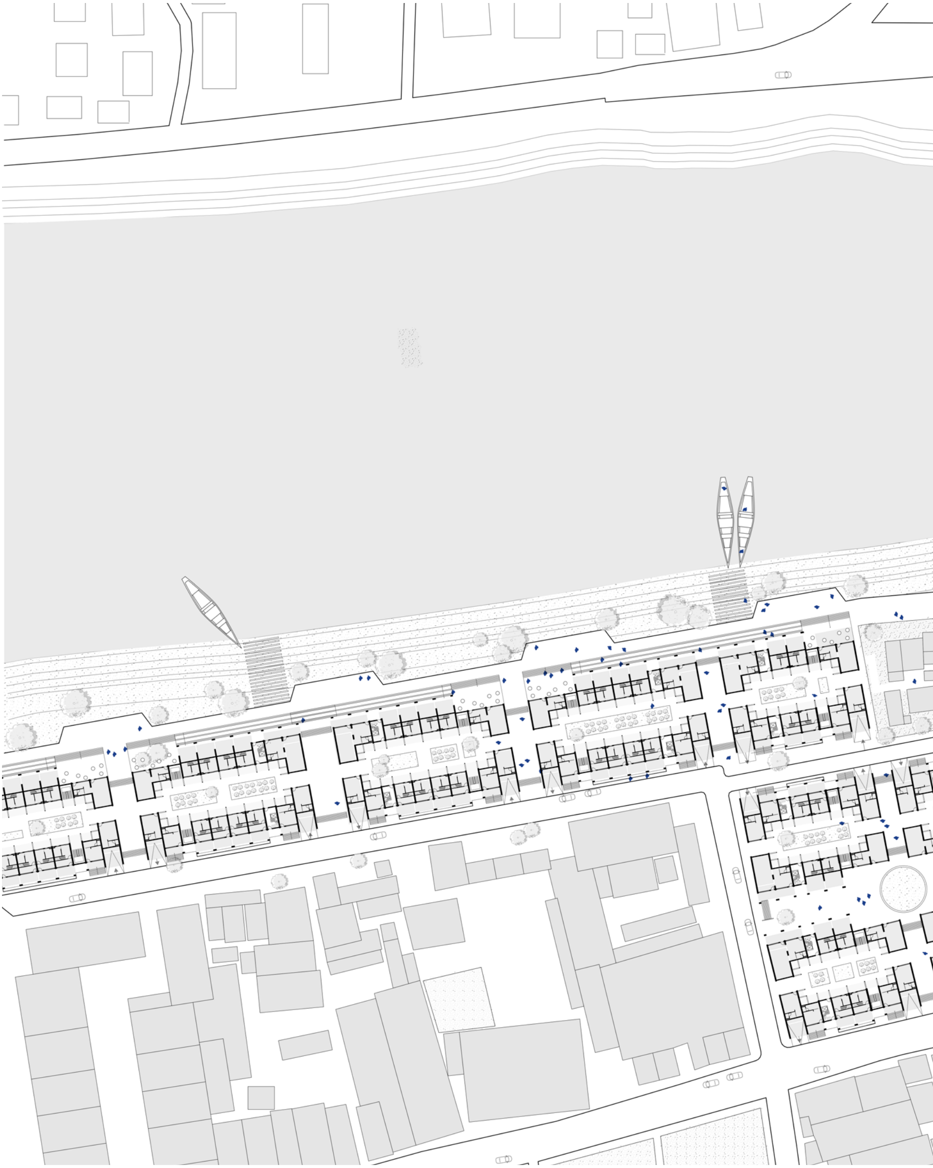
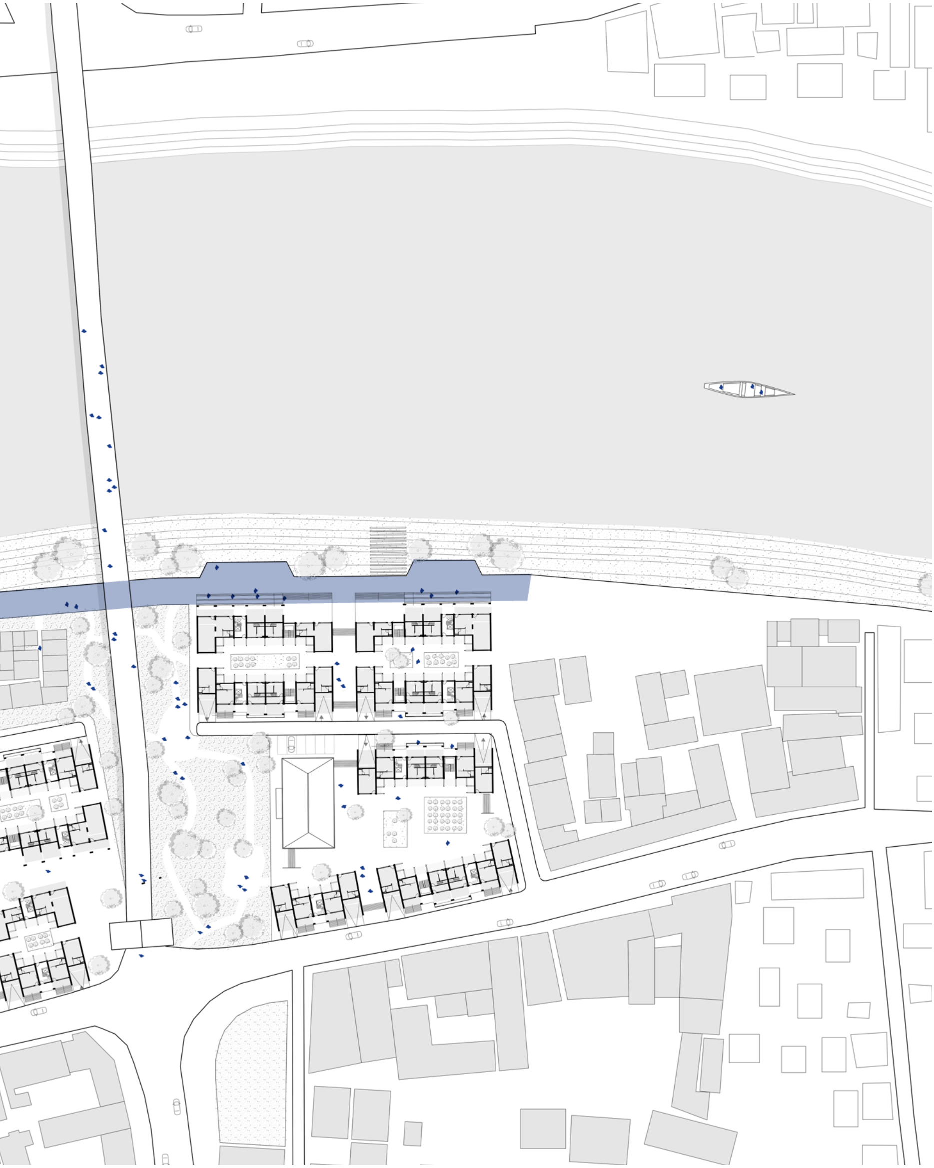
DESIGN I masterplan



