



Graduation report: research & design
Graduation Studio Dwelling: Global Housing 2024
Architecture of Transition in the Bangladesh Delta
AR3AD105

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Introduction



This research plan focuses on the livelihood of rural-urban households living in the urban poor settlements of Bangladesh. Livelihood is the strategies for migrants to sustain their lives and well-being through financial and economic factors. Examples in this area are the available job opportunities, housing situation, and the cost of living for migrants and their households. Due to urbanization, cities are overcrowded, and residents and new additional migrants commonly end up living in informal settlements. The search for a better life leads to mass migration from rural to urban areas and is currently a common trend in Bangladesh. A self-held interview with a rural household, located in the Haors of Bangladesh, made clear that the main reason for migrants to move from rural to urban areas is to seek a better livelihood and better job oppertunities. The research plan aims to understand the impacts of urbanization on households' livelihood and who end up living in urban poor settlements (informal settlements) of Bangladesh. By analyzing several topics regarding livelihood, generating income, and spatial equality, this research plan and final redevelopment design hope to understand the possibility for improvement of livelihood. The final aim is to use these new found understandings to make an integral and new spatial urban design for the current low-income households of the Sweepers' Colony and the new residents of all income types.

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Background




BANGLADESH


Sylhet City
Dhaka



Image 1: Bangladesh, a deltaic country *(Google Earth, 2024)*

Bangladesh is located the heart of South Asia, is a land of captivating contrasts and a rich cultural heritage. Its landscape is dominated by the sprawling delta formed by the confluence of the Ganges, Brahmaputra, and Meghna rivers, giving rise to a unique and intricate network of waterways. This deltaic character not only shapes the country's geography but also plays a crucial role in its socio-economic fabric, influencing everything from agriculture to transportation.[1]

The fertile delta soil, nourished by sediment deposits from rivers, sustains vital agricultural activities, providing **livelihoods** for millions and contributing significantly to the economy. Rivers serve as the primary water source for irrigation, drinking, and domestic use, essential for livelihoods and industrial development. Effective **delta management**, including flood control measures, is crucial for mitigating seasonal flooding and protecting lives and property.

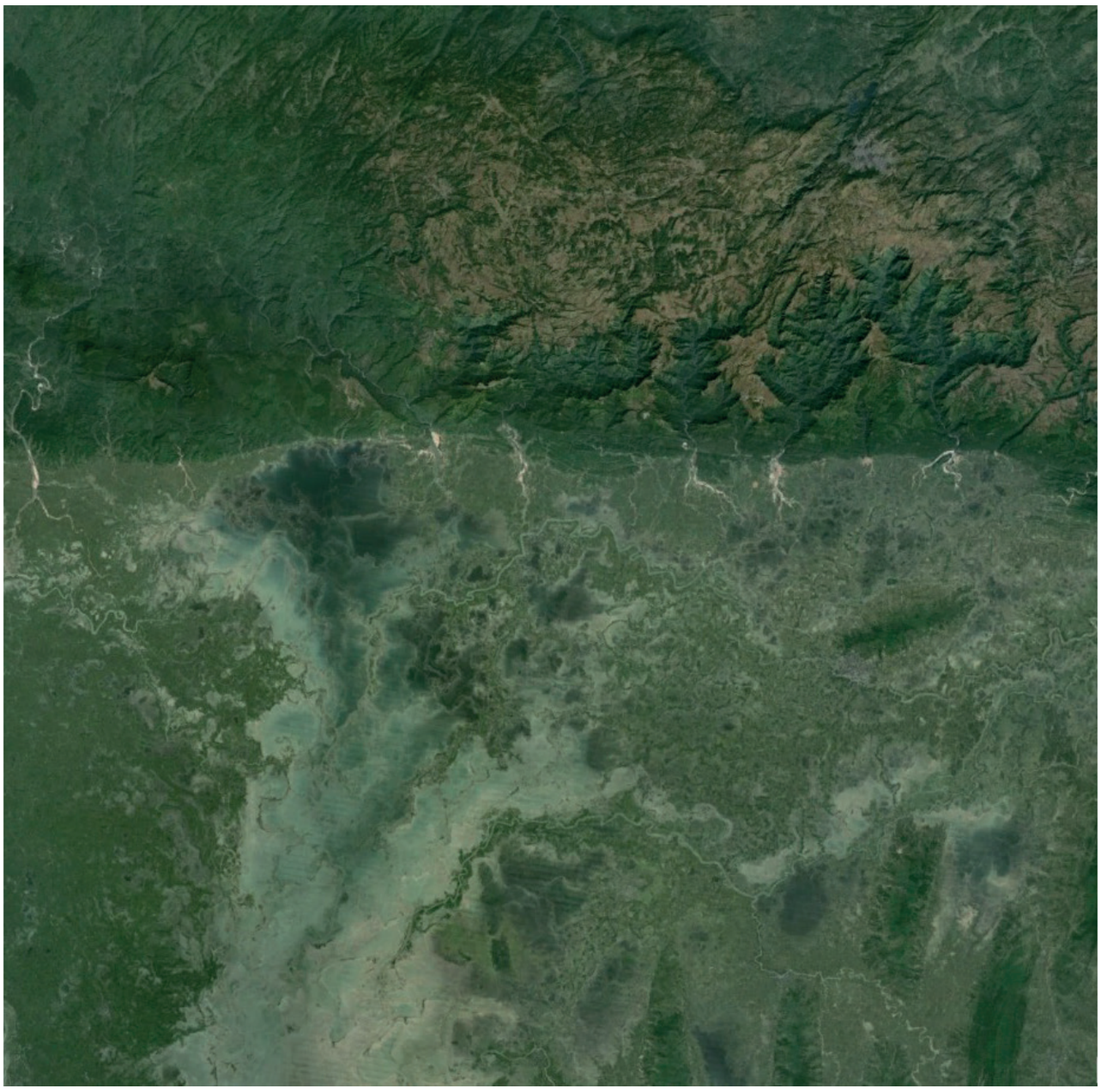


Image 2: North-East of Bangladesh *(Google Earth, 2024)*

The northeast part of Bangladesh is characterized by undulating **hills** and **valleys**, forming part of the larger Meghalaya Plateau. These hills, including the Khasi, Jaintia, and Garo Hills, extend from the Indian state of Meghalaya into Bangladesh. The terrain is relatively rugged compared to the flat plains found in other parts of the country, creating scenic landscapes. Despite the hilly terrain, the northeast region is also intersected by several **rivers** and their tributaries, including the **Surma**, Kushiyara, and Jadukata rivers. These rivers meander through valleys and gorges, creating fertile plains and supporting agricultural activities such as rice cultivation and fishing. The rivers also serve as important transportation routes, facilitating trade and commerce in the region. In the Sylhet Division lays **Sylhet City**, surrounded by a diverse landscape that includes hills, tea gardens, wetlands, and agricultural fields.



Image 3: Sylhet City *(Google Earth, 2024)*

Sylhet is often referred to as the “Land of Two Leaves and a Bud” due to its thriving tea industry. Sylhet City is connected to several neighboring towns and villages, forming a **network** of urban and rural settlements. These towns serve as centers of commerce, education, and healthcare for the surrounding rural areas. People from neighboring towns often travel to Sylhet for work, education, or medical services, fostering economic and social ties between urban and rural communities.

This natural environment not only contributes to the city’s scenic beauty but also provides **livelihood opportunities** for its residents. Tea cultivation in the surrounding hills, for example, is a major economic activity that supports thousands of families in the region. The proximity of **water bodies** like the Surma River and its tributaries ensures access to water for irrigation, fishing, and domestic use, further enhancing the livelihoods of the local population.[2]



Image 4: Sweepers Colony and surroundings *(Google Earth, 2024)*

On the south-side of the Surma river lays the **Sweepers' Colony**. This is a settlement with approximately 220 families with different religious beliefs (Islam and Hindu). The longitudal shape of this settlement lays directly along the riverbank and lays relatively low compared to the area on the other side of the settlement. This means water will flow from the city side directly into the settlement. Despite of the great height of the riverbank, the river will **overflow** annually and causes a waterlevel of 40 centimeters.

In some extreme cases, the water will rise even higher. Currently, the riverbank along the Sweepers Colony is paved. A lot of **activities** and **transportation** are happening on the whole riverbank and close to the bridge, where taxi-boats load and unload passengers. Even the residents make full use of the free space the riverbank gives them. The whole settlement is currently fairly green, there are some trees here and there, but less plants and bushes. The green park connected to the settlement on the left-side, makes up for that fact.

Sylhet City

Sylhet serves as the administrative center of the Sylhet Division. The city has almost one million inhabitants and is therefore the fifth-largest city in Bangladesh. Sylhet City has been ruled by various dynasties and empires, inculding the Mughals, British, and the Nawabs of Bengal. One of the notable landmarks is the Shah Jalal Dargah, one of the holiest sites in Bangladesh, which attracts thousands of pilgrims annually. Two additional landmarks, close to the design project will be described on the next page. Sylhet is a major commercial and financial center, contributing significantly to Bangladesh's economy. The tea industry generates substantial revenue for the city. While Bengali is the official language, Sylheti is a dialect spoken widely.

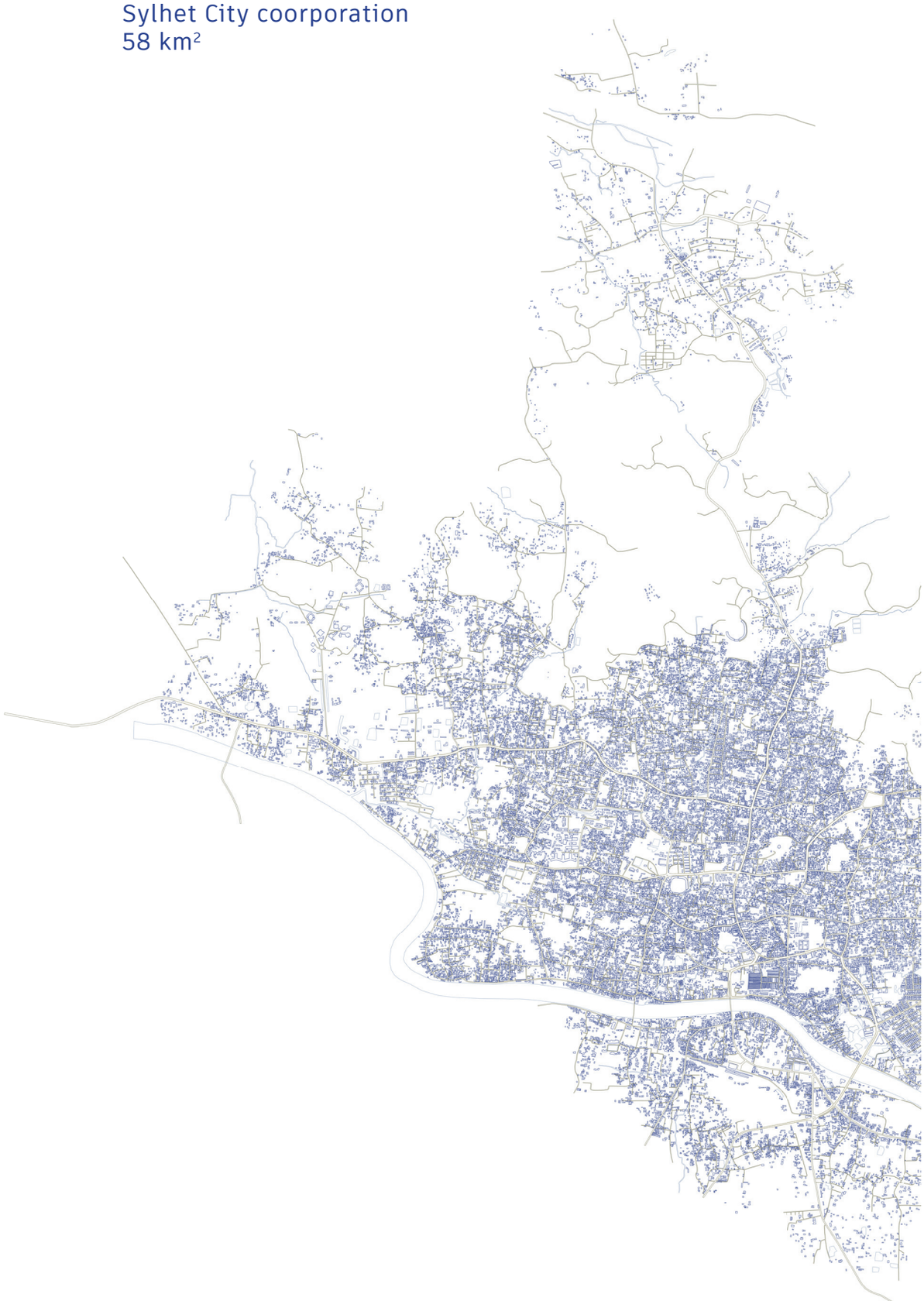
Sylhet is still a major financial and commercial center where several multinational industries and companies are situated. Construction and real estate has been growing expotentially in Sylhet. However, simoultaniously happening other major cities, Sylhet is undergoing a major transition where disparities between rich and poor are caused by increasing economic prosperity. Currently, Sylhet has more than 750 slums where almost 27 percent of Sylhet's population reside. These slums are typically (and locally) referred as "colonies", like the Sweepers' Colony. Like other countries in the world, Sylhet is exposed to multiple challenges induced by migration, industrialization and climate change.[3]

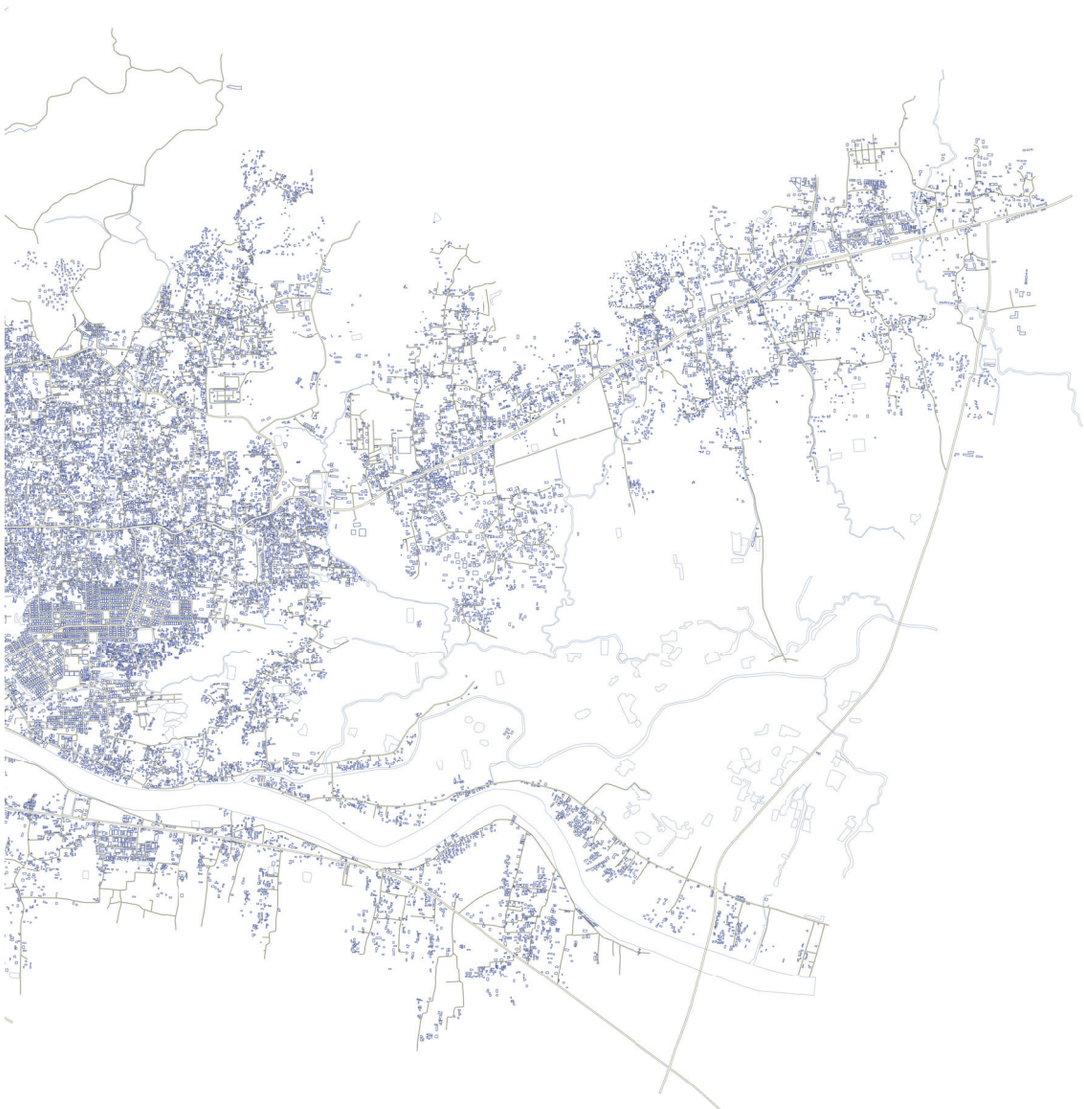
1. Choudhury, Giasuddin Ahmed, et al., 2012.
2. Hossain, Md Sarwar, et al., 2020.
3. Ahmed, Md Faysal, and Md Shahidul Islam, 2014.



Residents
Government
Urban area

999.374
Sylhet City coorporation
58 km^2





1:40000




1:5000

Landmarks of Sylhet City



Keane Bridge in Sylhet *(Own picture)*

One of the landmarks in Sylhet is the **Keane Bridge**, also named “the gateway to Sylhet City” is located right next to the Sweepers’ Colony. The construction of the bridge started in 1936 by the assignment of the provincial Government of Assam. The Keane Bridge, also known as the Surma Bridge, was built to serve as a vital transportation link over the Surma River. It was constructed to facilitate the movement of people, vehicles, and goods between different parts of Sylhet City and its surrounding areas. Before the construction of the Keane Bridge, transportation across the Surma River relied primarily on ferries, which could be time-consuming and unreliable, especially during periods of high water flow. It was named after Micheal Keane, the then English Governor of Assam. At that time, this bridge was one of the most important and famous road bridges of undivided India.

The bridge still plays a crucial role in connecting neighborhoods, facilitating trade and commerce, and improving accessibility for residents and visitors. Additionally, the bridge is the longest footover bridge in Bangladesh and became a attractive tourist spot.[4]



Ali Amjad's Clock *(Own picture)*

Another landmark in the city and close to the Sweepers' Colony is **Ali Amjad's Clock**. This clock tower is the oldest in Bangladesh, and therefore holds an import value for the city. The tower was named after the son of Nawab Ali Ahmad Khan of Prithimpassa, Ali Amjad Khan. The tower was built in 1872, and was at that time the only medium for knowing the time when no watch was around. The inspiration for the clock was drawn from the clock based in Delhi, India.

In the War of Independence in 1971, the clock was heavily damaged but was repaird years later. The triangular structure was given in a restauration around 2005 to make it more attractive for people who walked by.

The clock is made of tin and about eight meters high from ground to top. This clock tower is besides the Keane Bridge a popular tourist attraction.[5]

4.Daily Asian Age, 2016.
5. Abdul Kadir Jibon, 2018.

Sweepers' Colony
Site analyisis

221	Households, including the Hindu community
1105	Residents (average of five family members)
0,9	Settlement area [ha]
1228	Denisity [residents/ha]
244	Density [units/ha]

The residents
There are currently around 220 families living in this settlement. 21 families reside in the Hindu community and the rest in the Muslim community. Both communities are in a low-income group. The settlement has an alomst "informal settlement" ambiance, in both positive and negative ways. The people are spending their time mostly outside, the houses are gradually constructed in multiple fashions. Although the houses look solid and not shanty, the quality of the homes are sometimes in bad shape (mainly in the Muslim communinty). There aren't any hard numbers of the exact amount of residents and other demographic information.





Reisdents of the Sweepers' Colony *(Own picture)*







Neighbourhood of the Sweepers' Colony *(Own picture)*




আক্তার মামুর চাউমিন পাস্তা
প্রোঃ মোঃ আক্তার হোসেন, ০১৯০২-৮৪৮৪০৪
নিশিতা
মরিচ, হলুদ,
ধনিয়া গুড়া



Residents' occupation

The name "Sweeper" is in this case derived from the type of occupation the current residents of the Hindu community have. They are mainly cleaners of the city and governmental spaces, institutions, and buildings. Therefore, the Sweepers' Colony in Sylhet City refers to a residential area predominantly inhabited by individuals employed in sanitation and waste management services. These colonies are often established to accommodate workers who are responsible for cleaning streets, collecting garbage, and maintaining public hygiene within the city. In many urban centers, including Sylhet City, sweepers' colonies have historically been established to provide housing for sanitation workers and their families. Not all the family members are cleaners in particular, most of the time only one family member is a cleaner. This means that the other members of the household need to find other sources of incomes to make ends meet.

The occupations of the residents of the Islamic part of the settlements is more diverse. Many residents engage in informal economic activities to earn a livelihood. This may include street vending, small-scale trading, domestic work, day labor, and informal transportation services such as rickshaw pulling. These informal livelihoods provide income for households but often lack stability, security, and social protection. Also home-based work is prevalent, particularly among women. This may involve activities such as garment stitching, embroidery, handicrafts, and small-scale manufacturing. Home-based work allows residents to earn income while caring for their families but may be characterized by low wages, long hours, and limited access to market opportunities.



Occupations of the Sweepers' Colony *(Own picture)*









Inside the Sweepers' Colony *(Own picture)*





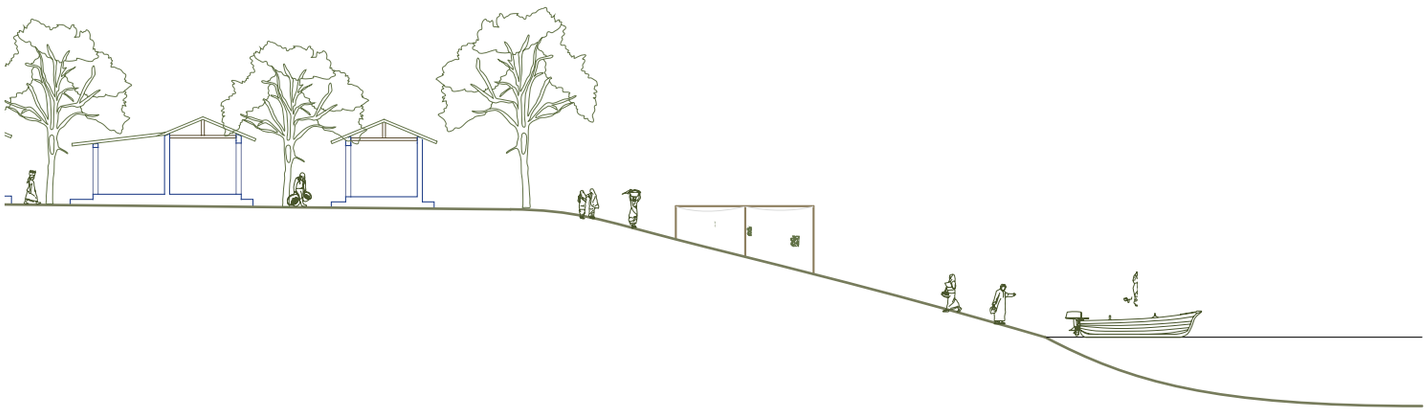
Section of the Sweepers' colony







Inside the Sweepers' Colony *(Own picture)*







Accessibility and transportation
The settlement is accessible by multiple streets with various widths. One main road starting from the west goes all the way through the settlement, but has a dead end. On the south-edge of the settlements, multiple pedestrian streets allowing you to enter the site from multiple directions. The Hindu community has their own entrance, close to the Keane bridge. In this same area, a lot of boat-taxies are laying port on the riverbank. This is the main used docking area for transportation across the river.



Entrances to the Sweepers' Colony *(Own picture)*







1:2000





Accessibility to the Sweepers' Colony *(Own picture)*





The riverbank of the Sweepers' Colony *(Own picture)*









The riverbank

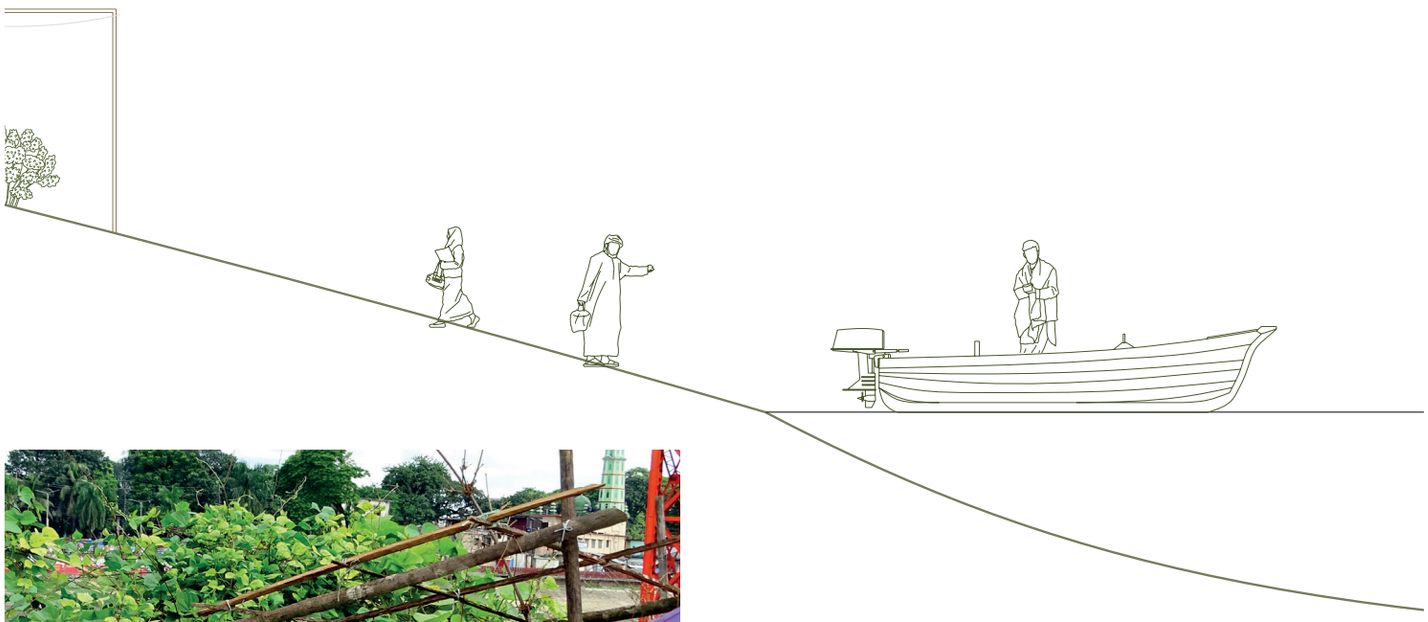






Image 5: Sweepers Colony riverbank *(Google Earth streetview, 2024)*







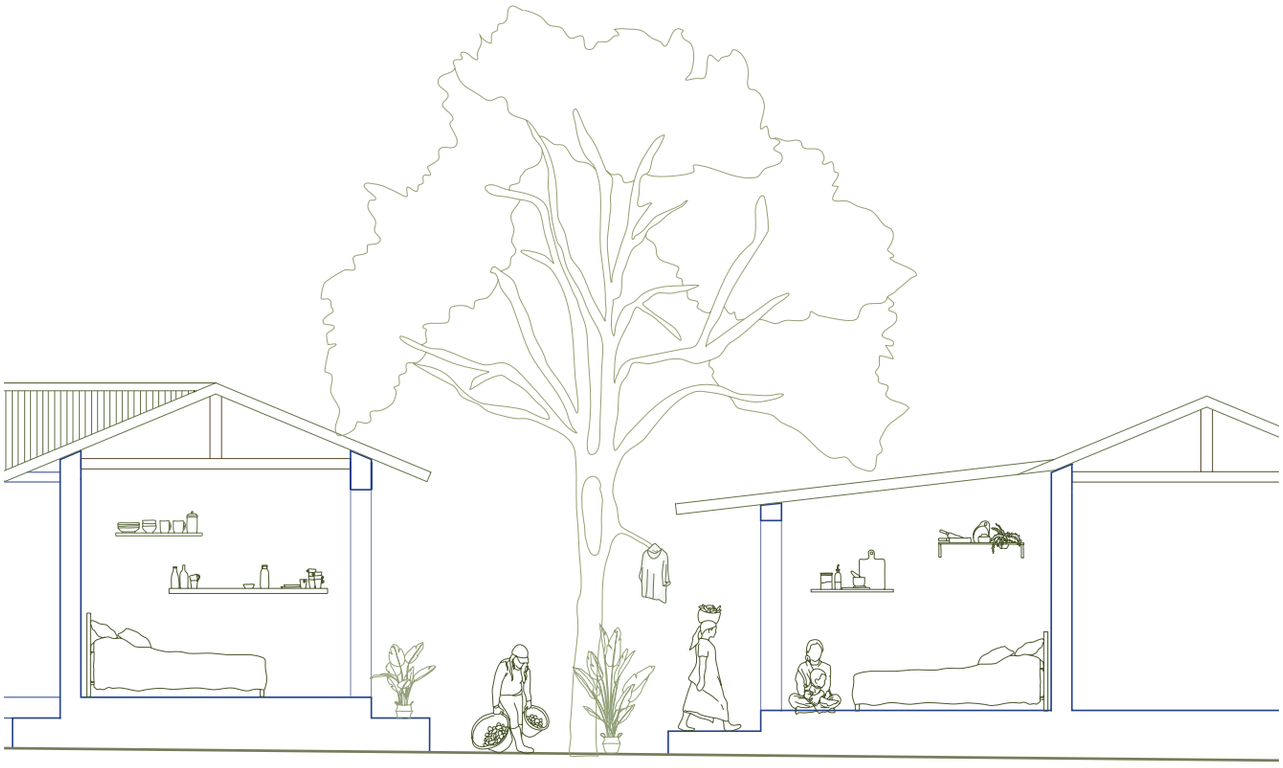
Settlement's housing and facilities
There is a noticable difference between the looks of the homes of the two different communities. The Hindu community's homes are colorful and decorated with ornaments and flowers. The homes of the Islamic community contain sometimes different building materials (CI-sheets and concrete) and are not decorated as much. These homes were built later and at a different pace than the homes of the Hindu community.

The average home in this settlement is quite small, mostly exists of only one room where they sleep, rest and store. The rooms are around 15 to 20 square meters and shared between one or even more households (mostly family members). This means that sometimes one unit is shared amongst more than eight people. Every one of the buildings on this "residential" plot are only one-storey high. They both share the same facilities, like the riverbank, toilet facilities and roads. There are some shops in the settlement, mostly food related. On the edge of the settlement is a "informal" school located. On the east-side of the settlement next to the bridge are some warehouses that are not legally used (not by the residents) but can be a good source of income. There is a small waste collecting facility across the river, very close to the settlement. Garbage trucks have been seen coming in and out and a very high pace.

In the whole city of Sylhet, there are more settlements of the Sweepers' Colony, because expension of this settlement is not plausible in this area. Therefore a six-storey building on the other side of the river, further away from the city centre, and accomodates more residents, who may come from the Sweepers' Colony original settlement. This building is built around the 90's - 00's. The residents of this more modern dwelling building do not all have a "cleaners" occupation. Like the settlement along the riverbank, there are mixed religions. The rooms which are for one household are connected by a shared corridor. In some cases, the rooms are shared between multiple families, they use one for sleeping and one room for storage for example. There is a washroom at the end of a corridor and shared by all the households. Cooking is mainly happening in the open corridor at any given place (not permanent). Little stoves are even placed in the stairwell.



Homes of the Sweepers Colony *(Own picture, 2023)*













Colors of the Hindu community in the Sweepers' Colony *(Own picture)*













Colors of the Hindu community in the Sweepers' Colony *(Own picture)*





Facilities in the Sweepers' Colony *(Own picture)*









Ownership and rent

The Hindu community does not have to pay any monthly fees to rent their home. Because of their long line of “cleaning families” and they were offered the space per family where they could built their own home. This means they only had to pay for construction materials by their own expense. The Muslim community however has to pay around 2000 TK a month for rent. This is mainly because they are later settlers and do not have the same agreement as the Hindu community.

This money goes to the Bangladesh Railway company, they own and manage the land and hold the lease of the Muslim community. In this case, the Railway Company is owned by the Government of Bangladesh and is therefore a public owner (in the end the government owns the land). The rules however may vary with other public housing programmes in Bangladesh and leans towards private ownership.

Challenges and stigmas

The residents of sweepers’ colonies play a vital role in maintaining the cleanliness and sanitation of the city, often working in challenging conditions to ensure public health and hygiene standards are met. However, they may also face socio-economic challenges and stigma associated with their occupation, including low wages, lack of access to education and healthcare, and social discrimination. There is still a general stigmatisation of this community because of their proffession and seen as “the lowest cast”.


ঢাকামেট্রো
ট-১৬-৪৪২৩

Surroundings



Image 6: Peripheral area of the Sweepers' Colony *(Google Earth, 2024)*




বদরুল স্টোর

Urbanization

Since 2007, more than half of the world's population has lived in highly dense cities, and this is even increasing as we speak.[6] A common reason for cities to grow tremendously is urbanization, a mass migration of populations from rural to urban areas (also known as rural-urban migration or RUM). But this phenomenon varies between countries, across highincome
countries (West Europe, the Americas, Australia e.g.) more than 80% of the population is currently living in urban areas, whereas in lower to middle-income countries, the majority still lives in rural areas. Another accurate representation of the state of urbanization is the rate at which urbanization is increasing in different
parts of the world. A nicely defined interactive map published by the UN in 2021 shows the increase in urban populations defined by the country. It shows distinctively the difference in population in urban areas between countries with different income averages. However, an even better representation of the term urbanization in this context (architecture and the built environment) is the ratio and proportion of people living in dense urban areas, rather than exact absolute numbers.[7]

There are many consequences that humanity faces due to urbanization. In the long term, the United Nations also projected recently that urbanization is expected to significantly impact the quality of life negatively.[8] The rate of urbanization in developing countries is the world's fastest. The population in both rural and urban Bangladesh was increasing until the mid-2000s when the rural population started to stagnate. Still, more people are living in the rural areas of Bangladesh than in cities. Since the 1960s till 2023, Bangladesh's urban population has increased by more than 2,500%, making it the 18th fastest-growing urban population in the world. The rural population in Bangladesh has increased only by 116% in the same period.[9]

6. Ritchie et al., 2018.
7. Tacoli, 2015.
8. cohen. 2015.
9. UN, 2019.



Climate induced migration

Everywhere in the world, migration has been the focus of intense political debate in recent years. But why does the livelihood of migrants in urban poor settlements matter in the context of architecture and urban planning? The consequences of migration have a major impact on migrants' livelihoods and create many (negative) impacts on their quality of life, especially in developing countries like Bangladesh which is one of the most densely populated countries in the world.[10] The reasons for people to migrate can vary, some people want to seek better work or education opportunities, but some people see it as no other choice and are forced to migrate (climate migration). Migrants can face displacement, loss of livelihood, and inadequate support systems when moving to an urban poor, dense area.[11] Several schemes from different articles give a clear overview of the push and pull factors that convince migrants to migrate from rural to urban areas (see Figures 6 and 7). This research plan focuses on the most common overarching pull factor for Raaj Biswas, more than 85% of men move to urban areas for work-related reasons.[12]

It is important to understand the general ways of urbanization, the causes, and the consequences that many migrants face. Rather than prohibiting or restraining migration, this research plan aims to get a better understanding of the effects of migration and livelihood, and eventually understand how to tackle the problems migrants face. In addition, the scope of this research is understanding a part of the migration and the livelihood of migrants who are now living in poor urban areas of Bangladesh. Therefore, this research plan focuses only on migrants. However, it is important to also understand every aspect of migration and the whole community in which migrants may live. This will be suitable for other research in the future.

The final aim of this research plan is to create an understanding of the previously mentioned topics, to at last, make an integral urban plan and spatial design for migrants and the urban poor and improve their livelihood, and therefore, quality of life. In the future, this will be applied for a design plan in more resilient communities in transitioning urban areas, of other developing countries, while keeping traditions and heritage.

One of the reasons of massive displacement of people worldwide is extreme climatic and geographic conditions, induced by the crisis around climate. There is not a universally accepted definition for "migrants" on an international level yet. "An umbrella term, not defined under international law, reflecting the common lay understanding of a person who moves away from their place of usual residence, whether within a country or across an international border, temporarily or permanently, and for a variety of reasons.".[13] This definition is cited by the International Organization for Migration, written in a report about a migrants' profile in Sylhet, Bangladesh. But this term includes several categories of people, such as migrant workers and international students. This research plan will focus on internal migration, where people move within the country they currently live in, specifically work migrants. Several pull and push factors determine the choice to migrate, migrants must adapt to new environments, and sometimes face difficulties regarding their financial and socio-economic status. Furthermore, this research will focus on the impact of migration on the migrants and their (adaptive) livelihood strategies, for living in urban poor areas of Bangladesh.

10. Nahar, 2020.
11. Hossain, 2012.
12. Biswas et al., 2019.
13. IOM, 2017.

Current housing situation in Bangladesh

An effect of rapid urbanization in combination with poverty, the market to rovide affordable housing, and de inability of the state, causes over 1 billion people to reside in informal settlements.[14] The city of Dhaka, Bangladesh, is growing significantly and one of the common causes is internal migration. The four largest cities of Bangladesh - Dhaka, Chittagong, Rajshahi, and Khulna – are lacking decentralizing opportunities and services regarding the massive stream of migrants. Many of these migrants now live in slums, and due to a lack of programs policies, and money, no other option is available. Bangladesh is one of the most densely populated countries in the world, and it has experienced rapid urbanization in recent decades.[15] This population growth and urbanization have led to an increased demand for housing in urban areas, where people often migrate in search of better economic opportunities. Many urban areas in Bangladesh have seen the proliferation of informal settlements or slums due to the inability of the government and local authorities to provide adequate housing for the growing population. These settlements often lack basic services like clean water, sanitation, and access to healthcare, leading to poor living conditions. More aspects of the housing crisis in Bangladesh are lack of housing quality, vulnerability to natural disasters, affordable housing shortage, and lack of governmental initiatives. The housing crisis in Bangladesh is complex and ongoing.[16]

14. Williams et al., 2018.
15. Choguill, 2002.
16. Rahman, 2016.



Reserach question

The main question of this research states: **What is the impact of rural-urban migration on the livelihood of migrants in informal settlements/urban poor areas?** To answer this question, several sub-questions will be answered regarding this topic.

1. *How does rural-urban migration affect the employment opportunities available to migrants in informal settlements?*

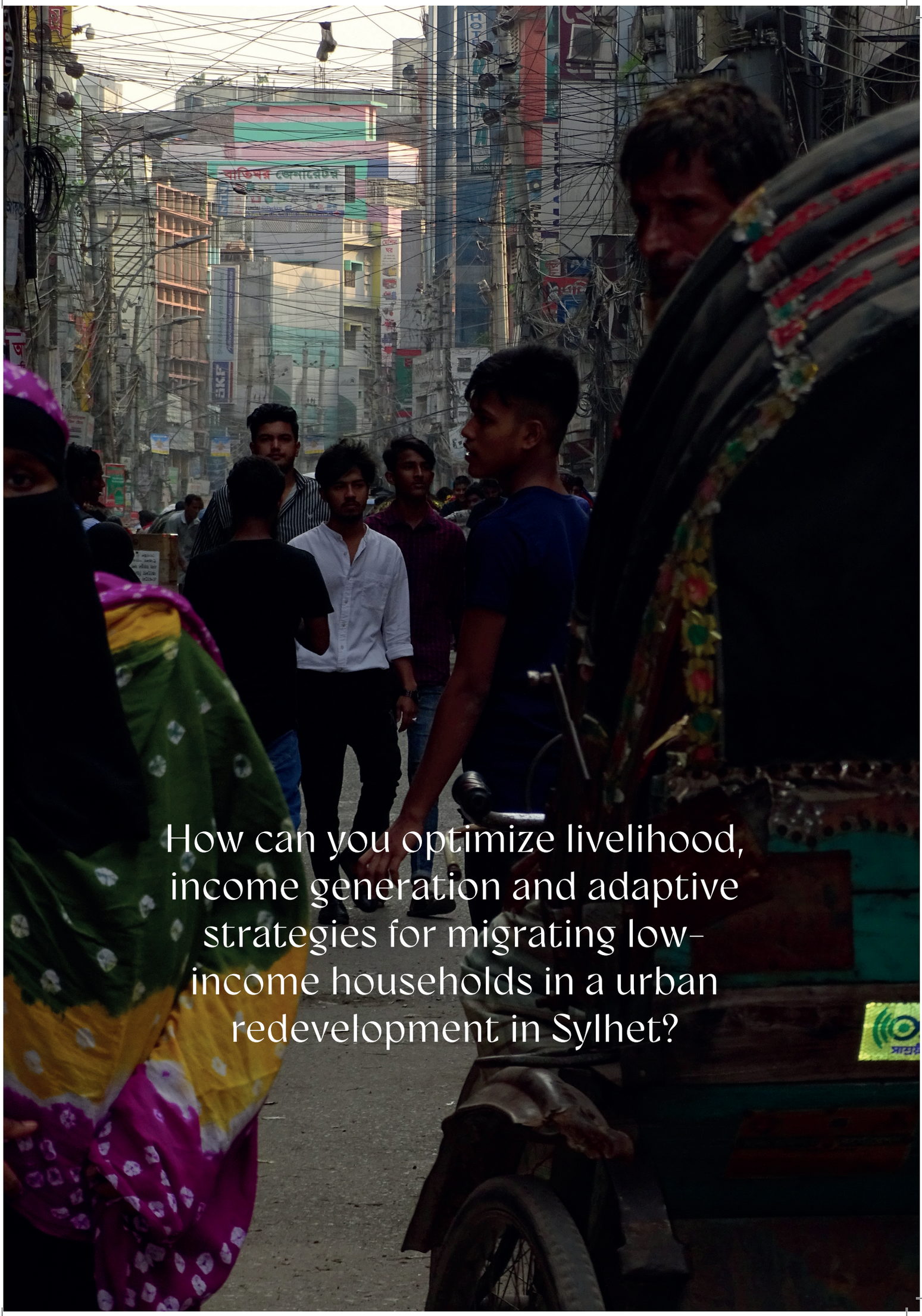
    a. The financial situation of migrants beforehand
    b. The effect of income levels and economic situation of migrants and their households
    c. Discernible patterns in the types of jobs or economic activities that migrants engage in

2. *What are the average costs of living for (migrants) in poor urban settlements?*

    a. The demographic of migrants and their households
    b. Housing situation and costs
    c. Additional living costs of migrants

3. *What are the adaptive strategies of migrants that contribute to better livelihood?*

    a. Education and skill development
    b. Additional employment strategies
    c. Informal, renting, sharing, and other housing strategies



How can you optimize livelihood, income generation and adaptive strategies for migrating low-income households in a urban redevelopment in Sylhet?



Research



Methodology

Different sorts of literature will be used for each chapter or to answer a sub-question.

The most used method for this research plan will be literature reviews, which will form most of the theoretical framework. Existing papers and articles about migration and urbanization will give a general overview of the literature. The literature review will be suitable for all three sub-questions.

Also, secondary data collection found by other researchers will be used to get a more comprehensive understanding of hard numbers and conclusions. This includes surveys interviews and focus group discussions with both migrants and potential migrants, and the urban poor in selected study areas (Bangladesh or developing countries, when needed).

This will in a way, coexist with statistical analysis, which will help to understand more about the demographic, economic, and social characteristics of the migrants and affected urban poor areas. This method will help to understand the spending habits and living costs of migrants (second sub-question), for example.

Besides the literature review, examining different case studies will help understand the lives of migrants in urban poor areas in developing countries. Specific neighborhoods or communities that fit in the profile of this research plan will provide a richer understanding of how immigration affects. This method is also suitable for every sub-question, to make found data more applicable and trustworthy.
Fieldwork on this matter is possible, but it is not certain how much information and possibilities there will be for the sake of this research topic. When the opportunity arises to visit a community or village where migrants live (willingly or unwillingly), interviews but also photographs will help conduct more thorough and realistic research.

This research does not only need hard numbers to conclude but also heartfelt feelings of real people. The combination of quantitative and qualitative methods, as well as spatial analysis, will provide in this case the best understanding of this issue and will also help in addressing the challenges that are faced.




SHAH

Livelihood in poor urban settlements

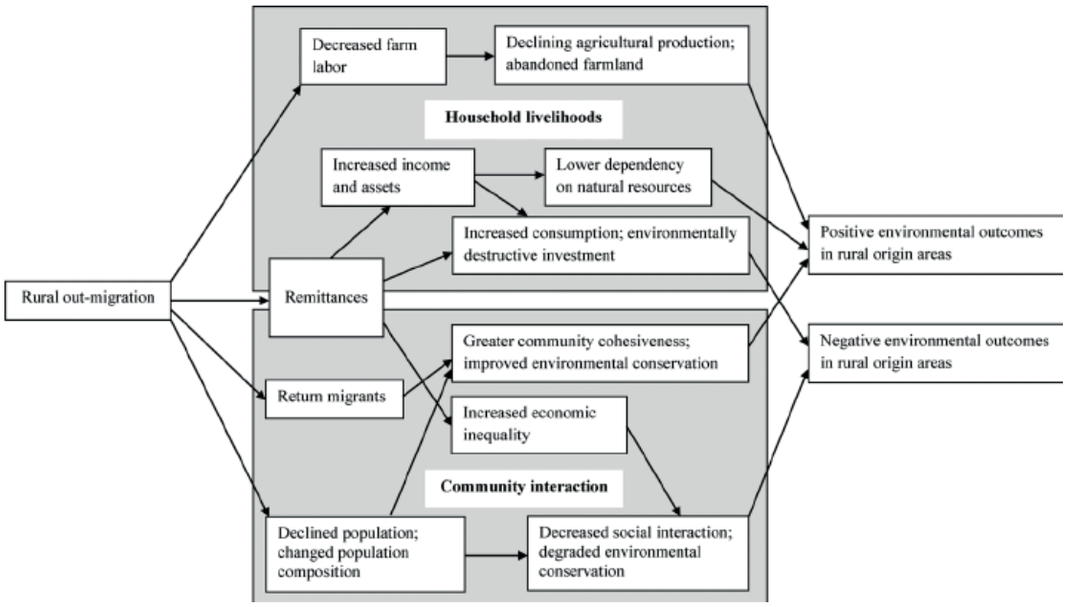


Figure 1: Qin, H. et al. (2012). Conceptual framework of rural out-migration in Society and Natural Resources

The top half of this conceptual framework about rural out-migration shows a clear overview of which topics are relevant for household livelihoods.[17] This conceptual model below (figure 11) is a great tool for communication across disciplines and helps to develop the sub-question: How does rural-urban migration affect the employment opportunities available to migrants in informal settlements? Most of the people who migrate from rural to urban areas are looking for better work opportunities, meaning that their financial status is not great. They mostly end up in informal settlements or low-income housing settlements, where rent is cheaper. Some articles state that people prefer job opportunities before housing. Different industries where people who migrate internally work are in the readymade garments industry, transport sector (rickshaw pullers), or as workers for higher income households.[19]

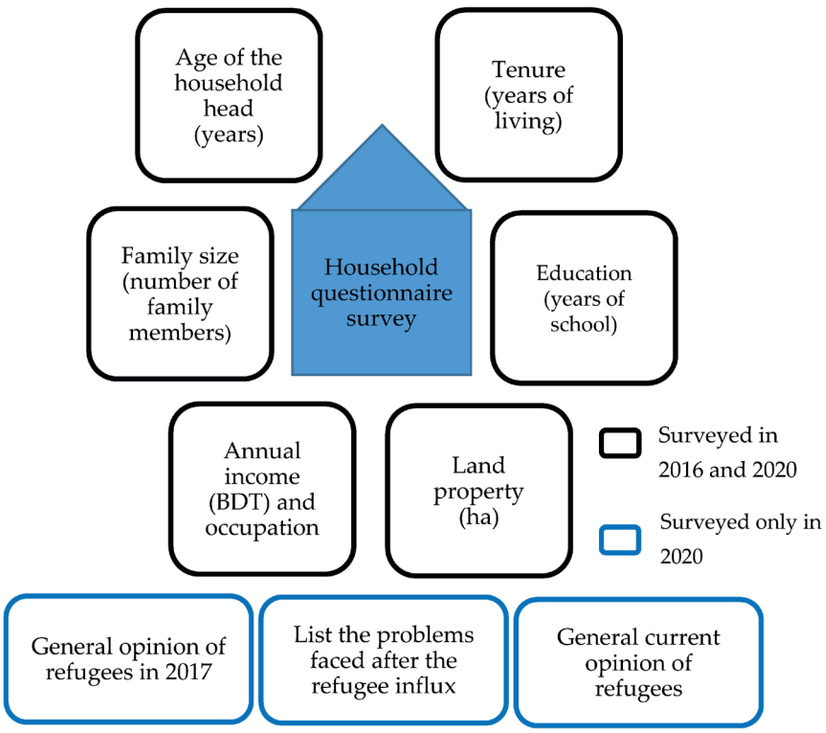


Figure 2: Ullah, A. Et al. (2021). Community household survey framework in Sustainability

This survey framework shows the different topics regarding households and relevant subjects of the refugee influx.[19] Although it is not the same target audience, it still shows similar topics that also can be applied to migrants. Forming the conclusion for the second sub-question, these topics are insightful to get a complete understanding of factors regarding housing and living costs. This research first explains the target demographic and household complexity of migrants. Thereafter, the type of land they own or rent and the expenses it comes with. Lastly, it describes their average annual income related to their profession.