scale 1:2000

Riverside promenade
Public



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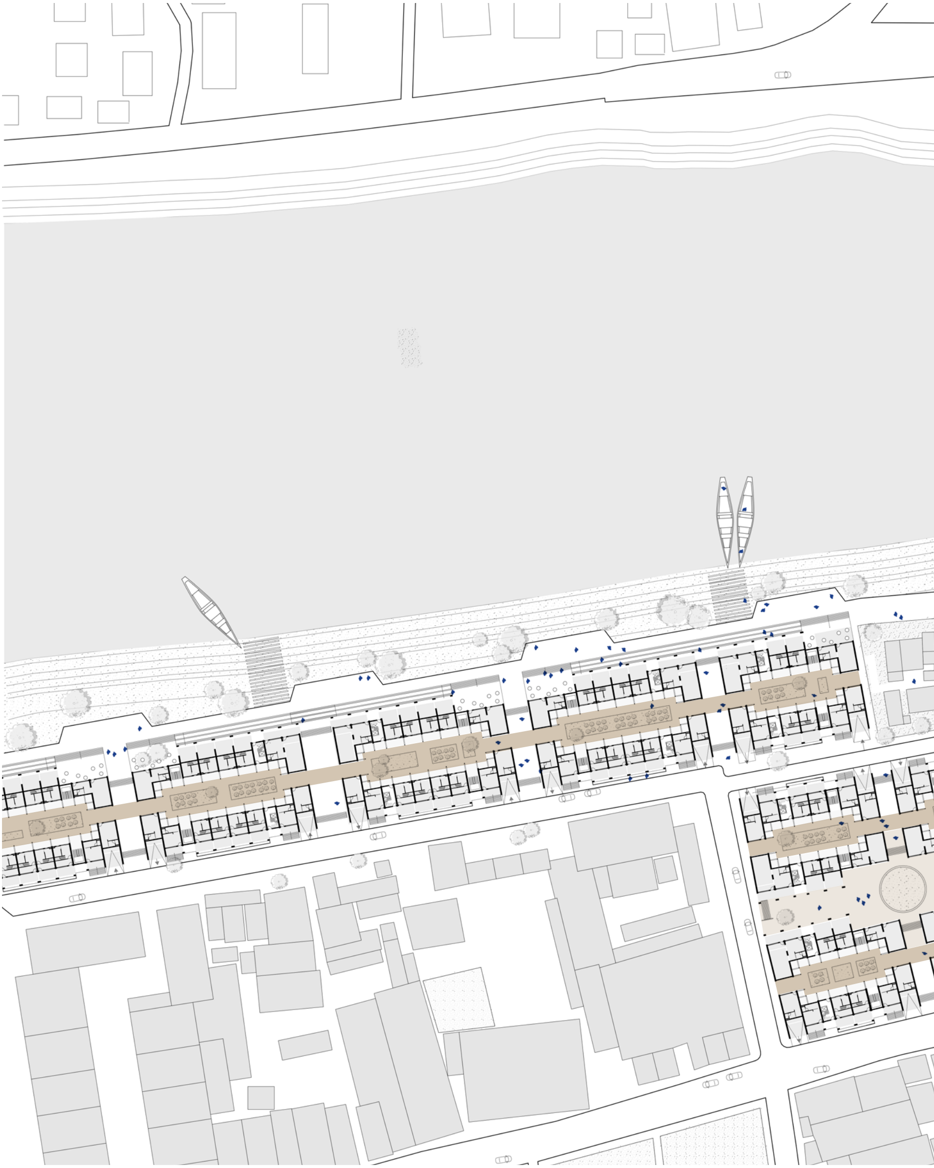
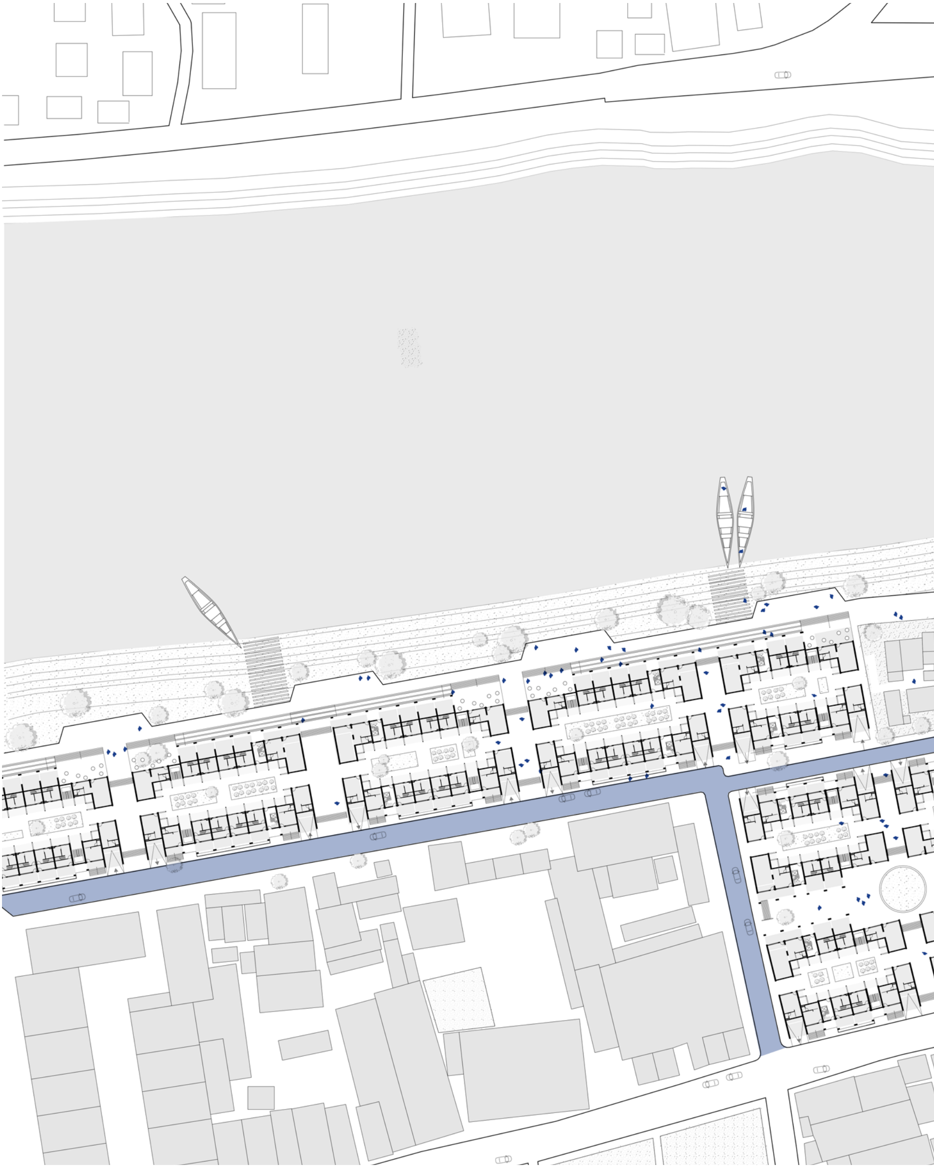
Riverside promenade
Public



Inner courtyard spine
Semi-public

scale 1:2000

Inner courtyard spine
Semi-public



New roads in masterplan
Public

scale 1:2000

DESIGN I masterplan section

The design consists of multiple layers of privacy, transitioning from public spaces such as streets and a riverside promenade, to semi-public areas like enclosed courtyards and a central square, and finally to more private spaces, including galleries and residential dwellings. The section below illustrates how these layers are interwoven throughout the masterplan.

scale 1:500

design

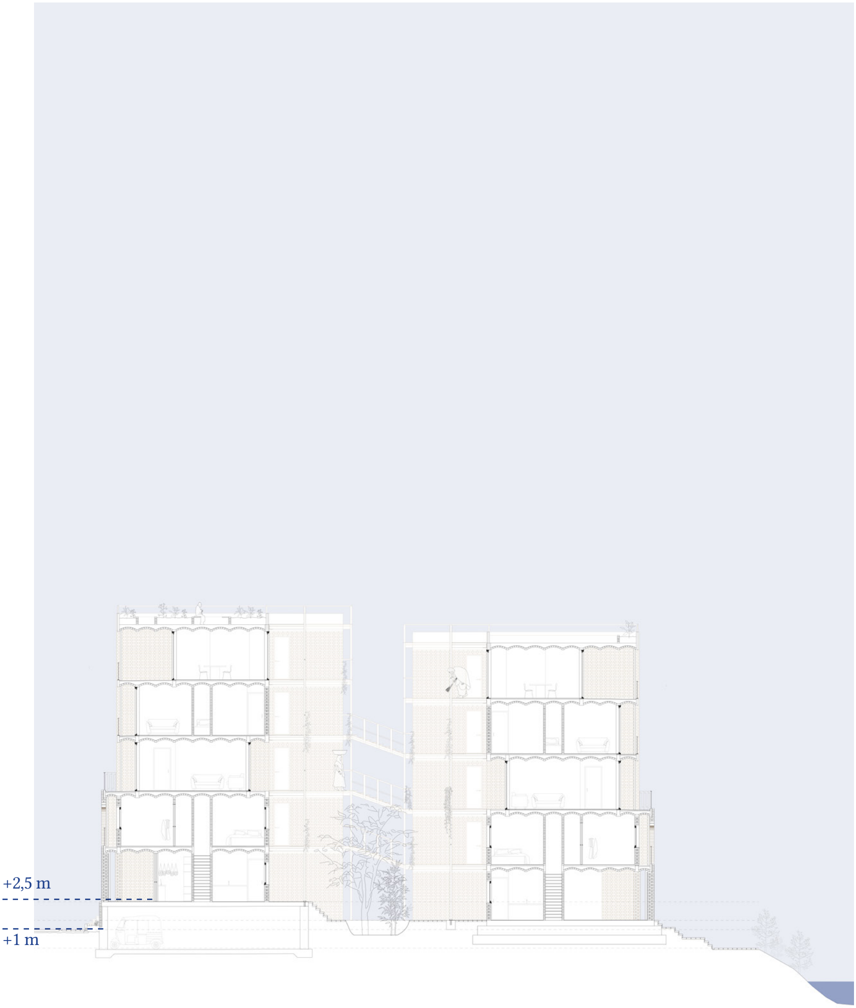
CLIMATE

Water management in masterplan

As part of the design's soft approach, the masterplan includes multiple lowered green areas that serve as water buffers and infiltration zones, allowing the monsoon water to seep into the ground and keeping it away from the dwellings. In this approach, water does not need to be blocked, but is instead given space within the landscape.