The unemployment rates are high, especially among the youth, and pose a significant challenge. The gap between job supply and demand remains a pressing issue. The urban poor might rely on walking or using public transportation due to the unaffordability of private transport. Access to basic utilities like electricity and water might be irregular or shared among several households in informal settlements. The urban poor often rely on government-funded healthcare facilities, which provide services at low or no cost, if possible. Education might be through public schools or informal education centres. Informal settlements often have a vibrant services sector, with residents providing a range of services to meet the needs of their communities. This may include informal childcare, eldercare, domestic services, tailoring, repair services, and informal education services such as tutoring. The services sector in informal settlements plays a crucial role in meeting the basic needs of residents and fostering social cohesion within communities.
Collective Enterprises: Some informal settlements in urban Bangladesh have organized collective enterprises or community-based initiatives to address common challenges and create economic opportunities. This may include cooperative savings groups, microfinance initiatives, community kitchens, and collective purchasing arrangements. These collective enterprises empower residents to pool resources, share knowledge, and support each other in improving their livelihoods.

Despite the resilience and resourcefulness of residents in informal settlements, livelihoods in these communities are often precarious and vulnerable to various risks and challenges. These may include eviction threats, lack of access to basic services such as water and sanitation, limited employment opportunities, exposure to environmental hazards, and social exclusion. However, residents demonstrate remarkable resilience in the face of adversity, finding innovative ways to cope with challenges and improve their quality of life.

Overall, the livelihoods of residents in informal settlements in urban Bangladesh are characterized by a mix of informal economic activities, home-based work, service provision, collective enterprises, and resilience strategies. Addressing the needs and challenges of residents in these settlements requires comprehensive approaches that focus on improving access to basic services, promoting inclusive economic opportunities, and empowering communities to participate in decision-making processes that affect their lives. It is found that almost all our respondents are working. Most work for themselves (that is, they are self-employed), though some have family support and a few works for an employer. The self-employed have low and irregular incomes. Men generally have access to more diverse and more lucrative employment opportunities than women. We have also observed that the livelihoods of the urban poor are vulnerable to disruption and predation by people with power over them, from unscrupulous landlords to the police.[20]

17. Qin and Flint, 2012.
18. Hasan, 2019.
19. Ullah et al., 2021.
20. Devereux et al., 2020.

Generating income and temporal trends

Rent can be a substantial portion of the cost of living. In urban poor areas like the Sweepers Colony in Sylhet, renting a one-bedroom space might cost about 2000 per month. In slums or informal settlements are housing costs relatively low. They might rent small shanty dwellings or live in makeshift structures within these communities, paying anywhere from 1,000 to 5,000 Bangladeshi Taka per month. The urban poor often spend a significant portion of their income on food for their family. Food is usually cheaper at local markets or street vendors. A meal from a street vendor could range from 20 to 100 Taka, depending on the type of food.[21]
The influx of migrants strains urban resources, leading to fierce competition for jobs. Because of this absence, it forces many migrants to settle for low-paying, unskilled work, making it difficult to sustain a decent livelihood. Most of them struggle to find decent work that matches their skills. Despite their resilience and determination, migrants often find themselves marginalized, facing higher unemployment rates and exploitation. Informal employment often becomes the only option, leaving them vulnerable to even more exploitation and inadequate wages. The monthly living costs for one person can almost reach up to 15 thousand Taka, depending on the size of the household. To see this in perspective, rickshaw pullers earn on average 8 thousand Taka per month.[22] This means that one person can not provide for their whole household, and multiple family members need to find an income generating source.

Spatial equality

Spatial inequality regarding income and livelihood highlights the uneven distribution of economic benefits and opportunities across different geographic areas and among various social groups. This inequality affects not only income levels but also the quality of life, access to essential services, and economic mobility. Addressing spatial inequality requires targeted policies and investments aimed at improving infrastructure, services, and opportunities in disadvantaged areas to create a more equitable society.[23]

Spatial inequality in Bangladesh is a multifaceted issue affecting various aspects of life, from access to basic services and infrastructure to economic opportunities and living conditions. Addressing these disparities requires targeted policies and investments to improve infrastructure, enhance service delivery in underserved areas, and create economic opportunities for lower-income groups. Efforts to reduce spatial inequality can contribute to more equitable and sustainable urban and rural development in Bangladesh.[24]

Achieving spatial equality in Bangladesh involves a holistic approach that combines infrastructure development, improved access to education and healthcare, economic diversification, equitable resource allocation, and strong social safety nets. By addressing the unique needs of different regions and populations, and ensuring that development efforts are inclusive and sustainable, Bangladesh can move towards greater spatial equality and balanced development.[25]

21. Matin, 2015.
22. Hasan et al., 2017.
23. Sen et al., 2019.
24 Jahan et al., 2000..
25. Saifuddin et al., 2022.





Types of work *(Own picture)*



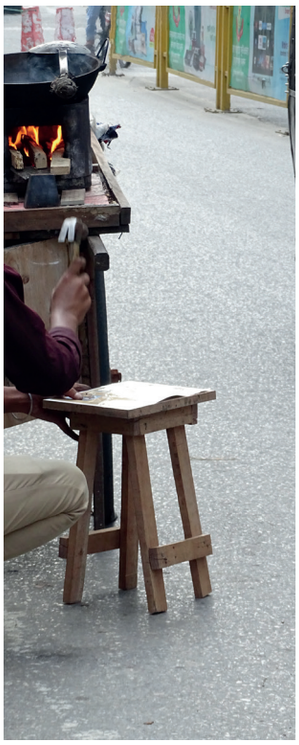









People and their occupation *(Own picture)*










নিশিতা ফুডস
আক্তার মামুর চাউমিন পাতা
নিশিতা
মরিচ, হলুদ,
ধনিয়া গুঁড়া





Design proposal

Design hypothesis

Vision
meaningfull spaces for residents and visitors
Social-spatial equality and resiliency
Permanent + temporal architecture (typology, materials, technology)
Incrementality > growth over time
Typology mix > simple residential design yet different patterns of inhabitation (income and size) > inclusive dwelling environment
Clustering > meaningfull community in a settelement
Goals
Place where residents have the oppertunity to generate income, getting stimulated to work for the community > more community feel.
Social equality and cohesion between all the different income groups.

- Resiliency of space and function
- Porosity means market oppertunities, creating jobs and income generating sources in multiple ways
- Living close to work (small scale industries, eateries, shops, workshops, etc.)
- Changing the image of Sweepers Colony
- Generating new urban land
- Learned from Sweepers Colony: intimate courtyards and small roads.
- Colourfulness and personalization. Adding nature. Static buildings but modified for own needs. Learning how to grow (smarter configuration of rooms instead of adding)
- Positive socio-economic impacts on the current residents



Distressing commercial and housing areas Sylhet City



Connection with the rest of Sylhet City



Clear accessibility from neighbourhood to dwelling



New large commercial area and workspaces



Porosity of the whole site and clusters

Meaningfull spaces residents and neighbourhood



Generating income oppertunities



Active riverfront with climate resilliency



Social- mix and cohesion



Living and working environment



Community feel at cluster level



Housing quality and equality



Variations of typologies

Neighbourhood strategy **Urban strategy** **Cluster strategy** **Dwelling strategy**

Program of requirements

1. 200 homes for re-housing of the current residents of the Sweepers' Colony
2. Different typologies for small and bigger households



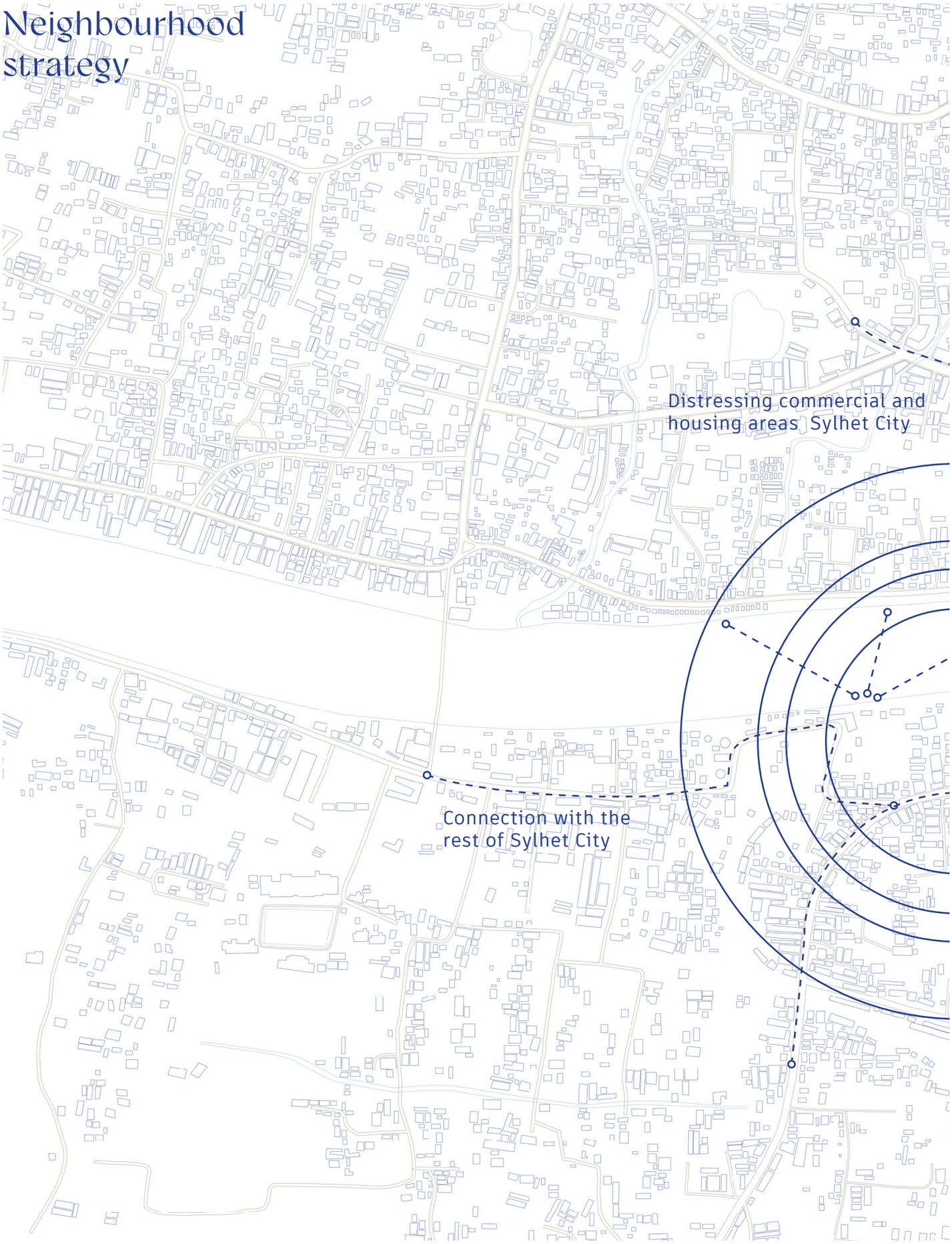
Residential area of current situation

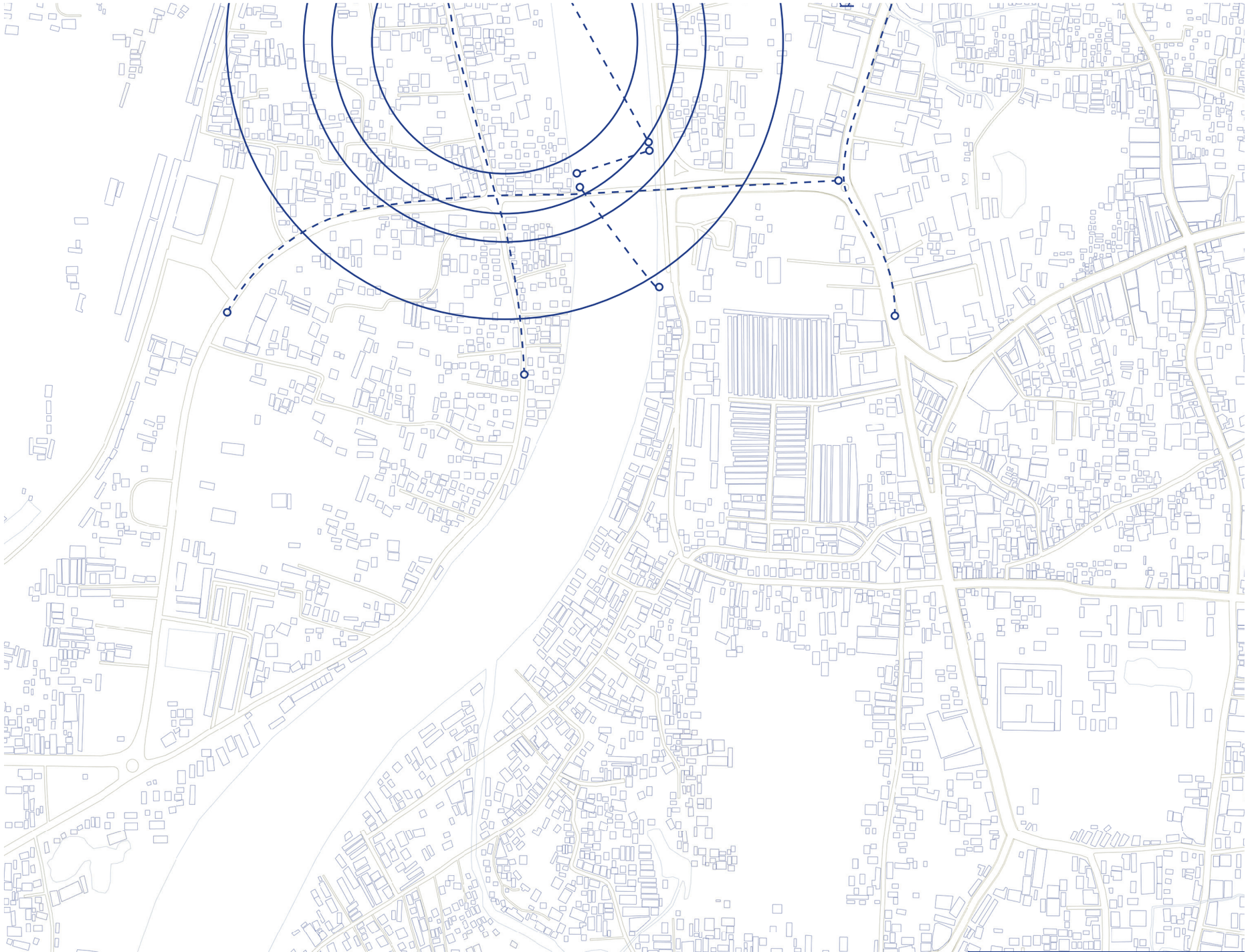


Current FSI= **0,37**

FSI goal= **2,5**
GSI goal= **0,5**

Neighbourhood strategy





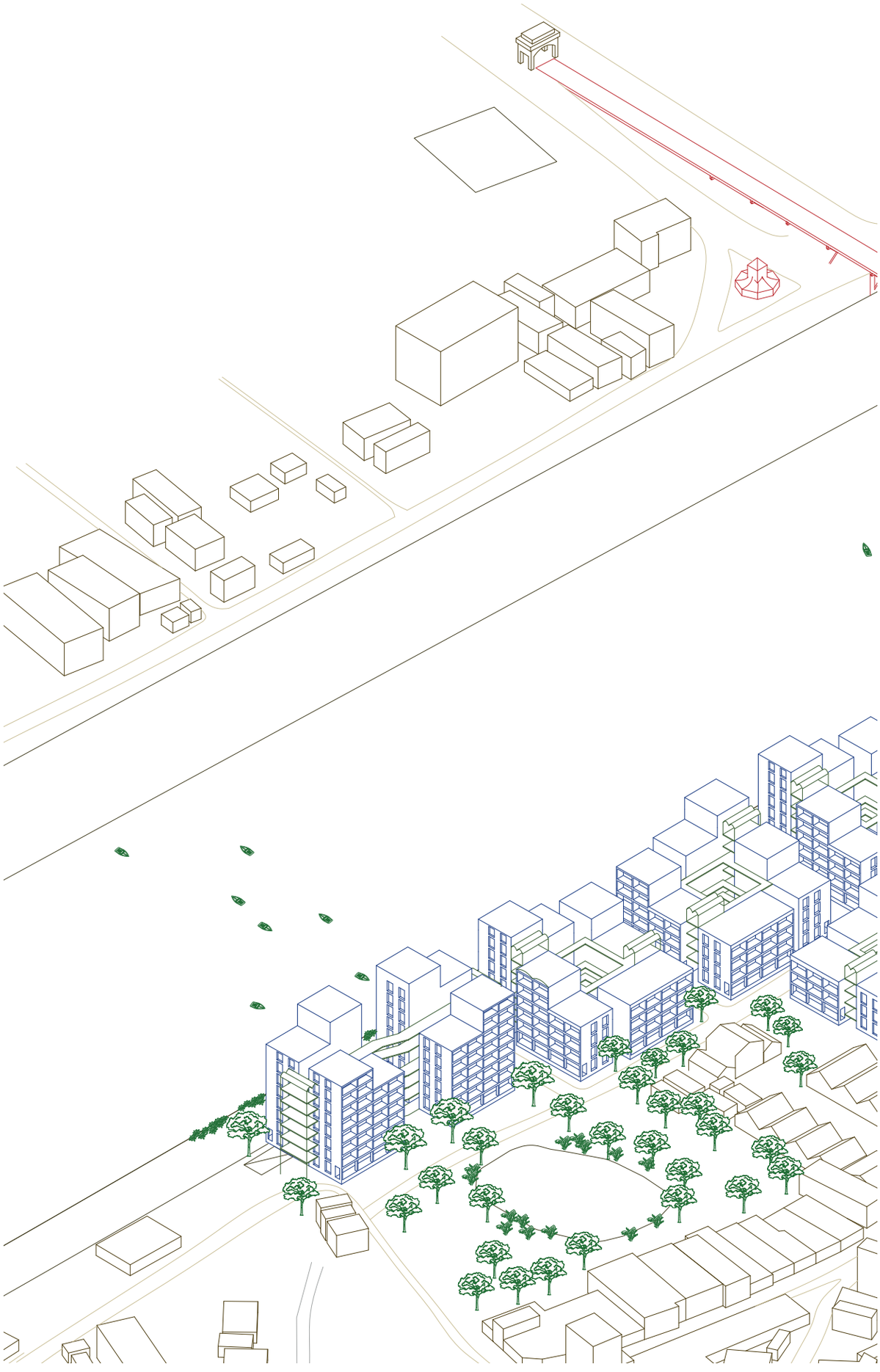
Dwelling strategy

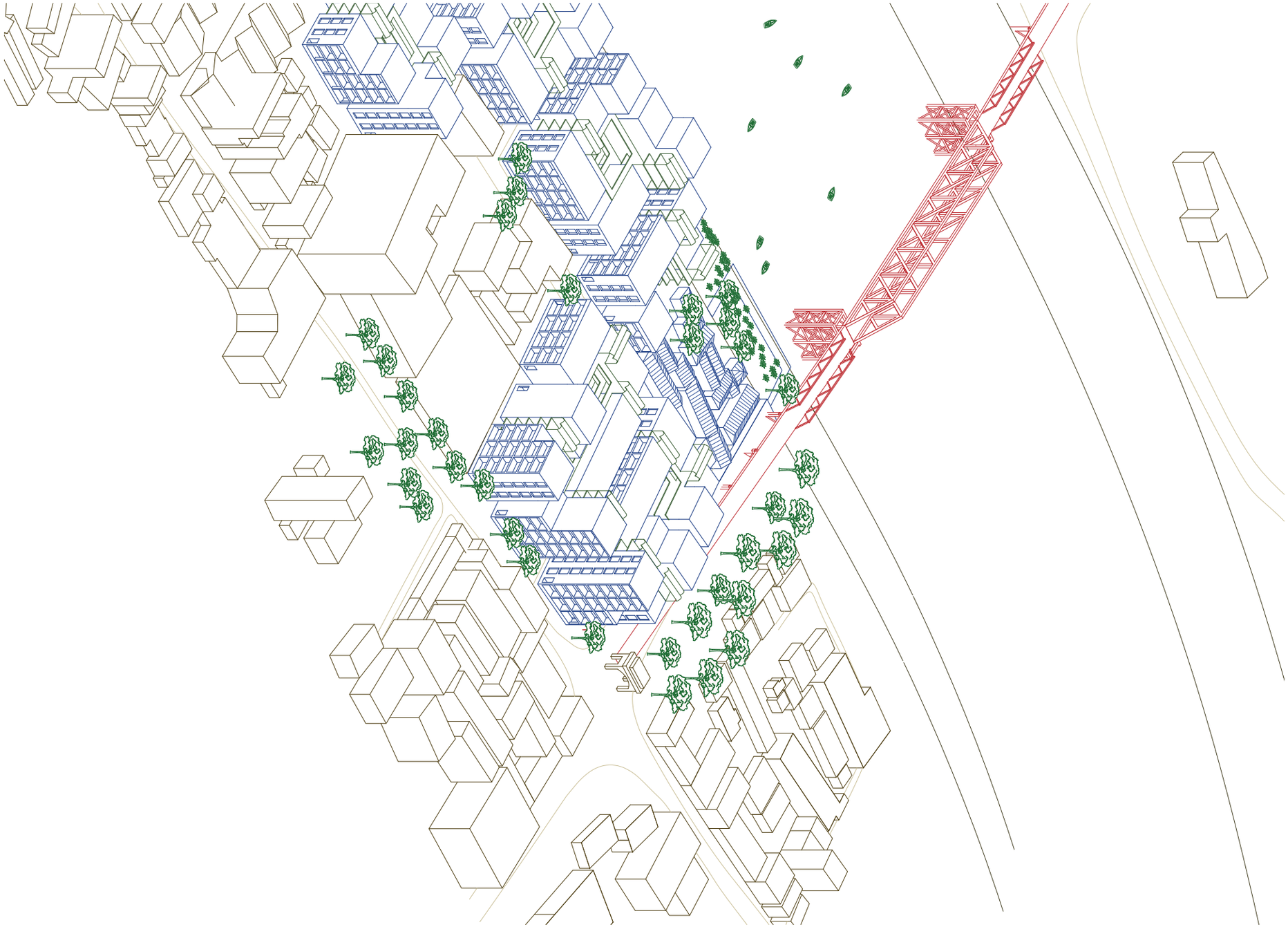
Cluster strategy

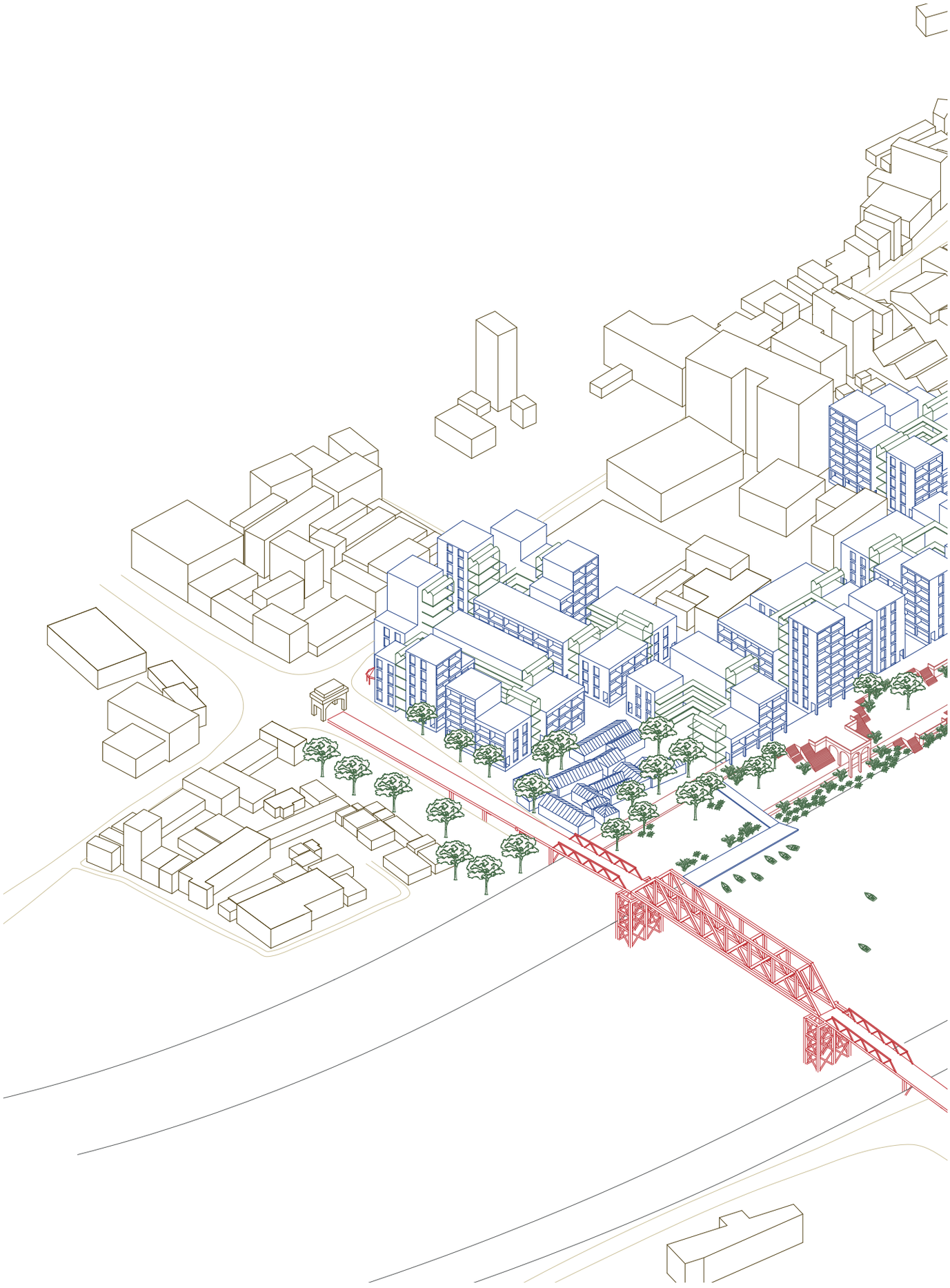
Urban strategy

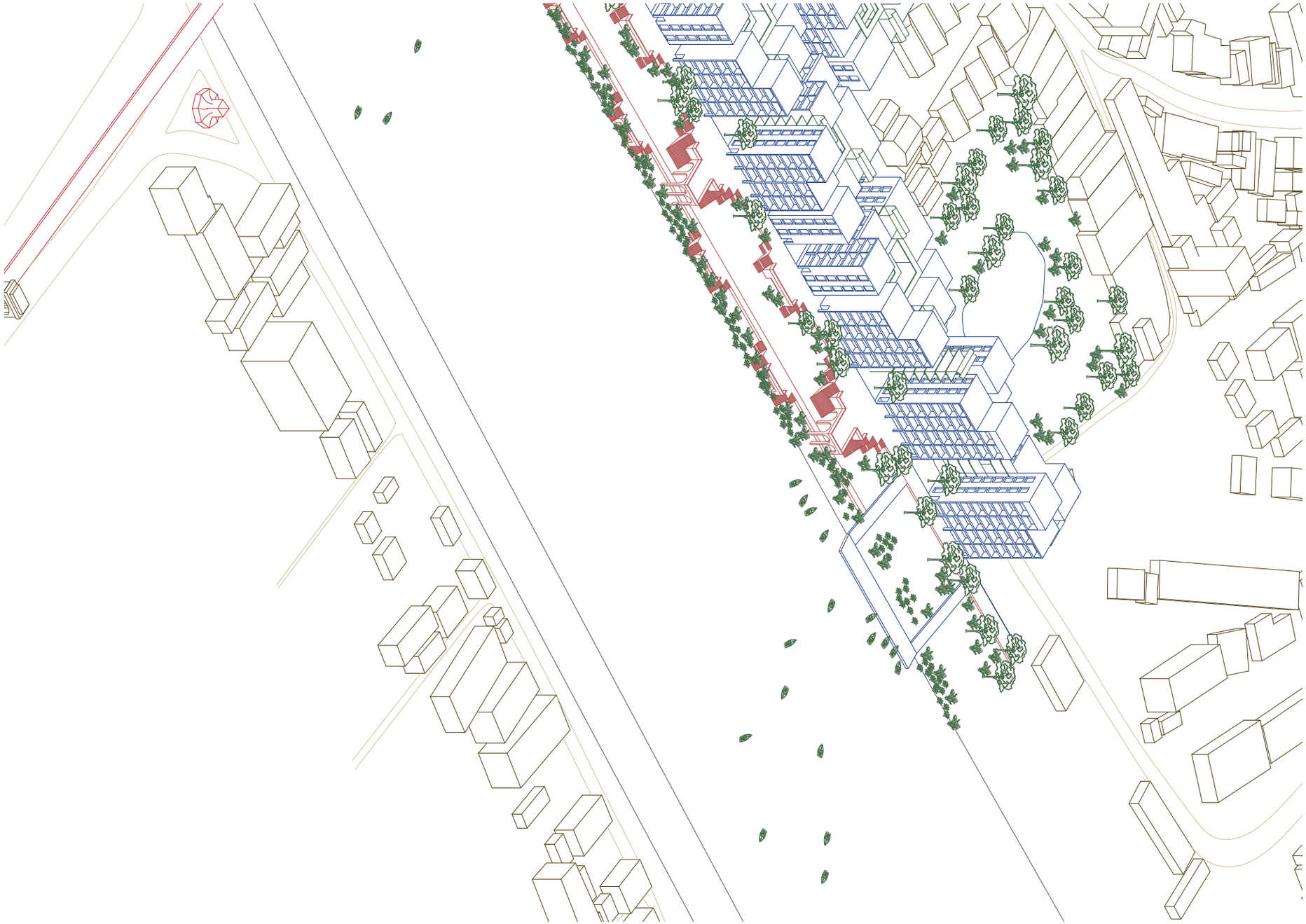
Neighbourhood strategy

Urban strategy

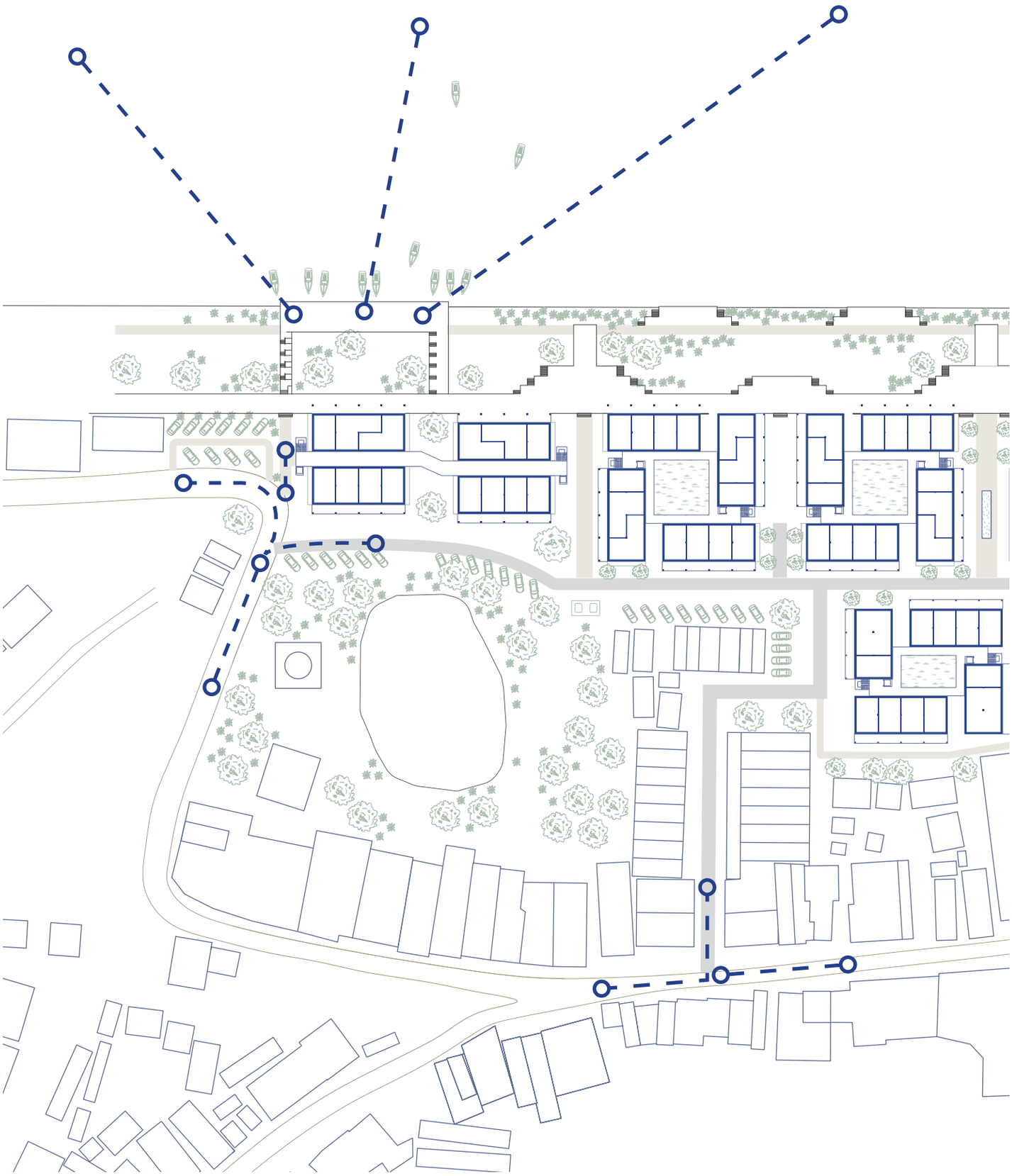


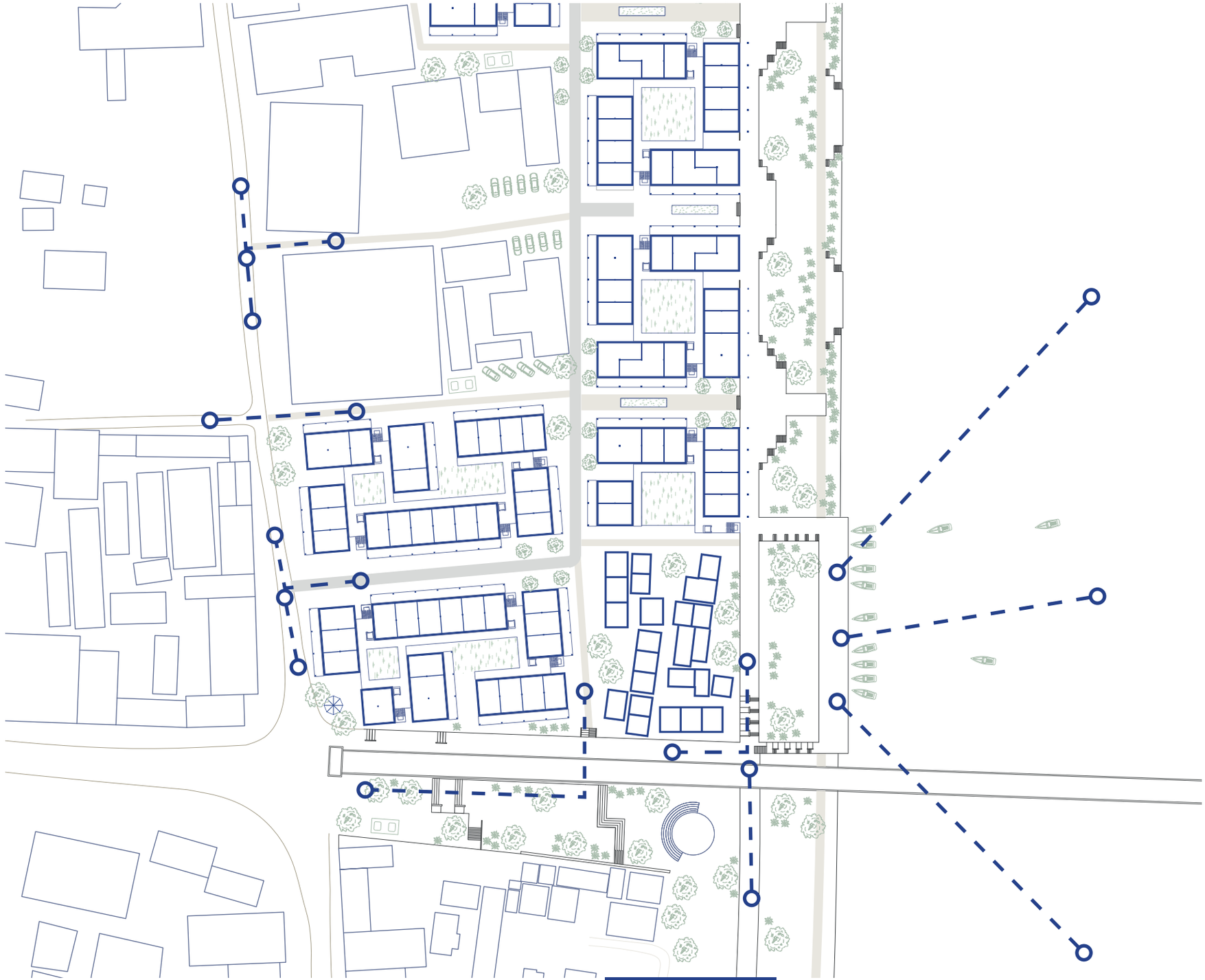






Masterplan accessibility





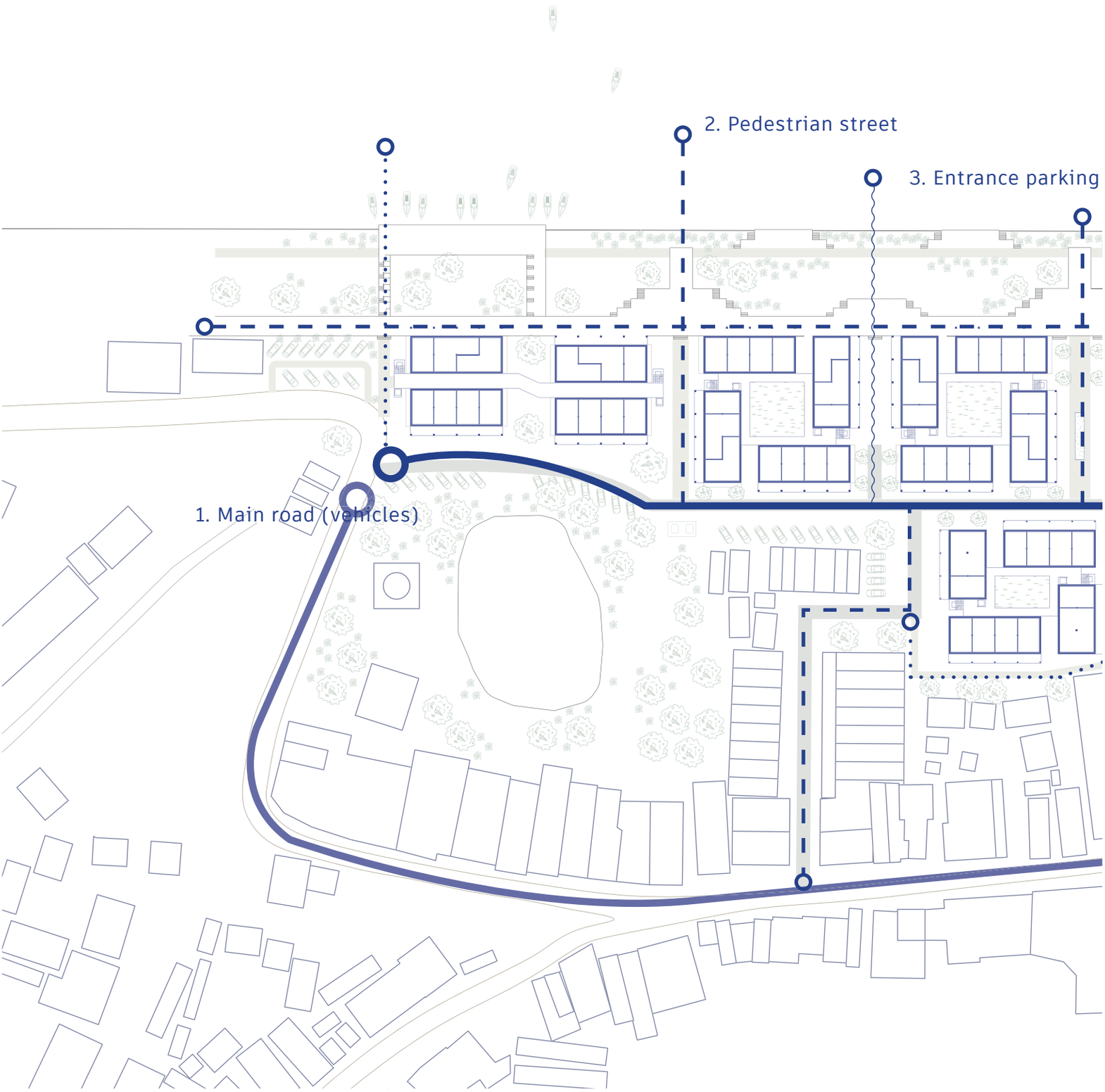
Dwelling strategy

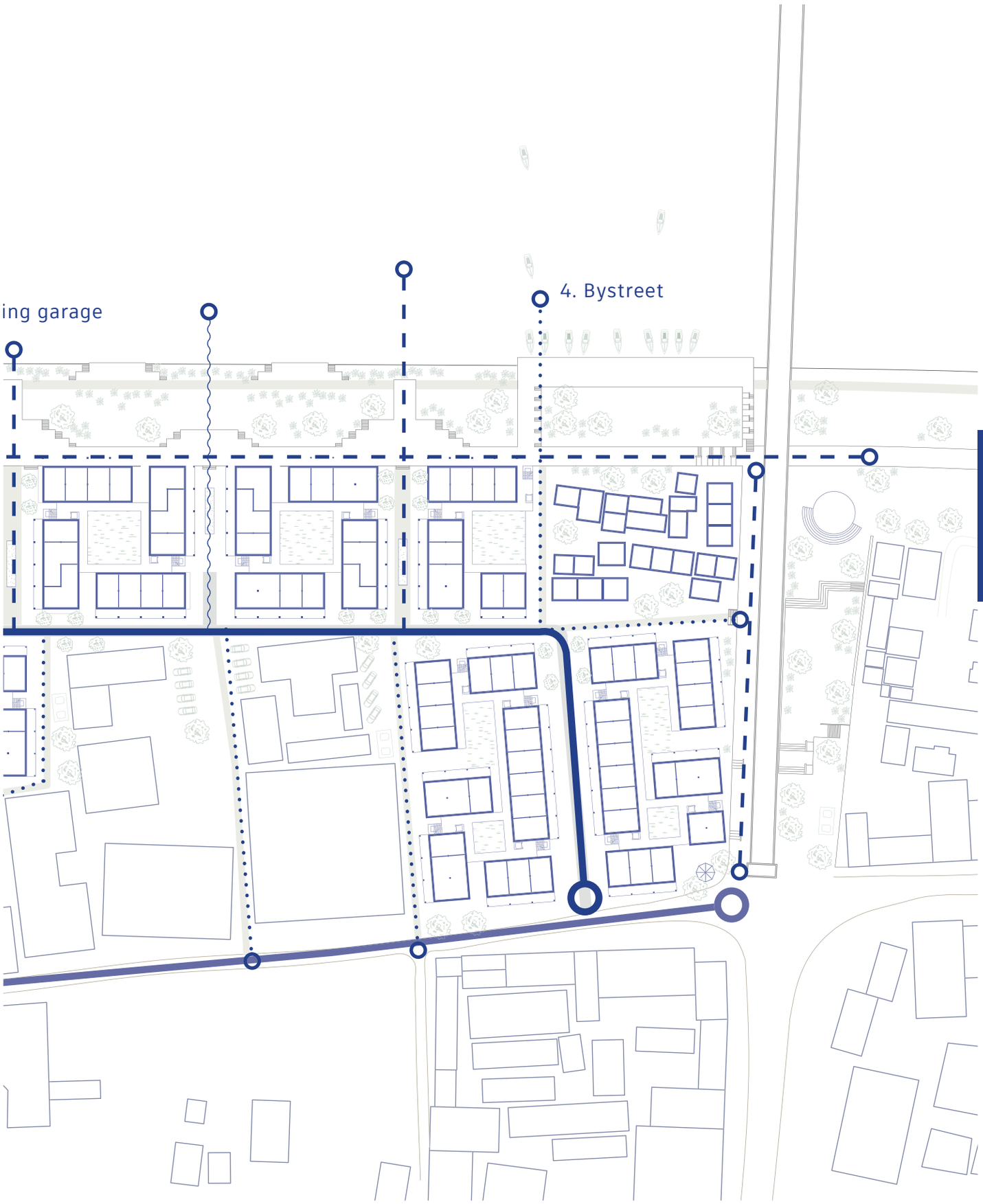
Cluster strategy

Urban strategy

Neighbourhood strategy

Type of streets

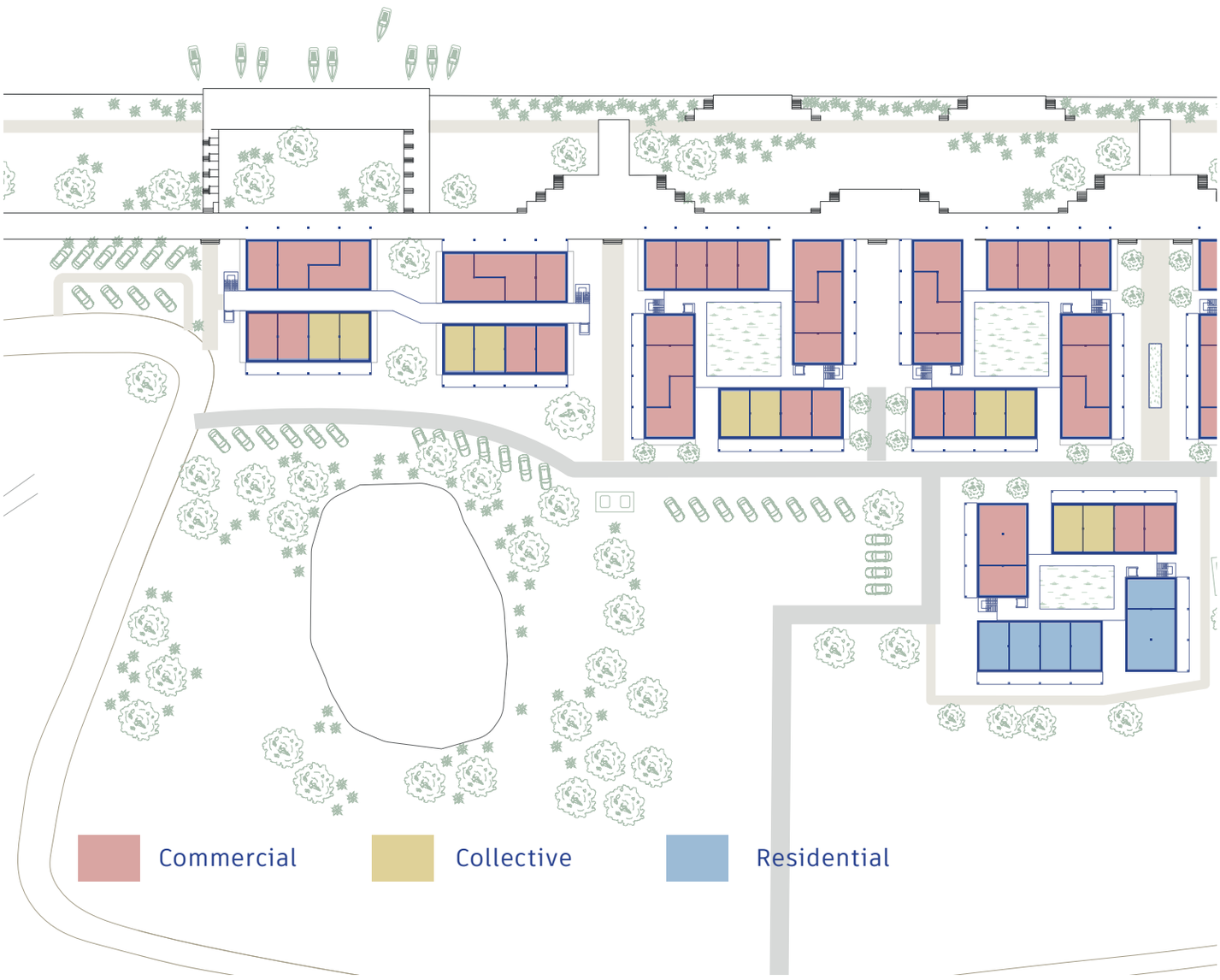



ing garage
4. Bystreet

Commercial plinth

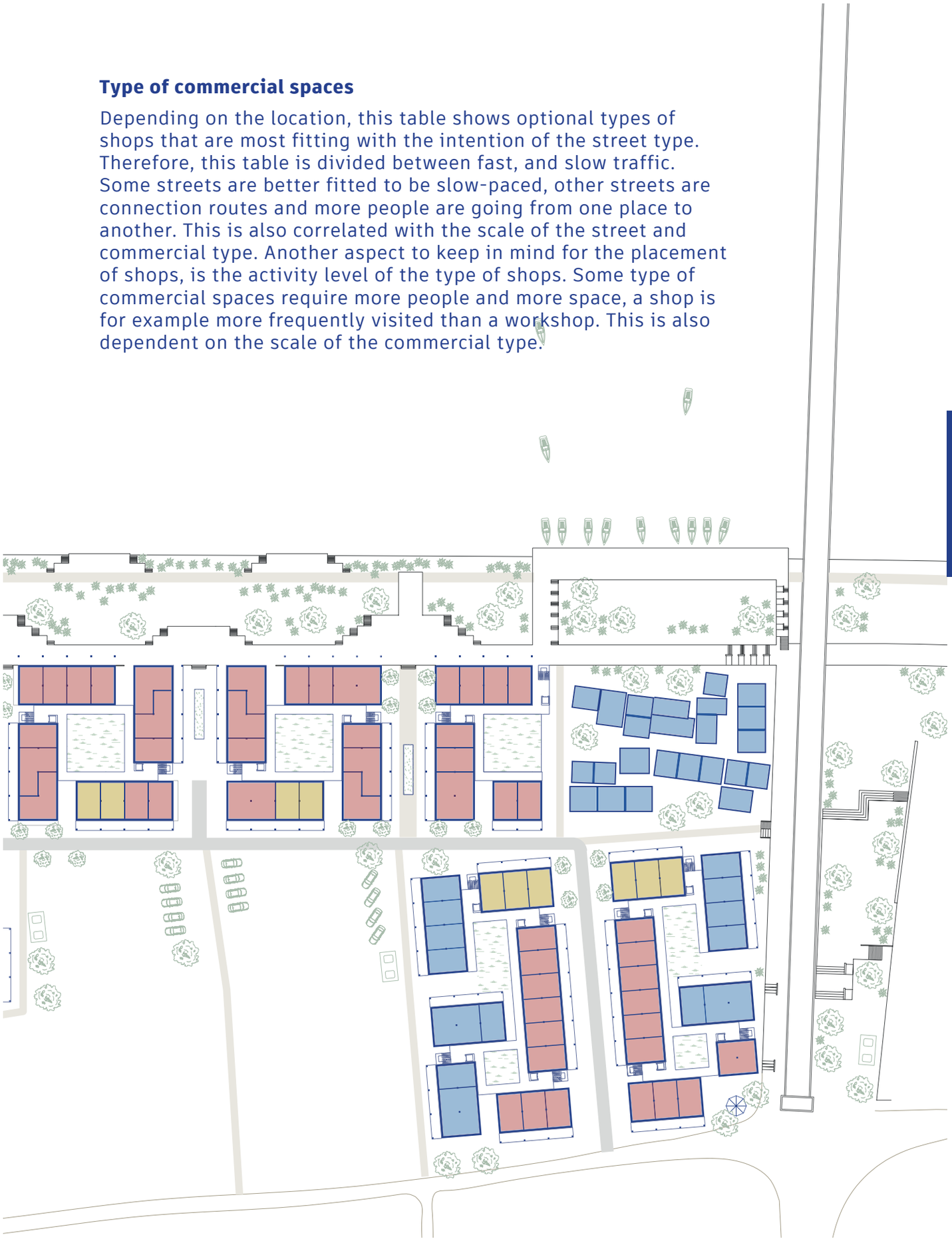
The collective spaces (yellow)

The total area of commercial space available is 4376 square meters. This does not include the collective spaces, owned by the house owner association of the concerned cluster. Each cluster has 80 square meters of free space, which they can use as commercial rent, transform it to a communal space or whatever they need as a cluster community. By making the space available for renting, the residents can use this money to pay for maintenance costs. Additionally, the conditions are that only the residents who chose to help administrating etc., have a right for the compensation.