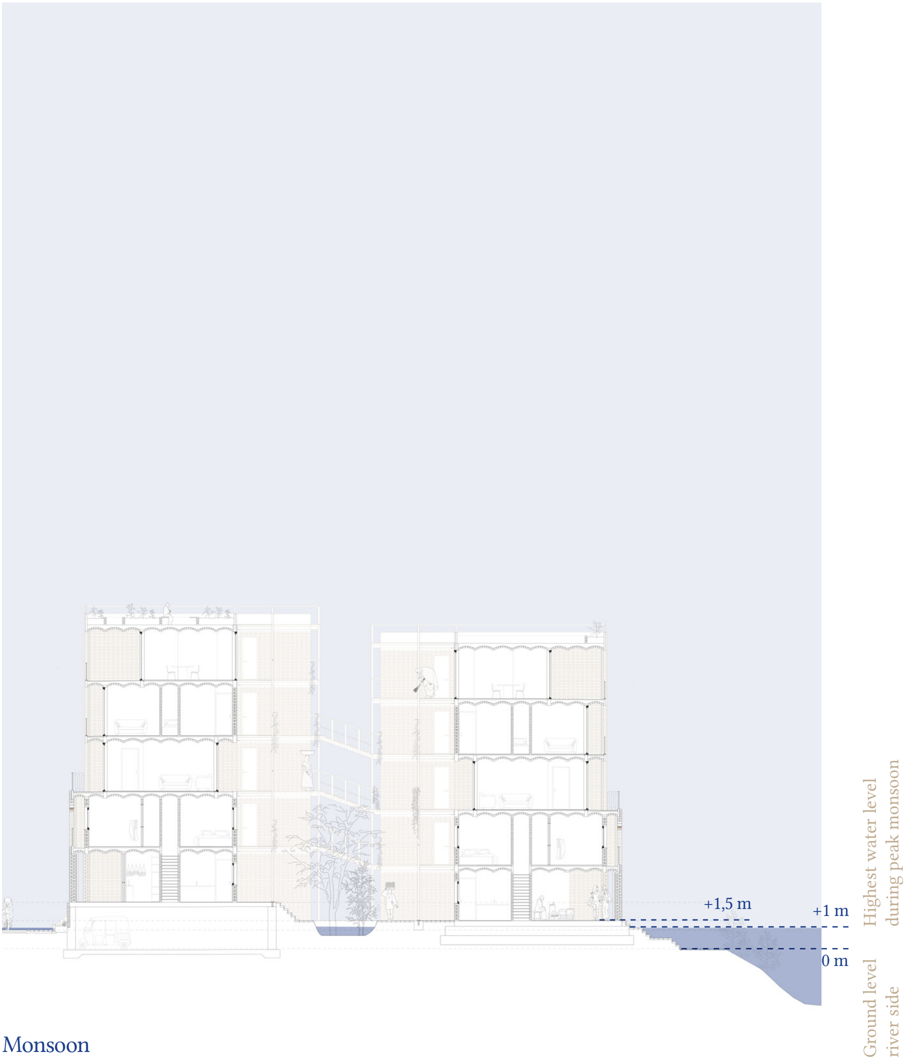
Flooding level

Both sides of the cluster are elevated 1,5 meters above ground level using the ‘dig and mound’ principle, in which the courtyard is lowered to allow water to collect and infiltrate into the soil.



Dry season

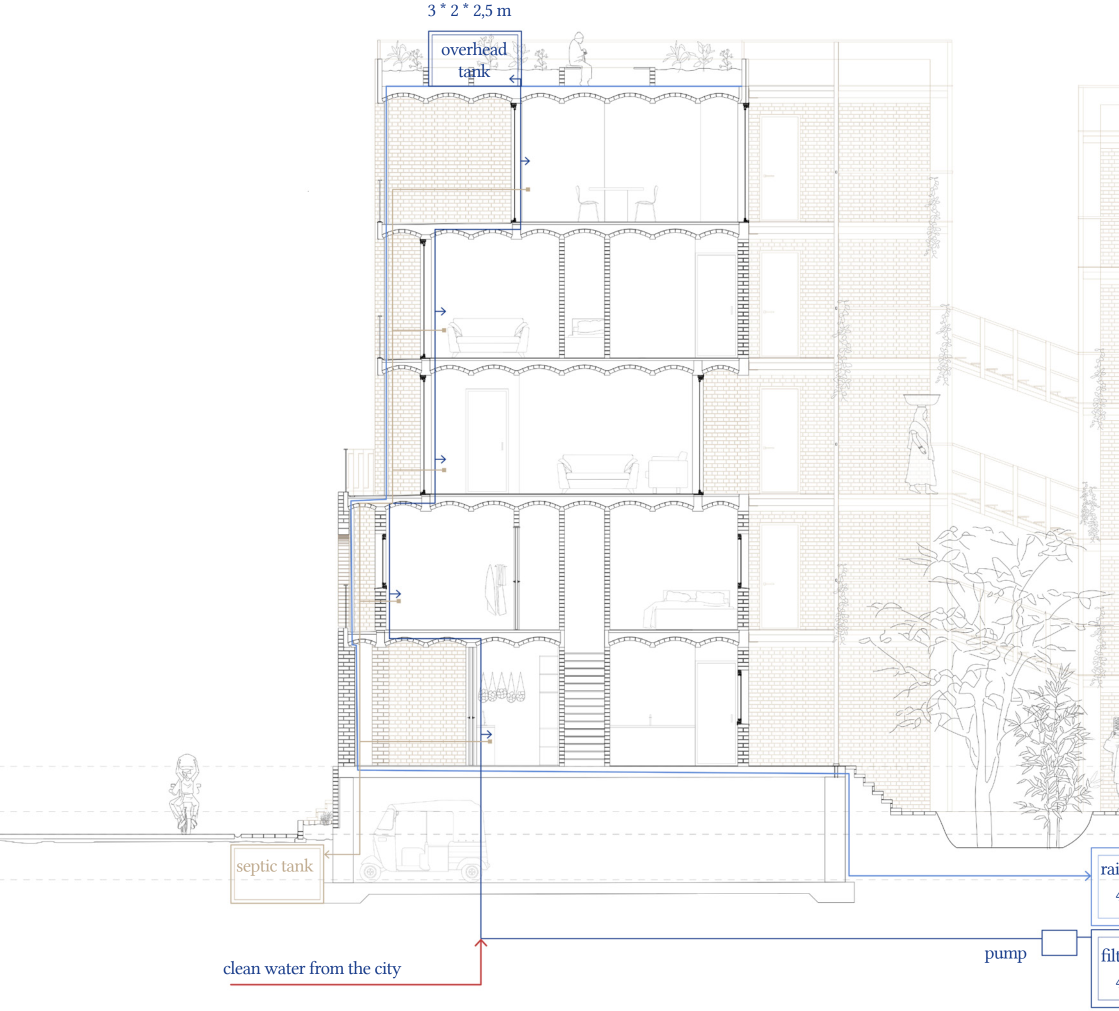
In principle, water levels will rise to a maximum of 0,8 up to 1 meter above ground level during the monsoon (as shown in the section below), which means the water remains 0,5 meters below the buildings. In addition, the ground floor primarily houses public functions, and the dwellings are maisonettes, meaning each unit includes a second living floor above ground level.



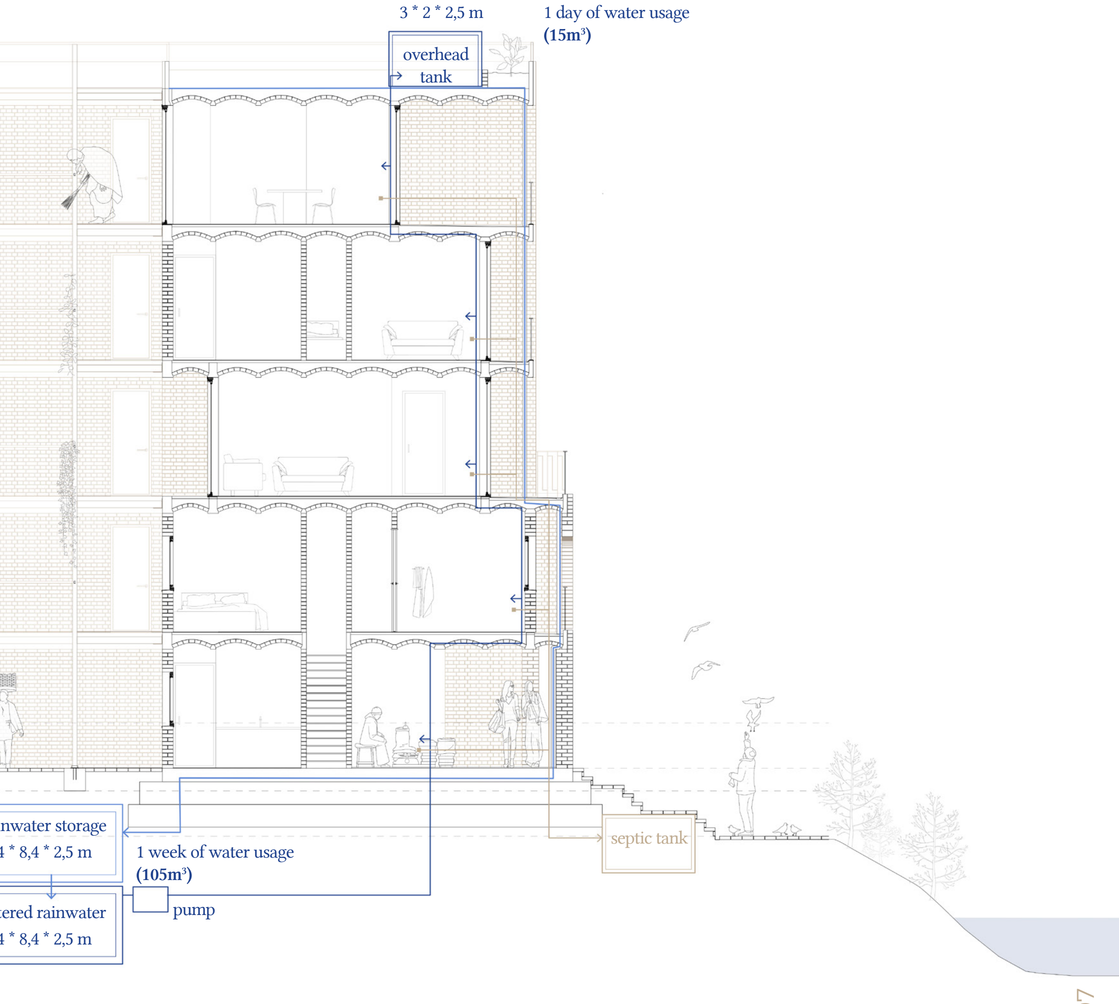
Monsoon

Water management in cluster

As there is lots of rainwater in Bangladesh, this rainwater will be collected to filter and use as non-drinkable tap water. As the water system is not always reliable, it is important to also be able to have a system that works separate from the city water system.



The design includes two underground water storage systems; one to store the rainwater (with a size that provides enough water to a cluster for 1 week of usage) and a treated rainwater tank (again to provide water to a cluster for 1 week). The treated rainwater is pumped once a day to the rooftop water storage, which provides the households with non-drinkable tap water from above. The capacity of this rooftop water storage is according to the daily usage of a cluster.



Water usage 1 person

150 liters per day person in Bangladesh living in formal housing, according to the Bangladesh National Building Code (Rahaman et al., 2024).
30 liters per person to flush the toilet.