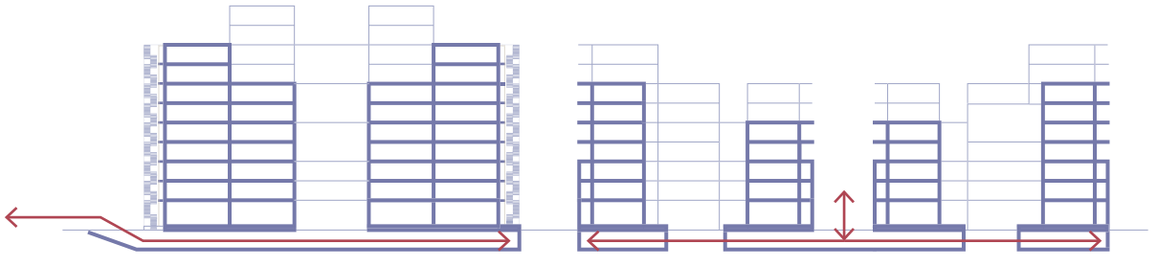


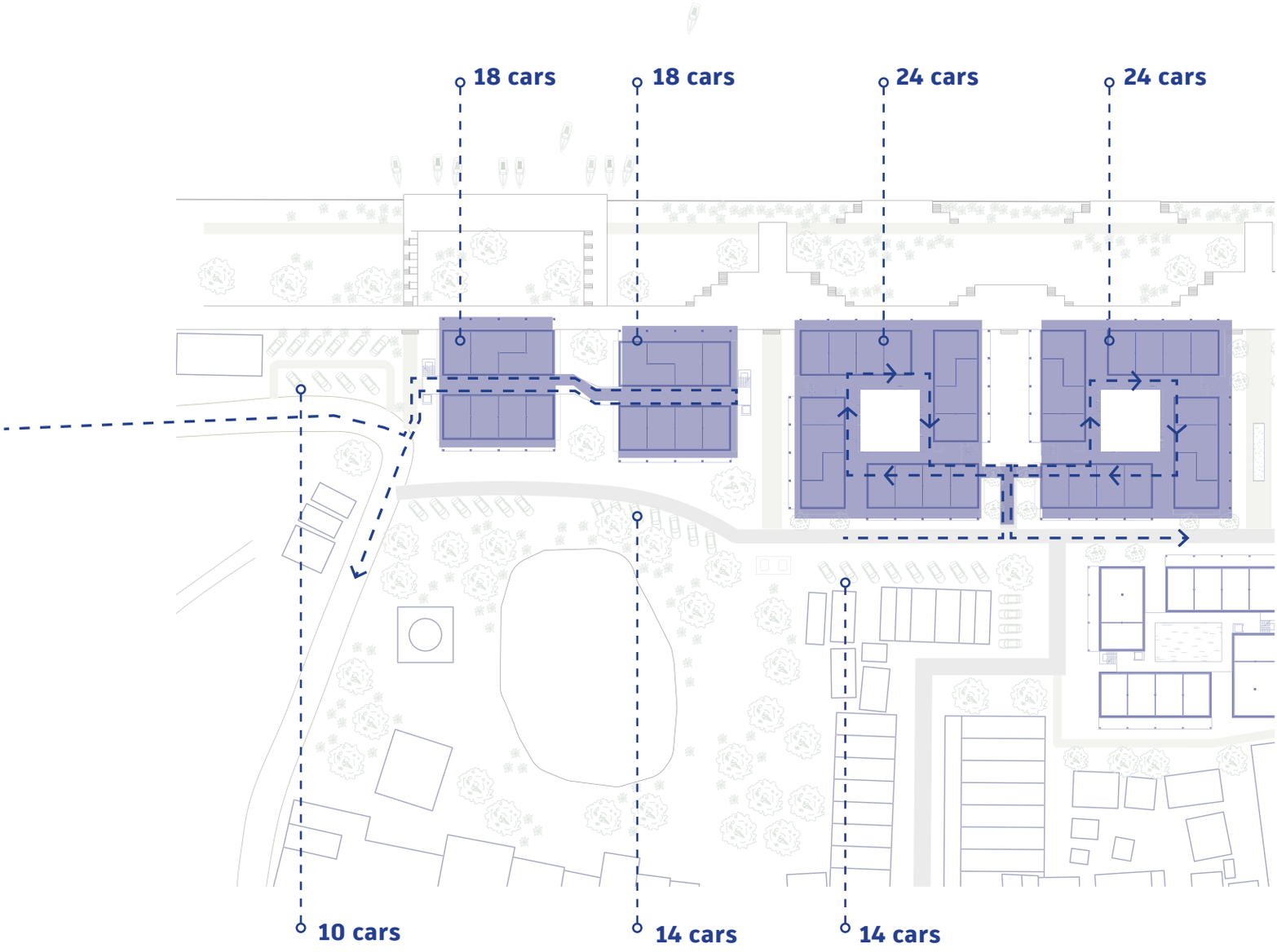
Type of commercial spaces

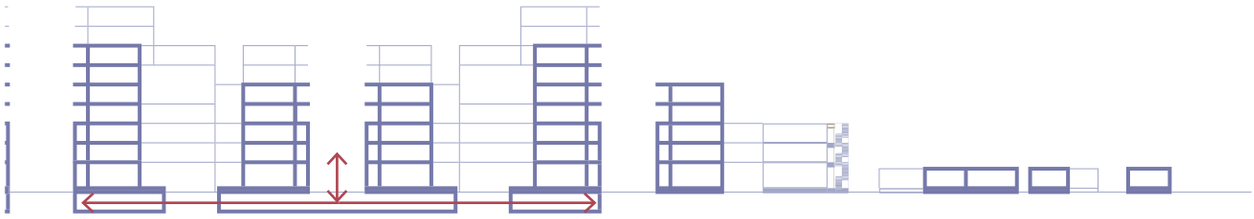
Depending on the location, this table shows optional types of shops that are most fitting with the intention of the street type. Therefore, this table is divided between fast, and slow traffic. Some streets are better fitted to be slow-paced, other streets are connection routes and more people are going from one place to another. This is also correlated with the scale of the street and commercial type. Another aspect to keep in mind for the placement of shops, is the activity level of the type of shops. Some type of commercial spaces require more people and more space, a shop is for example more frequently visited than a workshop. This is also dependent on the scale of the commercial type.

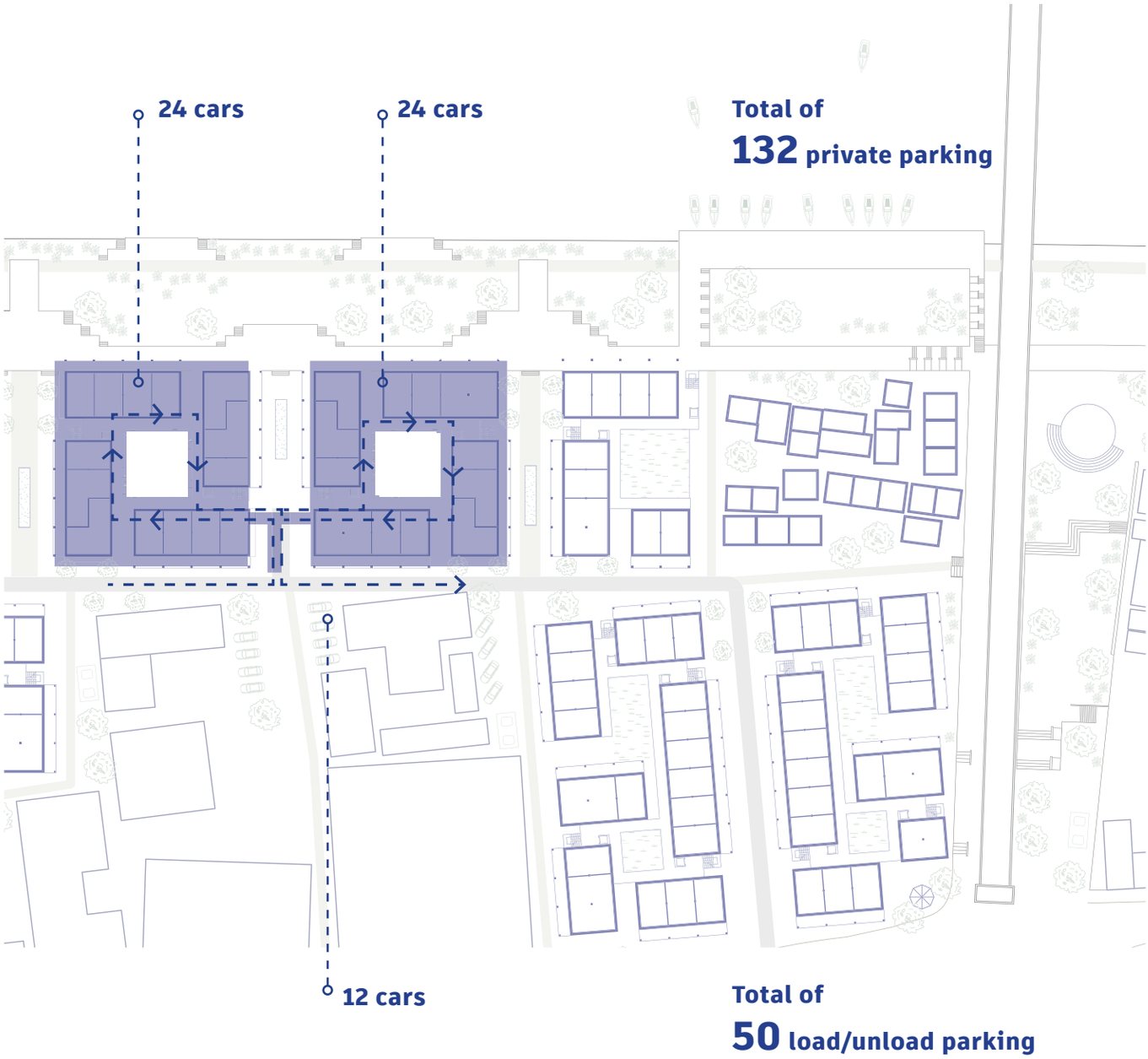


Parking

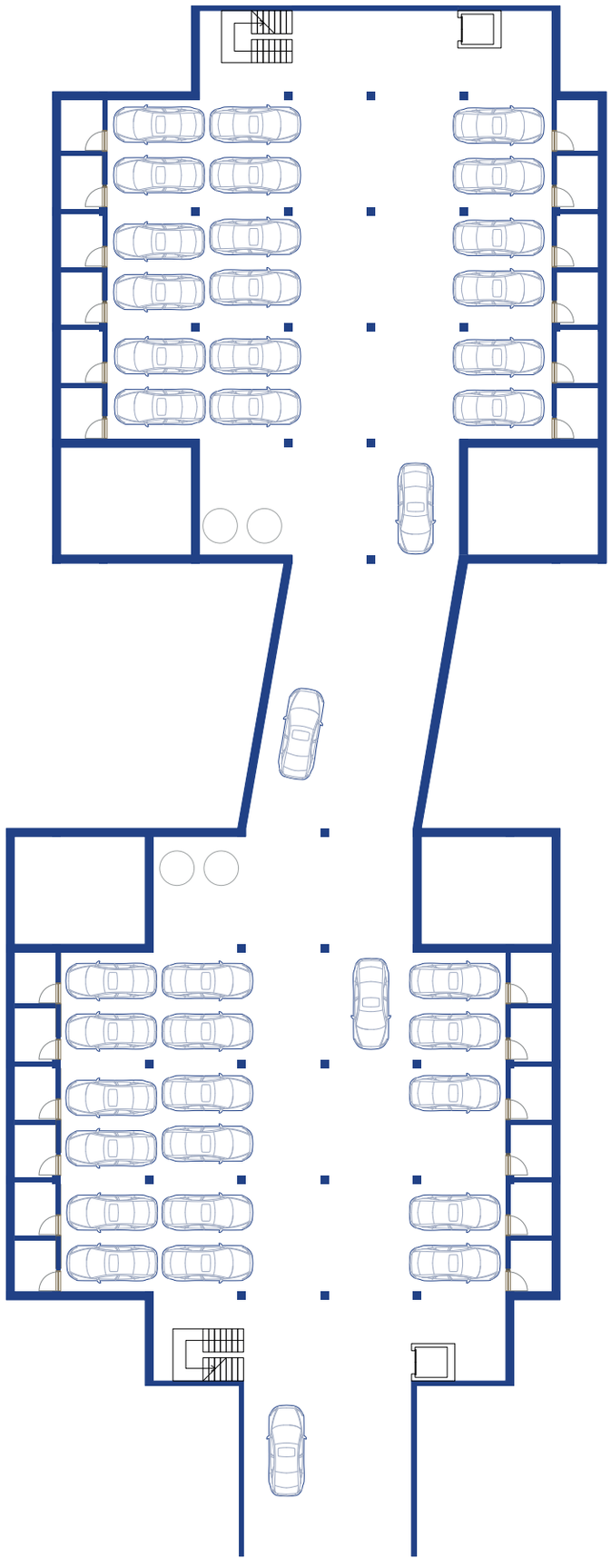




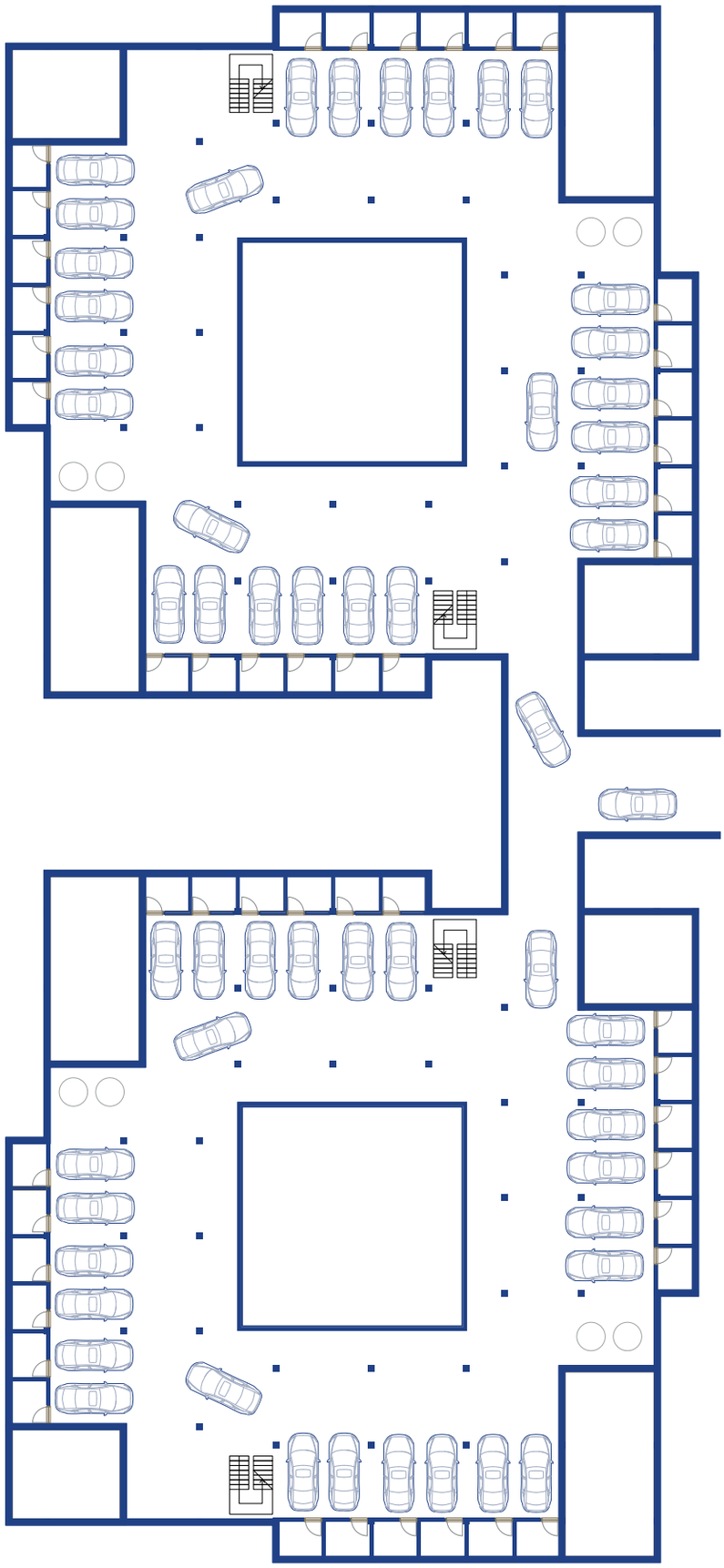



24 cars
24 cars
Total of
132 private parking
12 cars
Total of
50 load/unload parking

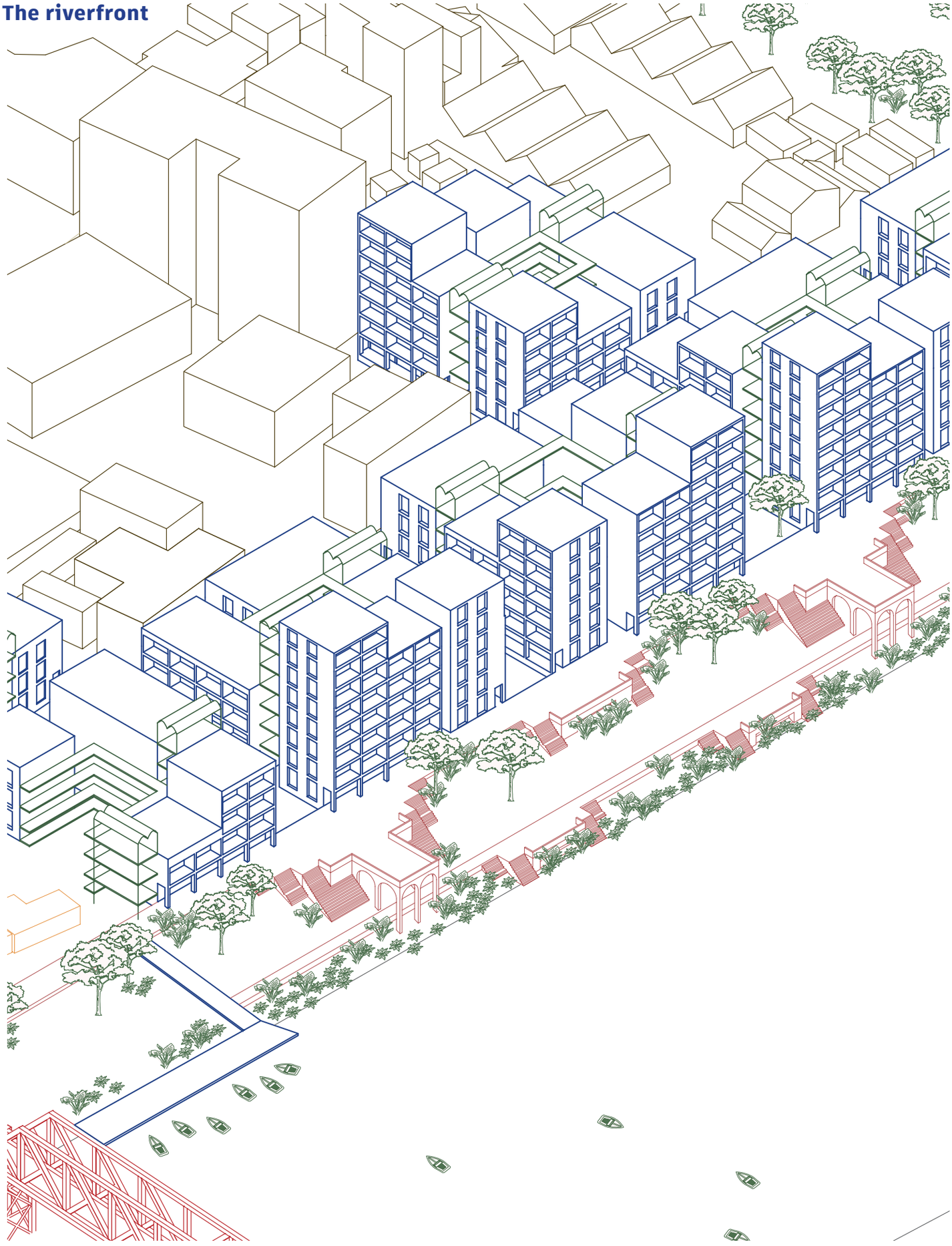
Parking garage 1

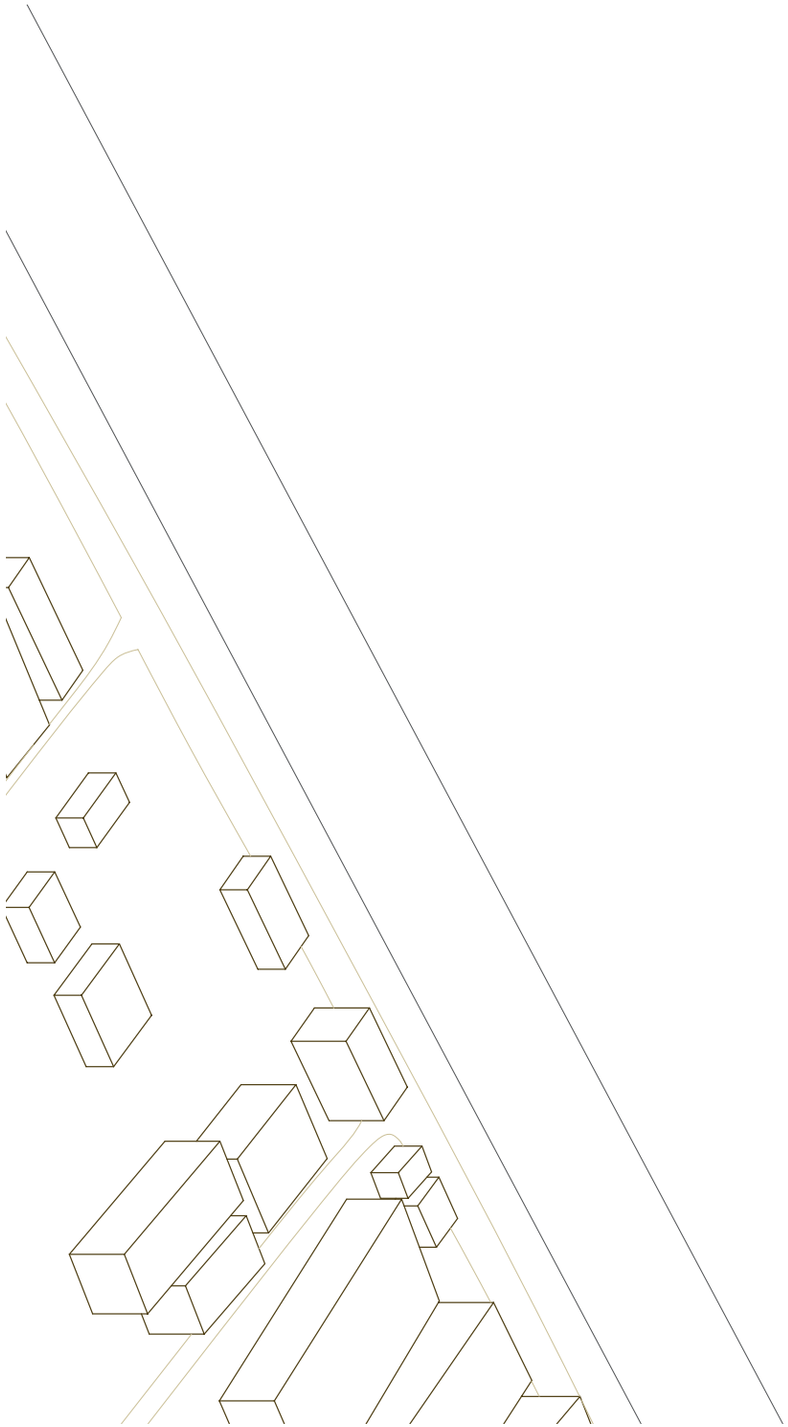


Parking garage 2 & 3



The riverfront





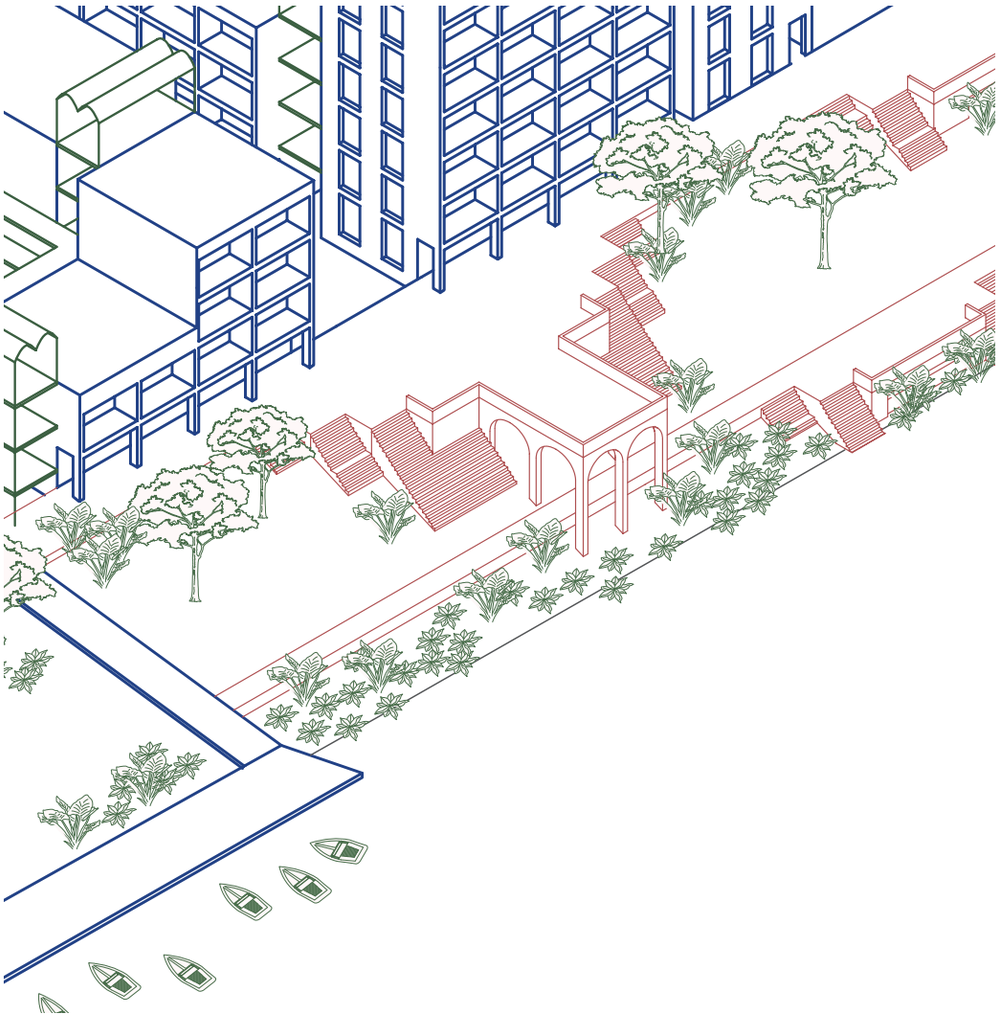
Dwelling strategy

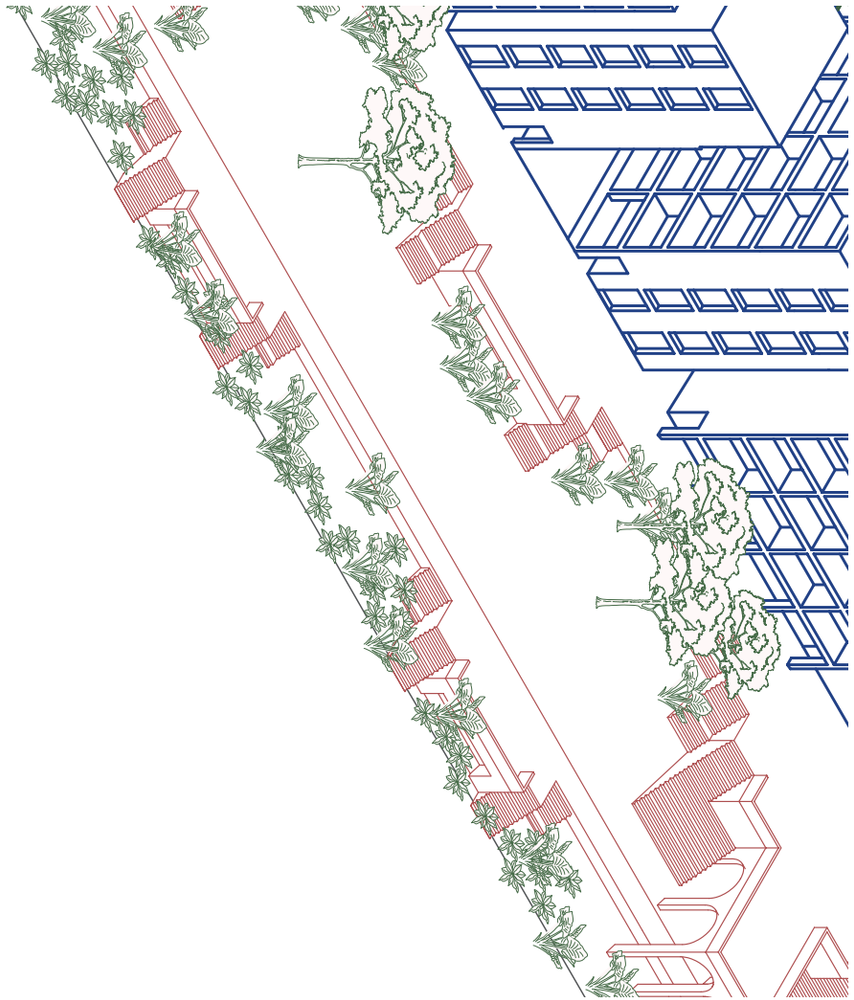
Cluster strategy

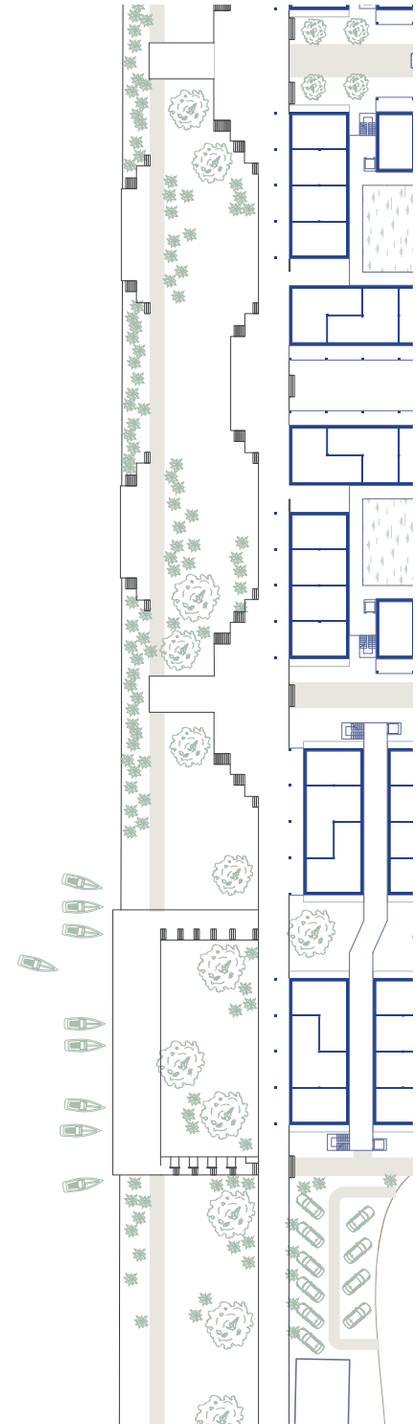
Urban strategy

Neighbourhood strategy









Dwelling strategy

Cluster strategy

Urban strategy

Neighbourhood strategy

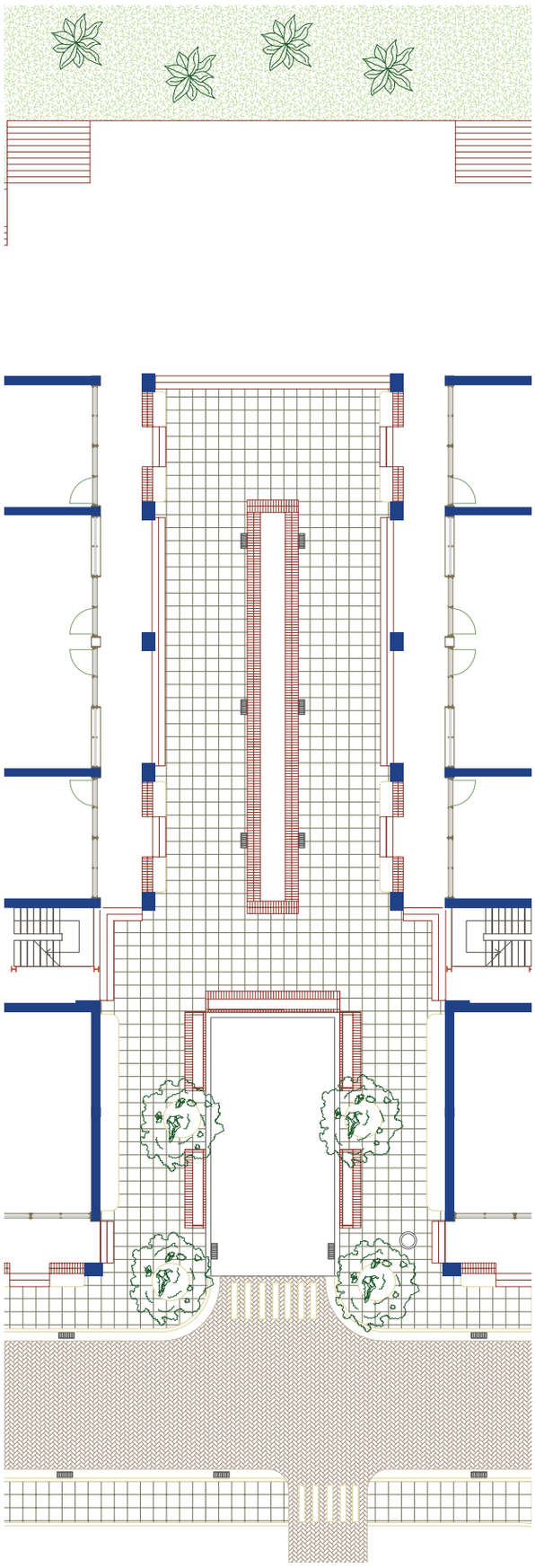
Floorplan cluster
Ground floor

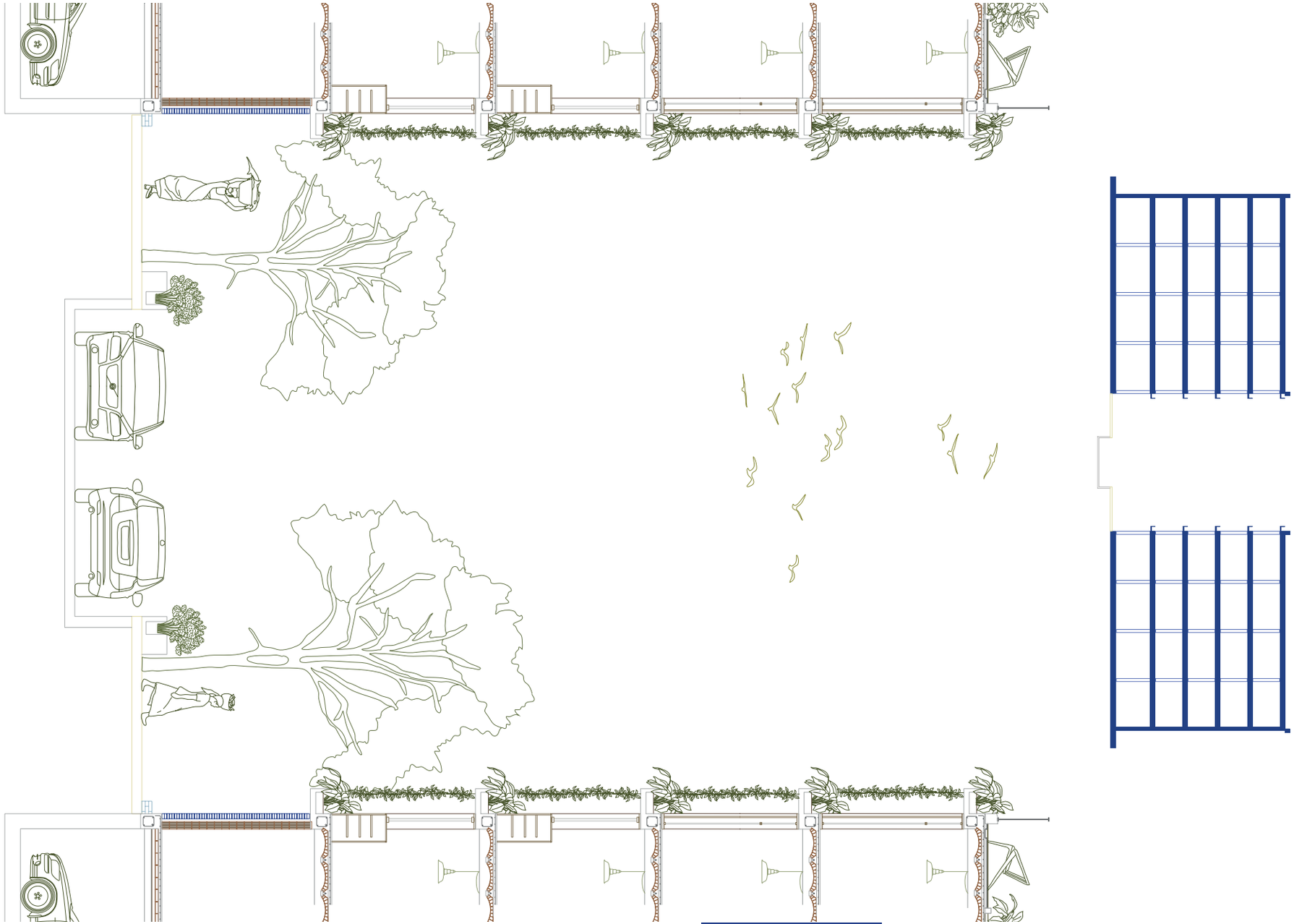


Floorplan Hindu community
Ground floor



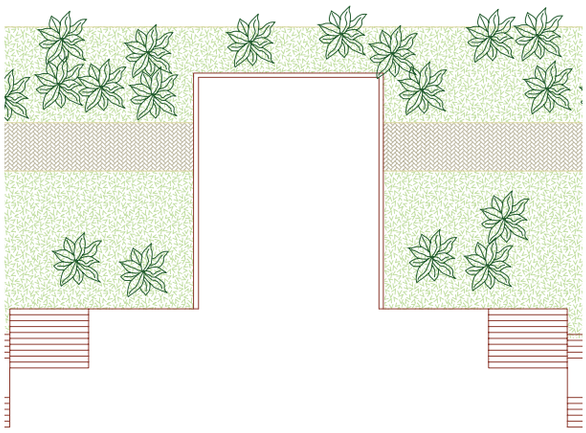
Street type 1
The entrance of the parking garage

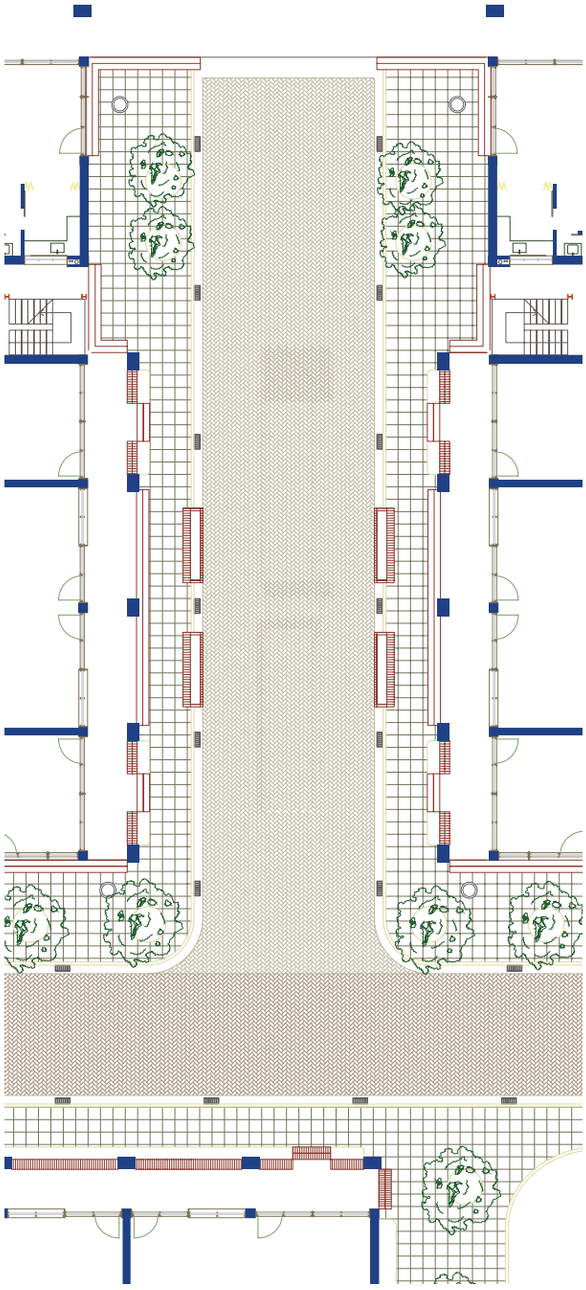


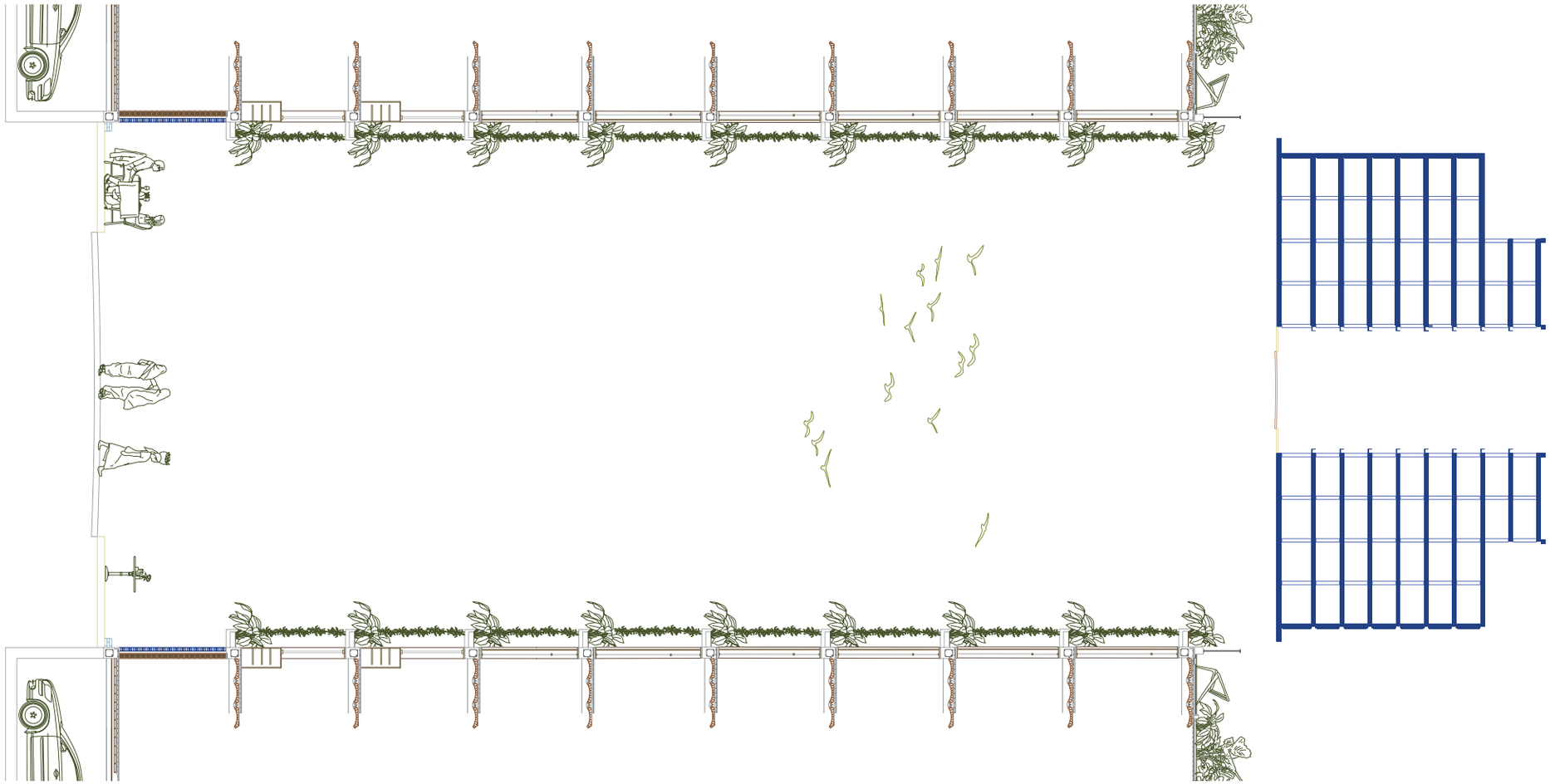


Dwelling strategy | Cluster strategy | **Urban strategy** | Neighbourhood strategy