Total of about **180 liters** water usage per person per day.

Amount of people per cluster (per four floors)

20 per corner (*3 = 60)

15 per small corner (*1 =15)

40 per four straight units (*2 = 80)

16 high income on the fifth floor

Total of **170 people** per cluster.

This means, a total of (170*30) **5.100 liters** of grey water could be used per day per cluster to flush the toilet.

Next to that, another (170*150) **25.500 liters** of clean water is needed per day per cluster.

Rainwater harvesting

The roof area is slightly sloped to harvest rainwater. As is also party consists of planters, the area to collect rainwater is around 350 m^2 per building, which is **700 m^2 per cluster** (with four straight units).

This will result in the following amount of rainwater that can be collected per month:

*Collected water (liters) = Rainfall (mm) (Weather and Climate, n.d.) * 700 m^2*

	Rainfall per month (mm)	*Average number of days with rain[2]*	*Rainwater collection per cluster per month (liters)*
January	13,2	1	9.240
February	62,2	1,9	43.540
March	203,4	5,2	142.380
April	534,1	10,9	373.870
May	705,4	14	493.780
June	858,9	17,5	601.230
July	799,7	18	559.790
August	640,6	16,7	448.420
September	506,3	12,1	354.410
October	214,9	6,2	150.430
November	31	1,8	21.700
December	14,3	0,5	10.010

As shown in the table below, Bangladesh experiences consistently high daytime temperatures throughout the year. Although night time temperatures drop slightly during the winter months, the overall climate remains warm, which means these climatic conditions are an important factor to take into account during the design process.

Temperature in Sylhet (Climate-Data.org, n.d.)

	Average temperature daytime (Celcius)	*Average temperature night time (Celcius)*
January	23.6	11.3
February	26.2	13.5
March	28.8	17.1
April	29.3	20.8
May	29.8	22.9
June	29.9	24.5
July	30.0	24.8
August	30.3	24.9
September	30.1	24.3
October	29.2	21.8
November	27.2	16.8
December	24.6	13.1

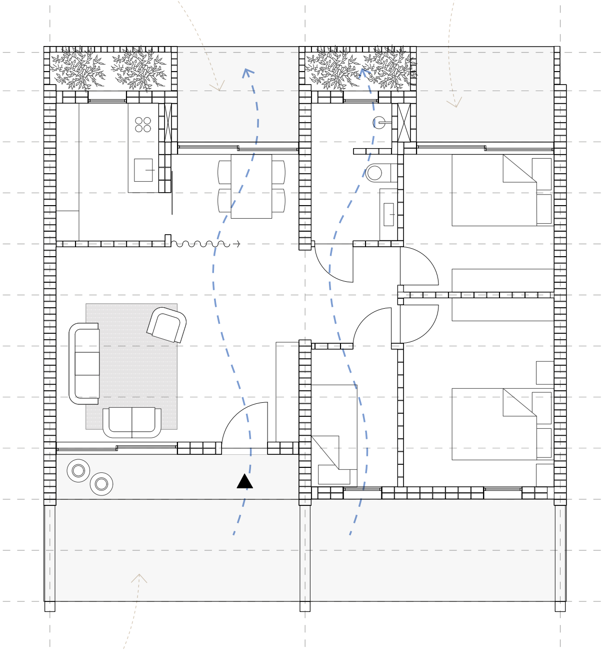
The units are designed with opposing door openings to facilitate natural cross-ventilation. Wind direction in Bangladesh varies by season: during the monsoon period (approximately April to October), winds predominantly come from the south, while in the dry season (November to February), they mainly come from the north (Weatherspark, n.d.).

Orientation toward the sun is also an important consideration. As the sun is lowest in the sky during the early morning and late afternoon, the east and west façades receive the most direct sunlight and therefore warm up the most. In response, the building and its units are designed with all major openings positioned on the north and south sides, aligning with both the seasonal wind patterns and solar exposure.

To protect the north- and south-facing windows from excessive solar gain, loggias have been incorporated, providing shade and passive cooling. This design feature is illustrated on the following page.

1000 mm logia for sun
and rain protection

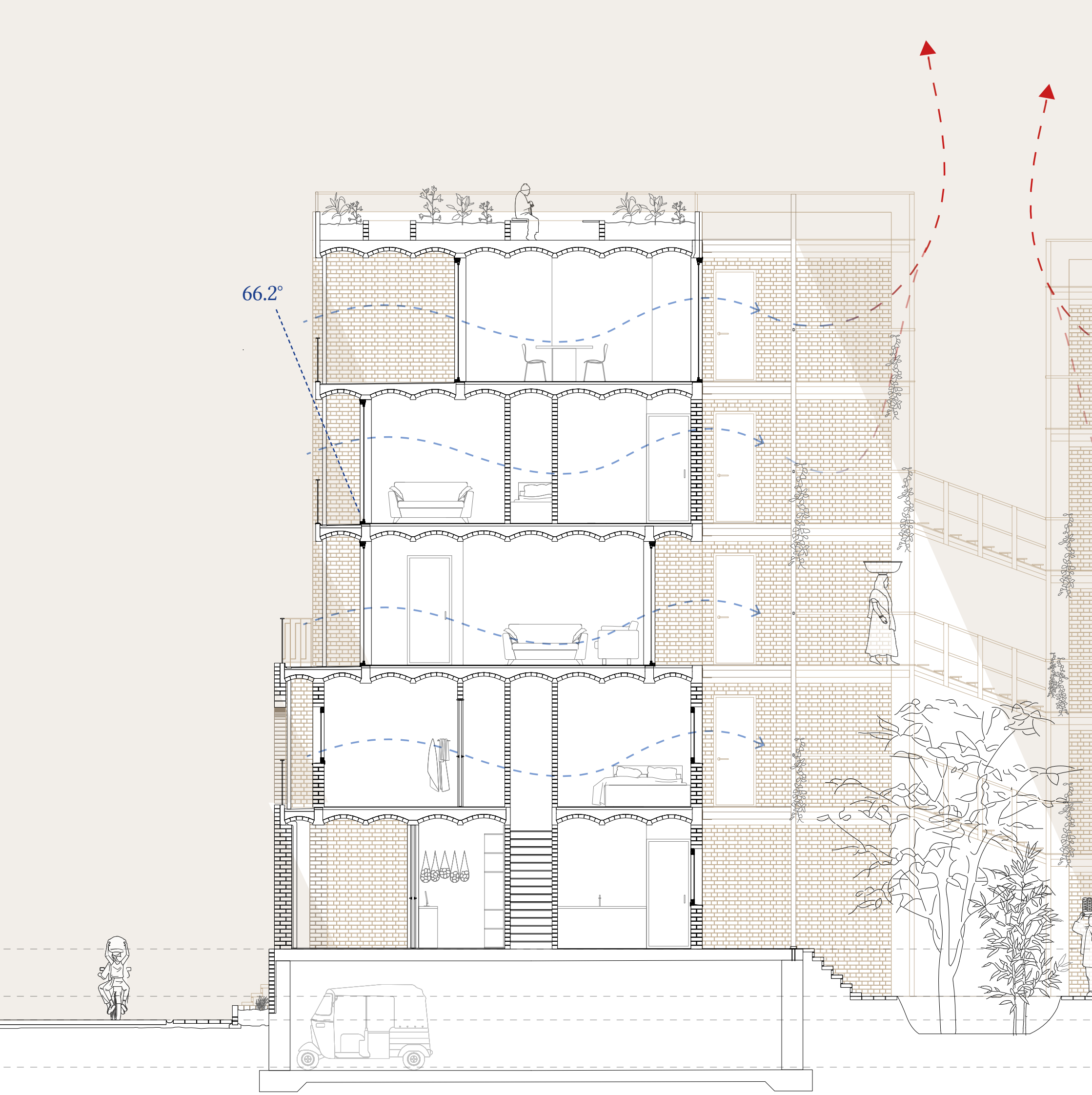
1000 mm logia for sun
and rain protection