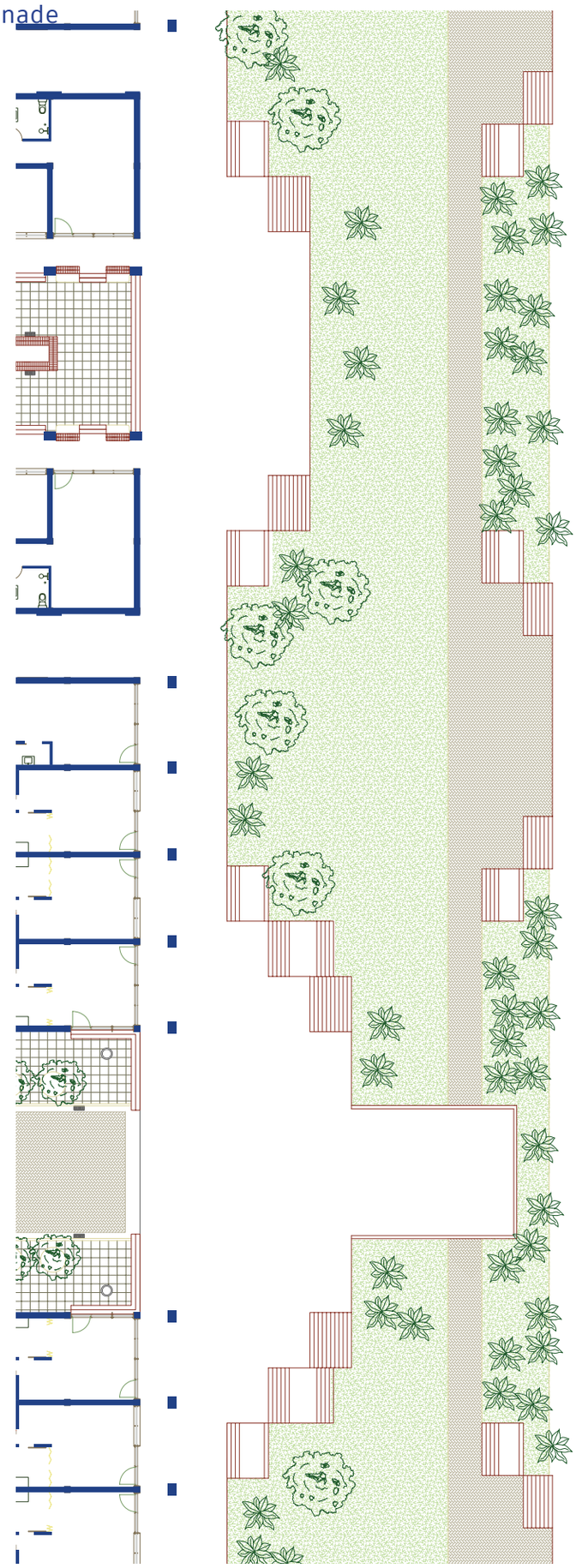
Street type 2
pedestrian street







Street type 3
the riverbank promonade





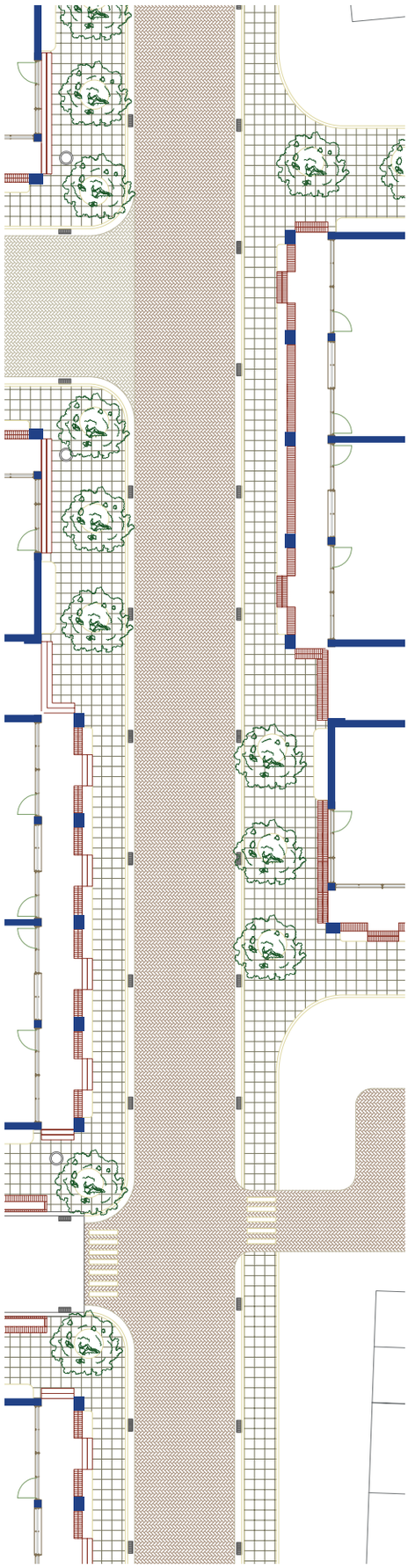
Dwelling strategy

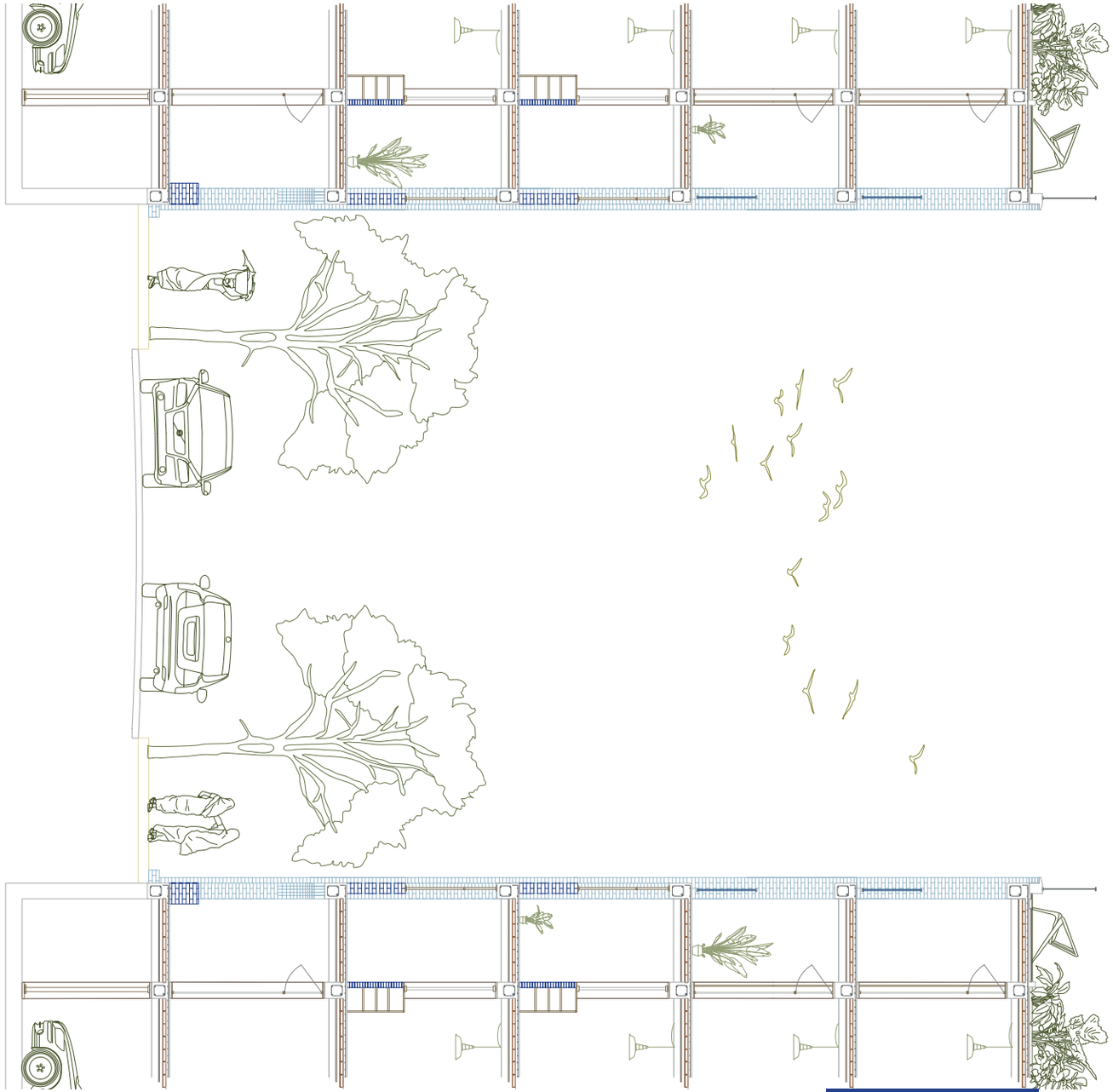
Cluster strategy

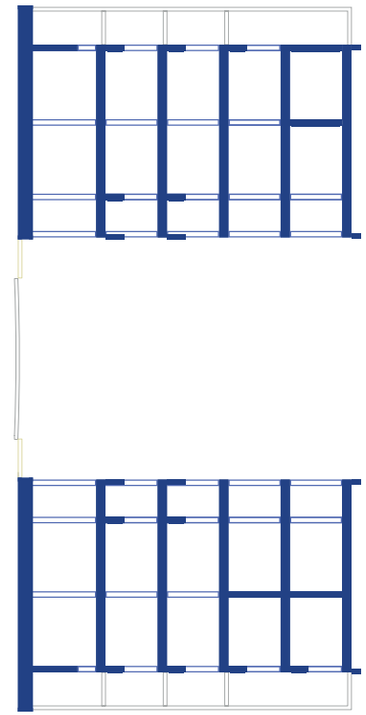
Urban strategy

Neighbourhood strategy

Street type 4
the connecting mainroad







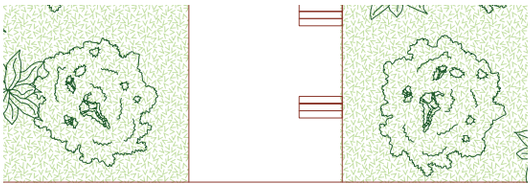
Dwelling strategy

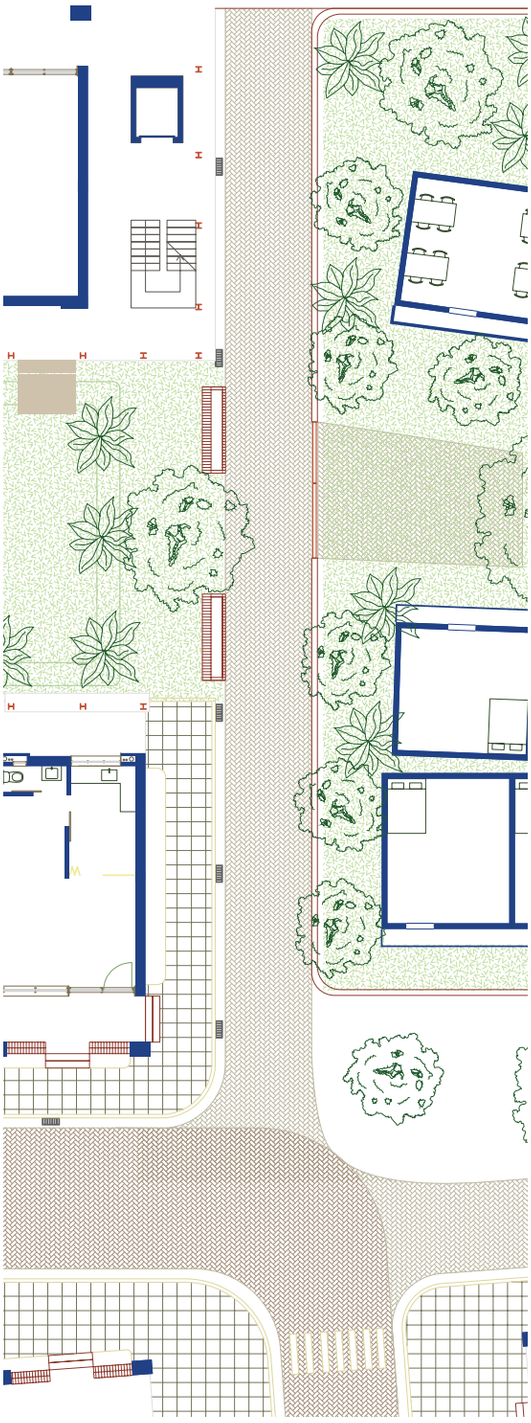
Cluster strategy

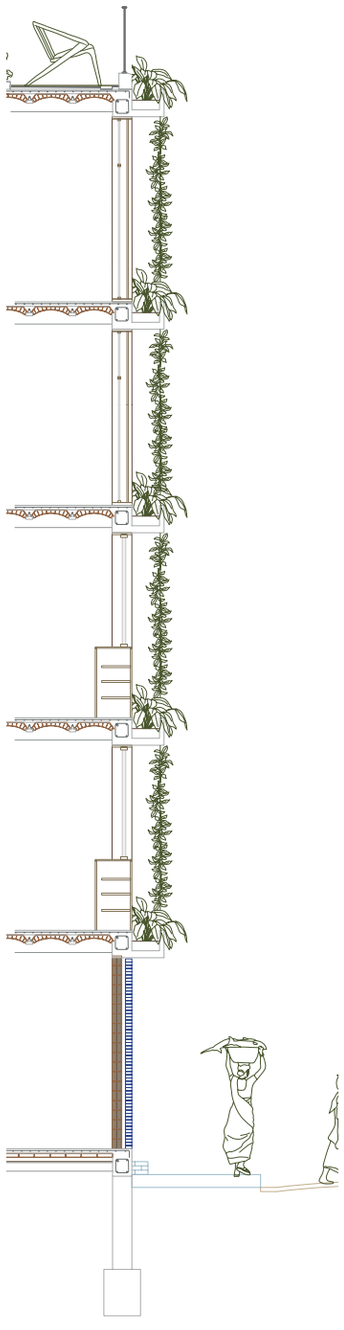
Urban strategy

Neighbourhood strategy

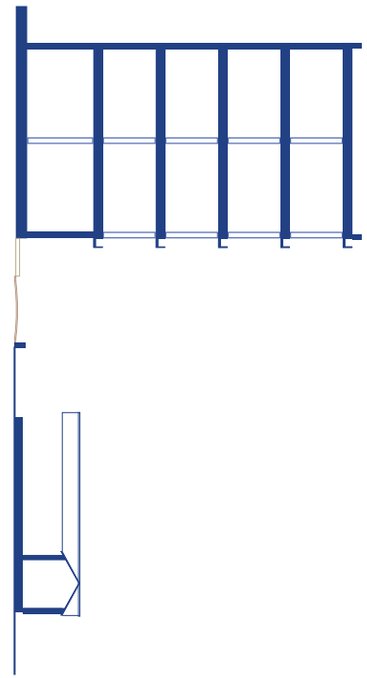
Street type 5
bystreet







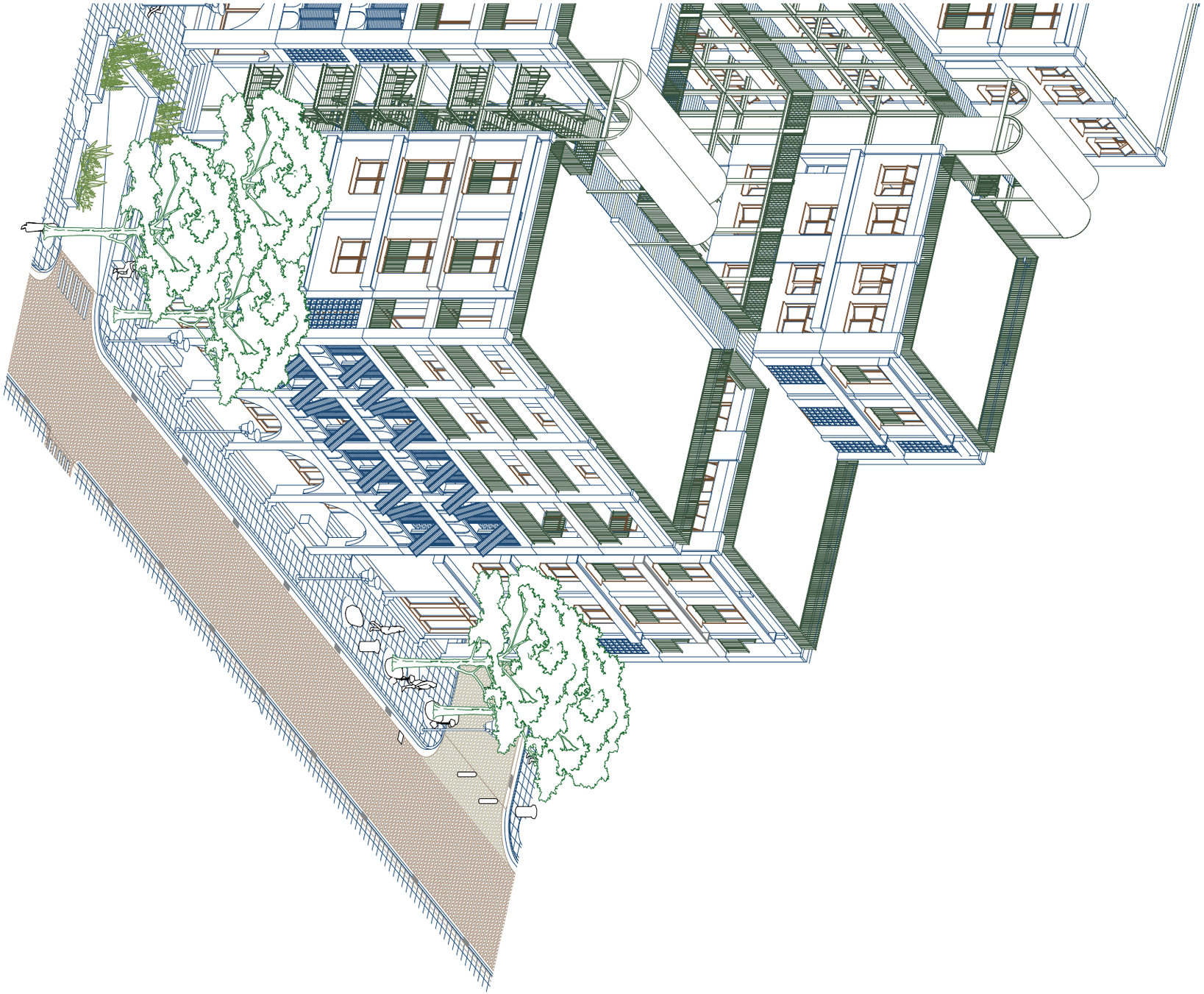




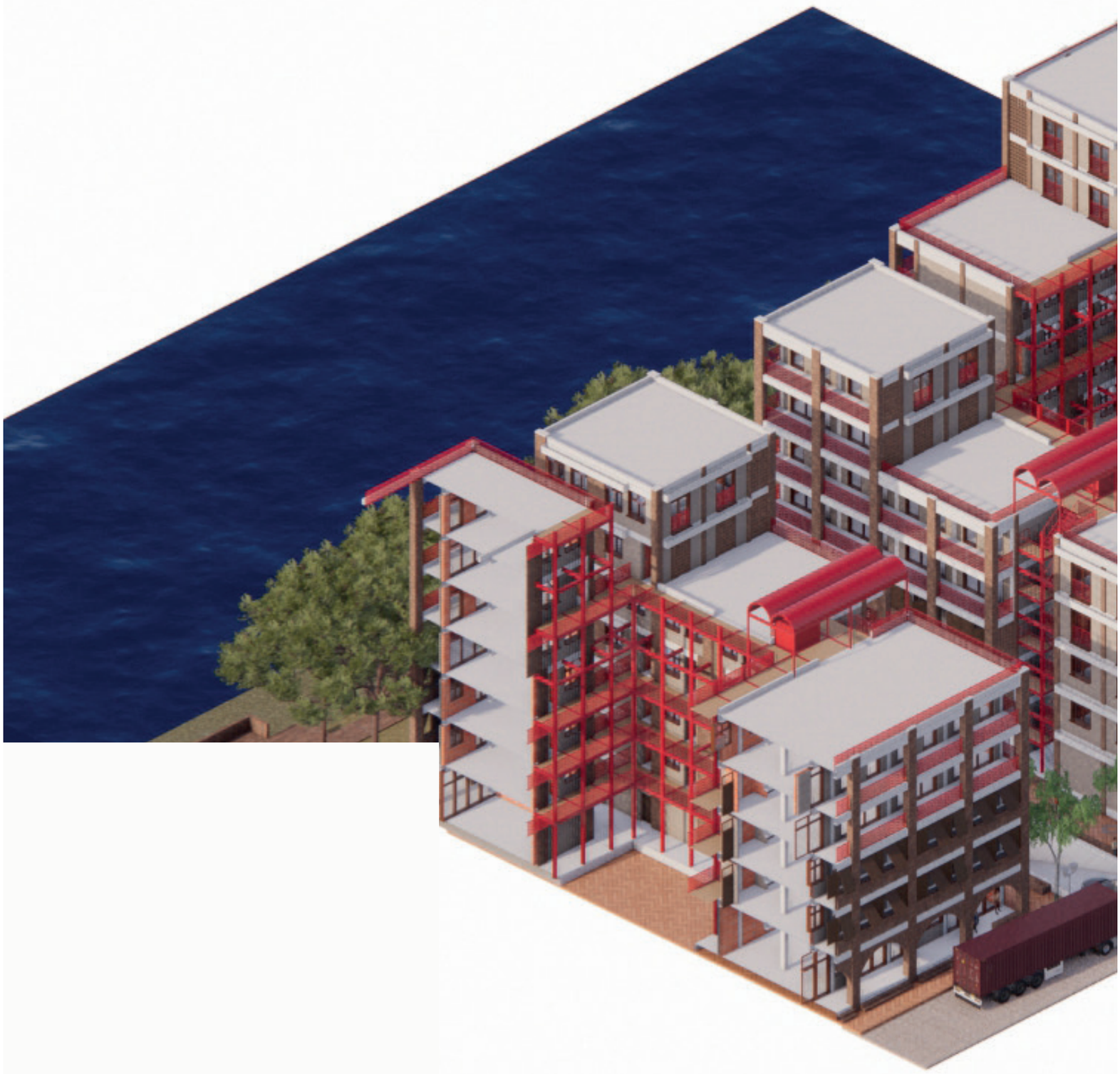
Cluster strategy

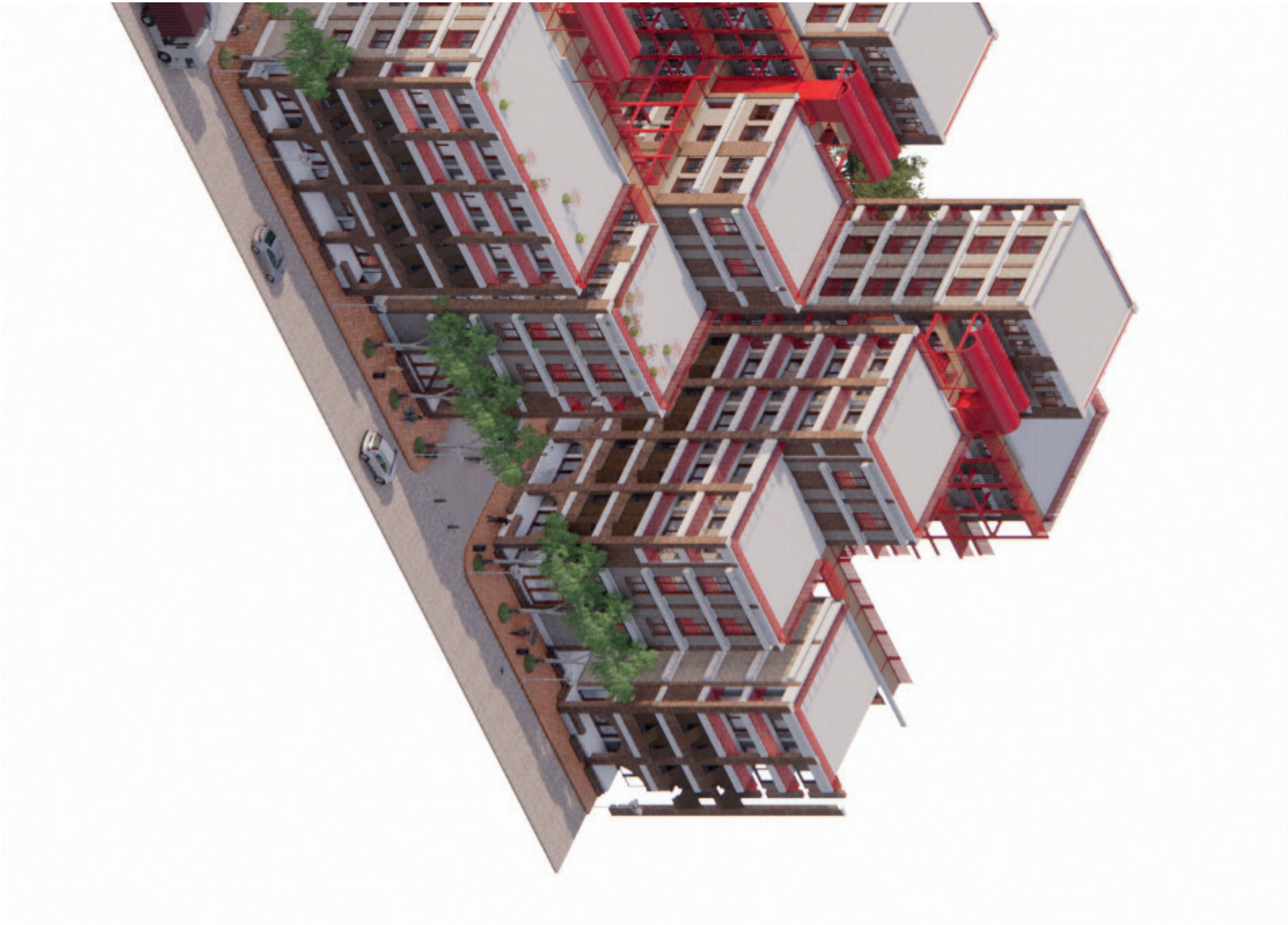
Isometric view SW





Isometric view SW





Isometric view NE



Elevation EAST





Elevation NORTH





Elevation SOUTH





Dwelling strategy

Cluster strategy

Urban strategy

Neighbourhood strategy

Elevation WEST





Section cluster



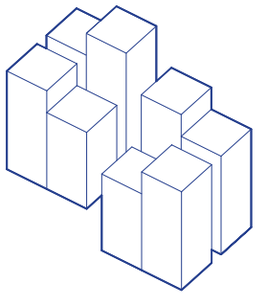


Cluster types



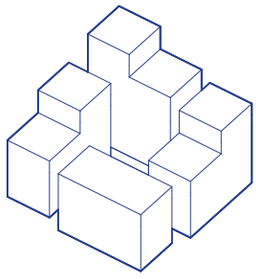
Cluster F
Cluster G
Cluster E
Cluster H
Cluster I

TYPE 1

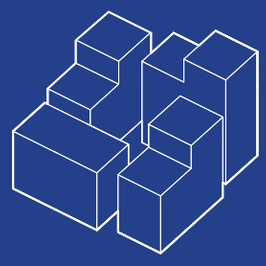


A: type 1

TYPE 2

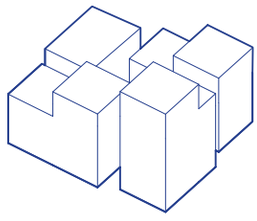


B: type 2



D: type 2

TYPE 3



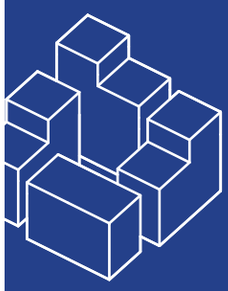
C: type 3

TYPE 4

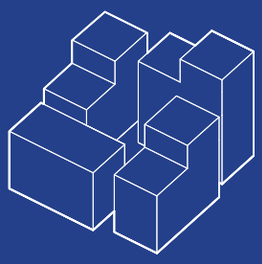
TYPE 5

Cluster B, D,E, and F (type 1) are the most common cluster type. Therefore, this cluster will be further

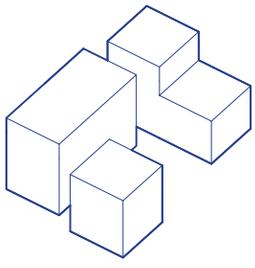
Chosen cluster to further elaborate



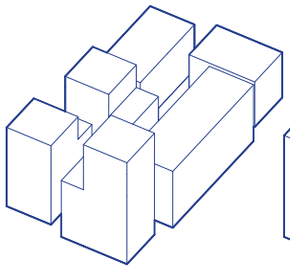
E: type 2



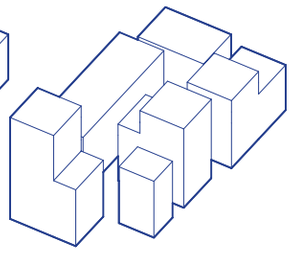
F: type 2



G: type 4



H: type 5

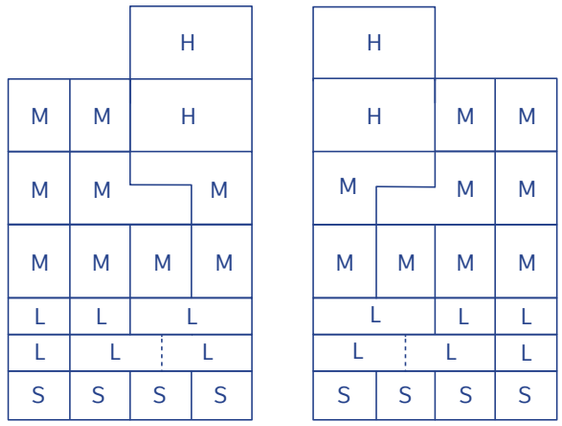


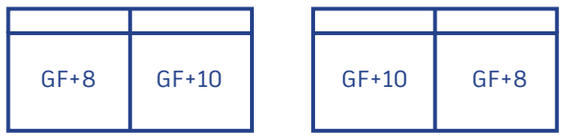
I: type 5

her elaborated

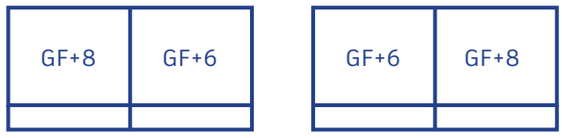
Type 1
Cluster A

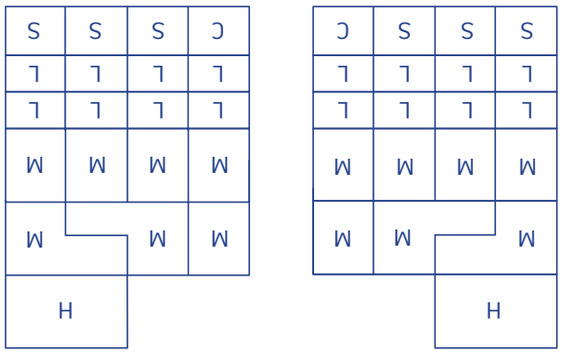
Section





Top view

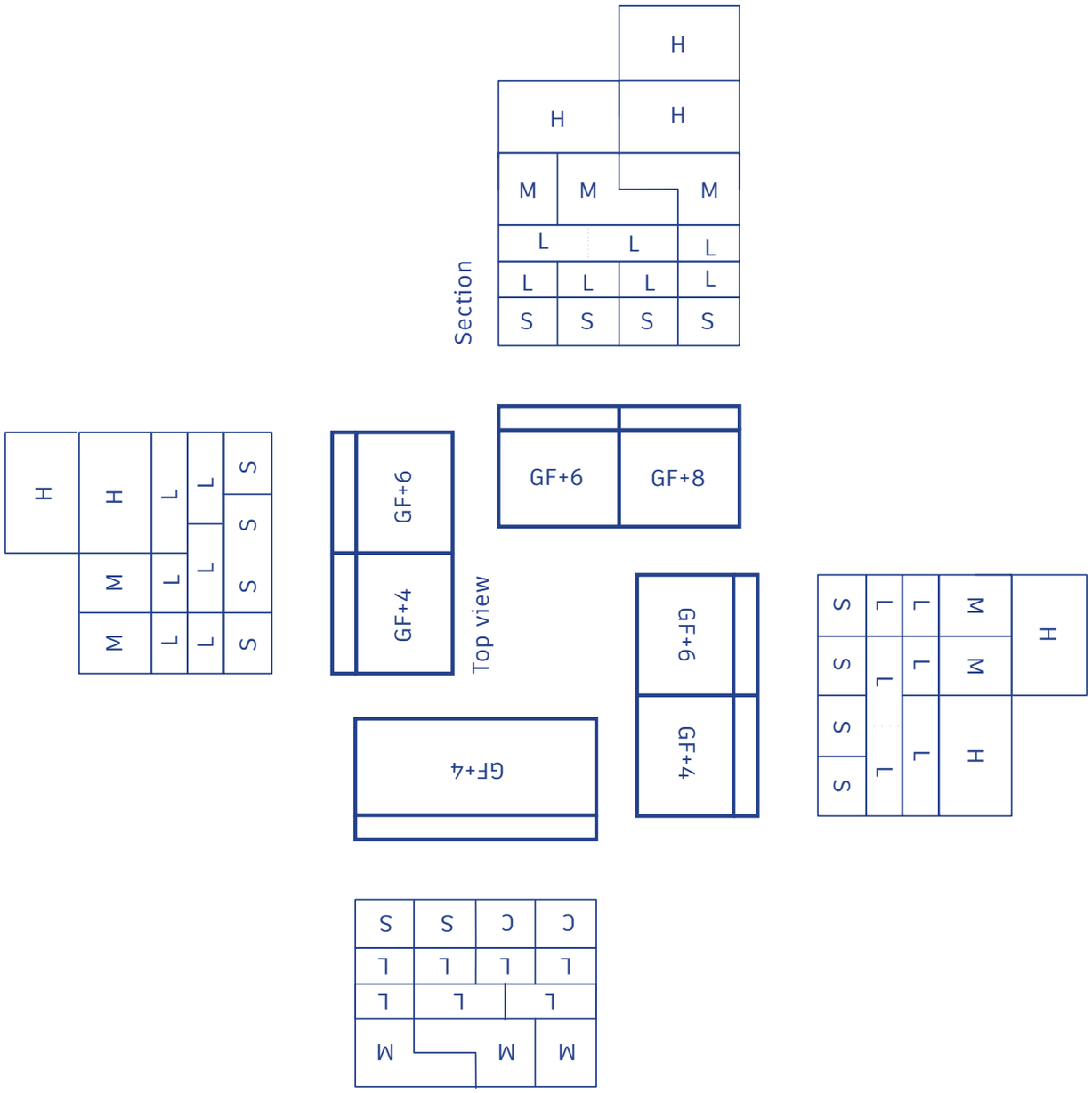




S shops & commercial space
C collective space
L low-income housing
M middle-income housing
H high-income housing

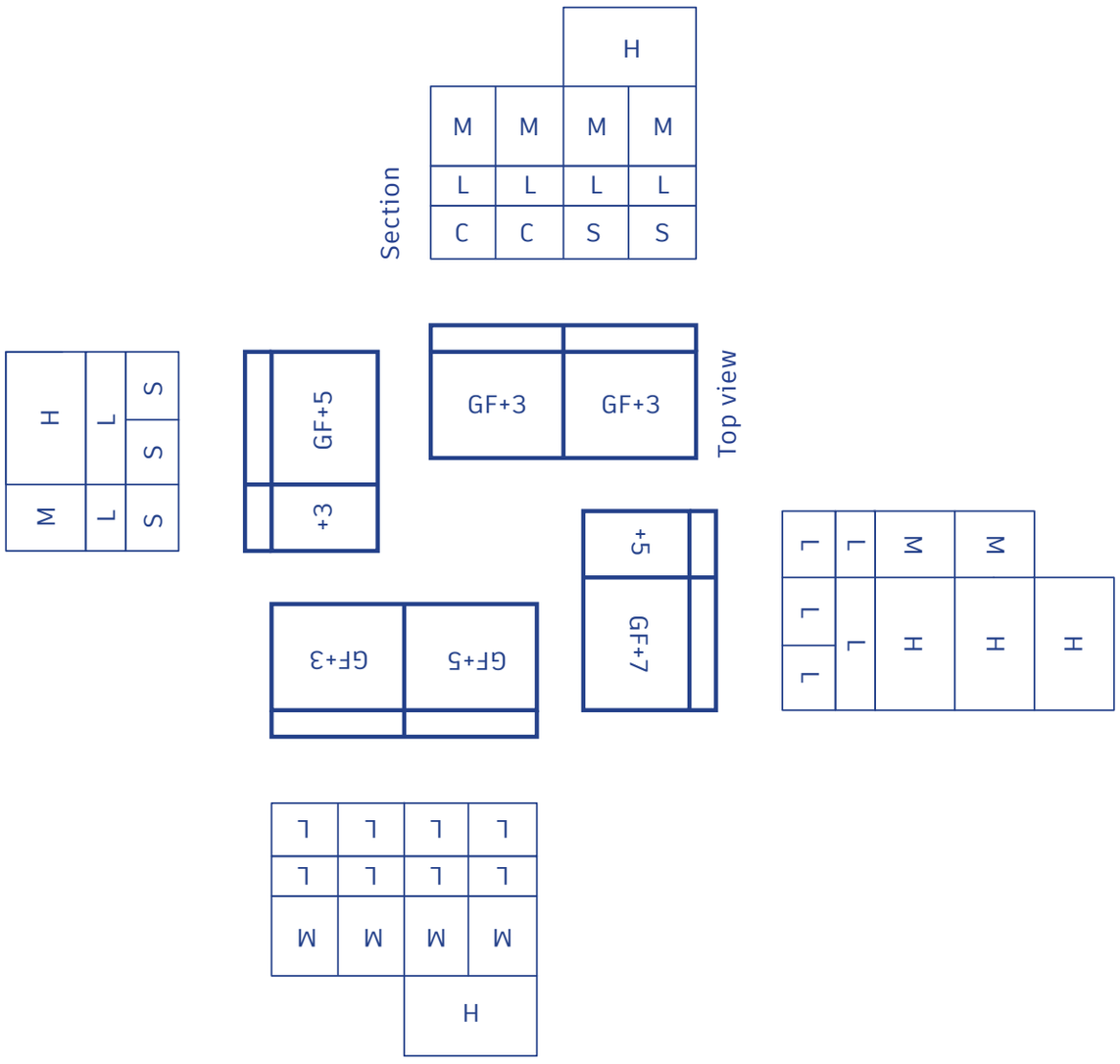
22x low-income units (small)
4x low-income units (medium)
2x low-income units (large)
24x middle-income units (small)
8x middle-income units (medium)
6x high-income units

Type 2
Cluster B
Cluster D
Cluster E
Cluster F



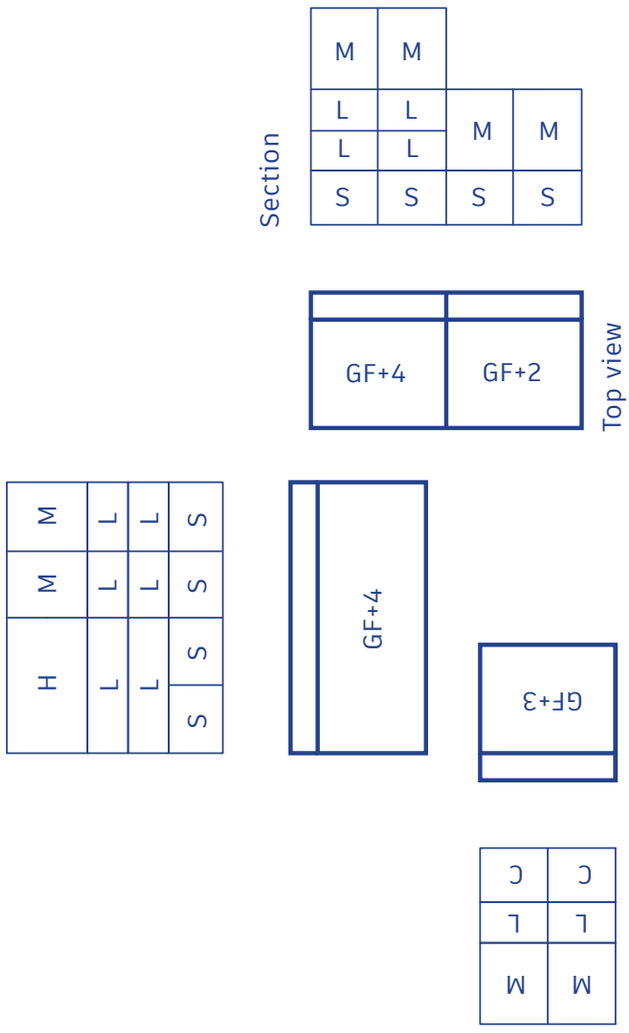
16x low-income units (small)
8x low-income units (medium)
2x low-income units (large)
6x middle-income units (small)
4x middle income units (medium)
7x high-income units

Type 3
Cluster C



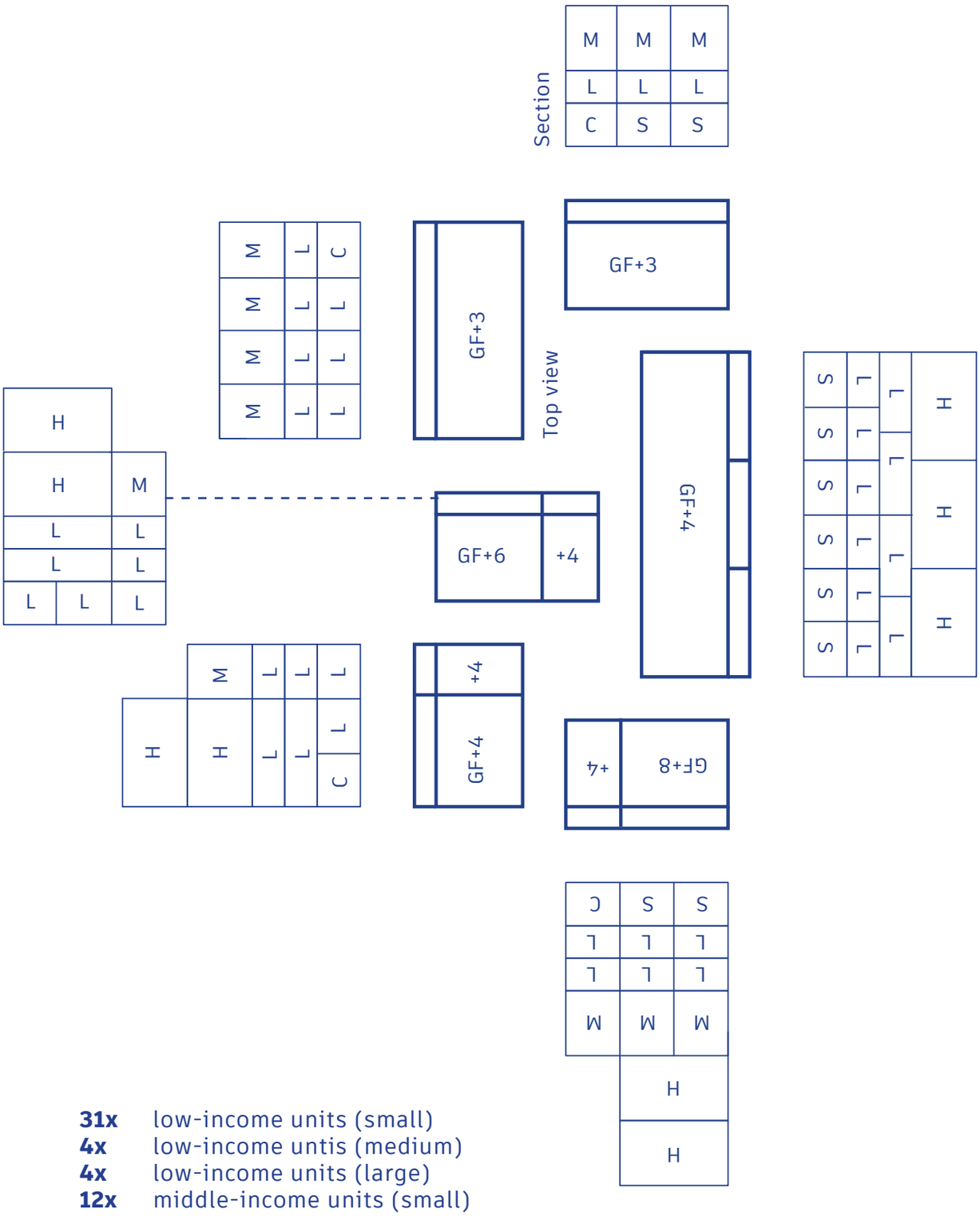
16x low-income units (small)
2x low-income units (large)
11x middle-income units (small)
6x high-income units

Type 4
Cluster G



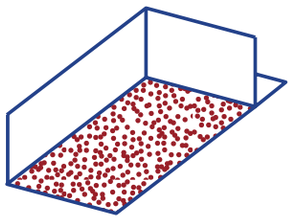
10x low-income units (small)
2x low-income units (large)
8x middle-income units (small)
1x high-income units

Type 5
Cluster H
Cluster I

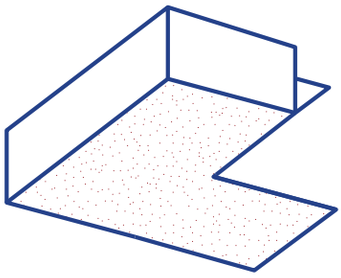


31x low-income units (small)
4x low-income untis (medium)
4x low-income units (large)
12x middle-income units (small)
9x high-income units

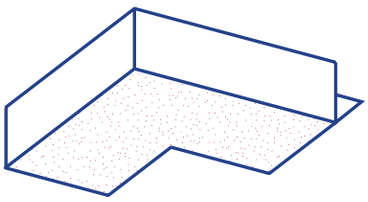
Low-income units
Page x-x



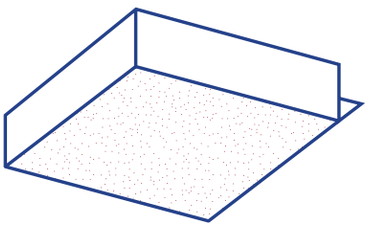
40 sqm interior
+
10 sqm exterior



60 sqm interior
+
10 sqm exterior

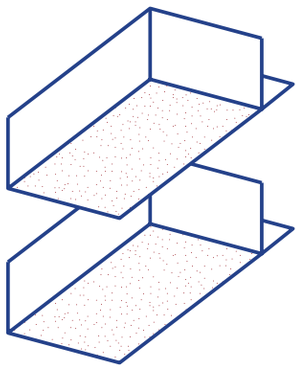


60 sqm interior
+
20 sqm exterior

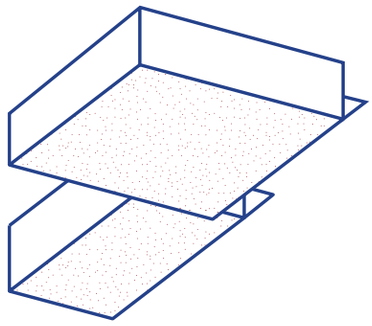


80 sqm interior
+
20 sqm exterior

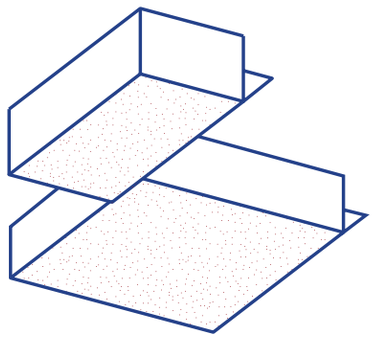
Middle-income units
Page x-x



80 sqm interior
+
20 sqm exterior

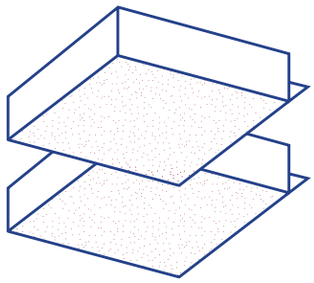


120 sqm interior
+
30 sqm exterior



120 sqm interior
+
30 sqm exterior

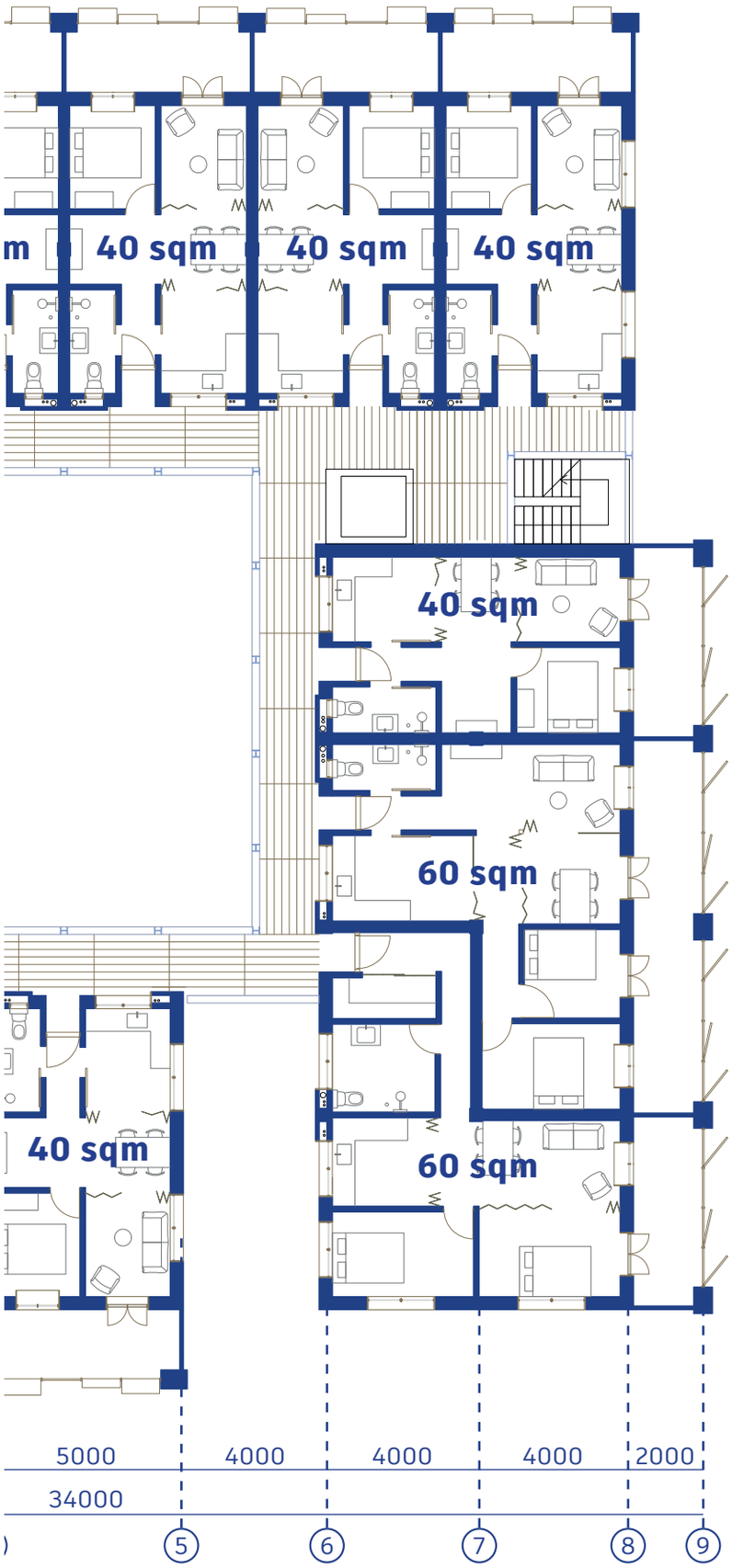
High-income units
Page x-x



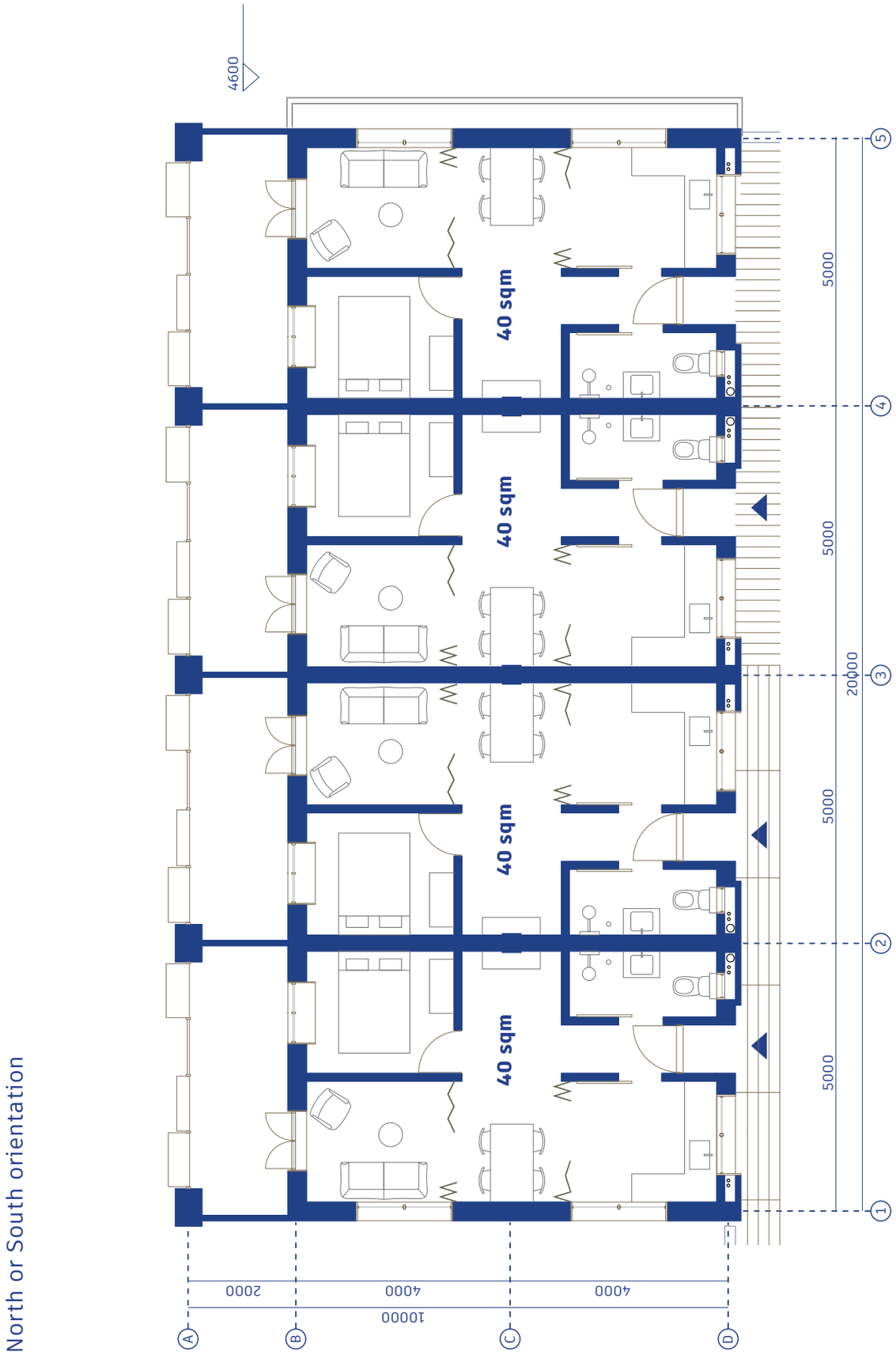
160 sqm interior
+
40 sqm exterior

Low-income housing
First floor - type 40sqm & 60sqm



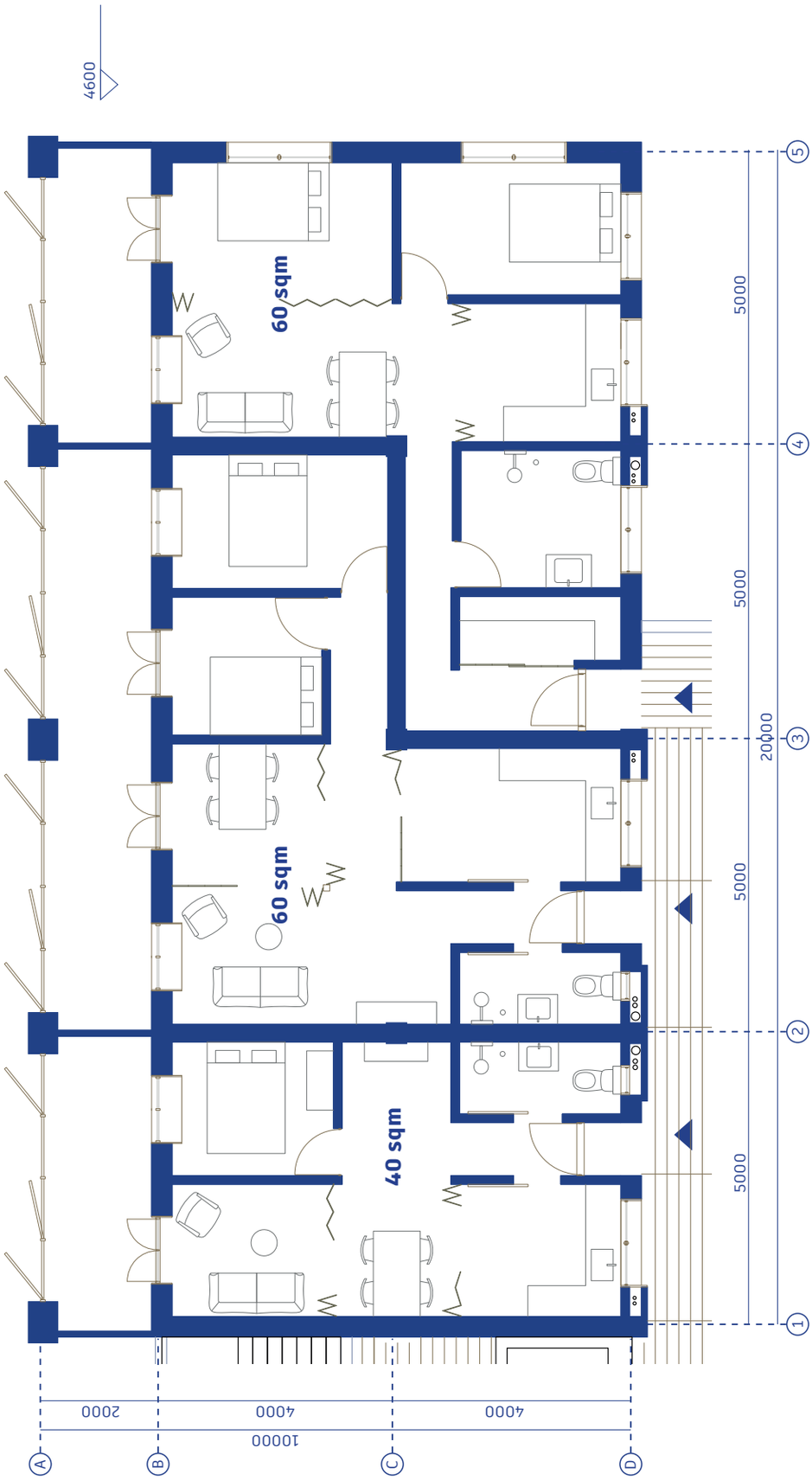

m
40 sqm
40 sqm
40 sqm
40 sqm
60 sqm
40 sqm
60 sqm
4600
5000
4000
4000
4000
2000
34000
5
6
7
8
9

Low-income housing
First floor - block 1 - type 40sqm



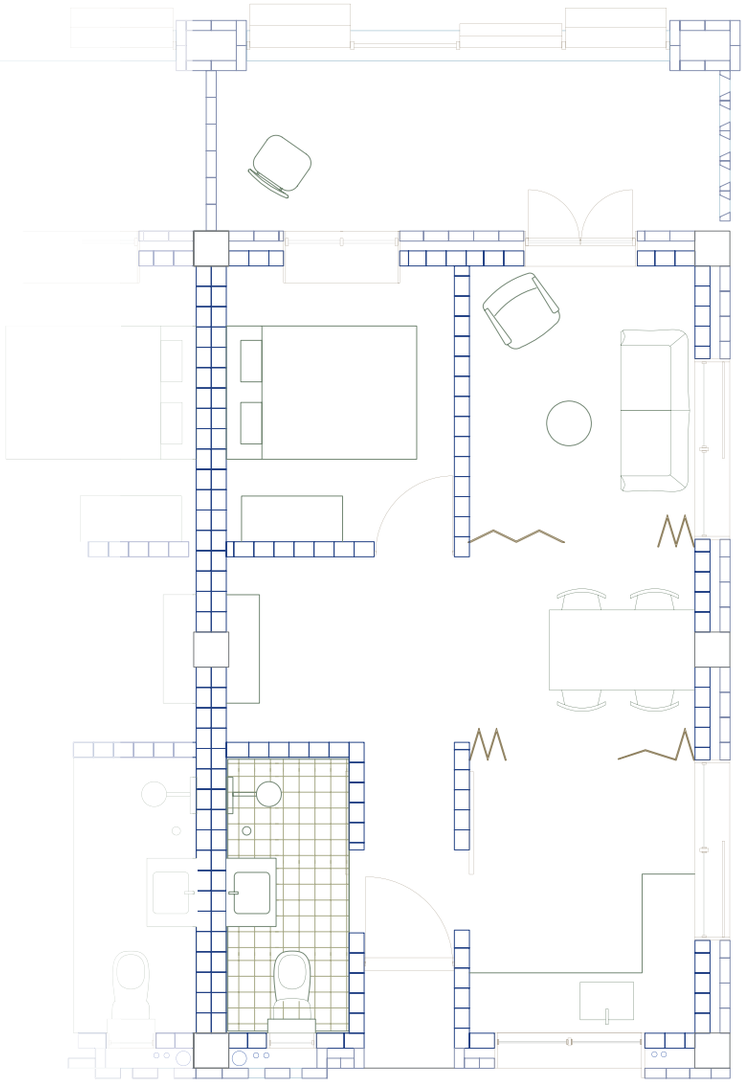
North or South orientation

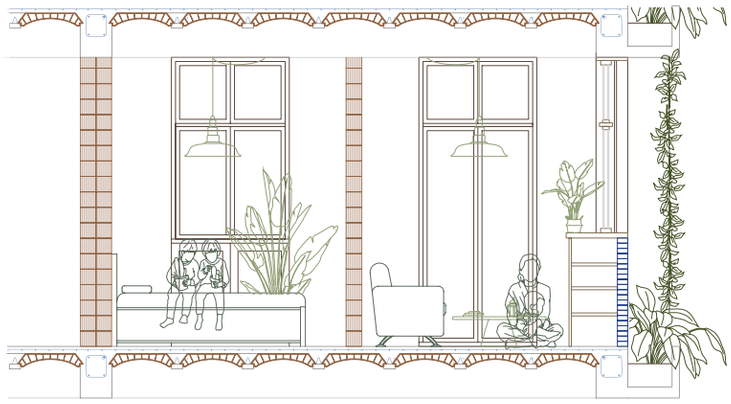
Low-income housing
First floor - block 2 - type 40sqm & 60sqm



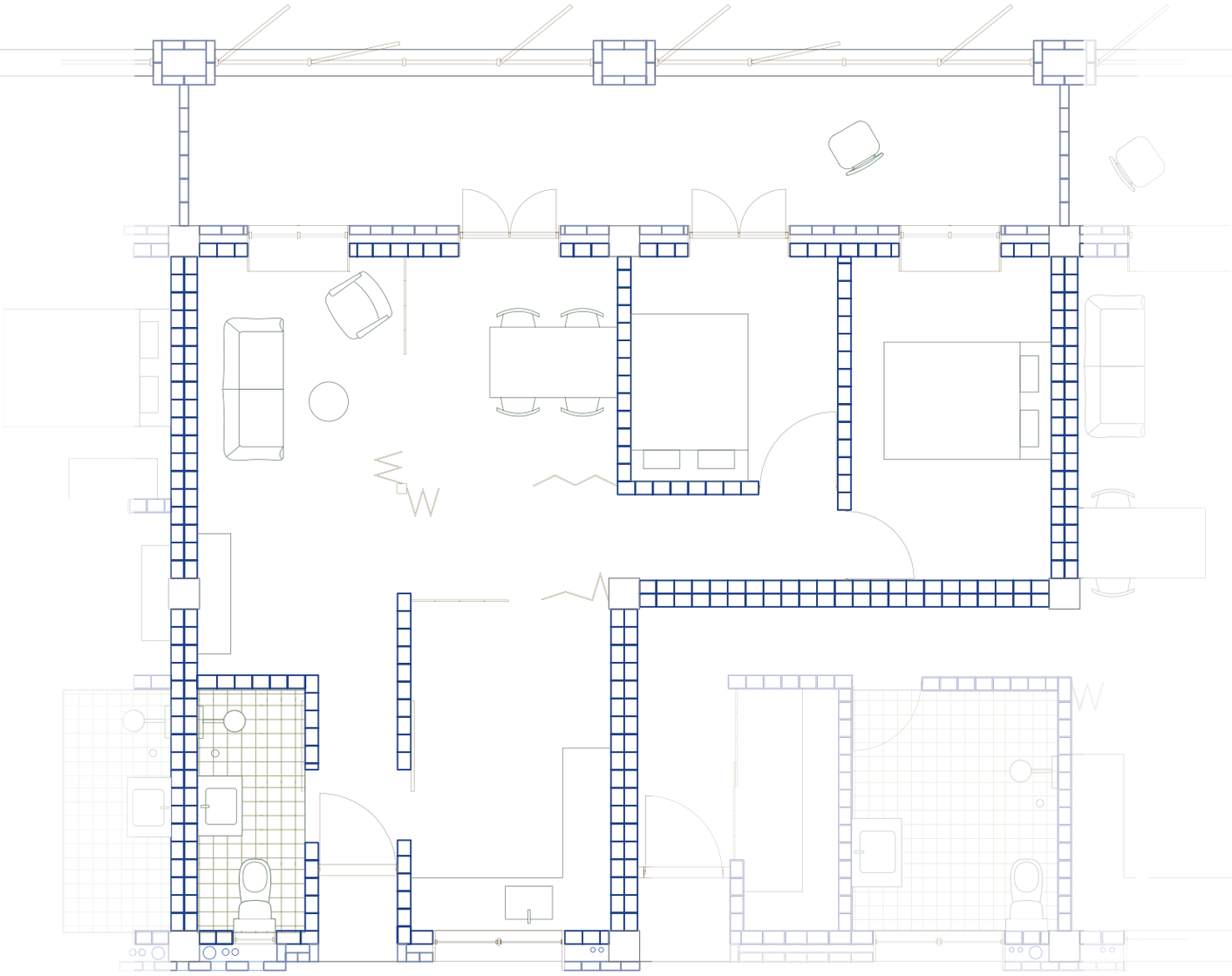
East or West orientation

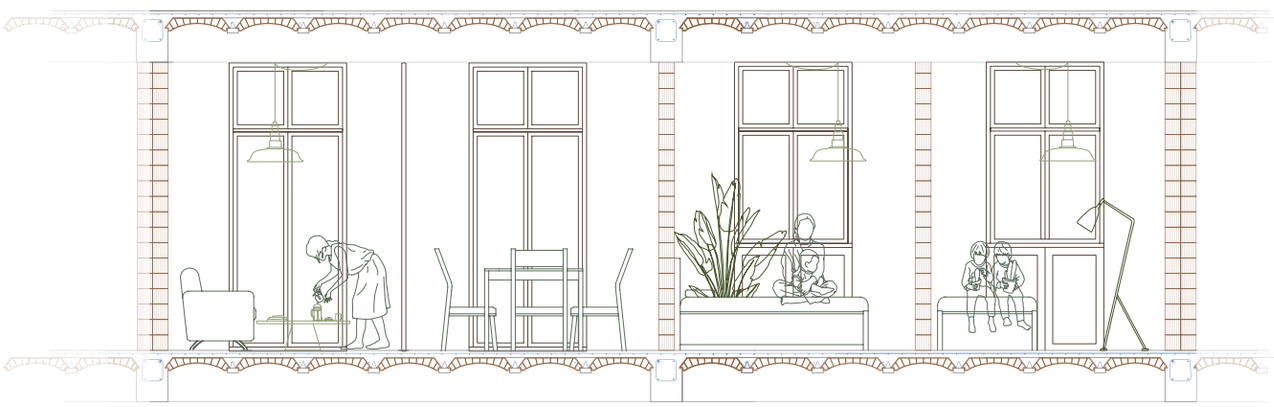
Low-income housing
40 sqm + 10 sqm balcony - appartment



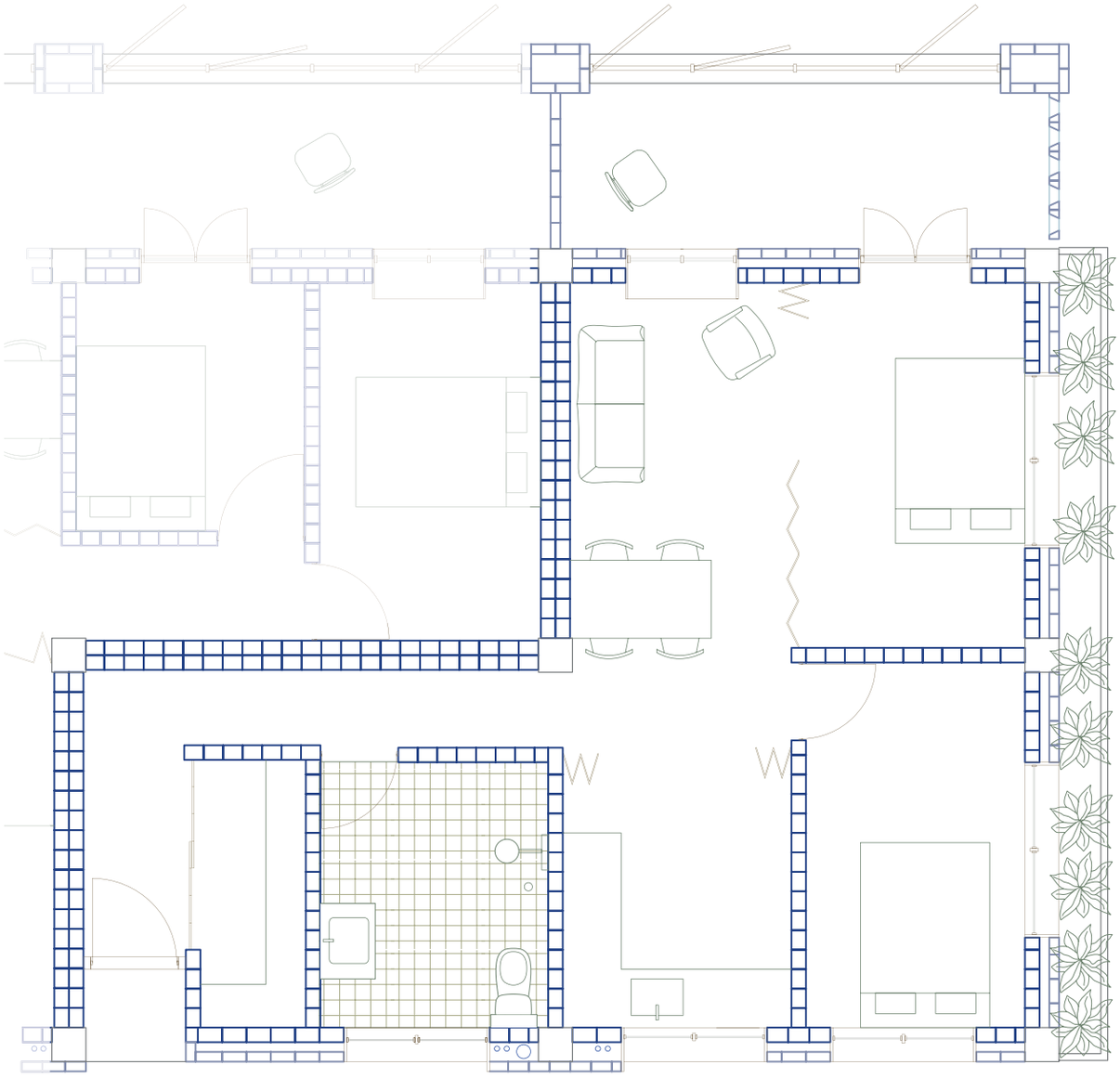


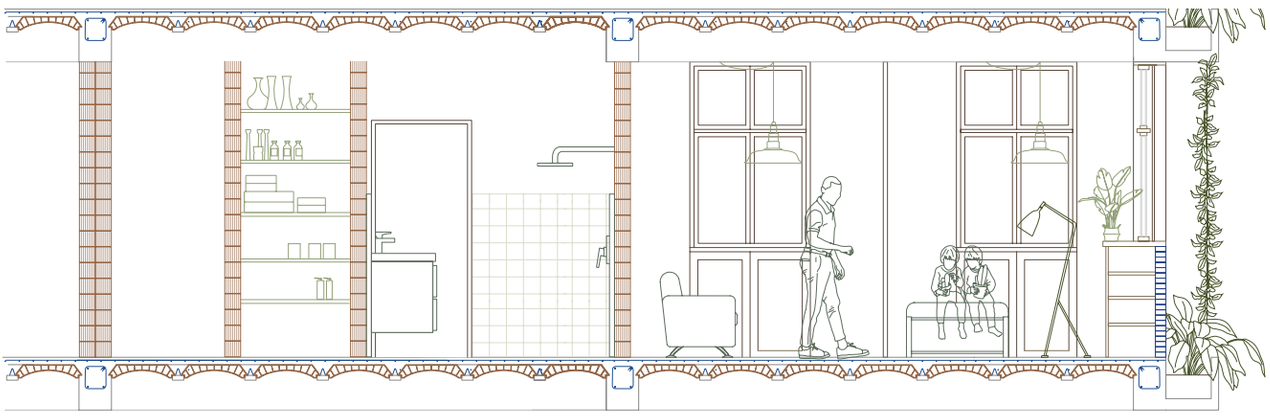
Low-income housing
60 sqm + 20 sqm balcony - appartment



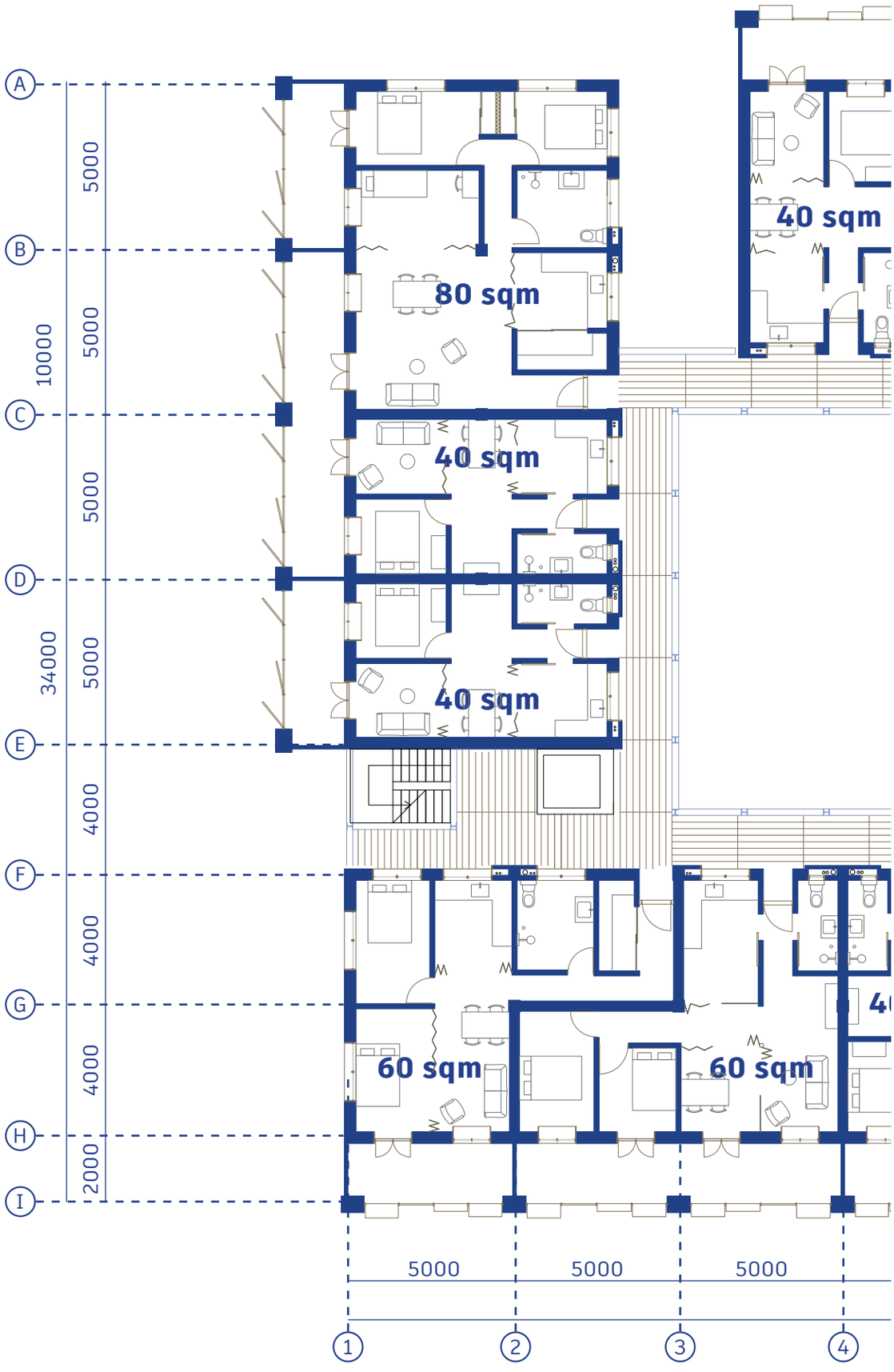


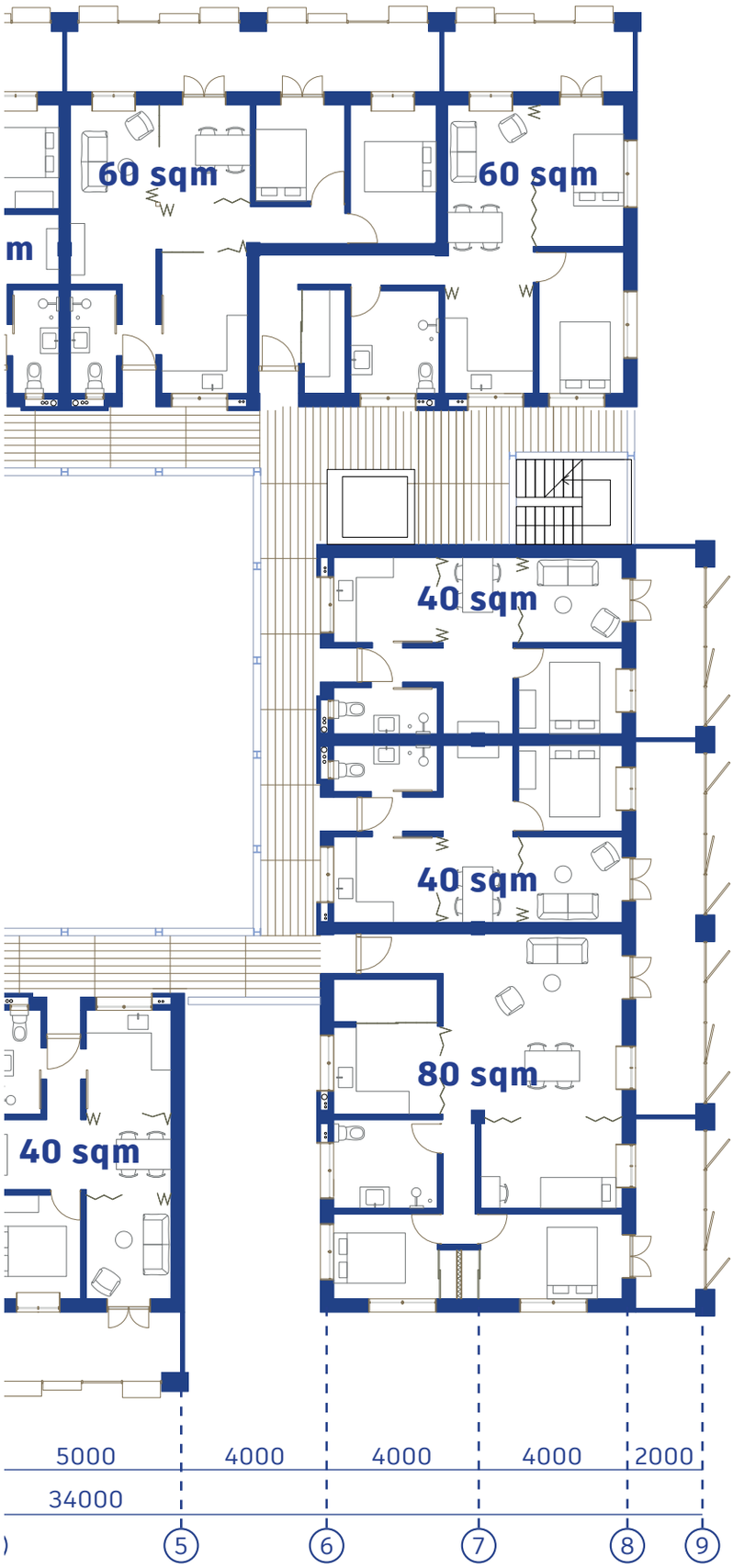
Low-income housing
60 sqm + 10 sqm balcony - appartment



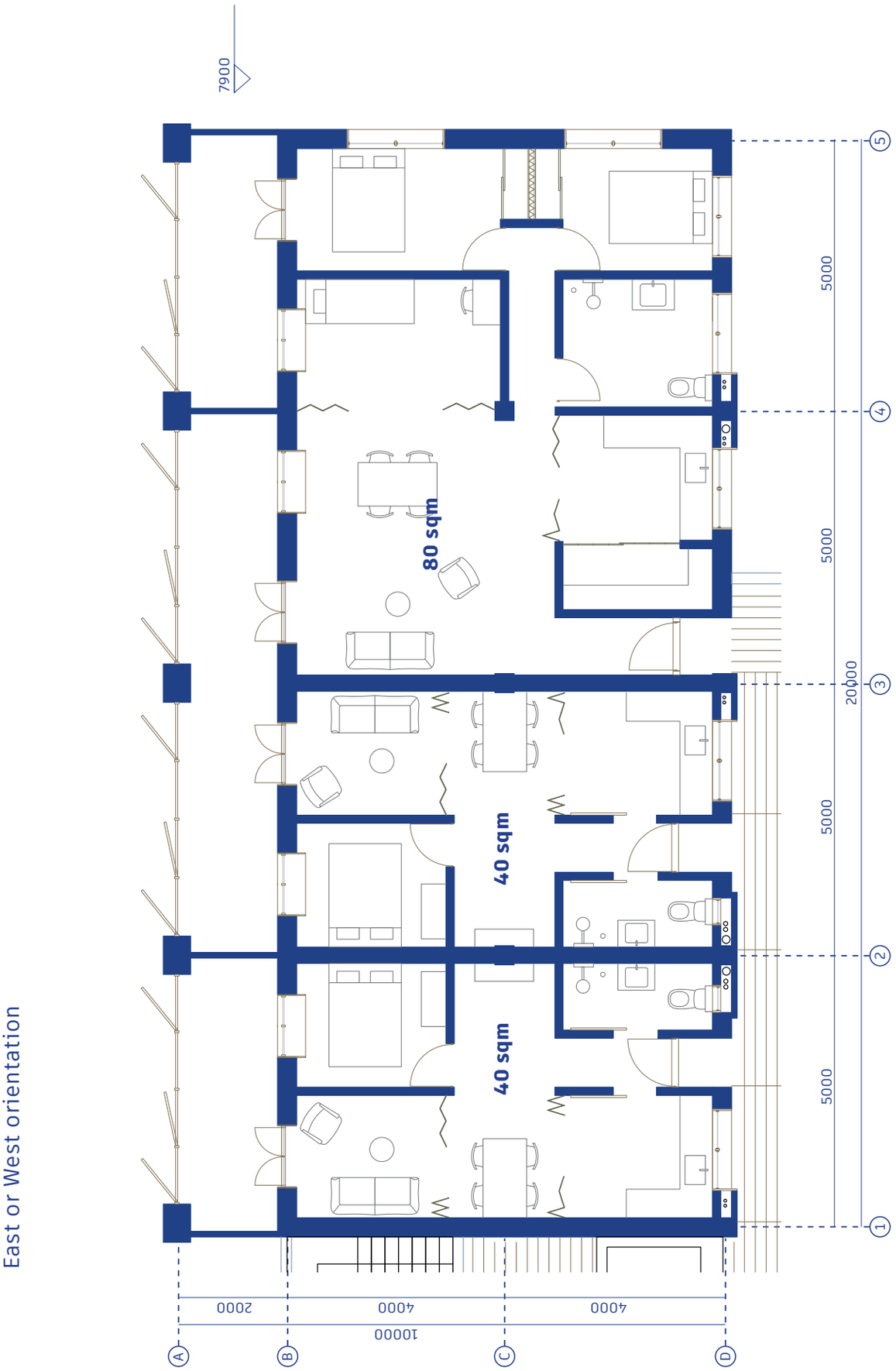


Low-income housing
Second floor - type 40sqm, 60sqm, and 80sqm



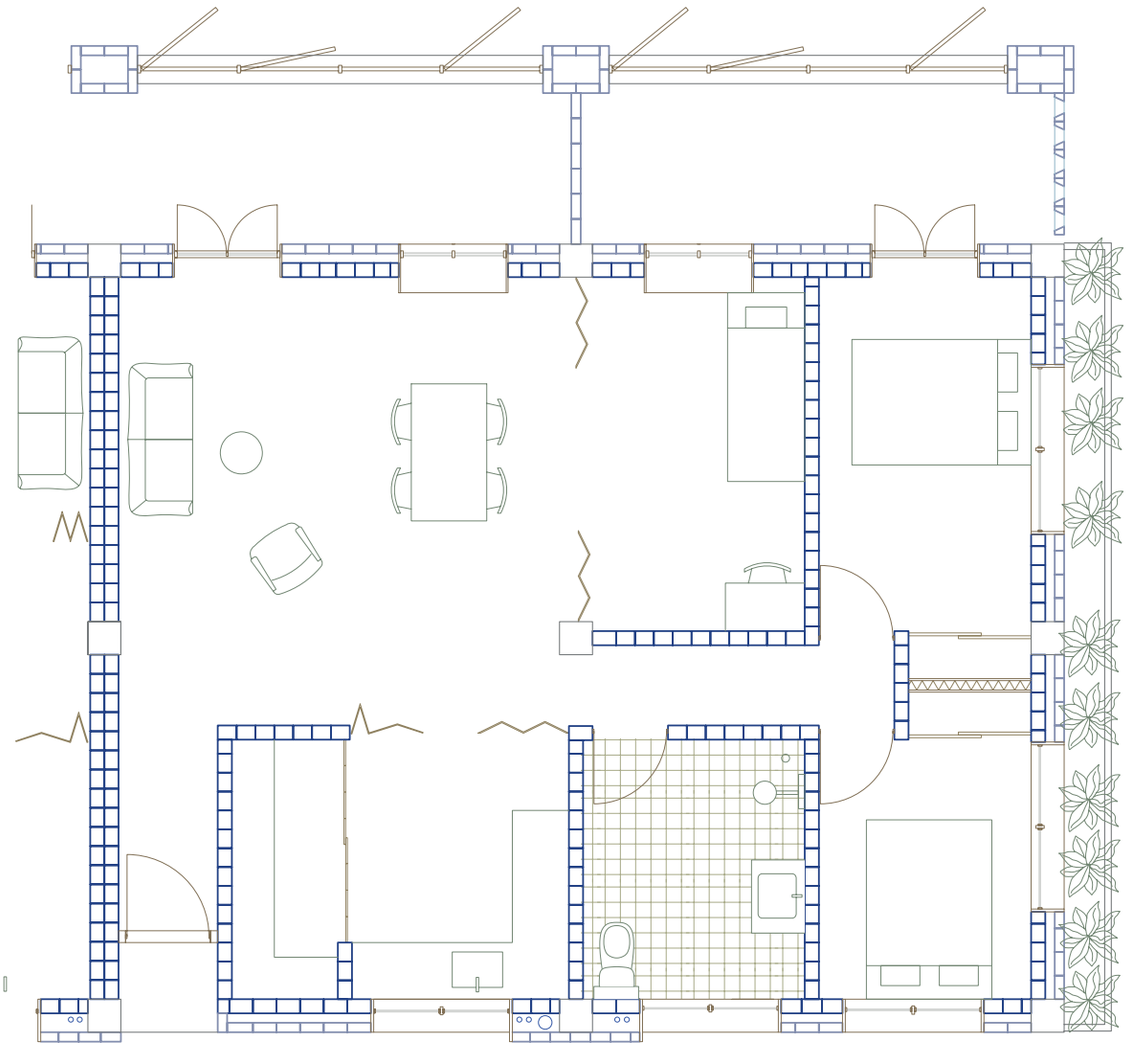

7900
60 sqm
60 sqm
40 sqm
40 sqm
80 sqm
40 sqm
5000
4000
4000
4000
2000
34000
5
6
7
8
9

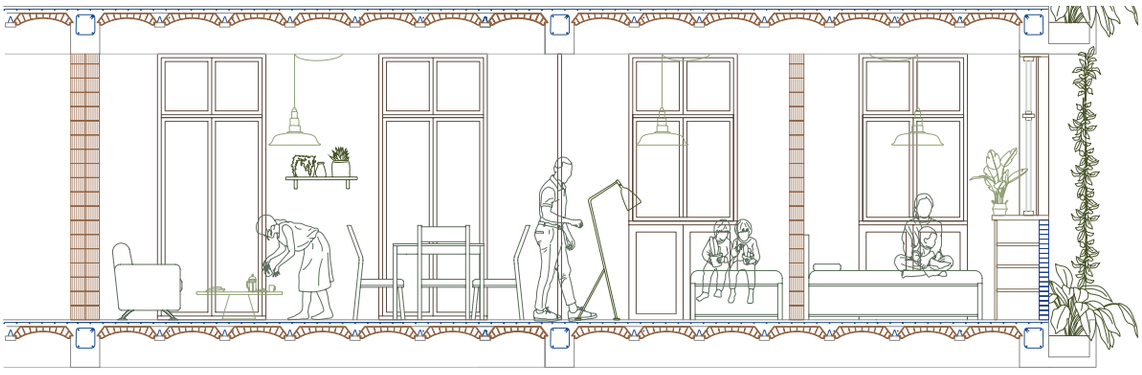
Low-income housing
Second floor - block 2 - type 40sqm & 80sqm



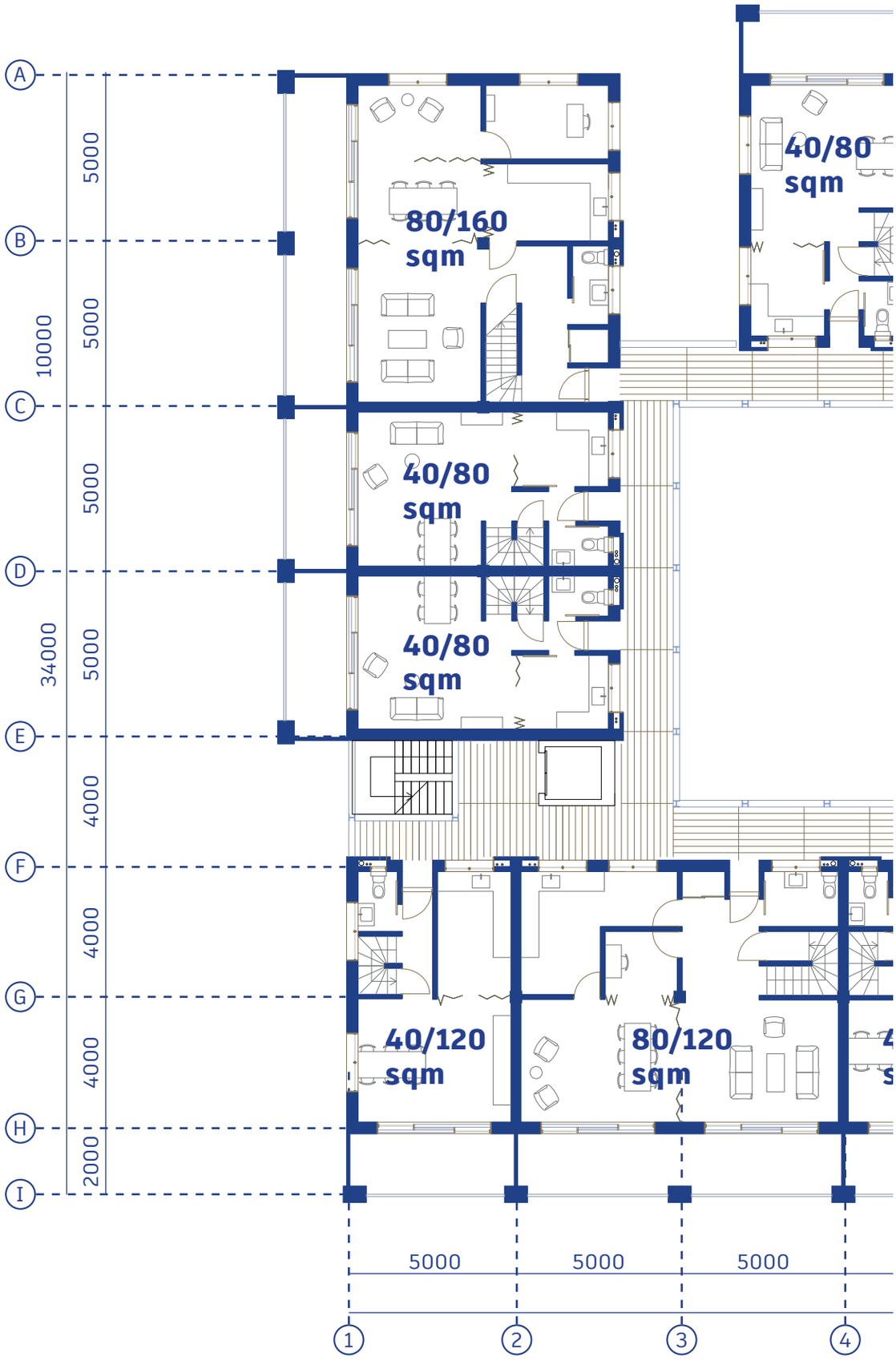
East or West orientation

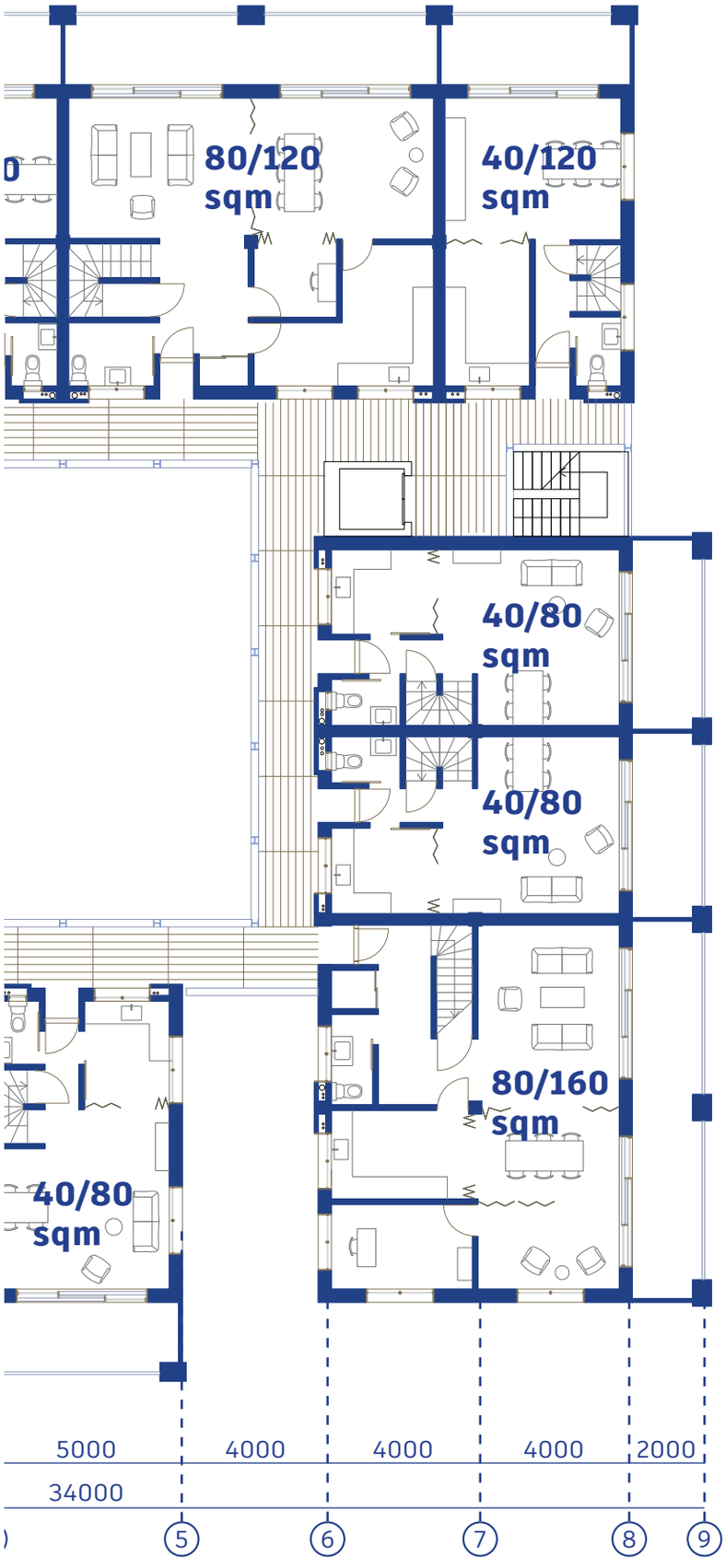
Low-income housing
80 sqm + 20 sqm balcony - appartment