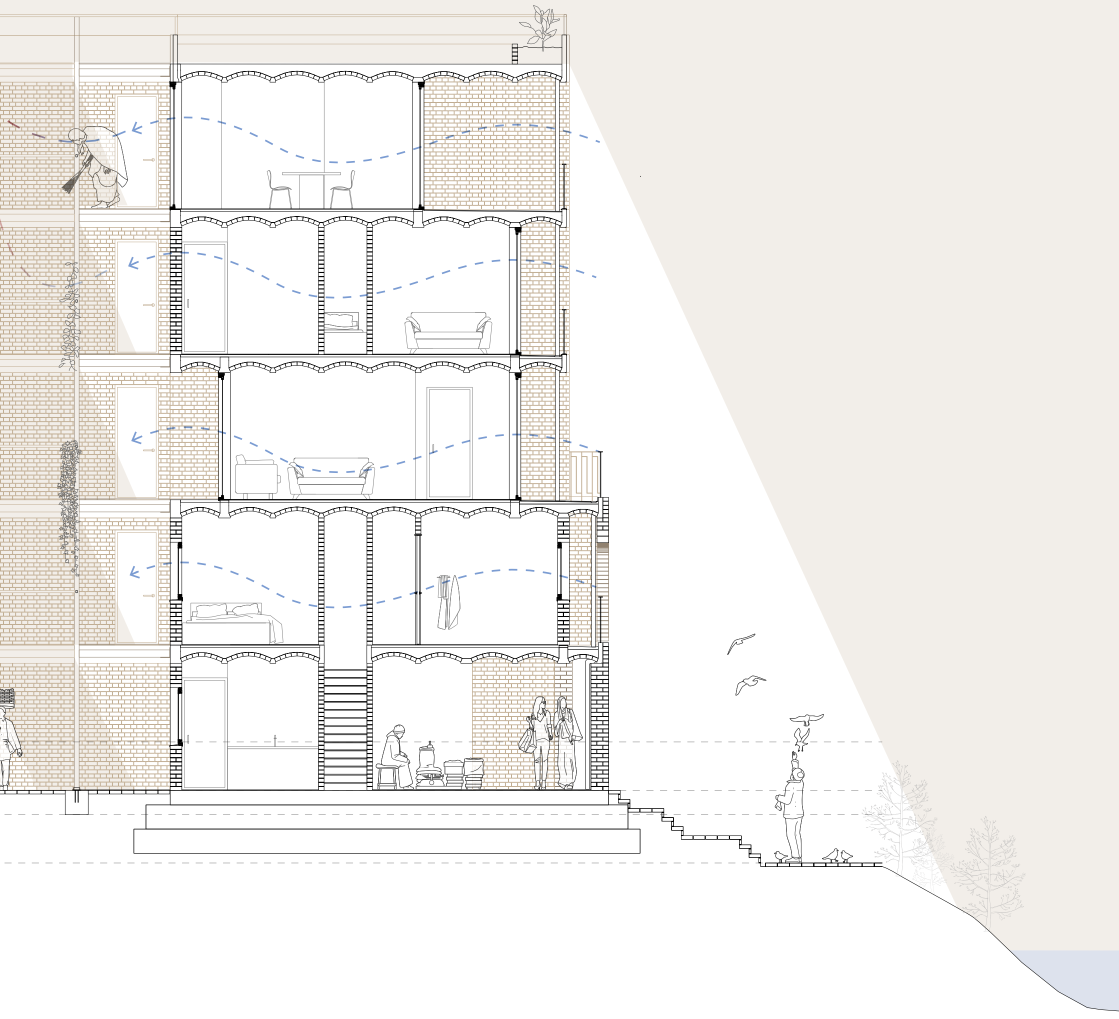
gallery towards courtyard also
protects the window openings

Example of how units are designed
to fit the Bangladesh climate

BUILDING TECHNOLOGY | climate



Sun angle
89.5° (summer)
75°–85° (monsoon)
41.2° (winter)
66.2° (spring)



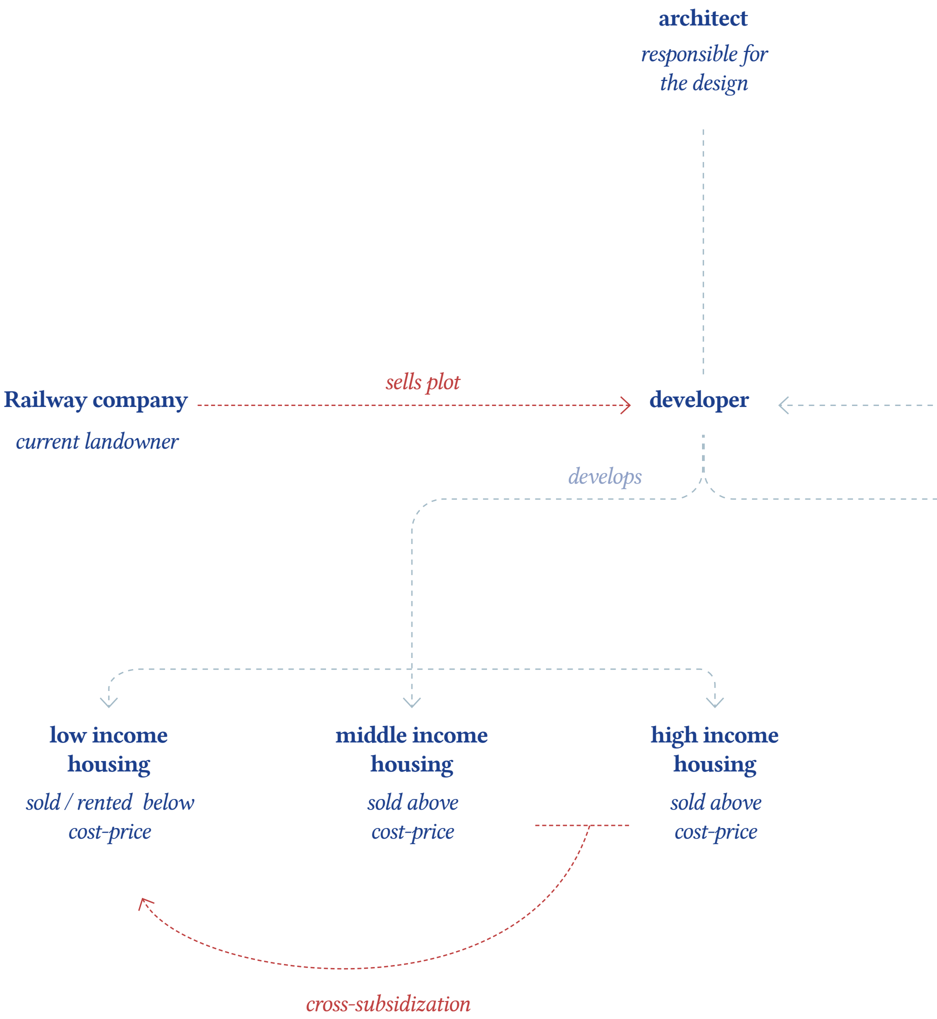
design

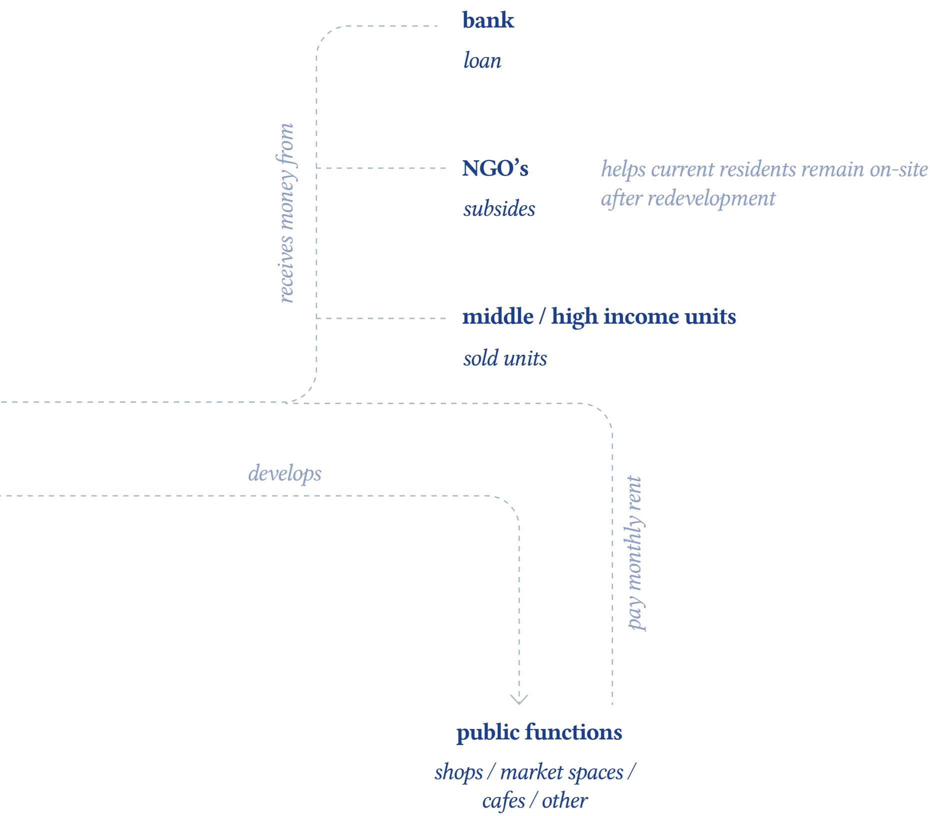
MANAGERIAL STRATEGY

MANAGERIAL STRATEGY I organization

The land on which the Keane Bridge community currently lives is owned by a railway company. In order to make the project feasible, the land must either be sold by the railway company or transferred through a strategy that allows the company to benefit from the project's future profits.

The managerial scheme below presents a suggestion for how the project could be implemented in a feasible and practical way.





Overview of the management strategy for project implementation (Author, 2025)

MANAGERIAL STRATEGY I project abacus

Existing
10.460 m² built area on 2,1 Ha
FSI = 0,5
GSI = 0,5

Proposal
44.732 m² on a site of 2,1 Ha
FSI = 2,1
GSI = 0,4
Dwelling / Ha = 170

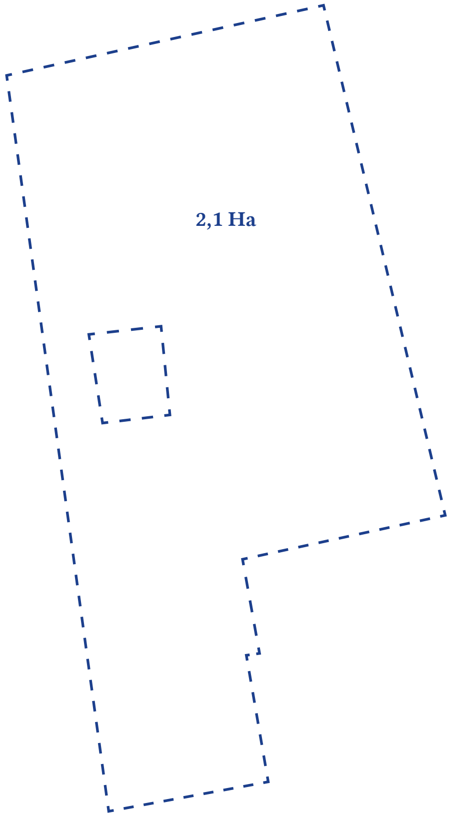
Dwelling types per cluster *(as shown in the floorplans)*

Income group	*Unit*	*Bedrooms*	*m²*	*Amount*
Low	Shop house	2	60	4
Low	Maisonette	2	50	4
Low	Apartment	1	30	9
Low	Apartment	3	50	12
Middle	Maisonette	2	65	2
Middle	Apartment	3	65	4
High	Apartment	3	80	2
High	Maisonette	5	140	2

Public functions per cluster

Amenities	*m²*	*amount*
Shop fronts	9	4
Market space	9	4
Shops	26	2
Cafes	52-70	2
Other	28	2
Parking	480	1

Other public functions
Recreational pedestrian street + sitting spots along river
Park


2,1 Ha

MANAGERIAL STRATEGY I building phases

As the land is currently still lived by people, and to make the project more feasible, it will be built in phases.