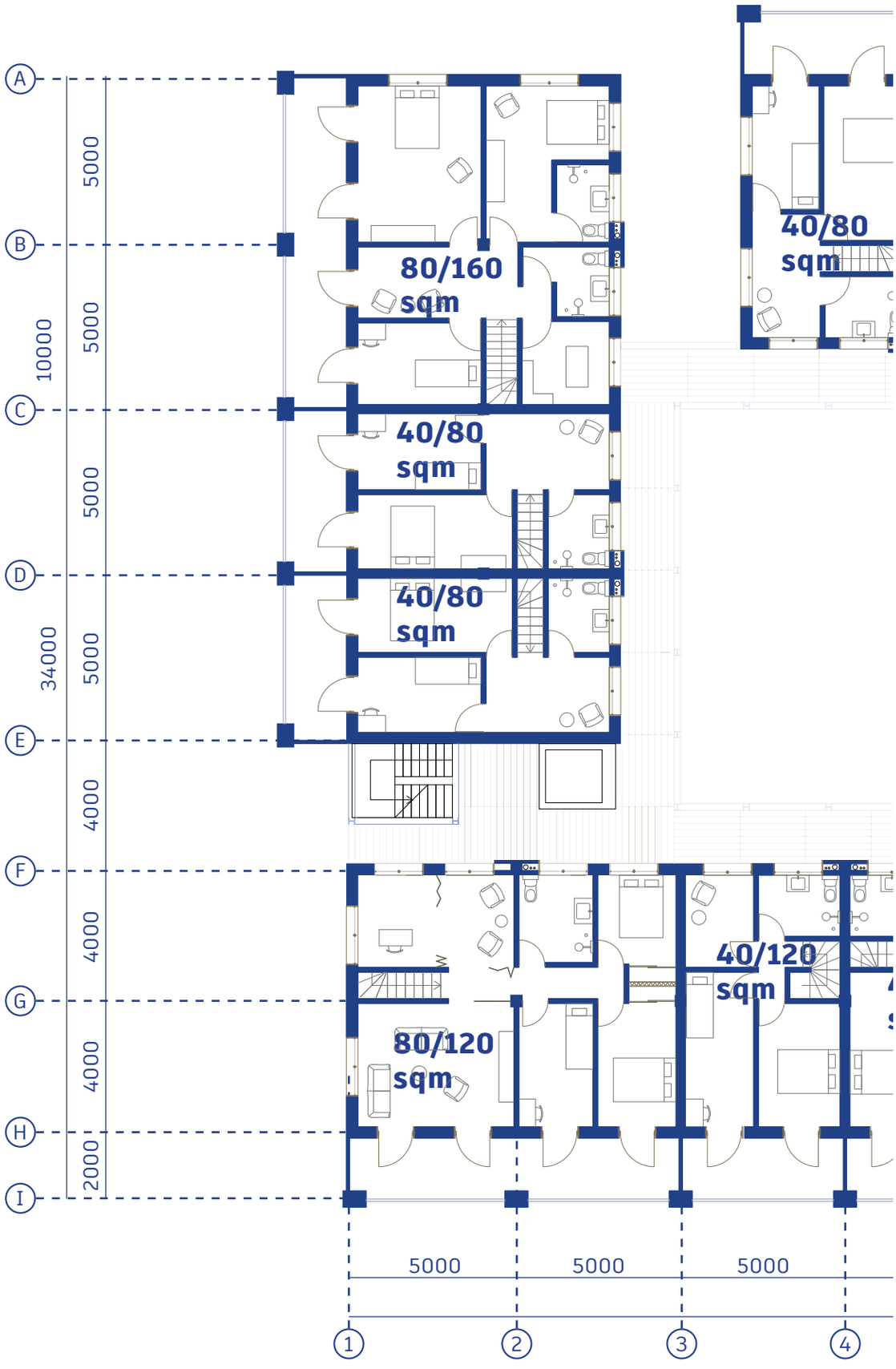


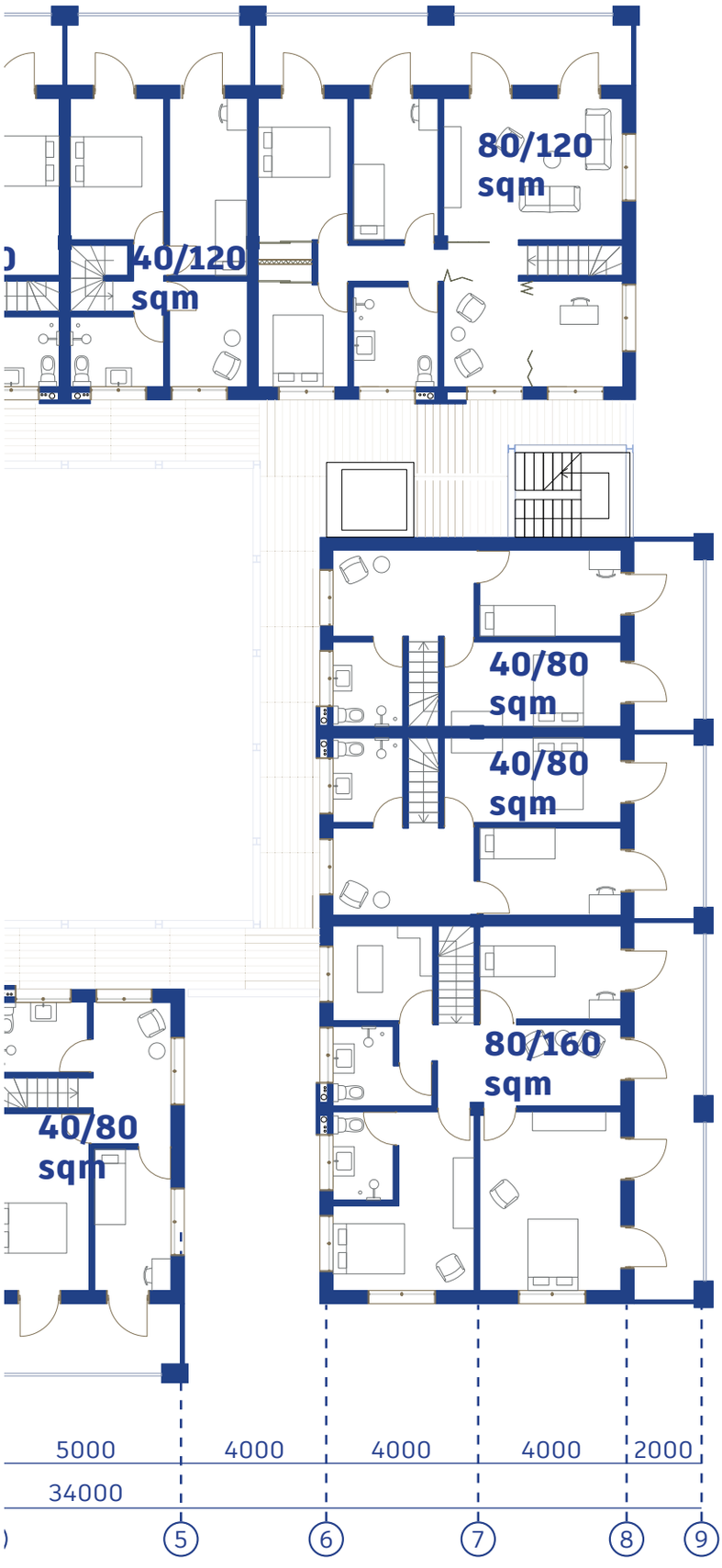
Middle and high-income housing
Third floor - type 80sqm, 120sqm, and 160 sqm (duplex)




80/120
sqm
40/120
sqm
40/80
sqm
40/80
sqm
80/160
sqm
40/80
sqm
10700
5000
4000
4000
4000
2000
34000
5
6
7
8
9

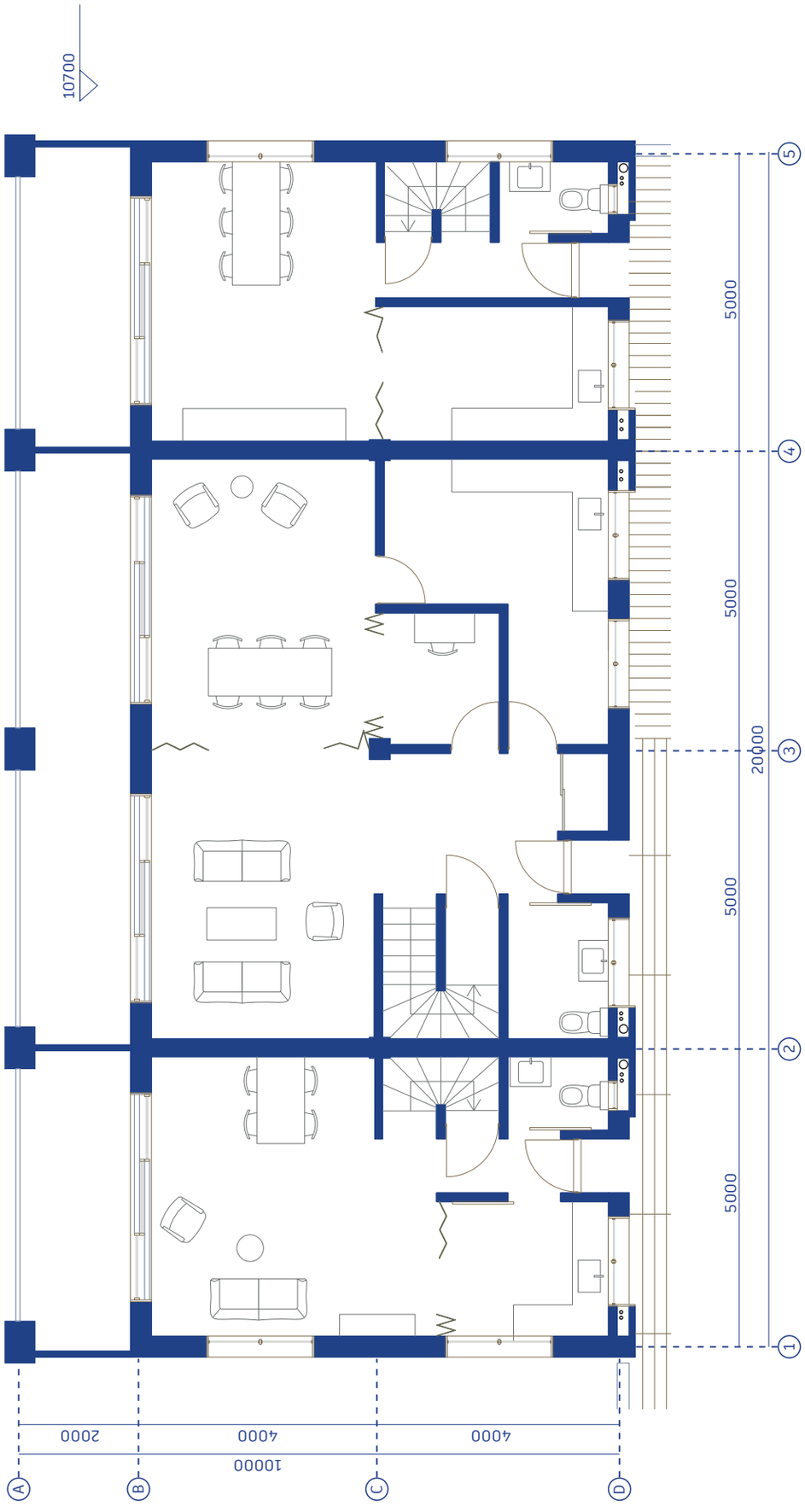
Middle and high-income housing
Fourth floor - type 80sqm, 120sqm, and 160 sqm (duplex)




14000
80/120
sqm
40/120
sqm
40/80
sqm
40/80
sqm
80/160
sqm
40/80
sqm
5000
4000
4000
4000
2000
34000
5
6
7
8
9

Middle-income housing

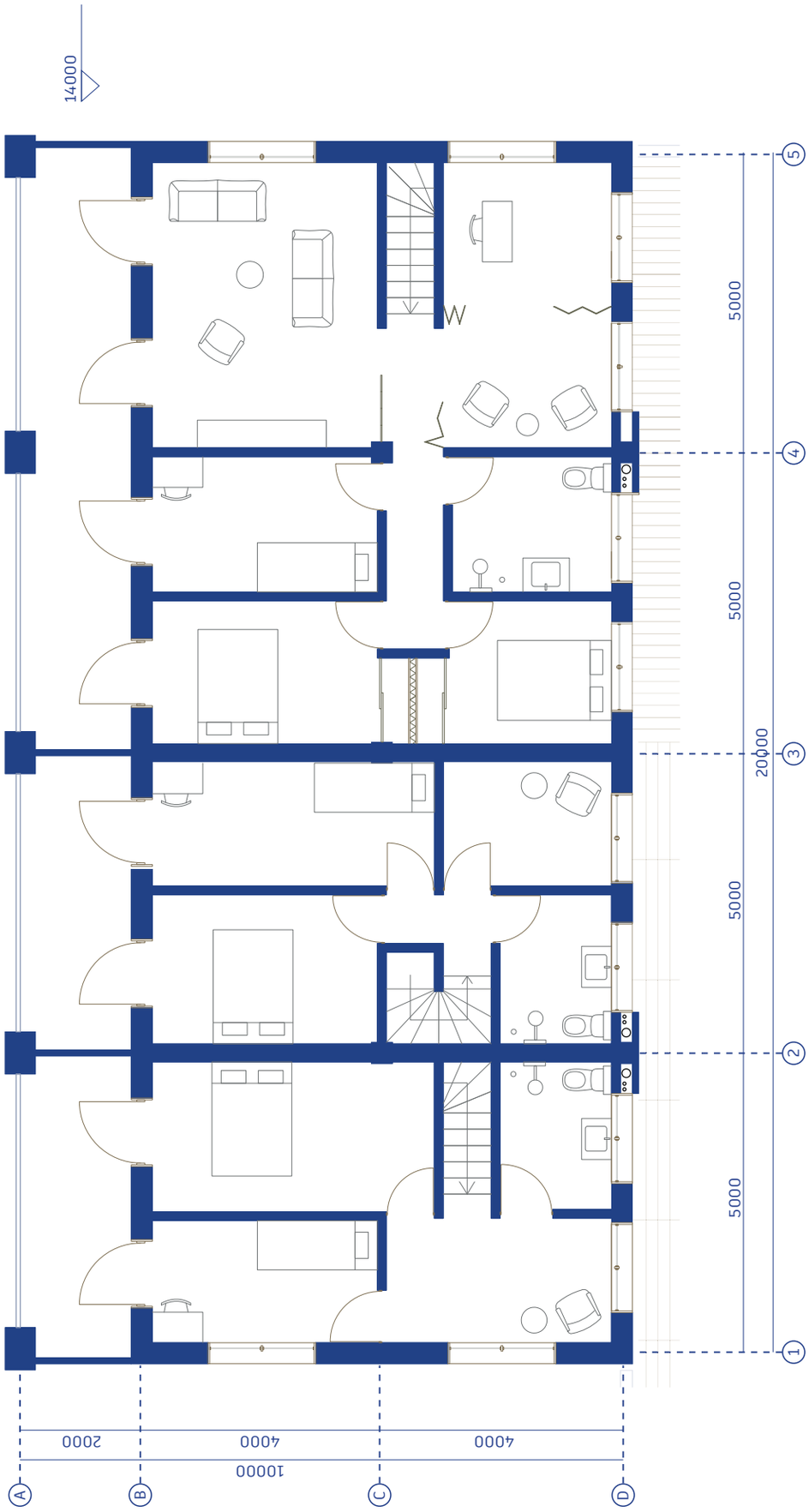
Third floor - block 1 (downstairs) - type 80sqm & 120sqm (duplex)



North or South orientation

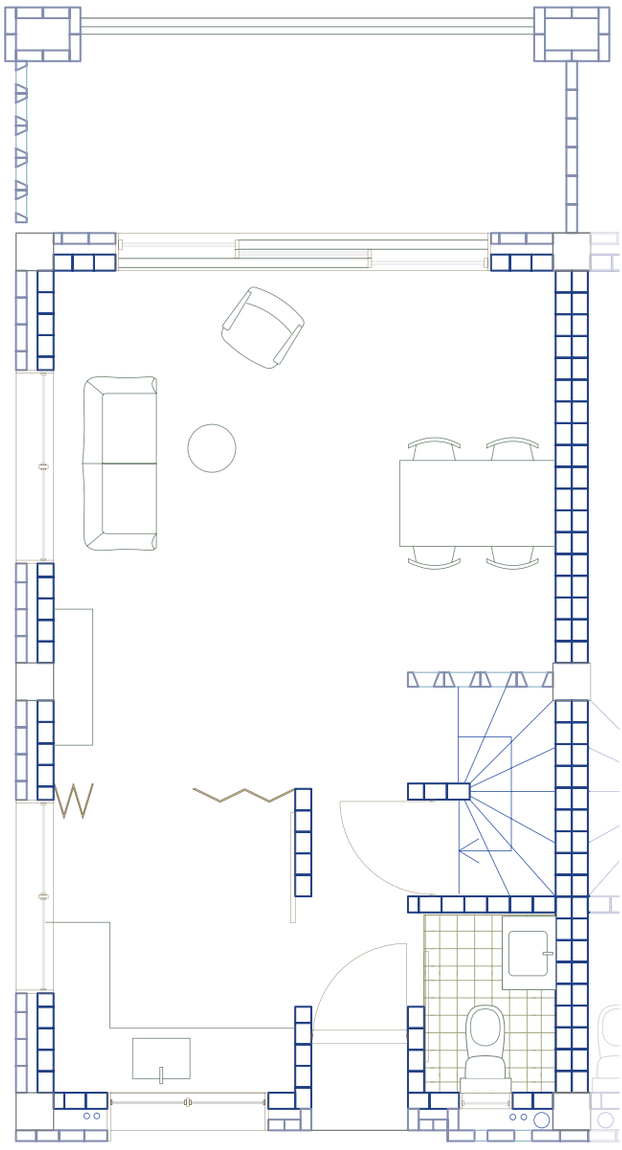
Middle-income housing

Fourth floor - block 1 (upstairs) - type 80sqm & 120sqm (duplex)

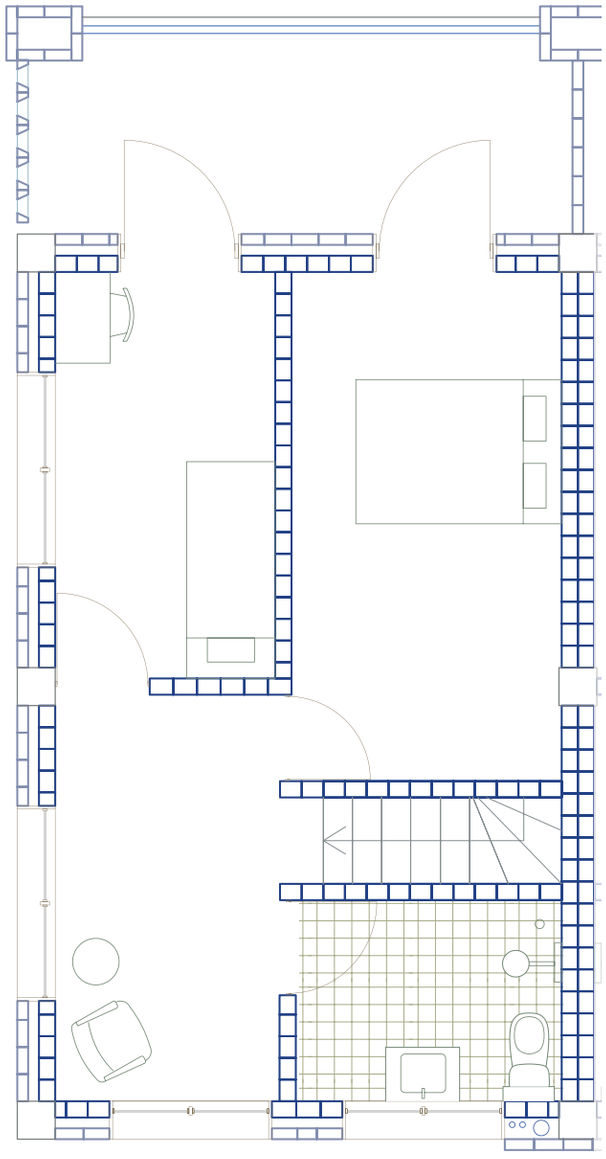


North or South orientation

Middle-income housing
80 sqm + 20 sqm balcony - duplex



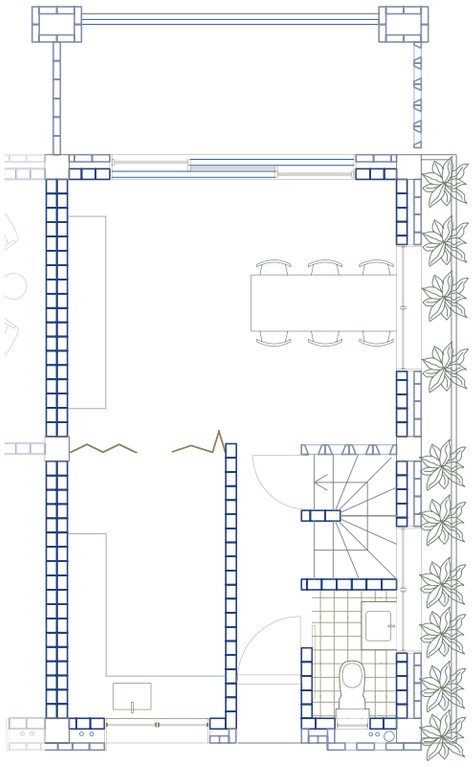
Level 1



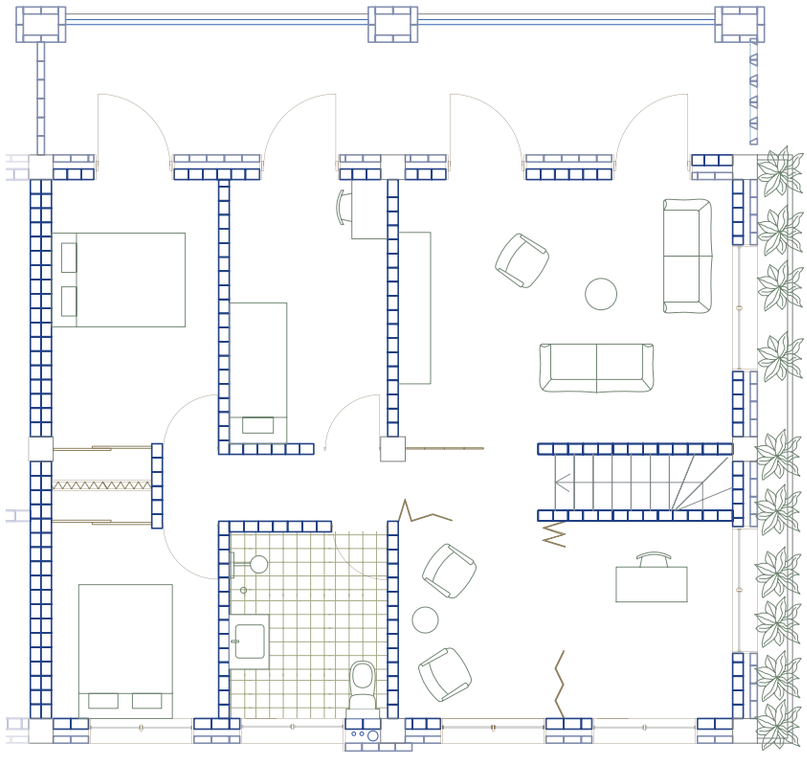
Level 2



Middle-income housing
120 sqm + 30 sqm balcony - duplex

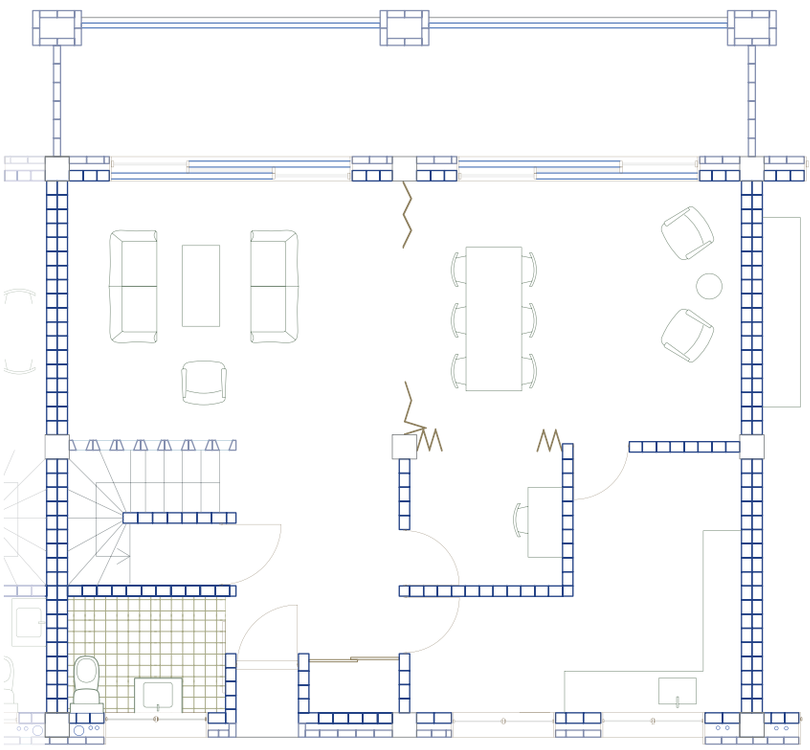


Level 1

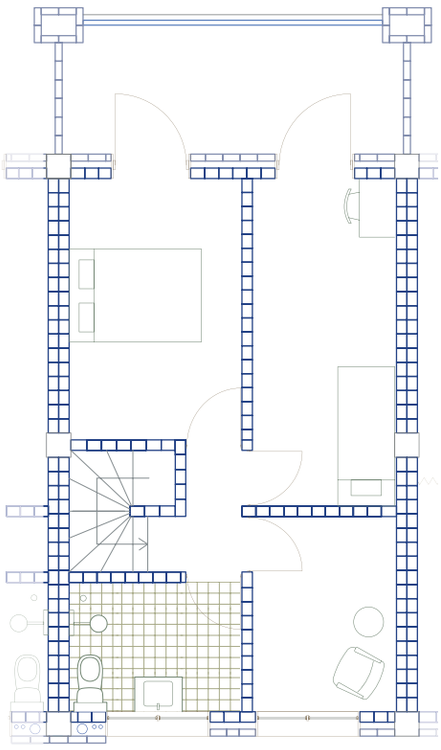


Level 2

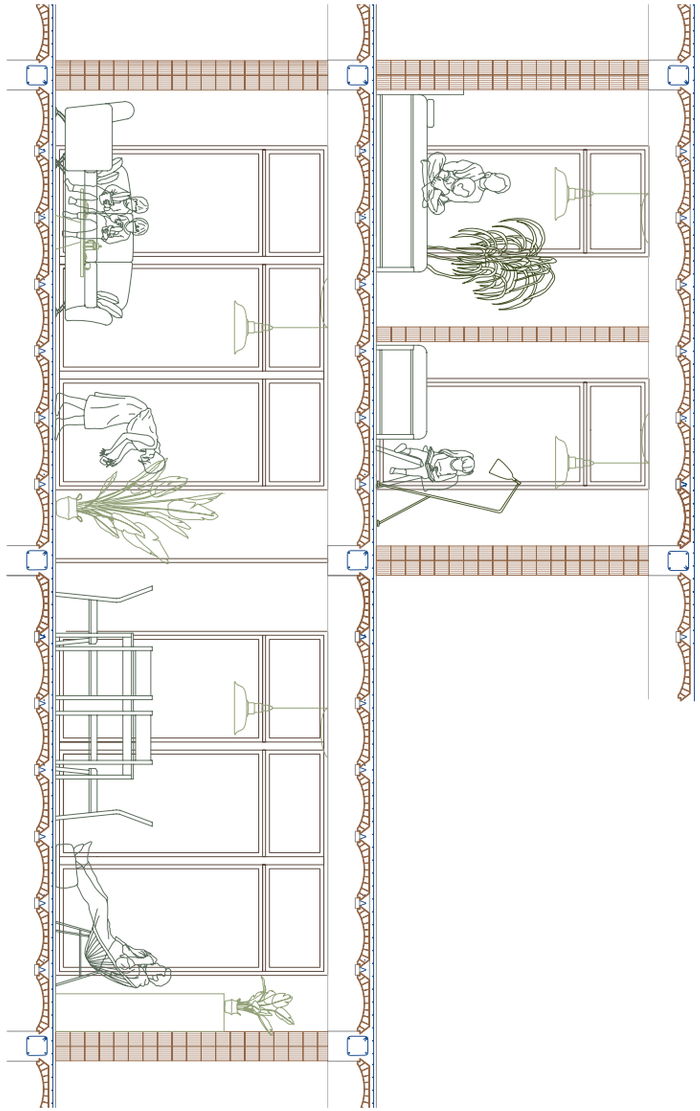
Middle-income housing
120 sqm + 30 sqm balcony - duplex

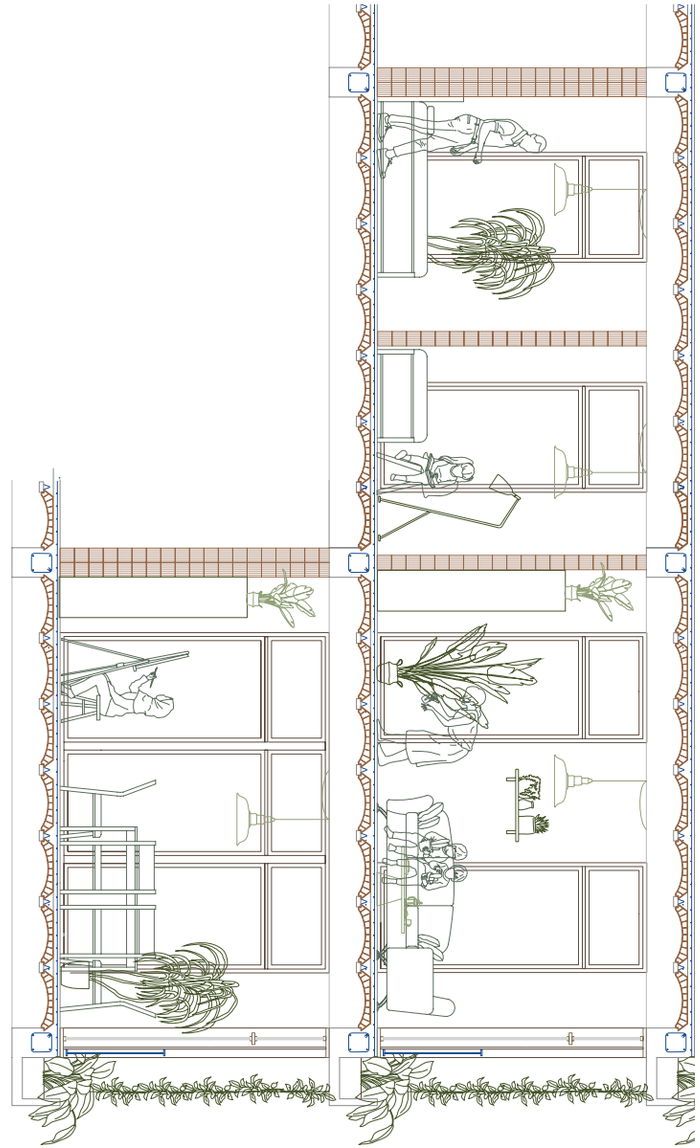


Level 1



Level 2





Dwelling strategy

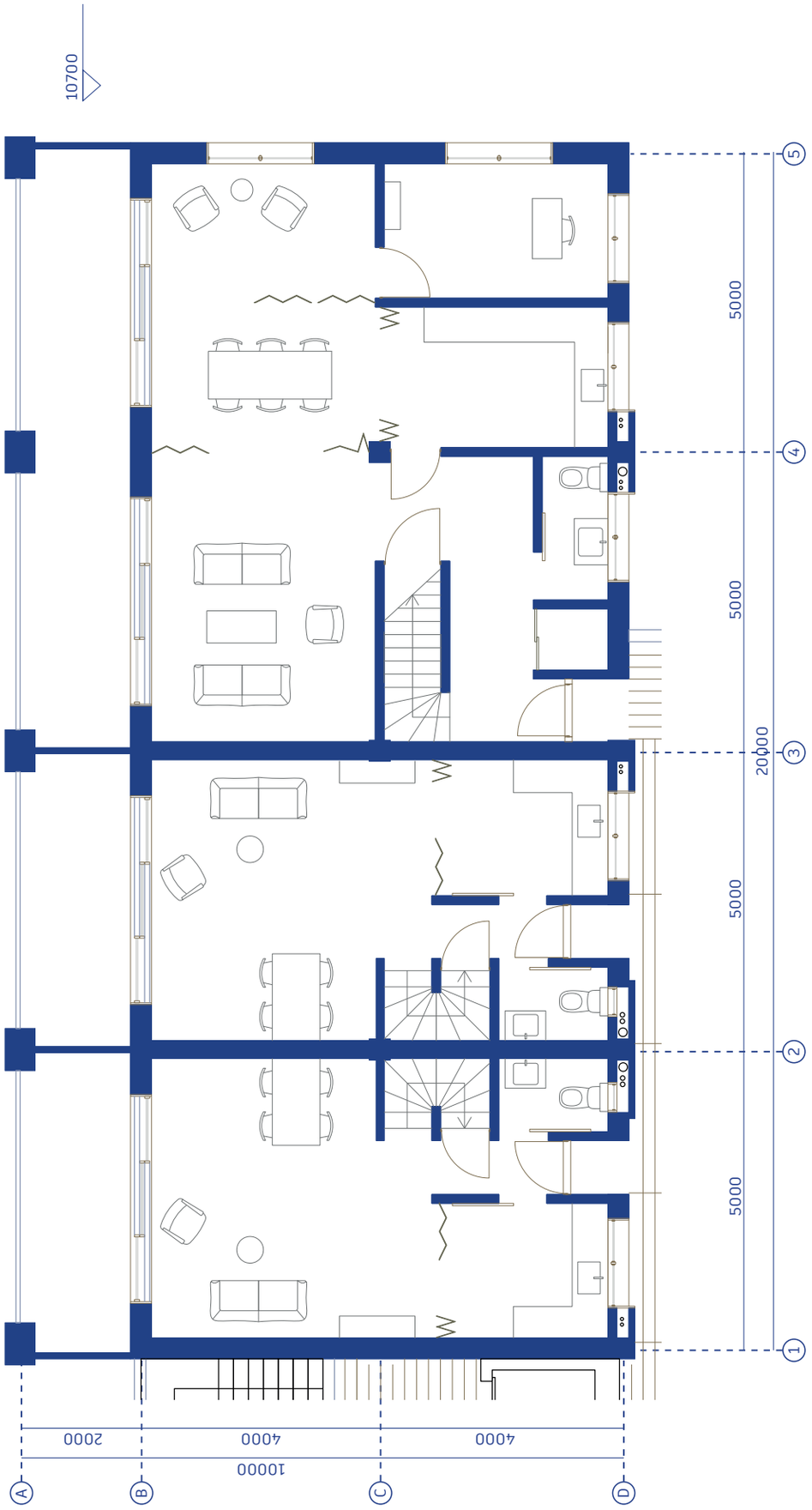
Cluster strategy

Urban strategy

Neighbourhood strategy

Middle and high-income housing

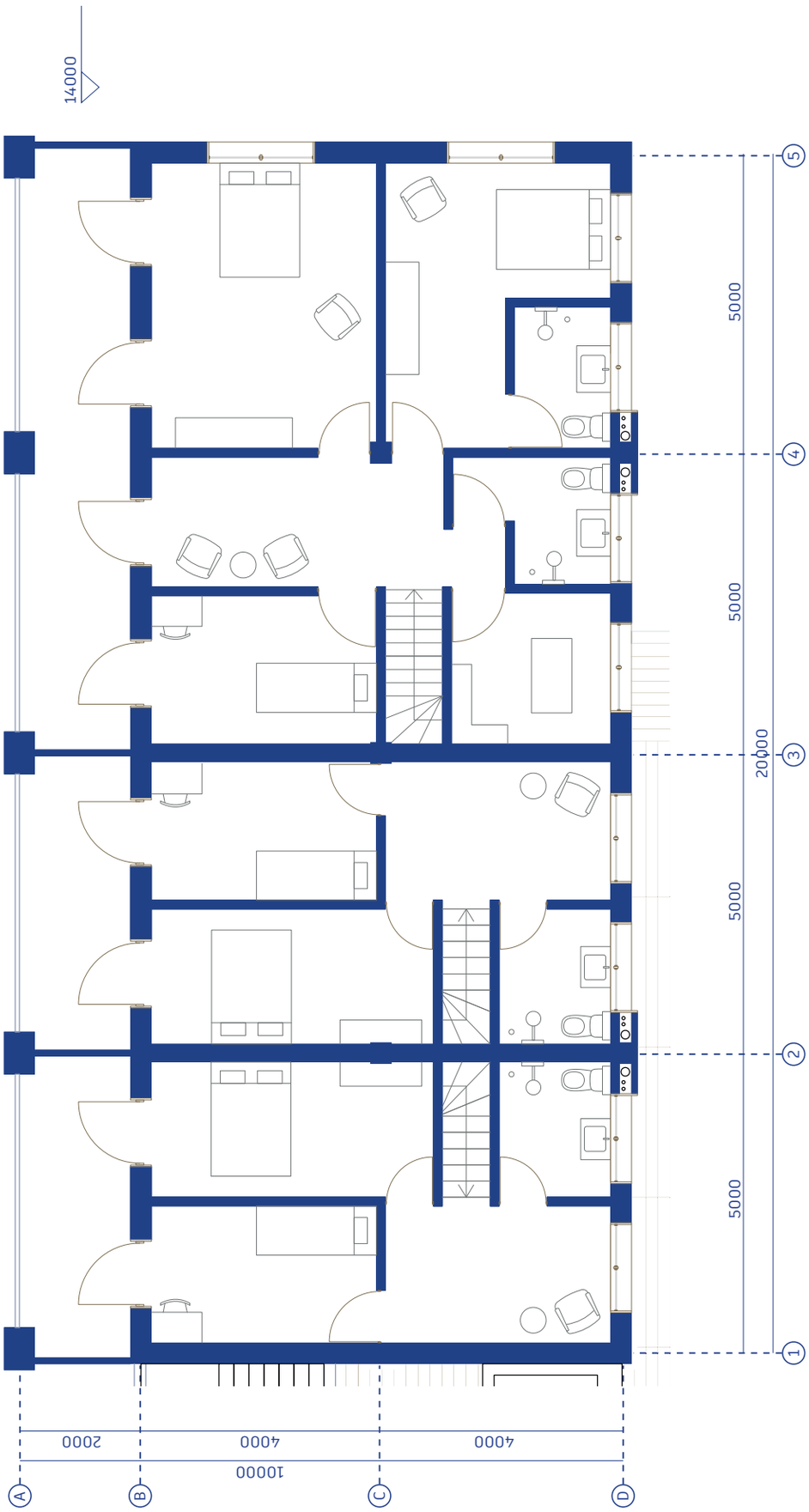
Third floor - block 2 (downstairs) - type 80sqm & 160sqm (duplex)



East or West orientation

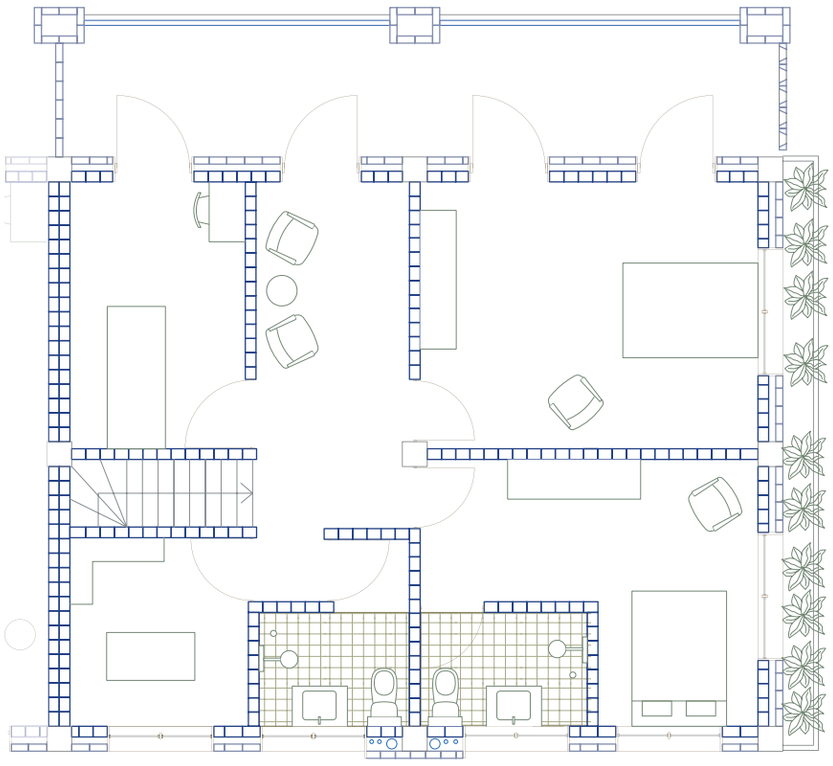
Middle and high-income housing

Fourth floor - block 2 (upstairs) - type 80sqm & 160sqm (duplex)

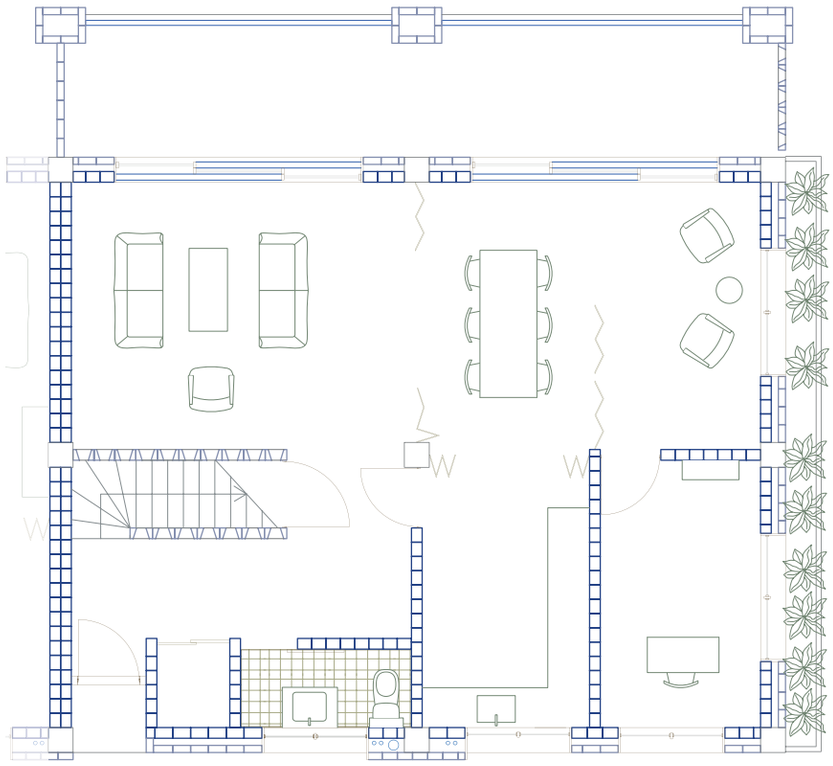


East or West orientation

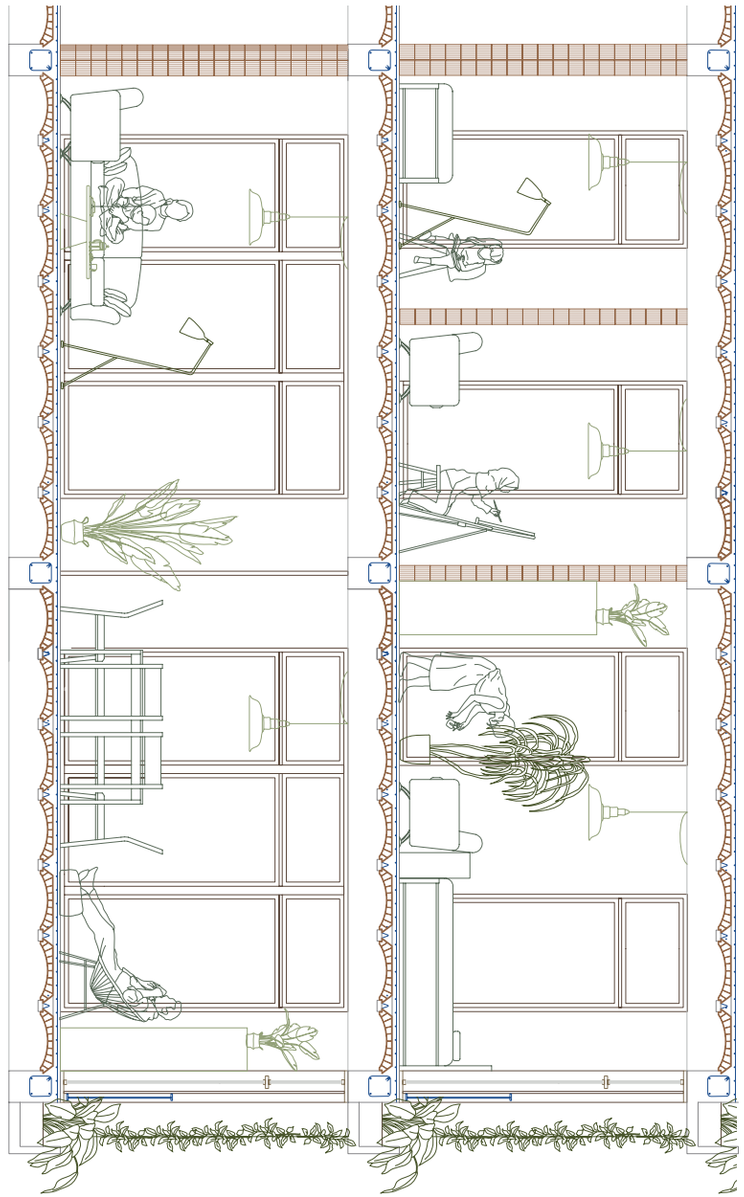
High-income housing
160 sqm + 40 sqm balcony - duplex



Level 2



Level 1



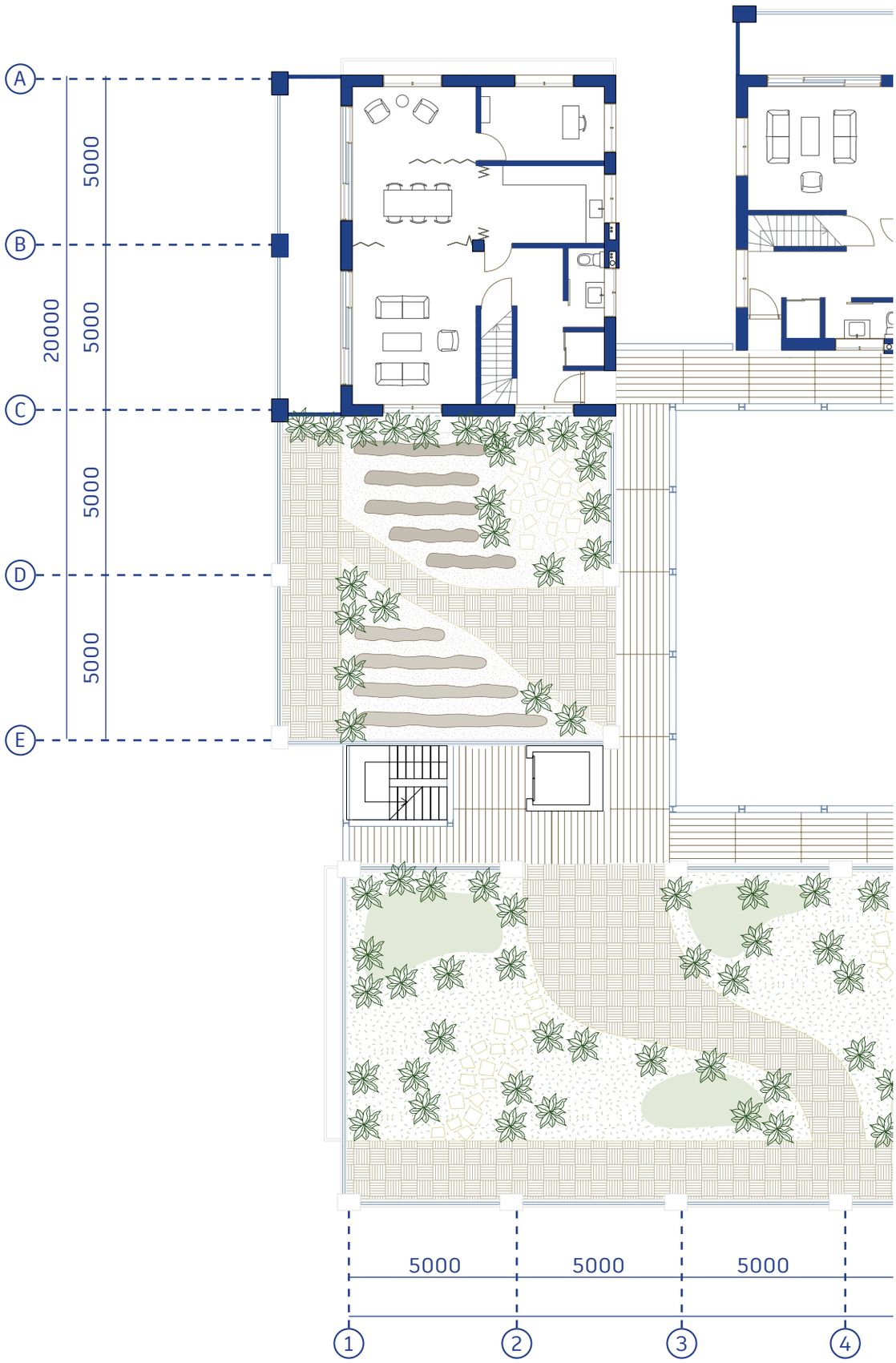
Dwelling strategy

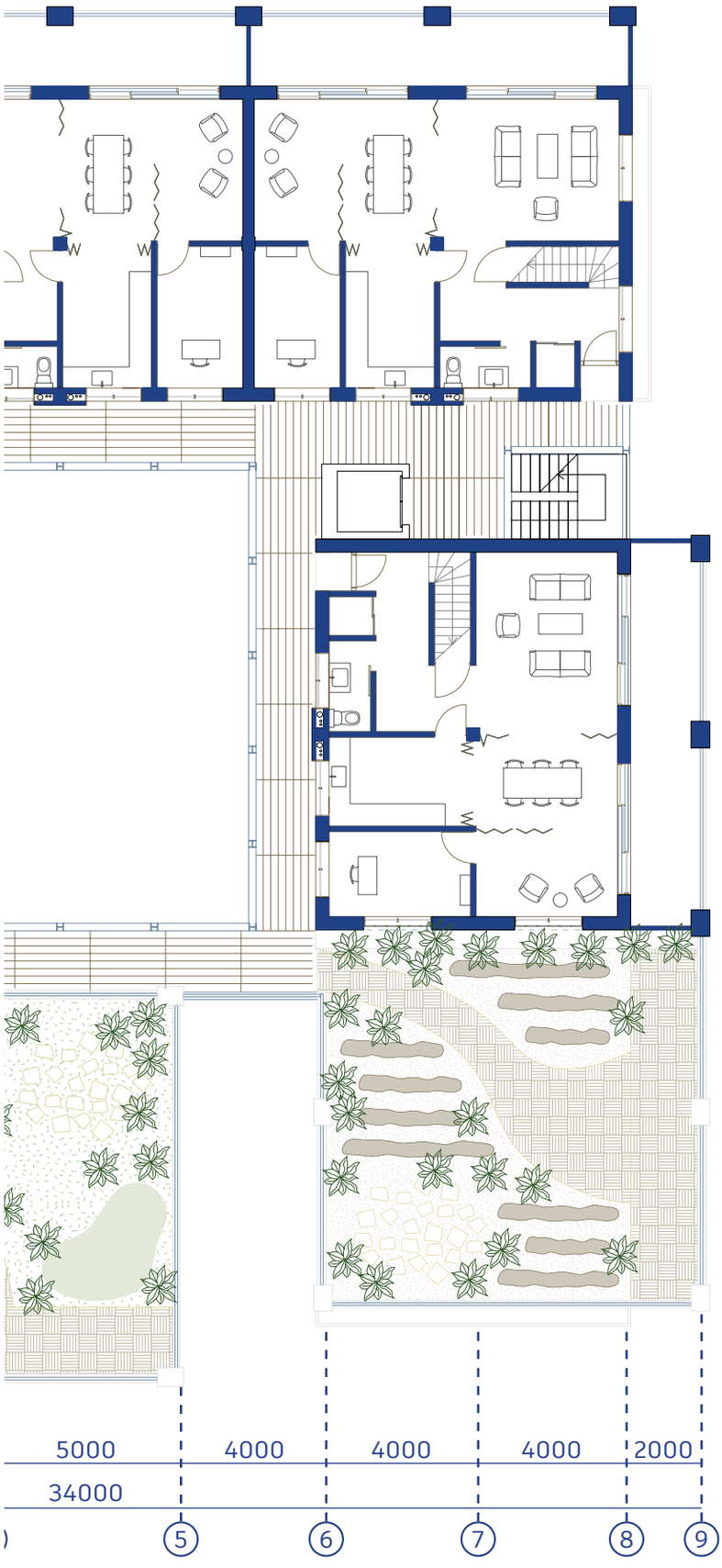
Cluster strategy

Urban strategy

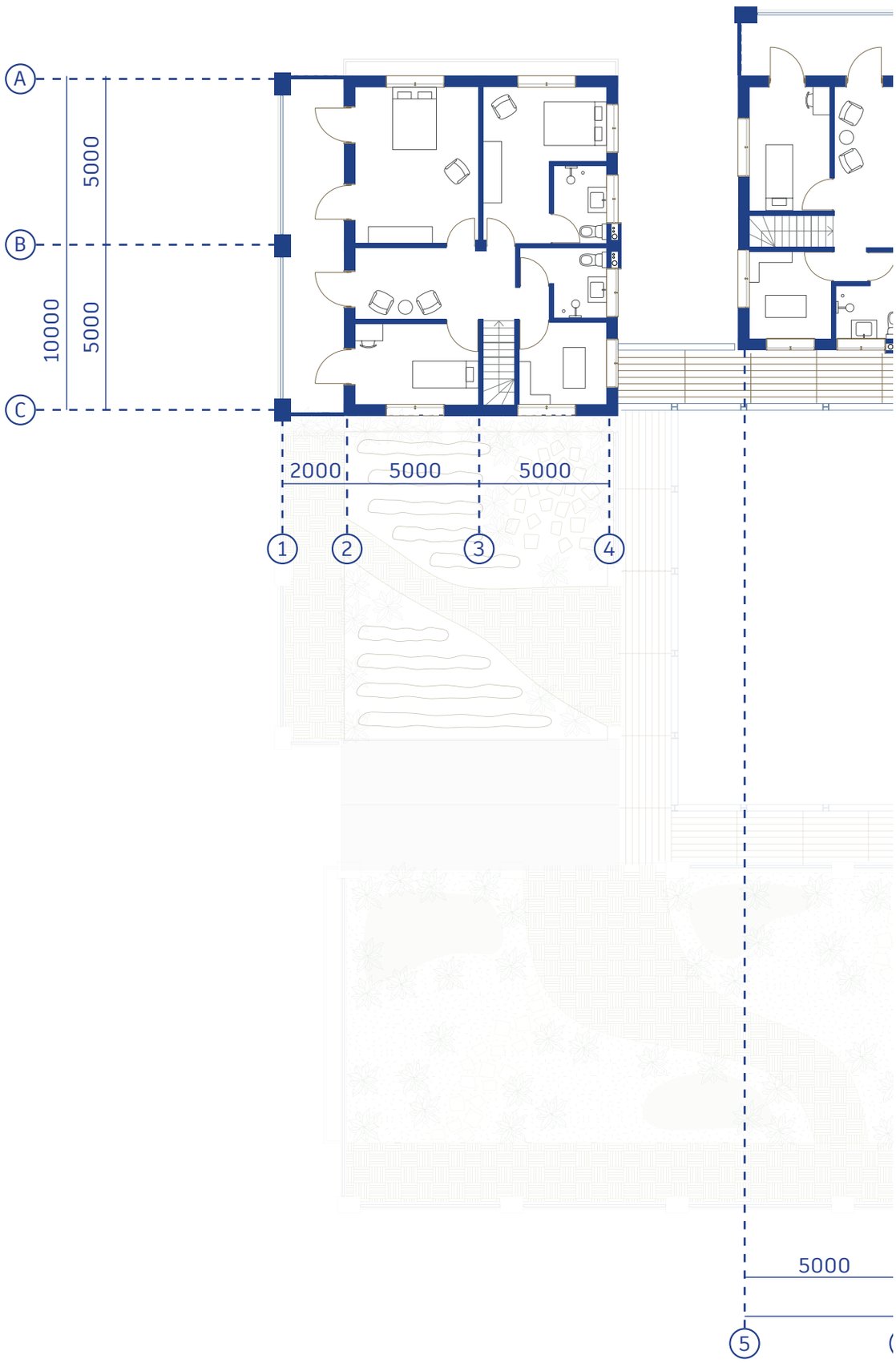
Neighbourhood strategy

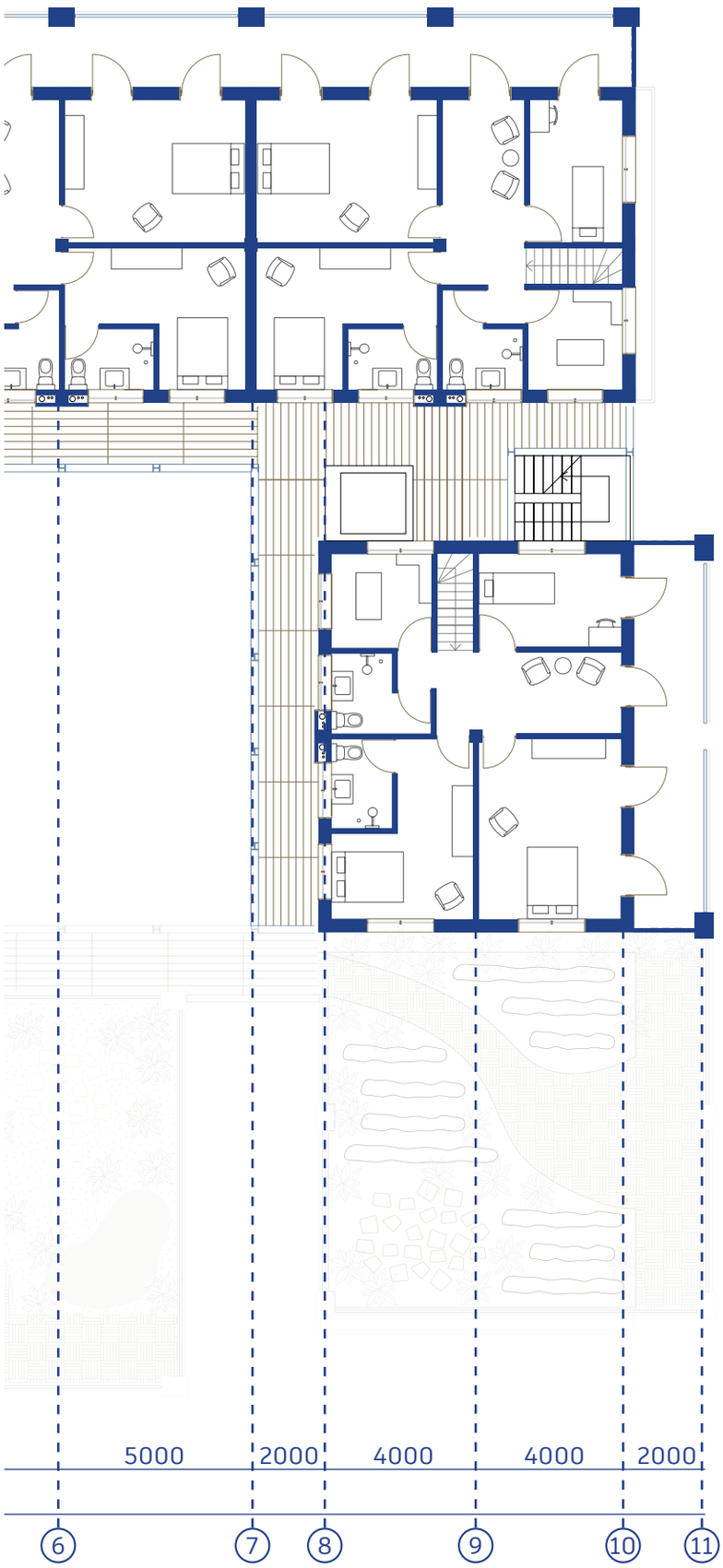
High-income housing
Fifth floor - type 160 sqm (duplex)



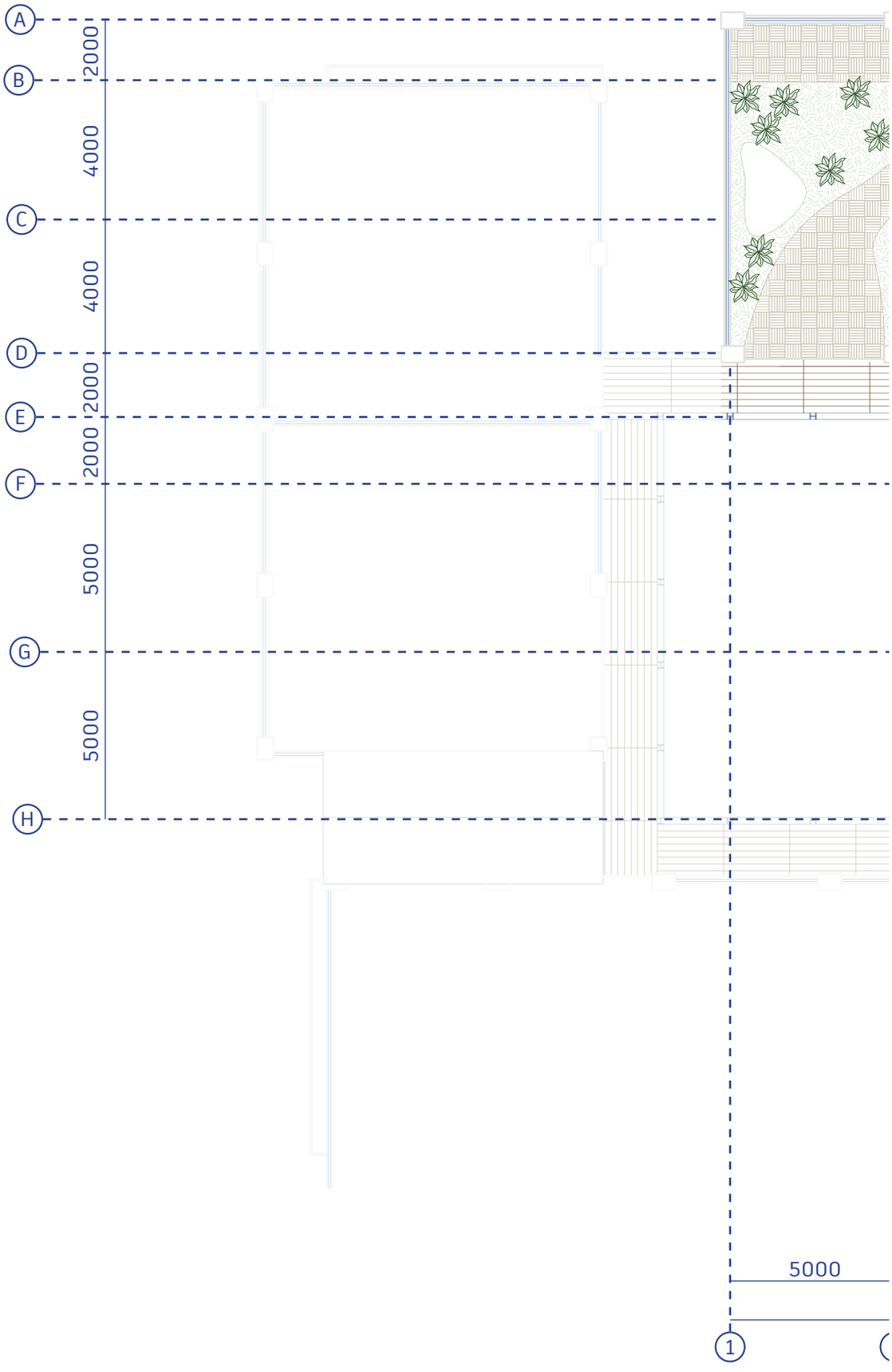

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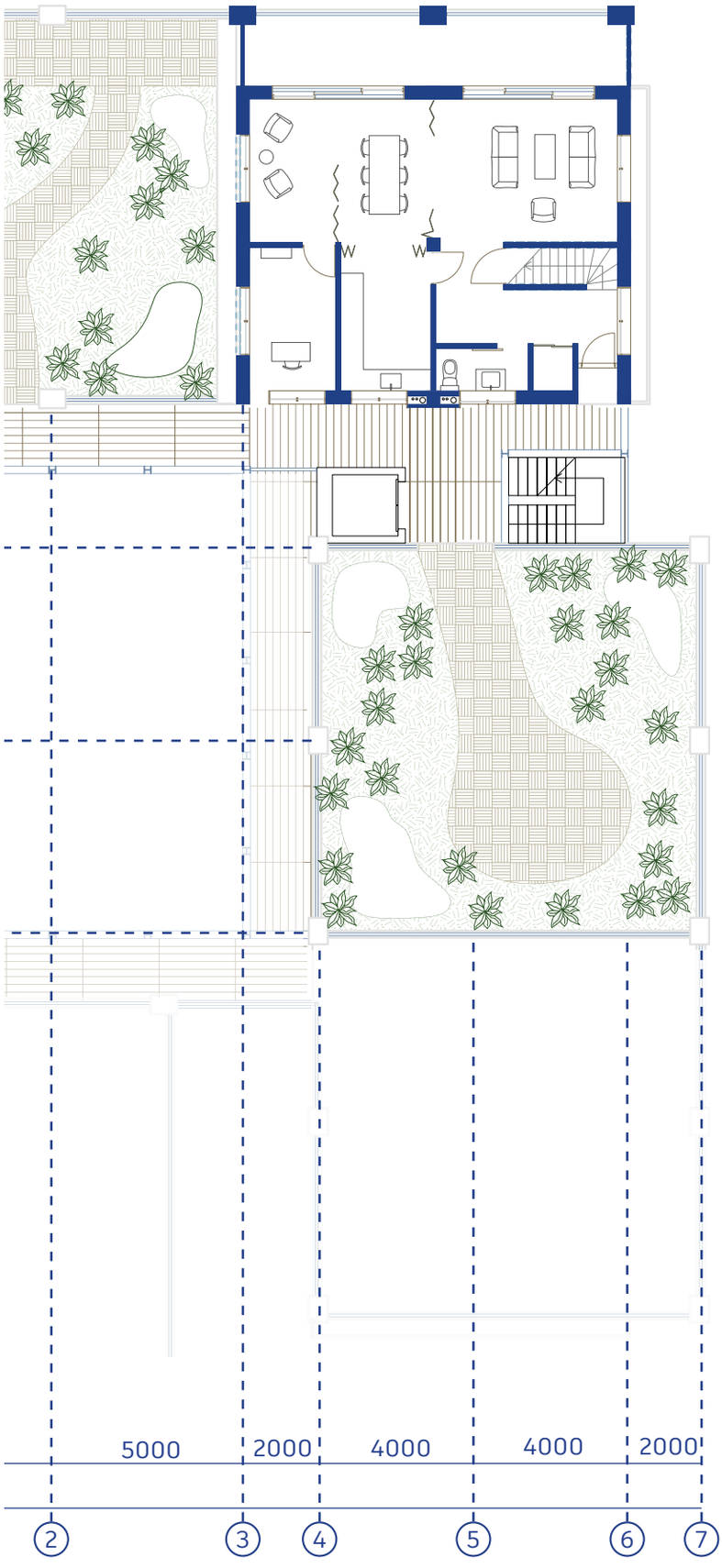
High-income housing
Sixth floor - type 160 sqm (duplex)



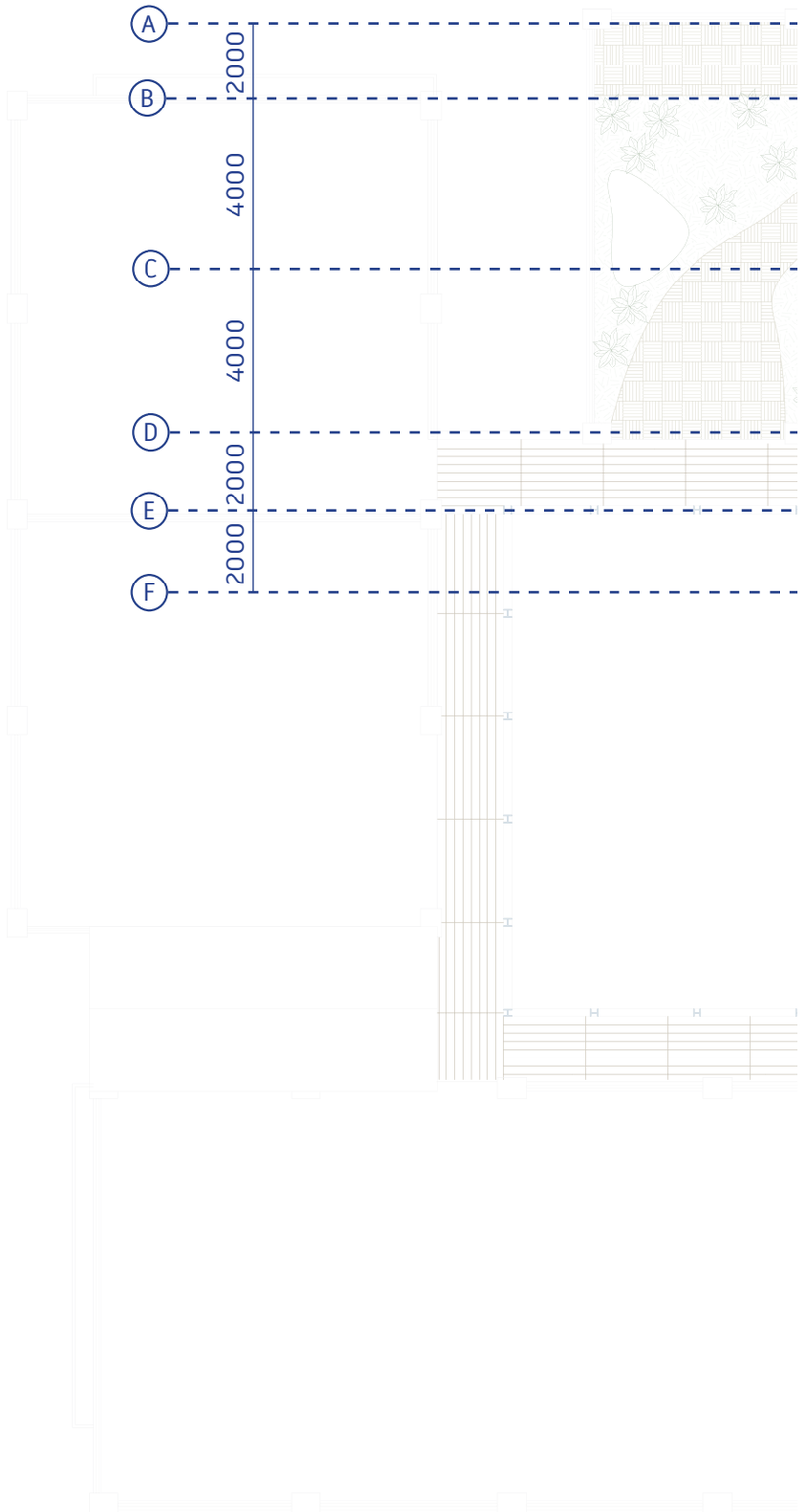

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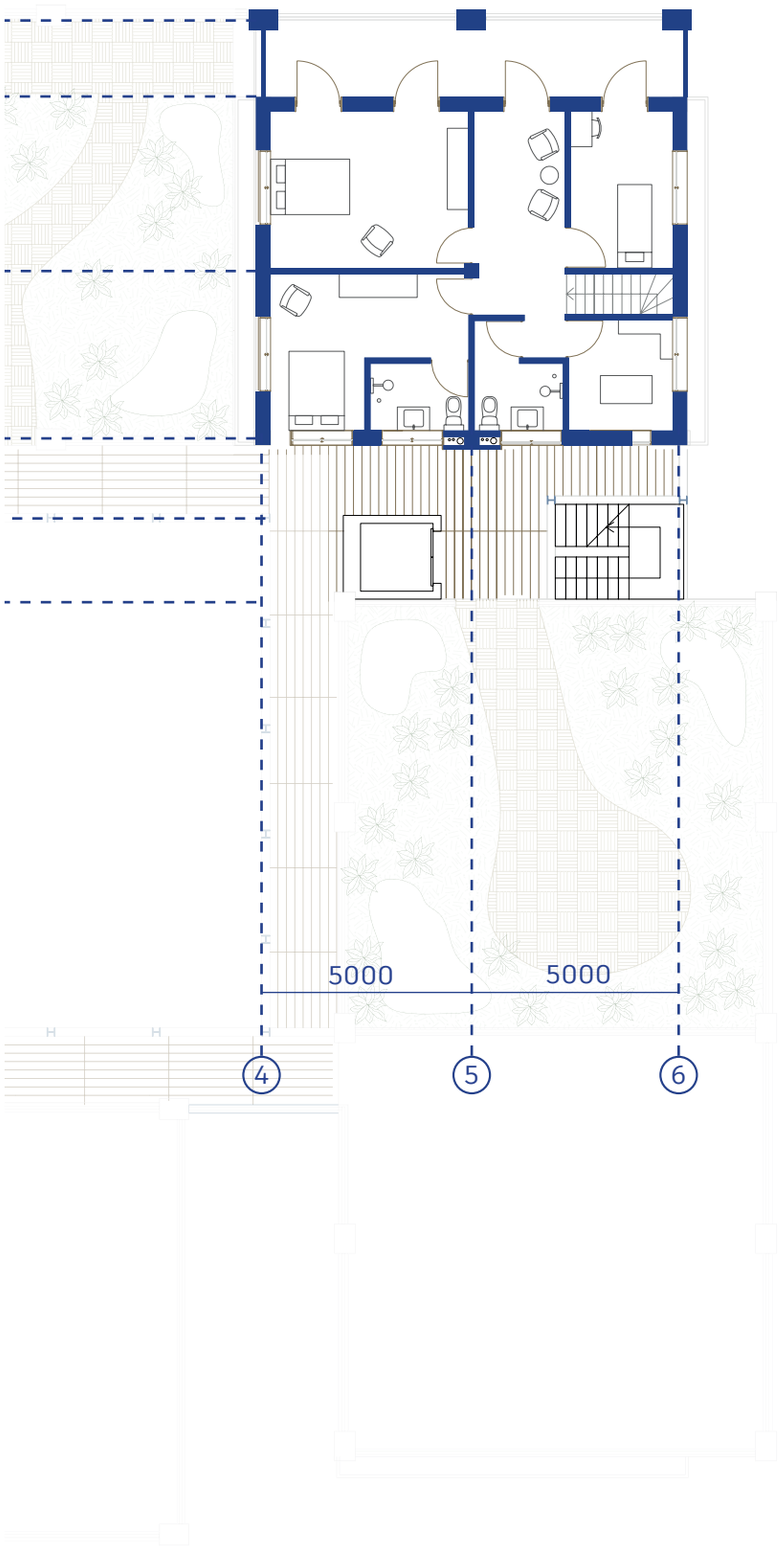
High-income housing
Seventh floor - type 160 sqm (duplex)

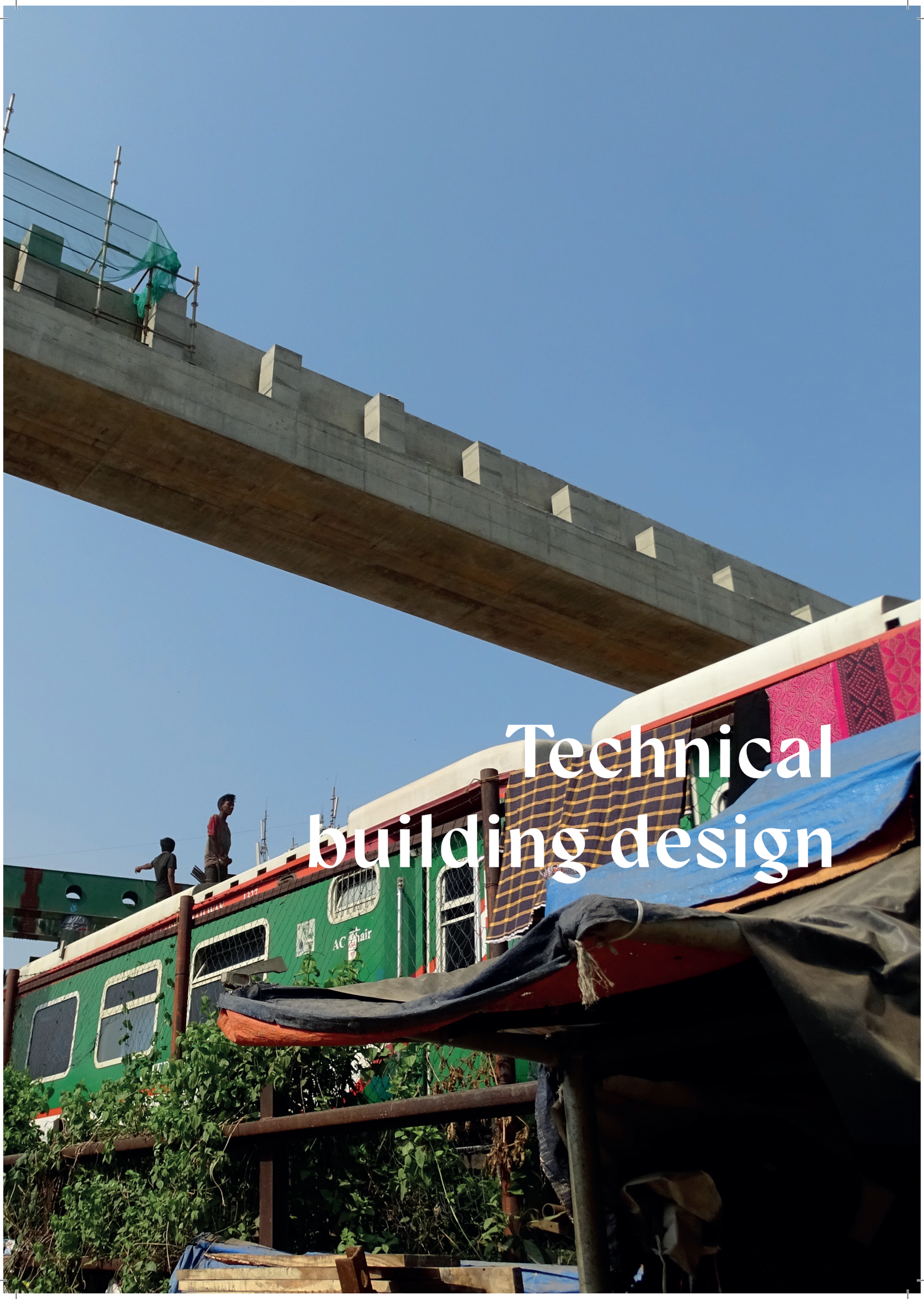



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7

High-income housing
Eighth floor - type 160 sqm (duplex)




27700
5000
5000
4
5
6



Technical building design

Climate of Sylhet

Altitude	**21,63 m** (70,76 ft)
Annual precipitation	**158,65 mm** (6,25 in)
Warmest month	April (**34,63ºC** / 94,33ºF)
Coldest month	January (**13.28ºC** / 55,9ºF)
Wettest month	July (**416,18mm** / 16,39in)
Driest month	January (**1,94mm** / 0,08in)
Number of days with rainfall	**161** days (44%)
Average humidity	**67,88%**

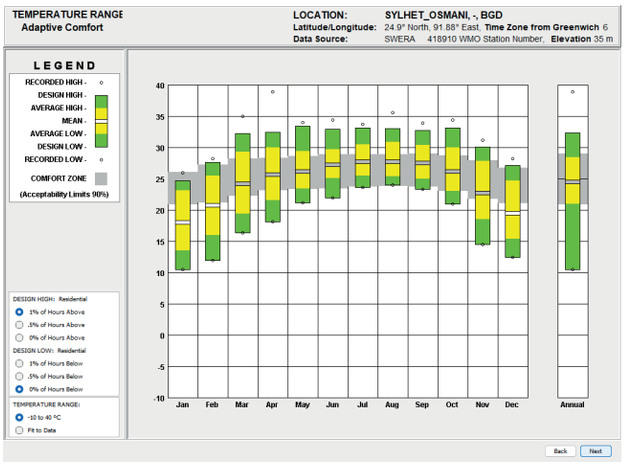


Image 7: Temperature range of Sylhet, including comfort level *(Climate Consult, 2021)*

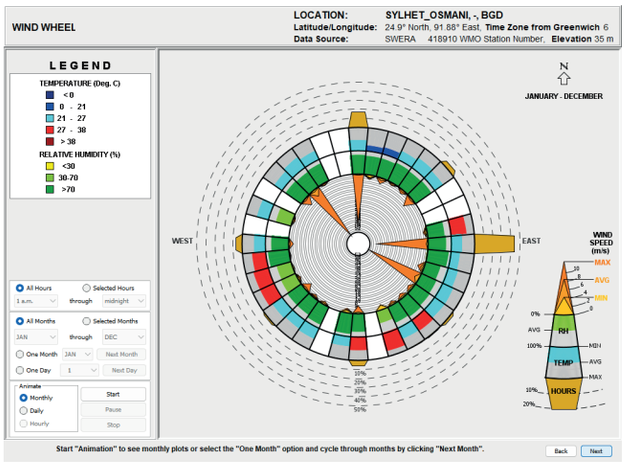


Image 8: Monthly wind wheel of Sylhet, including temperature, humidity and wind direction *(Climate Consult, 2021)*

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Nov	Oct	Dec	Year
Record high °C (°F)	33.0 (91.4)	36.0 (96.8)	41.0 (105.8)	41.0 (105.8)	42.0 (107.6)	41.0 (105.8)	39.0 (102.2)	39.0 (102.2)	38.0 (100.4)	37.0 (98.6)	35.0 (95.0)	32.0 (89.6)	42.0 (107.6)
Average high °C (°F)	26.38 (79.48)	29.48 (85.06)	33.12 (91.62)	34.63 (94.33)	34.51 (94.12)	33.21 (91.78)	32.16 (89.89)	32.92 (91.26)	32.8 (91.04)	31.97 (89.55)	29.59 (85.26)	26.77 (80.19)	31.46 (88.63)
Daily mean °C (°F)	20.78 (69.4)	23.43 (74.17)	27.15 (80.87)	29.61 (85.3)	30.45 (86.81)	30.1 (86.18)	29.21 (84.58)	29.74 (85.53)	29.36 (84.85)	27.78 (82.0)	24.47 (76.05)	21.57 (70.83)	26.97 (80.55)
Average low °C (°F)	13.28 (55.9)	15.08 (59.14)	18.38 (65.08)	22.48 (72.46)	24.22 (75.6)	25.54 (77.97)	25.22 (77.4)	25.44 (77.79)	25.01 (77.02)	22.13 (71.83)	17.79 (64.02)	14.79 (58.62)	20.78 (69.4)
Record low °C (°F)	7.0 (44.6)	9.0 (48.2)	12.0 (53.6)	18.0 (64.4)	12.0 (53.6)	19.0 (66.2)	17.0 (62.6)	17.0 (62.6)	22.0 (71.6)	14.0 (57.2)	12.0 (53.6)	10.0 (50.0)	7.0 (44.6)
Average precipitation mm (inches)	1.94 (0.08)	13.69 (0.54)	27.3 (1.07)	125.72 (4.95)	255.68 (10.07)	383.66 (15.1)	416.18 (16.39)	276.08 (10.87)	251.29 (9.89)	138.04 (5.43)	9.35 (0.37)	4.84 (0.19)	158.65 (6.25)
Average precipitation days (≥ 1.0 mm)	0.45	1.45	5.55	16.18	21.73	25.91	27.45	26.82	22.64	10.09	1.55	0.64	13.37
Average relative humidity (%)	56.48	50.2	49.06	59.78	70.1	78.98	83.08	81.19	79.53	73.83	68.11	64.27	67.88
Mean monthly sunshine hours	8.62	8.55	10.87	12.26	12.48	11.63	11.4	11.61	10.8	10.79	8.73	8.59	10.53

Image 9: Monthly averages of the climate in Sylhet *(Weather and Climate, 2022)*

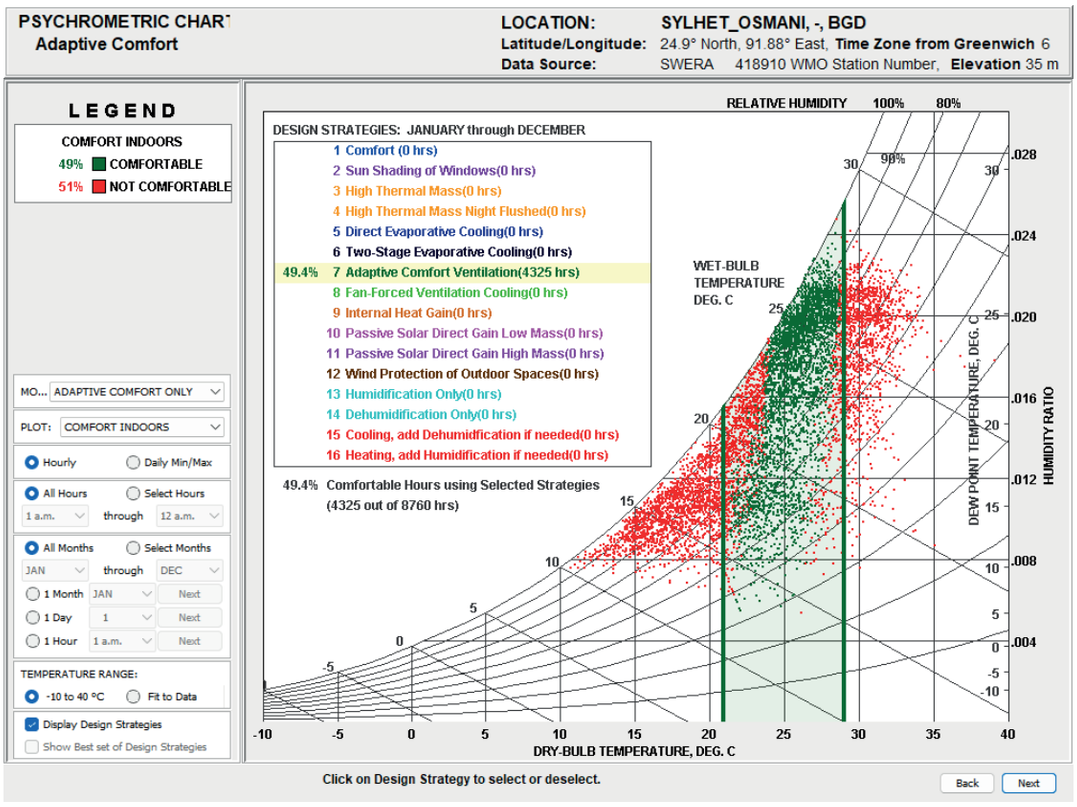
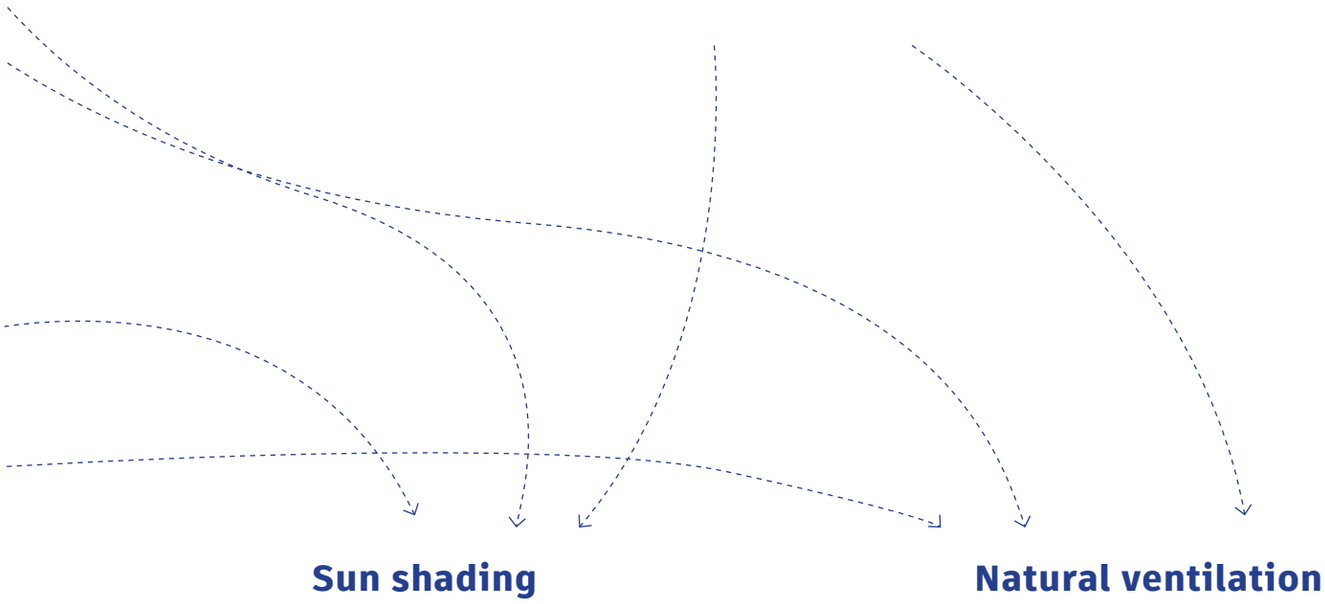
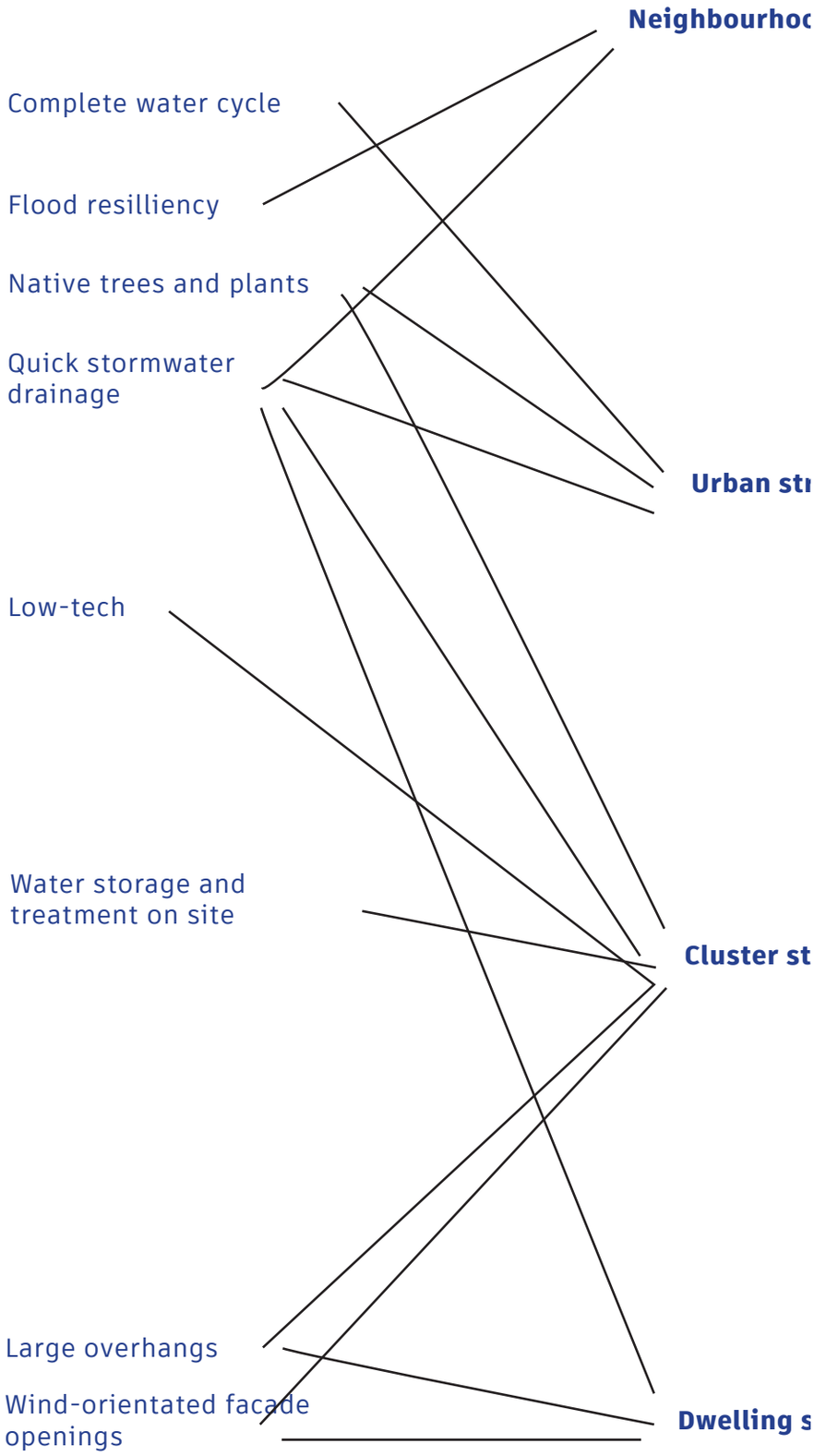


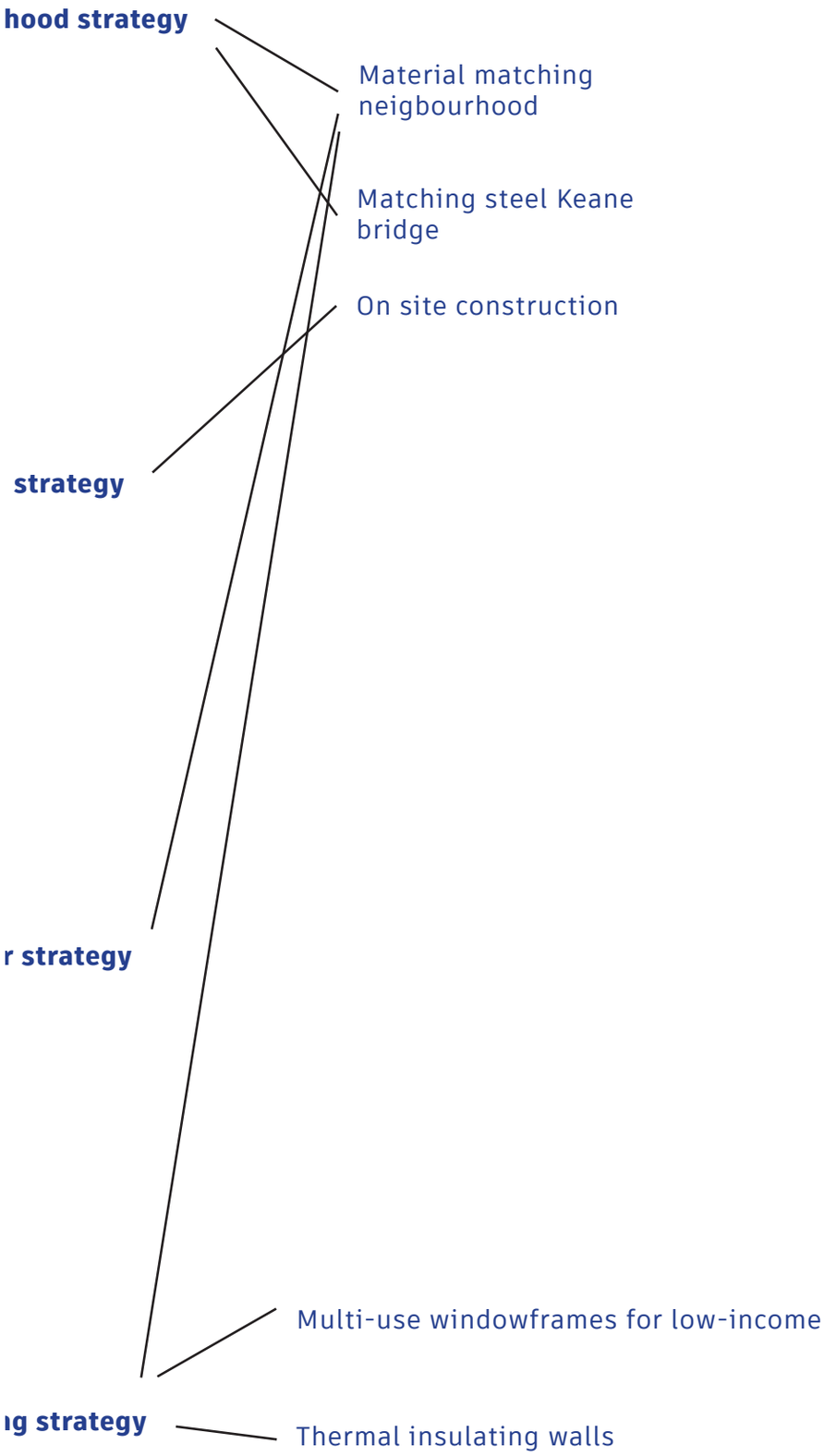
Image 10: Average indoor comfort level in Sylhet with dry-bulb temperature and humidity ratio *(Climate Consult, 2021)*

According to this chart, 49,4 percent of the hours indoor will be comfortable. This means important measurements need to be taken to make indoor comfortable at lower and higher temperatures. Besides cooling, you see in the chart that a good insulated home is also appreciated when temperatures drop below 21 degrees Celcius.