Phase 1
Start building where the least houses are located. School can be temporarily moved.

Phase 2
Redevelop informal settlement, residents can be relocated into the finished dwellings.

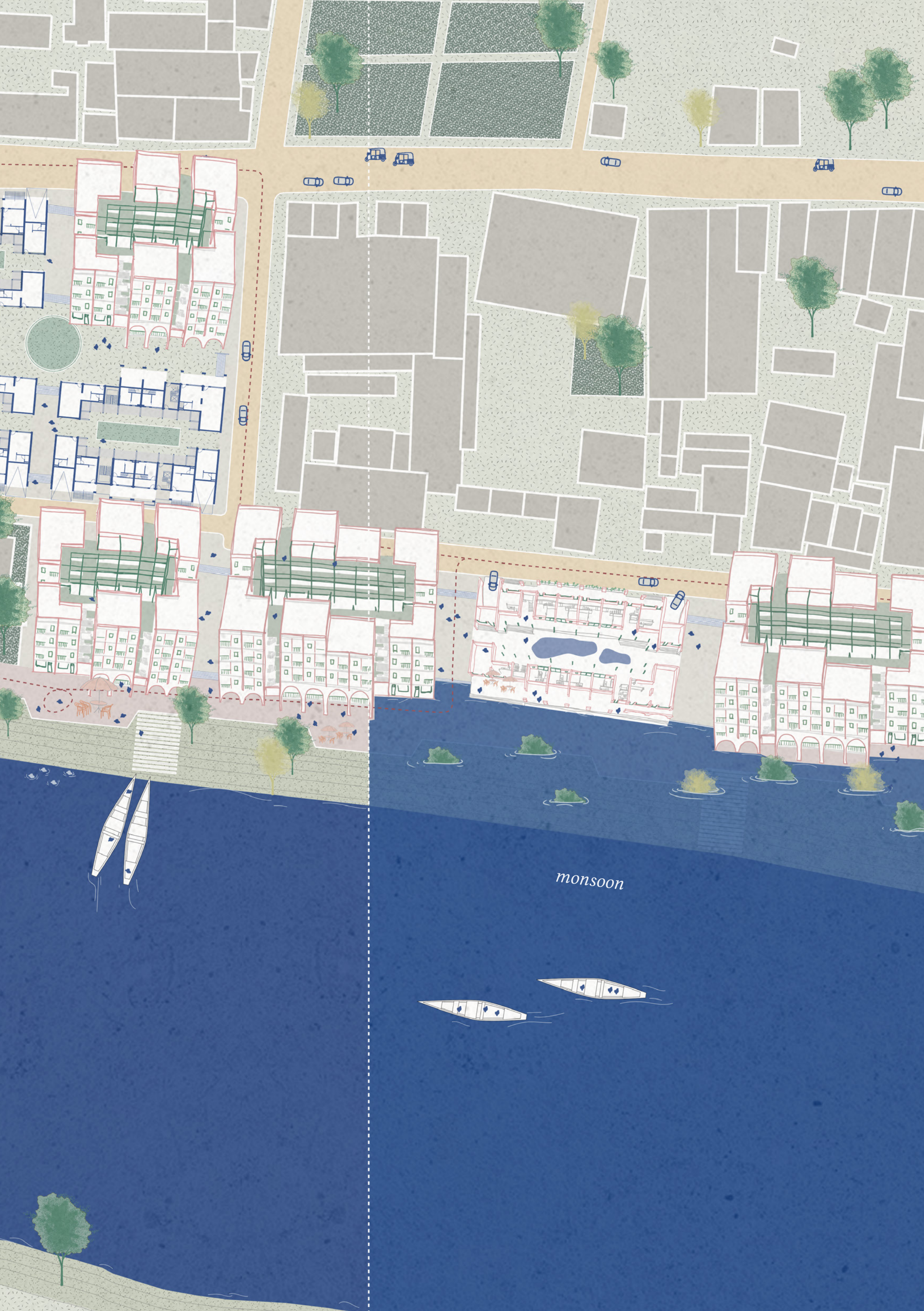
Phase 3

Redevelop right side of Keane Bridge. Wood workplace will be relocated outside the city.

Phase 4

Built public functions. School, park, riverside promenade.

SYNTHESIS


monsoon

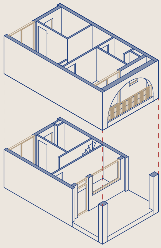
living** with the **monsoon

SOFT-APPROACH

This project builds on existing ways of living to propose a design that remains close to the lived reality of communities in Bangladesh. By incorporating courtyards, keeping the architecture grounded at the street level, and integrating context-specific elements into the floorplans, the design remains familiar and accessible.

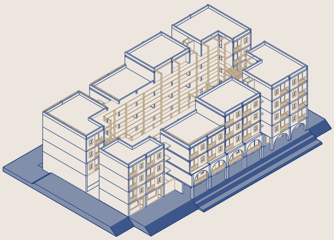
It reflects a 'soft approach' to the monsoon, acknowledging the presence of water every year. Rather than resisting it, the design embraces seasonal flooding and ensures that people can continue to live safely in their homes, without being displaced to the streets during these periods.

Dwelling



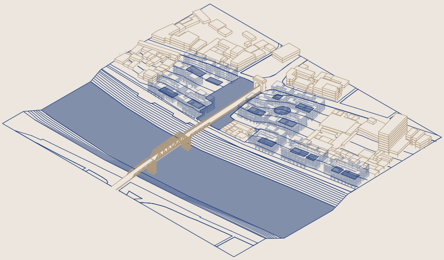
Most ground-floor units are public or maisonettes with a second floor, allowing residents to stay at home even in the rare case of flooding above the raised plinth.

Cluster



The cluster is elevated by 1,5 meters, keeping it safely above monsoon flood levels of 0,8 to 1,0 meters.

Masterplan



Lowered green zones act as buffers and infiltration areas, letting monsoon water seep into the ground instead of being going towards the buildings.

REFLECTION

What is the relation between your graduation project topic, your master track and your master programme (MSc AUBS)?

Over the past year, I took part in the Global Housing graduation studio, which focuses on housing as a global and complex challenge, especially in fast-growing urban areas in the Global South, along which Bangladesh. The studio looks at housing not just as a building task, but as something deeply connected to social, political, and environmental conditions. A central theme within the studio is the urgency to create better housing solutions, enhance living standards, and support more equal access to housing in rapidly urbanizing regions of the world. Bangladesh, with its combination of rapid urban growth and high vulnerability to climate change, particularly flooding, formed the starting point for my graduation project. These conditions raise questions about how cities can grow in a way that remains liveable, inclusive, and resilient, especially for communities living in exposed and informal areas. The aim of this project is to redesign the riverbank next to Keane Bridge, Sylhet, by integrating local knowledge, habits and materials to design a flood resilient community, using housing as a catalyst.

The Global Housing studio works across three scales: the unit, the cluster, and the masterplan, all of which are strongly interconnected. Before starting the studio, I didn't fully realise how important the relationship between these scales would be, or how much it would shape the design process. While the structure of the studio allowed for a step-by-step approach, starting with the unit, then the cluster, and finally placing it within a larger urban context, the reality of designing showed that each step required constant reflection on the others. Every decision made on one scale had consequences on the others, which meant going back and forth throughout the process. In the end, this led to many iterations, not just in floor plan designs, but also in how the clusters were organised and how they fit into the urban fabric. This process shows that although I'm graduating within the Architecture track, designing in this context required thinking across all these scales at once. The spatial layout of a unit affects how a cluster functions socially, just as the placement and organisation of clusters shape the rhythm and resilience of the wider neighbourhood, which also strongly connects to Urbanism.

How do you assess the value of your way of working (your approach, your used methods, used methodology)?

In September, we started the studio by diving into literature and conducting online research to better understand the context of Bangladesh and its housing situation. One of the issues that stood out to me the most was the recurring flooding and its impact on people's living conditions. As a result, my research plan focused primarily on this topic.

Initially, the idea was to visit Bangladesh in October, which would have allowed us to gather first-hand insights early on and refine our research accordingly. However, due to political unrest, the trip was postponed until December. This delay challenged our ability to understand the context directly and raised a key question for me:

How can we, as architects, design in a context that we are unfamiliar with and have only experienced for a short period (in our case, just three weeks)? This question is particularly relevant when it comes to housing design, where it is important to have a deep understanding of the everyday lives, habits, and social dynamics of the people for whom we are designing. Housing goes beyond providing shelter, it reflects and supports how people live their daily lives.

My approach, therefore, was to begin by learning from how people currently live: how they build their homes, inhabit space, form communities, and cope with challenges like seasonal flooding. Rather than applying external ideas, I aimed to build on these existing practices and reinterpret them in a way that could accommodate higher density while staying aligned with local ways of living. This involved observing and mapping everyday routines, spatial layouts, and social structures, using these insights as the foundation for the design process. In doing so, I aimed to create a context-sensitive proposal that supported rather than replaced existing lifestyles.

Beforehand, I expected to create a design that would avoid the need to migrate to the city and preserve rural ways of living in a scaled-up design. However, after visiting Bangladesh, I came to understand that migration to the city is often inevitable, as people from rural areas still require income sources during the flood season. When we visited potential project sites, one stood out in particular: the Keane Bridge area. This is a location where people live on a small scale while facing the direct effects of flooding. Due to ongoing urbanization and its central position within the city, this site asks for a higher-density intervention. At the same time, the way of living that already exists needed to be respected.

This also affected the research plan I had prepared beforehand. Initially, the focus was on how people deal with regular monsoon floods and identifying where these strategies fall short during more destructive floods. But since the design site turned out to be in an urban context, that approach did not fully apply. I adjusted the research to better fit the site, using the same underlying principles I had developed earlier, but without the specific comparison between regular and extreme flooding.

Although this wasn't a location or type of project I had initially envisioned working on, it aligned well with my approach and methodology. The Keane Bridge site is a riverside location in the city that floods annually, where I could translate local lifestyles into a higher-density, flood-resilient design that aligned with the human scale and supports the continuity of daily life.

REFLECTION

How did your research influence your design/recommendations and how did the design/recommendations influence your research?

As written above, the main aim of the project was to design housing that fits with people's way of living while also being flood-resilient. The research formed the starting point for the design and directly shaped many of its elements. For example, insights from the research were translated into the floorplans: how kitchens are always placed in a separate space, how both kitchens and bathrooms are positioned along the façade, and how living and dining areas are separated to allow for receiving guests without mixing with the private, female side of the household.

The overall housing typology was also based on research findings; the small scale of living, the importance of courtyards, and the fact that people live mostly on the ground floor outside, the courtyard as an extra living room (which is also why the buildings aren't too tall). Small shopfronts along the street were included for the same reason. In that sense, the design was constantly shaped by the research.

The influence also worked the other way around. At one point, I got stuck in the masterplan phase, trying to bring everything together, and Rohan recommended looking at case studies such as the Asian Games Village and Dar Lamane housing. These helped clarify certain ideas I was already trying to work out in the design. This shows that the research was not just something done at the beginning, but part of an ongoing back-and-forth with the design.

Inspired by Anna Heringer, who sees architecture as a tool to support local economies, empower communities, and celebrate cultural identity through materials and building techniques, I started thinking about how to work with locally available resources. Her idea that "money should go to the people, not to cement" shaped my strategy: use as many local materials as possible, so the investment benefits local workers and systems. This led to a structure based on load-bearing brick, avoiding the need for concrete in the main construction. The building remains mid-rise, but grounded in a construction method that is common and manageable within the local context.

For a long time, the gallery structure was designed in bamboo, also a local material, but especially in an urban context, the feedback sessions made me realise that material choice should also be appropriate in urban context. In the final weeks, based on input from Rohan, Marina and Rocio, the decision was made to switch to steel. While not a local material in the same sense, steel in Bangladesh is often sourced from recycled material, particularly through the shipbreaking industry, and has a long lifespan, which makes it a responsible choice within this context.

This is just one example of how the weekly feedback sessions helped move the project forward. Both Rohan and Rocio brought experience from working in the

Global South, and were able to ask the right questions at the right time. Marina's feedback was especially valuable in the final phase, as she has a deep understanding of designing and building in the Bangladeshi context. Her input always came a week or so before the main presentations, giving me the chance to adjust things just in time. These moments of feedback and revision are documented in the 'design process' chapter of the graduation report booklet.

How to design in a context that is so different from what we know and are used to? - Rural life on a char close to Dhaka (Author, 2024)

How do you assess the academic and societal value, scope and implication of your graduation project, including ethical aspects?

I believe the value of this project lies in how it connects local, everyday realities to larger spatial and environmental systems. The project adds academic value by showing how housing design can operate across different scales while responding to real-life conditions such as flooding, informality, and urban growth. It explores how context-based design can support both spatial and social structures, and how housing can act as a catalyst within a larger urban system. The design process also reflects on how architectural systems can be developed from local ways of living, rather than imposed from the outside, which adds to ongoing academic conversations around housing in the Global South.

REFLECTION

From a societal perspective, the project proposes a way of living that builds on what is already there, culturally, socially, and physically, instead of replacing it. It offers a spatial alternative to forced relocation by showing how higher-density housing can be built in flood-prone areas, while still respecting the way people already live. By using local materials and responding to local building knowledge, it also supports economic and social resilience. Ethically, the project is about working with a context, not just in it. It recognises that people have their own systems, spatial, social, and economic, and that good housing design should support these, rather than overwrite them.

How do you assess the value of the transferability of your project results?

My design approach usually starts with its direct relation to its environment and the specific characteristics of the site. I believe in context-based architecture, which means that this project, in its exact form, is not something that can simply be copied and placed elsewhere. That said, I do think the approach behind it is transferable: starting from what already exists in the surroundings, understanding what is needed, and designing in a way that adds something meaningful to the public realm. The way a building is designed plays a key role in shaping the urban layout and defines how the public space works, and how people interact with it.

The project shows how housing can be designed in an unfamiliar context by learning from how people live and what spatial qualities support that. It also explores how buildings relate to one another on an urban scale; creating a clear public zone along the river, a more semi-private inner spine connecting the courtyards, and a public street edge on the other side.

The housing is designed for a monsoon-affected area, so it also shows how to design buildings that remain liveable during the rainy season, for example by raising the ground level, avoiding residential units on the ground floor, and placing public functions and maisonettes instead. It also includes strategies for collecting and using rainwater. These elements aren't one-size-fits-all solutions, but they offer useful ideas for working in similar climates or flood-prone contexts.

The outside of Geneva camp, Dhaka, showing the result of rapid urbanization. (Autor, 2024)

Small public streets with shop fronts in Geneva Camp, Dhaka. (Autor, 2024)

REFLECTION

What have you learned from this project?

One of the main things I've learned from this project, apart from designing in a context you're not familiar with (which brings certain challenges, like not fully understanding the local dynamics or cultural references but it also shaped my entire approach: learning from what's already there and designing from observation, rather than assumptions), is the role of systems in housing design. In most of my previous projects, I focused on developing a unique solution for a specific site or problem, often on a smaller scale. But in the context of affordable housing, especially in a fast-growing city, it's not just about designing one house, it's about thinking in systems that can work across a larger area. This meant moving away from one-off solutions and thinking in systems that could be applied more widely.

I also learned a lot about how I design. Because this project was larger in scale than what I had previously worked on before, it also asked for a different design process. Normally, I tend to find one strong concept early on, often based on a key insight from the (site) research and apply this to guide the whole design. I tried to do that here too, with the idea of 'living with the floods', but I quickly realised that it didn't provide enough concrete input to start for example designing housing layouts right away.

I also tend to want things to be right from the start, which means I often try to solve everything in my head or in rough conceptual sketches before actually working it out properly. In this process, I realised that larger systems can't really be solved all at once. It's more a matter of starting somewhere, improving as you go, moving to the next scale, and then adjusting the smaller scale again based on that. That back-and-forth, between unit, cluster, and masterplan, helped me make progress much faster than when I was trying to figure everything out upfront.

How will you use the final weeks of the graduation period?

In the weeks following the P4 presentation, I want to focus on creating visuals that help tell the story of the project. The 'technical' parts (the construction, floor plans, masterplan) are finished, but the way people will actually live here, and how the design supports that, could be communicated more clearly.

Through a detailed section model over a full cluster that brings together the architecture and landscape, including the height differences on the site, the courtyard, and the overall atmosphere, I want to show how the design works on a human level. I also want to make a series of detailed sketches or collage-style renders to communicate how different spaces in the project are experienced. Finally, I plan to make one large synthesis drawing or visual that brings everything together, the full story and the spatial system in one overview.

Small scale, high density living in Dhaka. (Autor, 2024)

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All drawings and photographs were created by the author, unless otherwise stated.

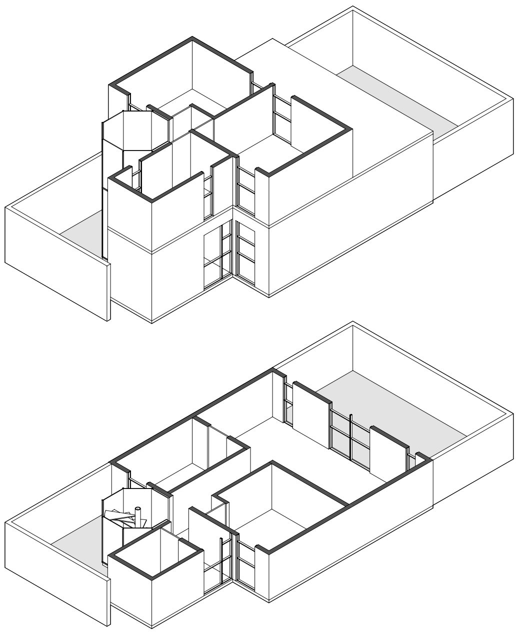
OTHER | Previ Lima case study

PREVI, in Lima, Peru, was analysed as a first case study on affordable housing around the world.

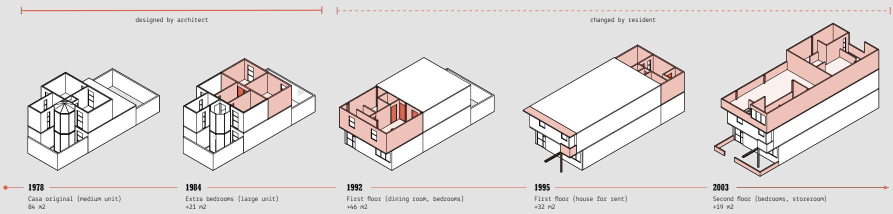
PREVI (Proyecto Experimental de Vivienda) was developed in response to Peru's rapid urbanisation in the 1960s, driven by large-scale rural-to-urban migration. As rural areas could no longer support growing populations, many migrated to cities like Lima in search of better opportunities. Peter Land, the conceptual architect behind PREVI, proposed a model of low-rise, high-density housing as an alternative to sprawling slums or vertical high-rises common in developing countries.

PREVI was a prototype for socially and environmentally sustainable housing tailored to low-income families. Unlike high-rise apartments in cities like Hong Kong or Singapore, its design focused on incremental growth and flexibility, allowing families to expand their homes gradually (horizontally or vertically) over time. This approach encouraged personalisation and cultural expression, offering a more adaptable model of urban housing.

Though PREVI never became the large-scale model it aimed to be, it remains a key experiment in alternative urbanism. Informal expansions by residents gave the neighbourhood a distinct identity, and the project continues to inspire discussions around affordability, resilience, and participatory design in social housing.



Axo of a PREVI unit by Jacques Crousse, Federico, Páez, Ricardo Pérez León (Author, 2024)

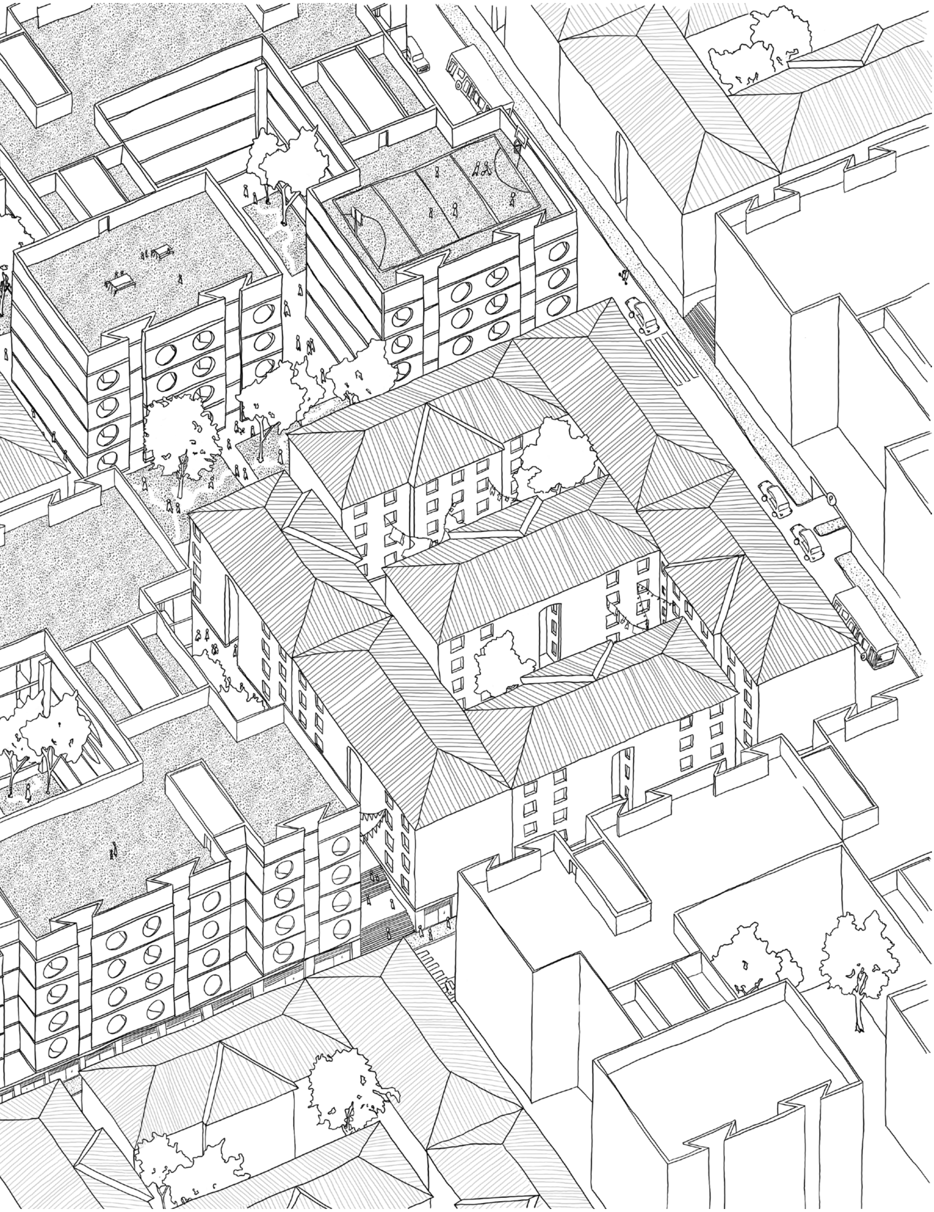

designed by architect
changed by resident
1978
Casa original (medium unit)
84 m2
1984
Extra bedrooms (large unit)
+21 m2
1992
First floor (dining room, bedrooms)
+46 m2
1995
First floor (house for rent)
+32 m2
2003
Second floor (bedrooms, storeroom)
+19 m2


1978
Medium unit

OTHER | pilot project

Before visiting Bangladesh and starting the actual design, a pilot project was designed to get familiar with density at a given FSI and maximum building height.

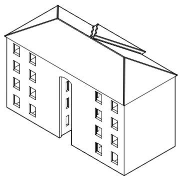
For this challenge, a maximum building height of 5 was allowed, while reaching an FSI of 3,0.



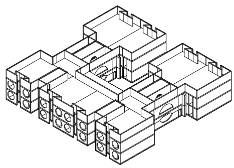
Synthesis of pilot project density challenge (Author, 2024)

OTHER I pilot project

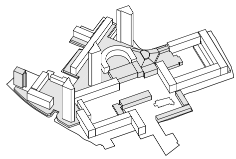
The pilot project is designed based on the following references, which were analysed as case studies at the start of this graduation studio.



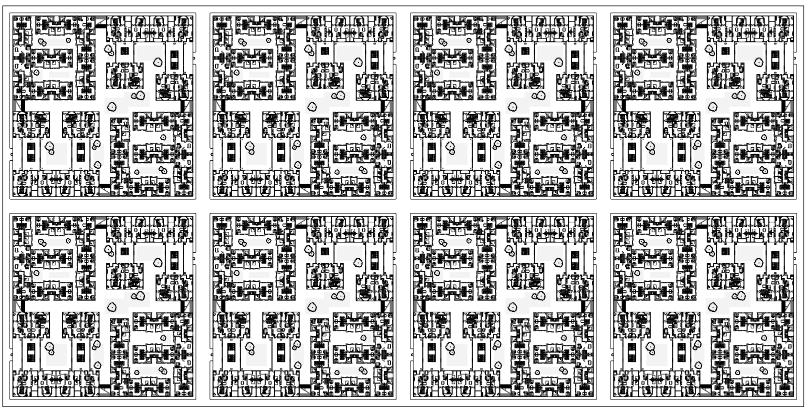
Peabody Square
Henry Darbishire
London, UK
1871
FSI 2,06



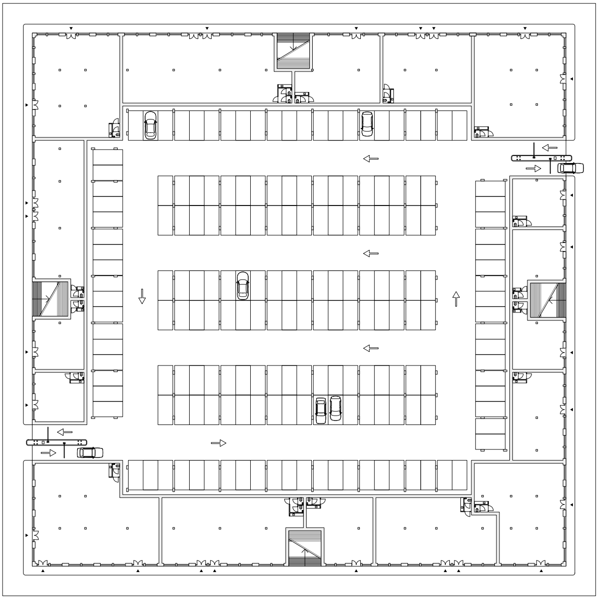
National Assembly
Louis I. Kahn
Dhaka, Bangladesh
1962-1983
FSI 0,39



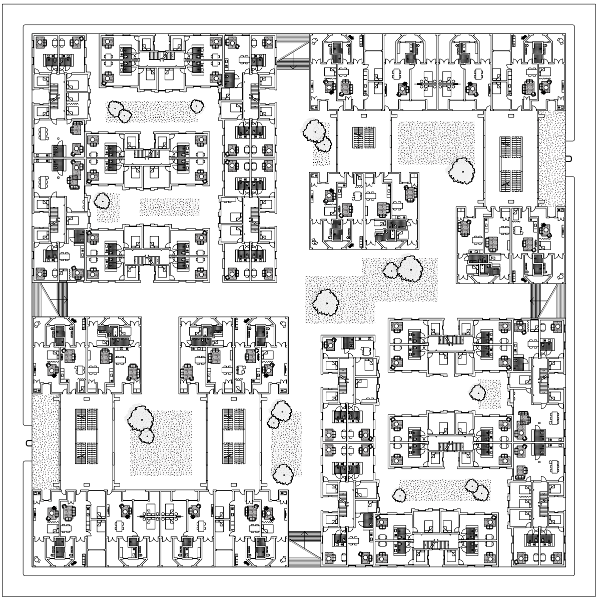
Barbican
Chamberlin Powell & Bon
London, UK
1976
FSI 2,30



Urban fragment (replicability)



Ground floor plan



Typical floor plan