BDT strategies




hood strategy
Material matching neigbourhood
Matching steel Keane bridge
On site construction
strategy
r strategy
Multi-use windowframes for low-income
ıg strategy
Thermal insulating walls

Material choices

Type	Material	Application
Load-bearing structure	Concrete	Construction frame, floor
	Steel	Structure walkway
Exterior	CSEB	Masonry infill wall
	Steel	Overhang, balustrade
	Timber	Floor walkway
	Bamboo	Louvers, shutters
	Aluminum	Window and door frames
	Fired brick	Pavement and street elements
	Glass	Glazing
Interioir	Hollow block	Masonry infill wall, ceiling infill
	Galvanized steel	Rainpipes
	CSEB	Balcony balustrade and divider



Conrete



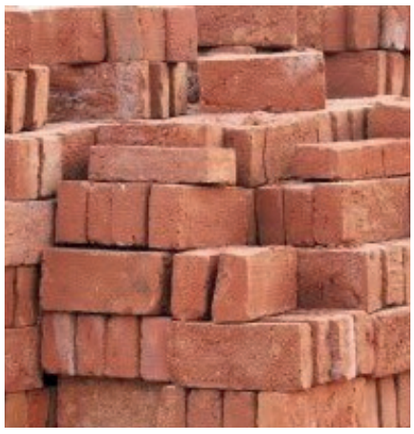
Steel



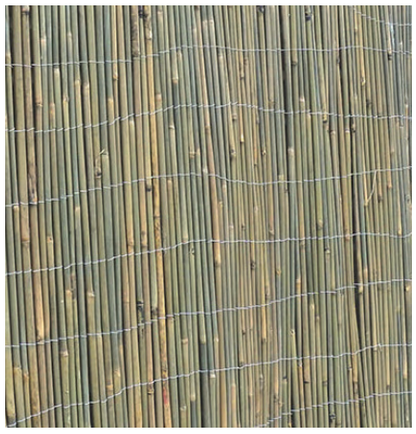
CSEB



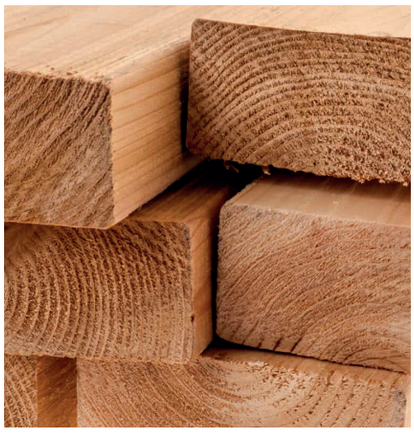
Hollow clay block



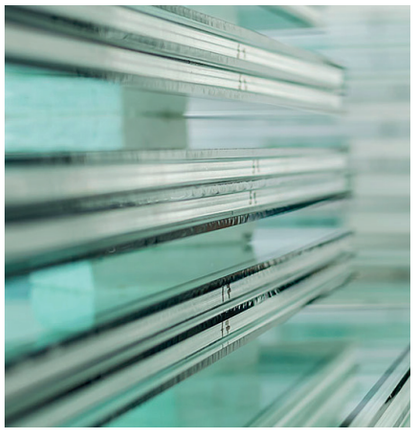
Fired brick



Bamboo



Timber

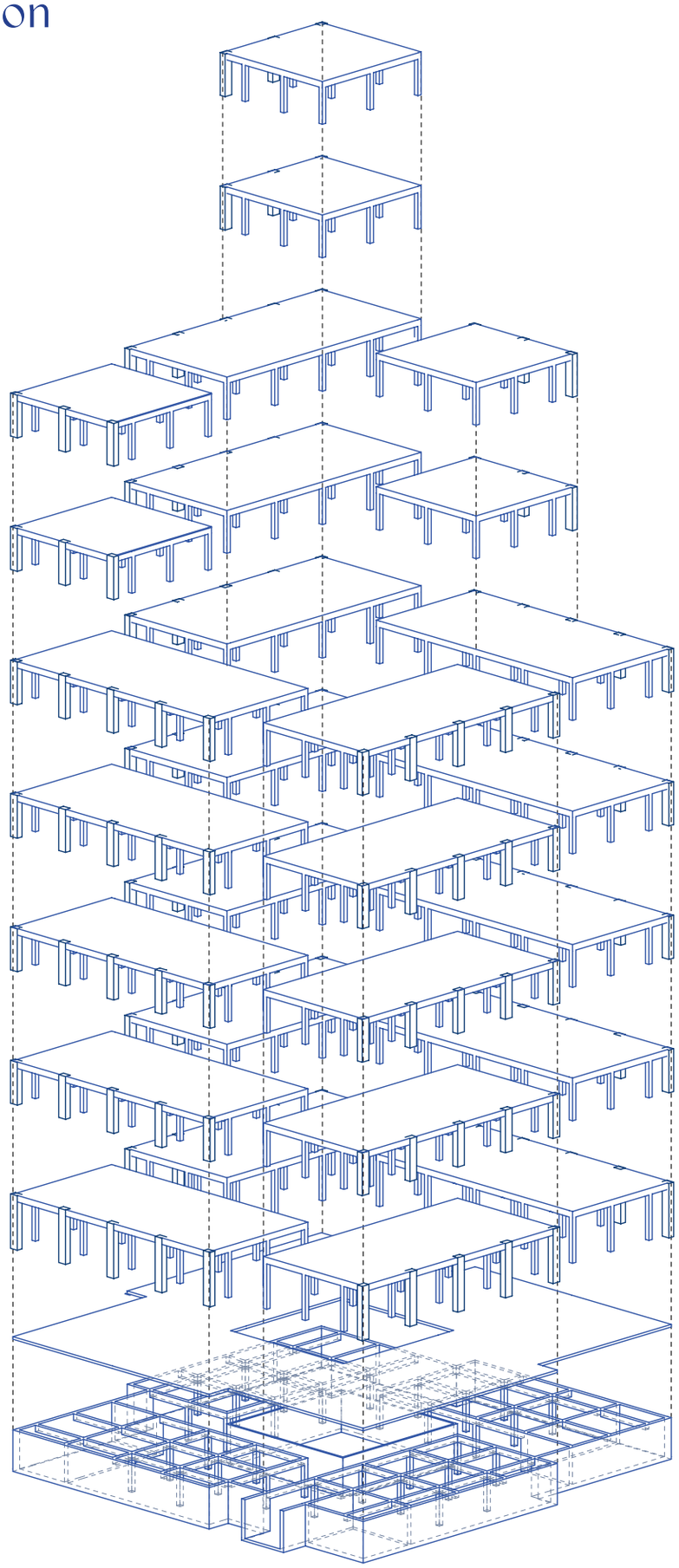


Glass

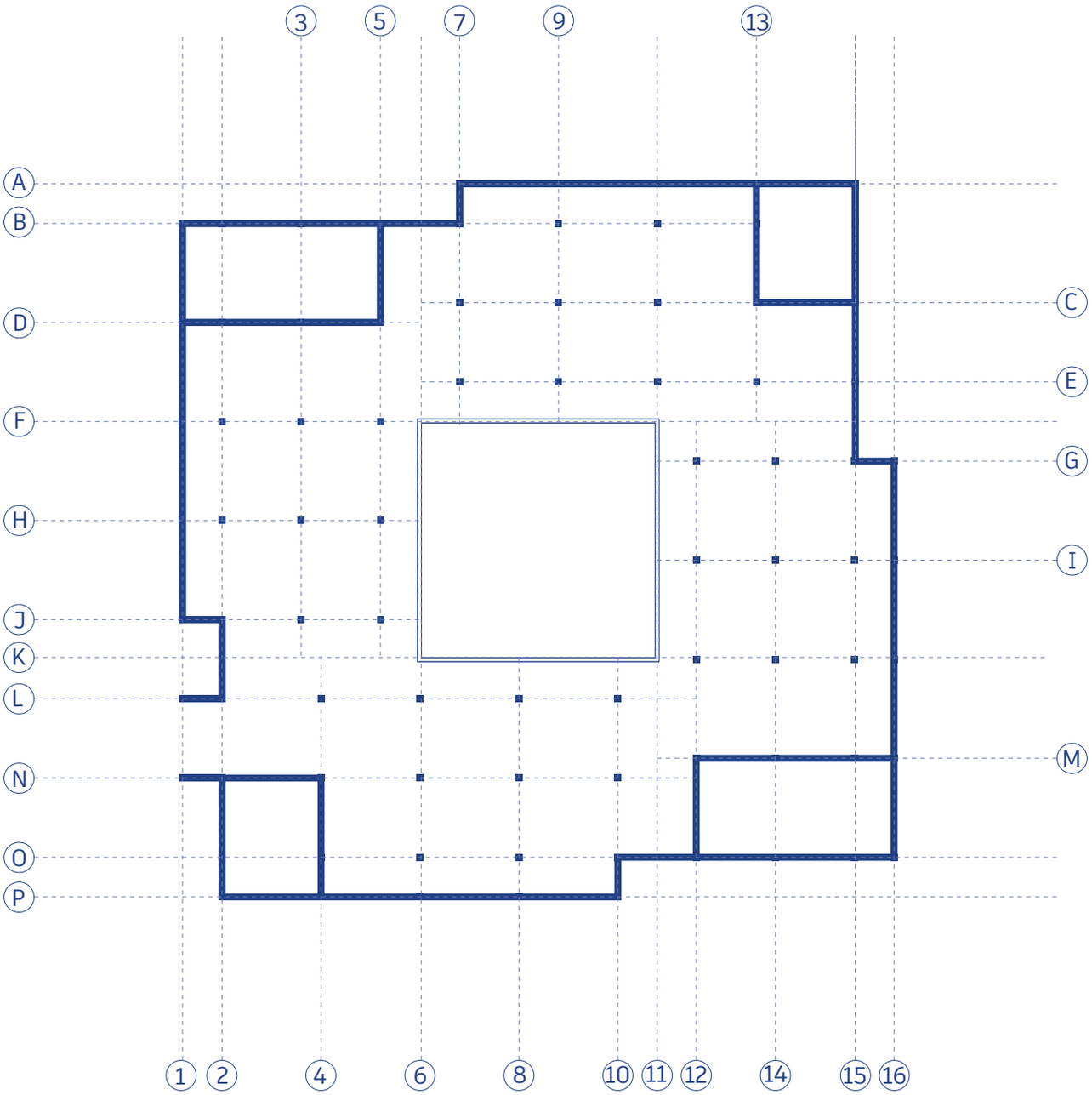


Galvanized steel

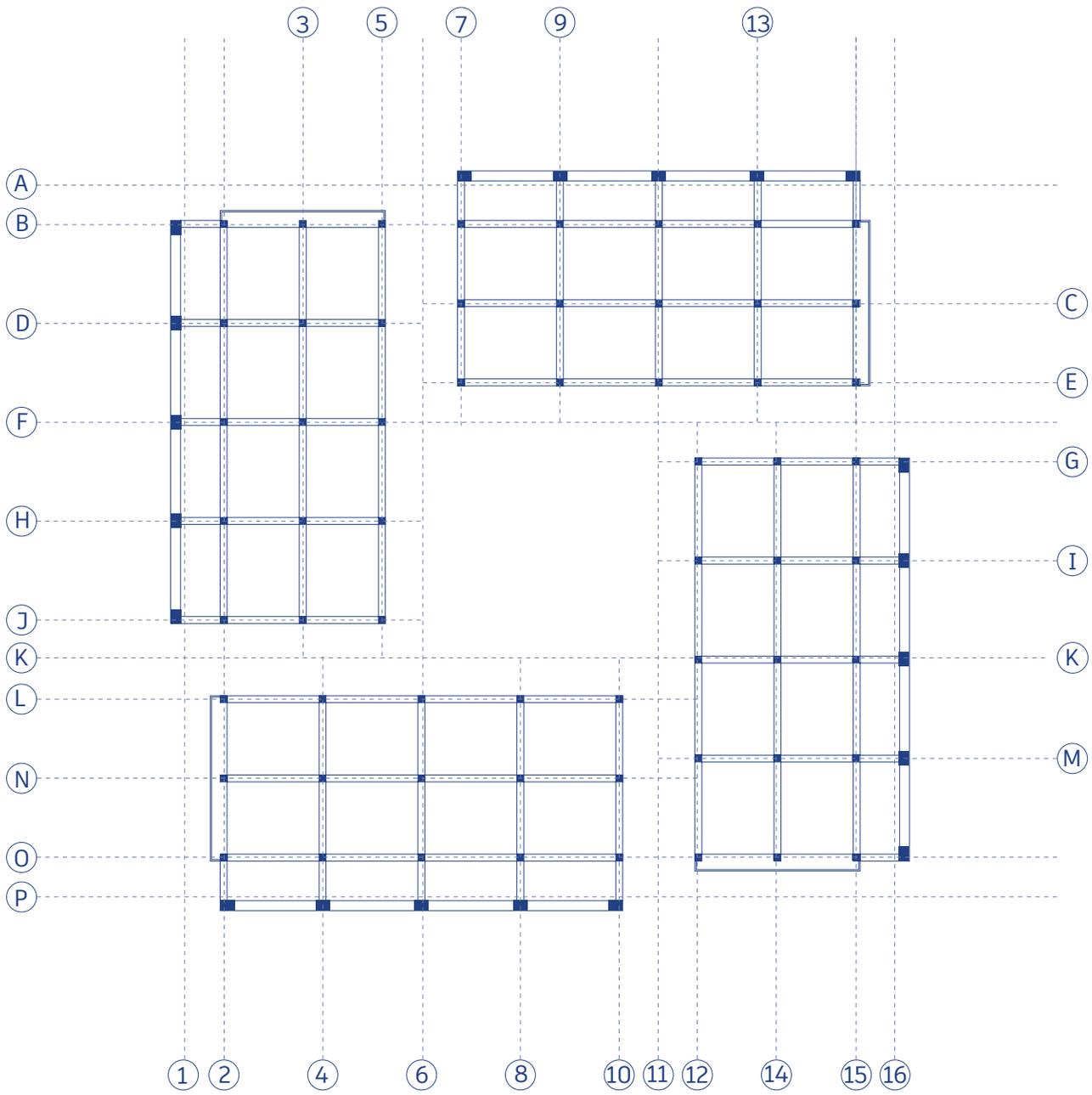
Construction



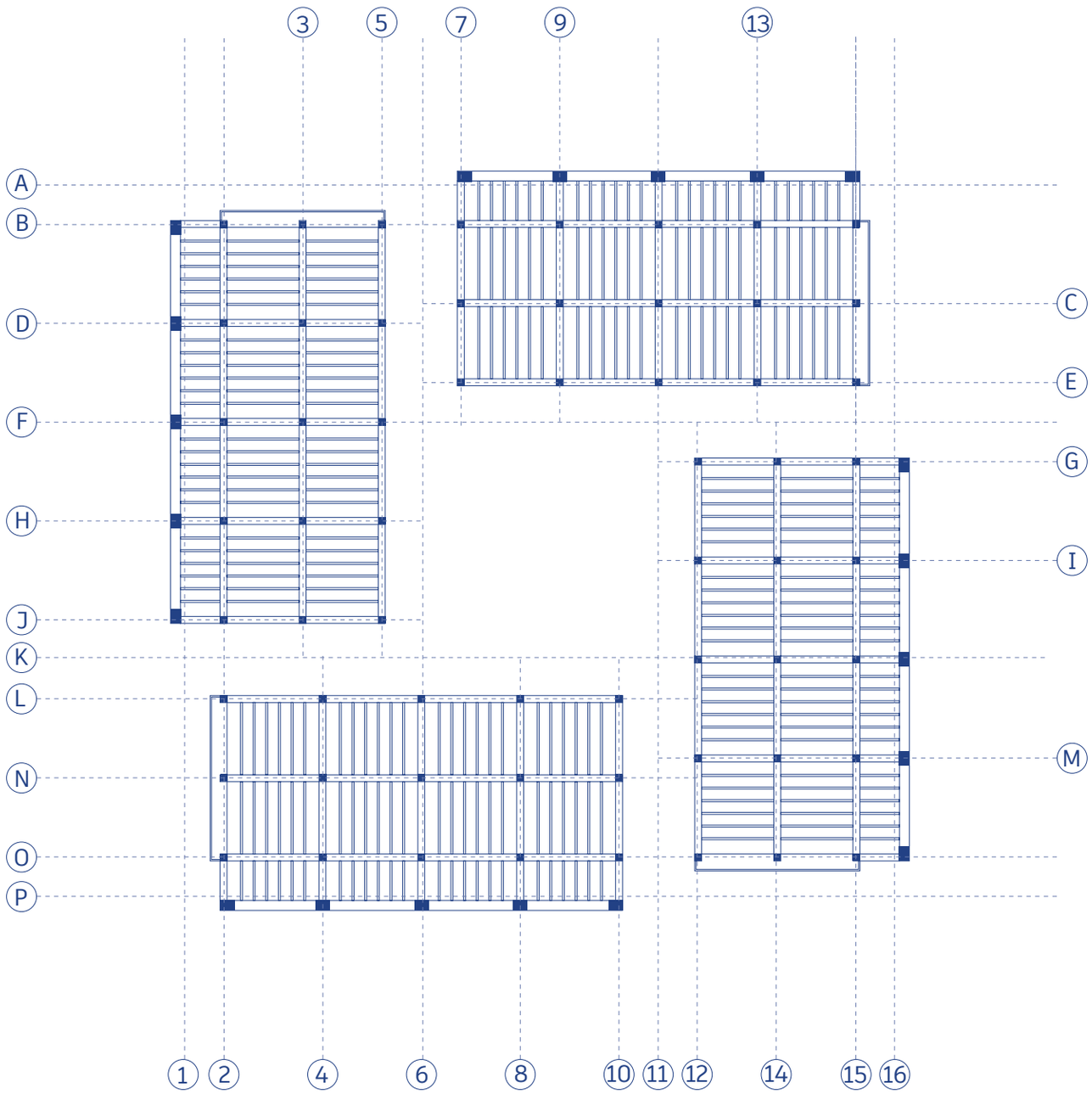
After clearing and preparing the site, the start of digging the foundation will happen at the same phase as the infrastructure and services phase. The parking/storage basement will have a cast-in-site conrete exterior wall with supporting colomns as the start of the foundation for the rest of the levels.



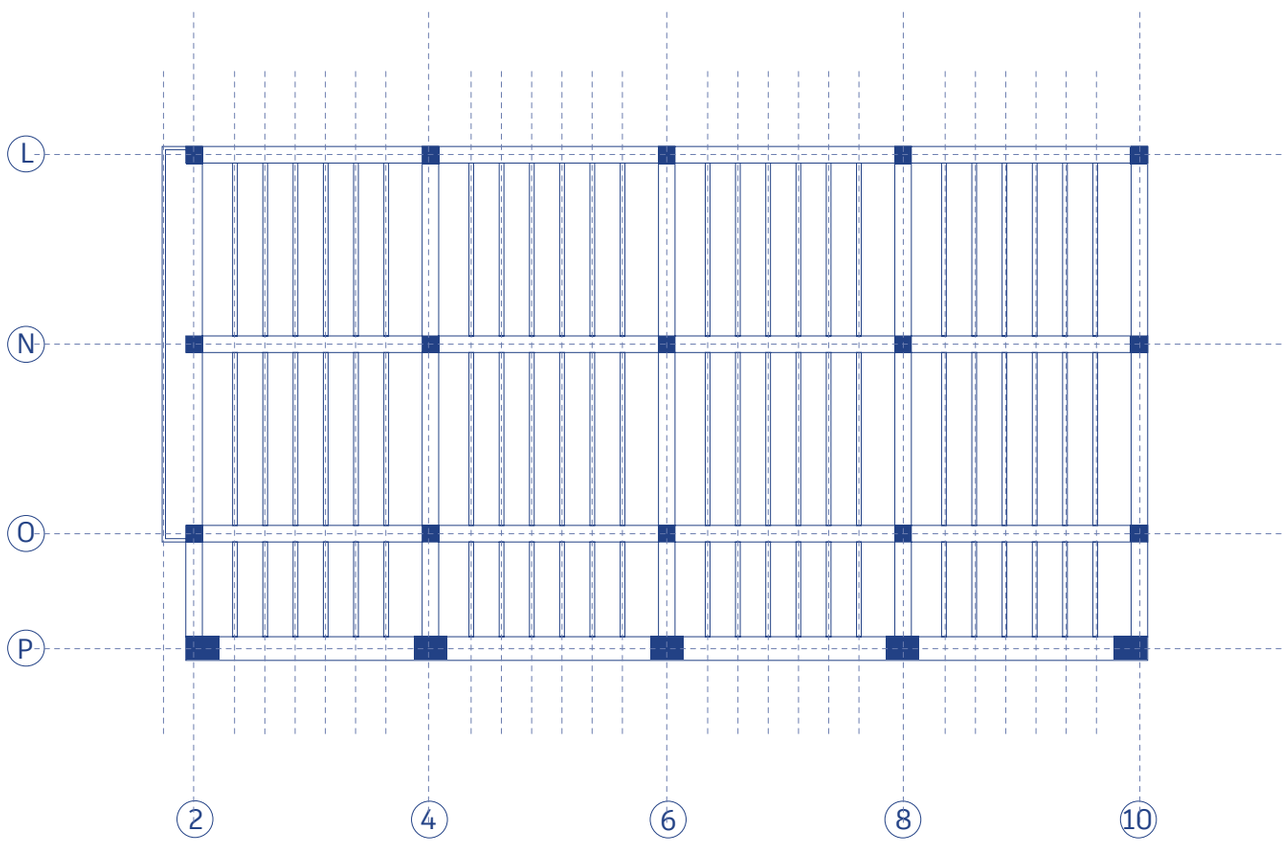
Foundation and parking/storage - sub-level 1

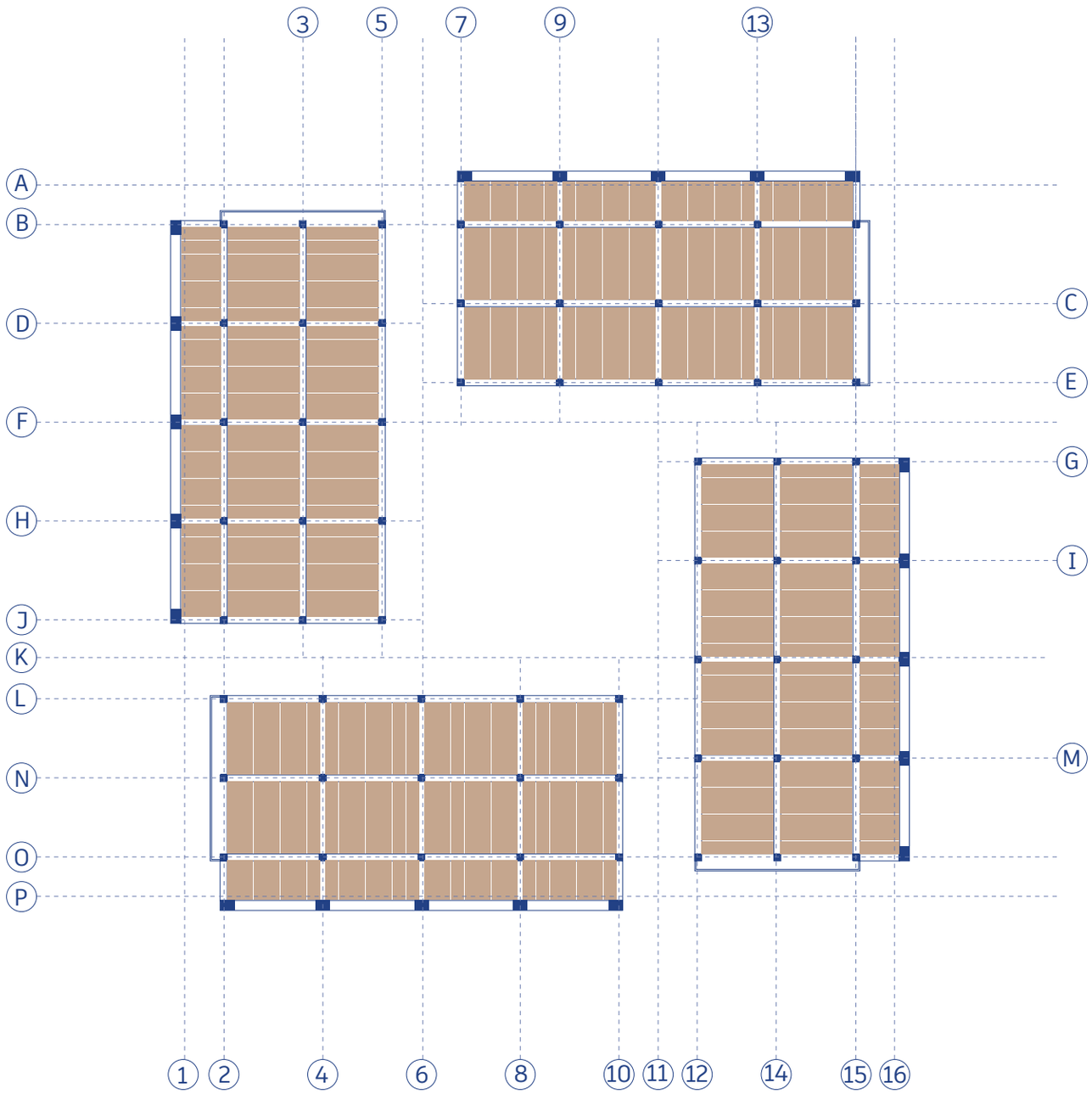


Casted-on-site oncrete colomns and beams - GF till roof

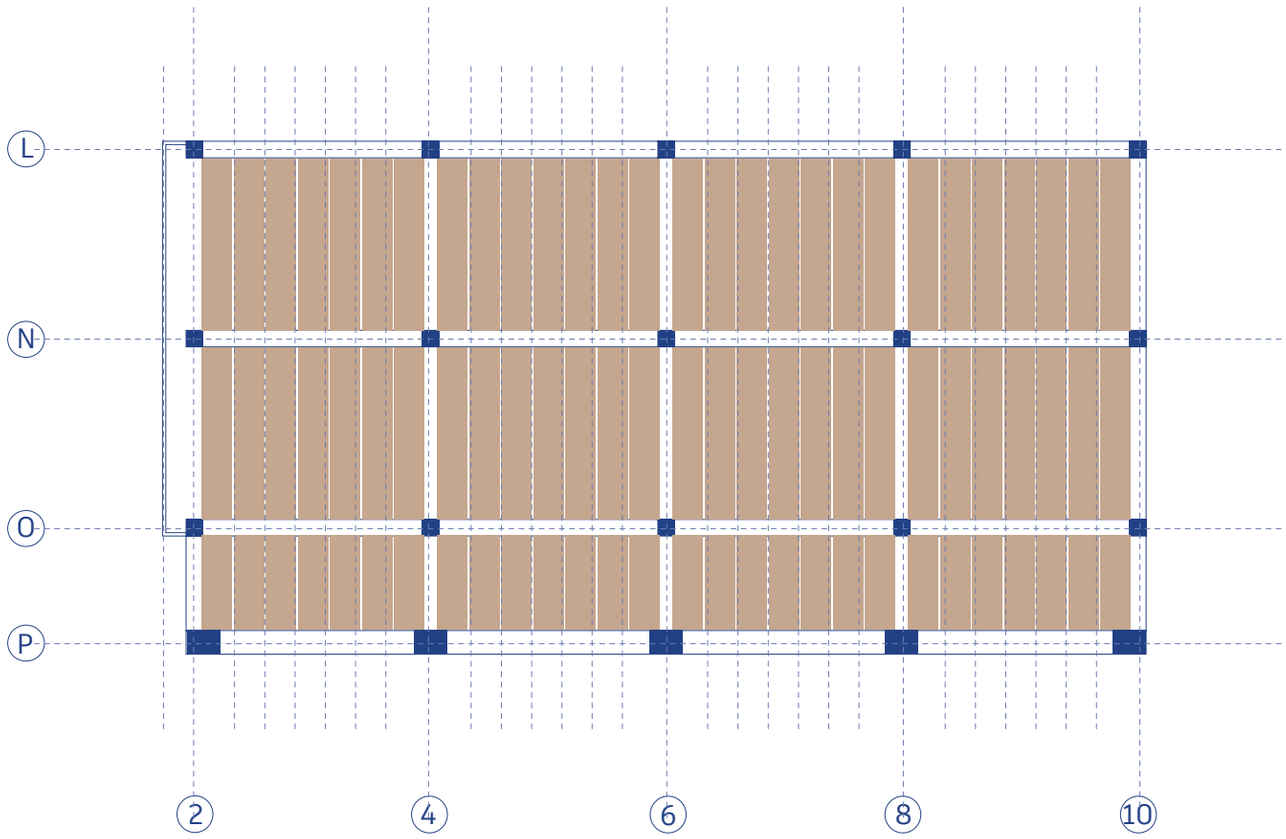


Sub-construction casted-on-site concrete beams (casted simultaneously)

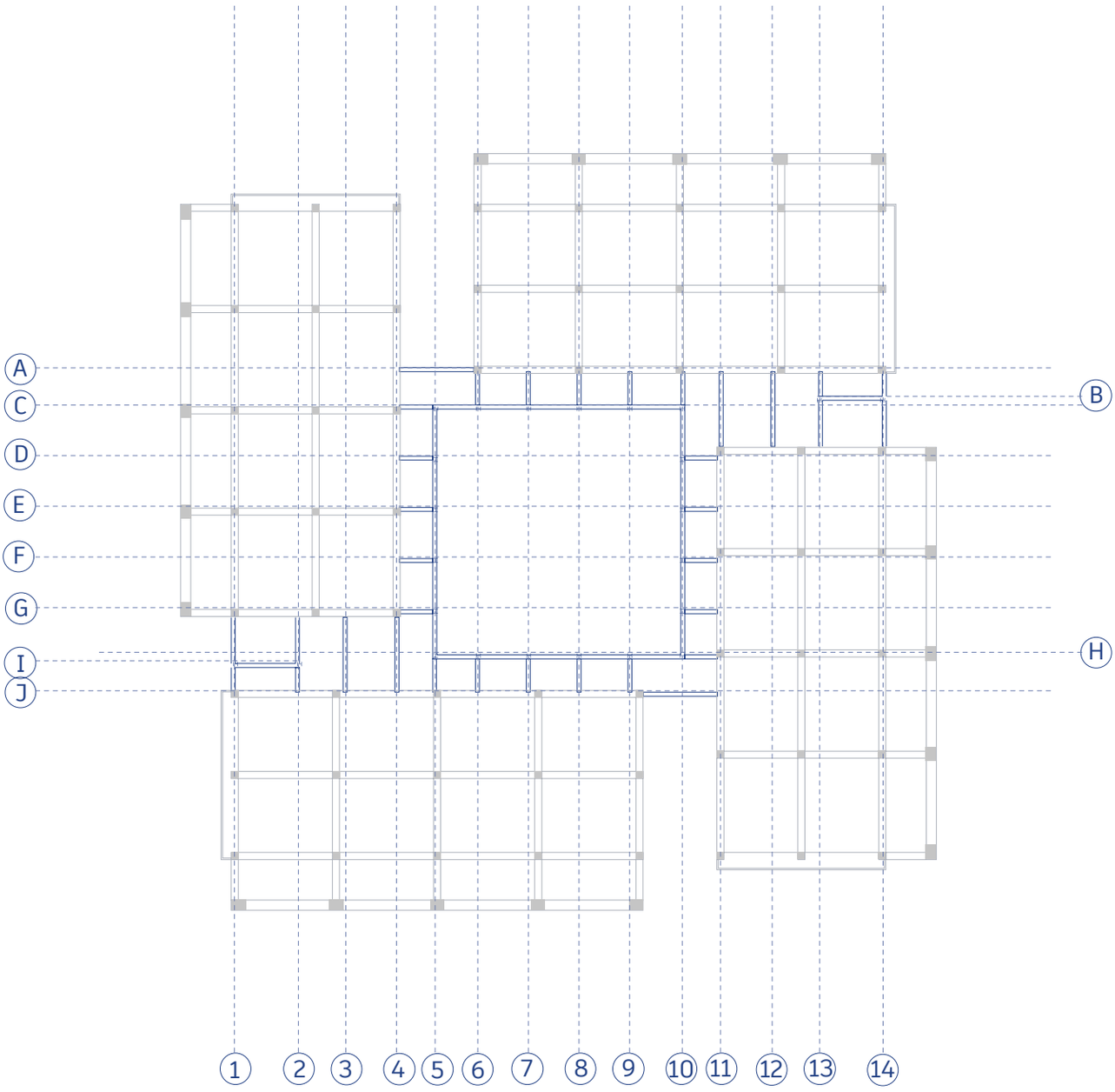

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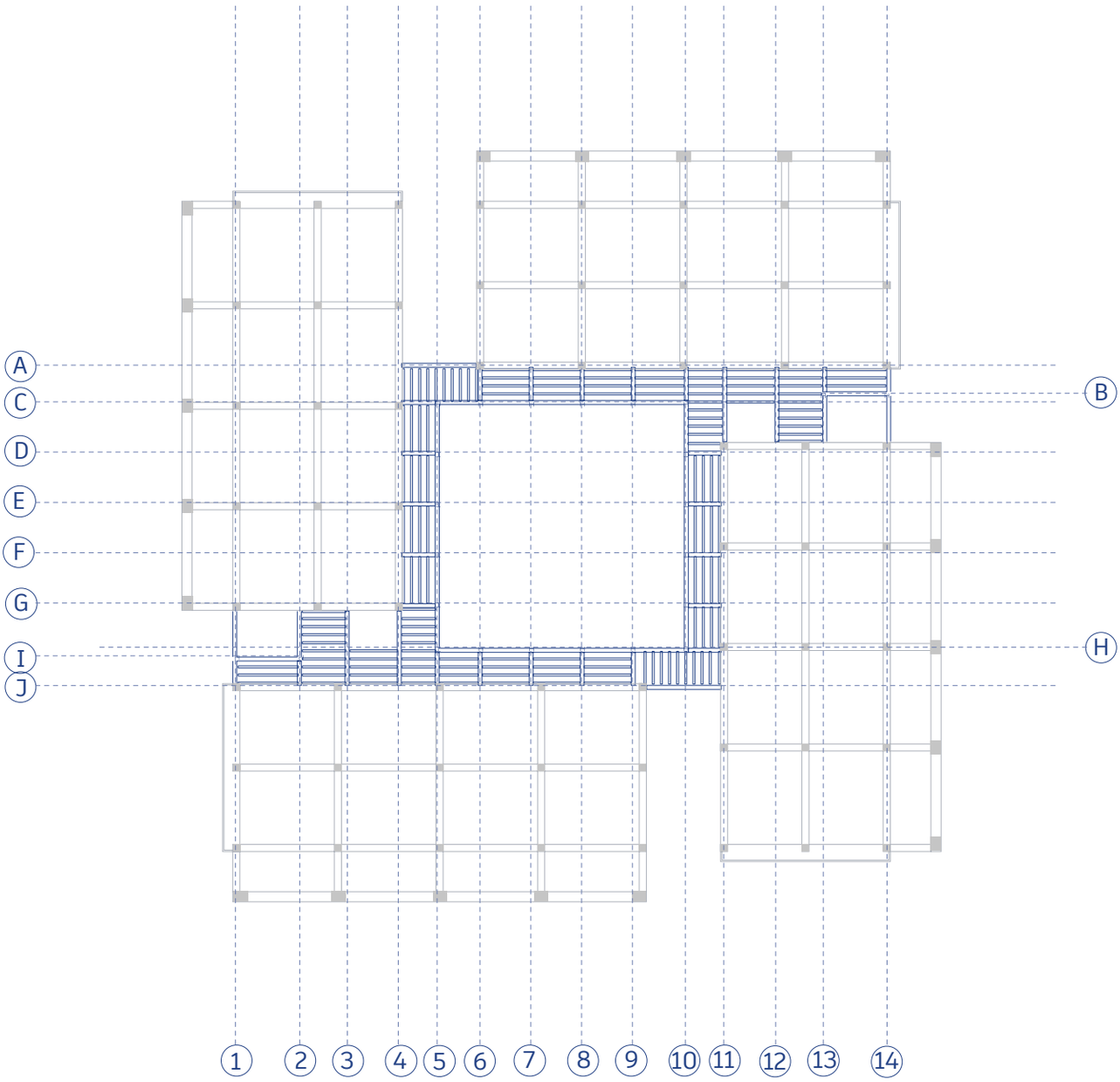
Placement of hollow ceiling blocks on sub-construction



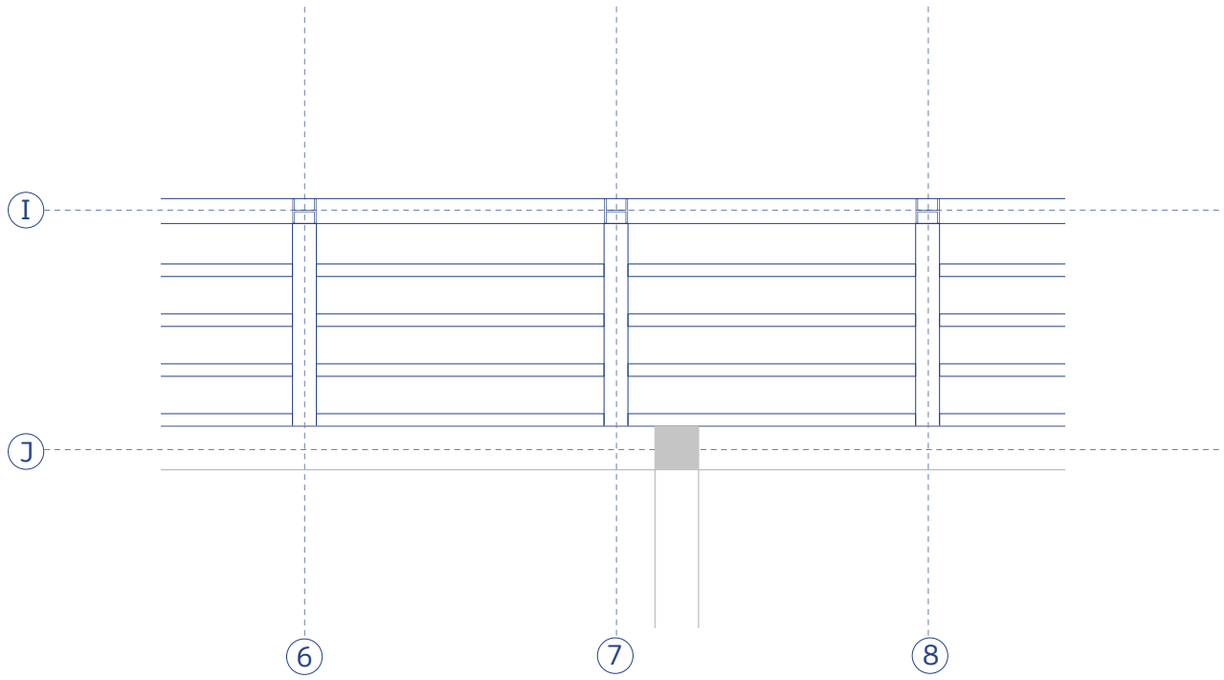
Pooring of concrete to connect the concrete beams



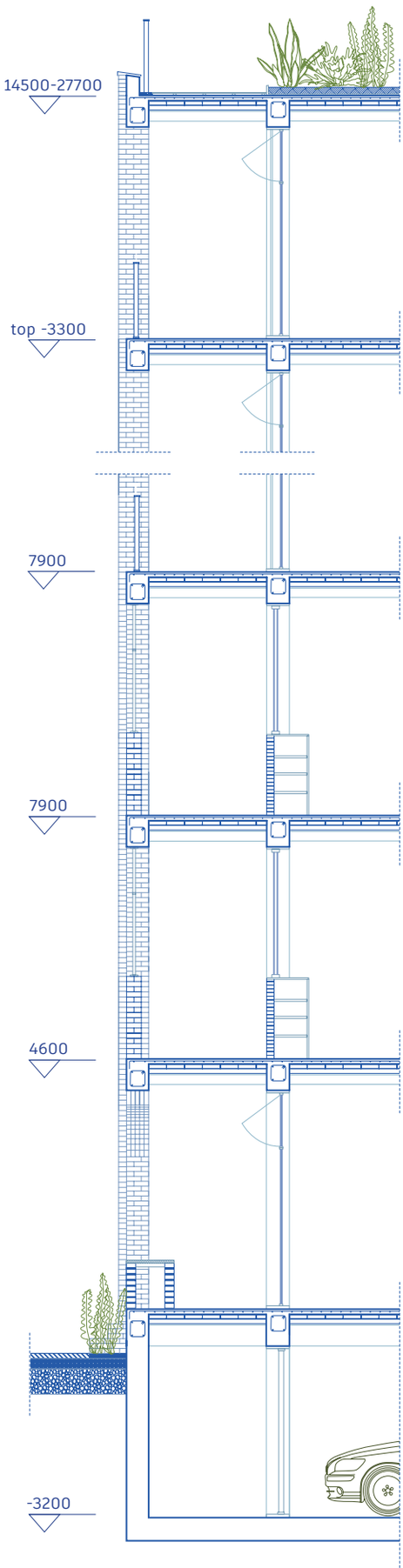
Secondary construction steel (I-profiles)



Sub-construction T-profile

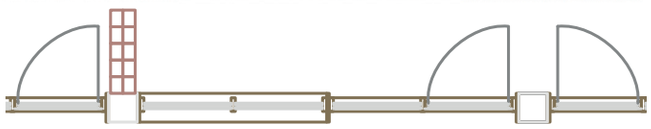

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Fragment 1: balcony



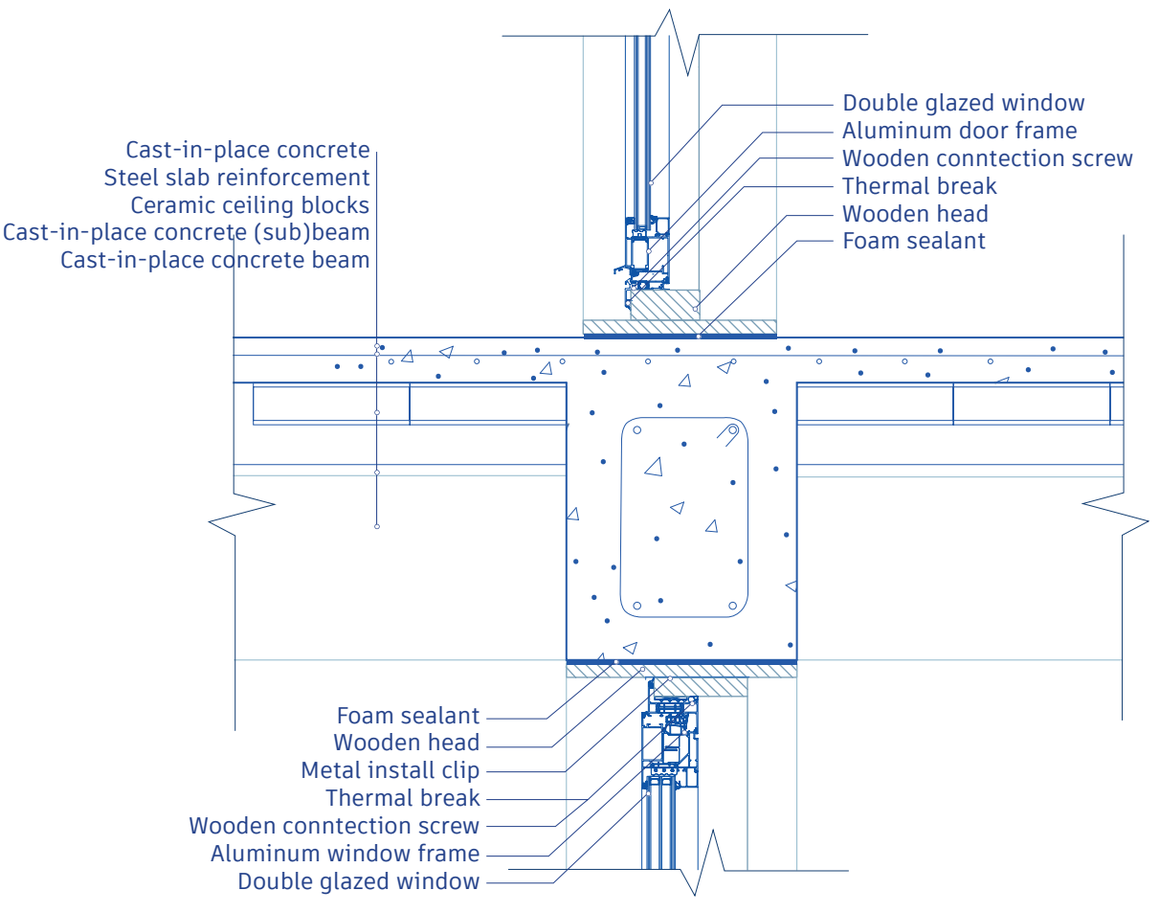




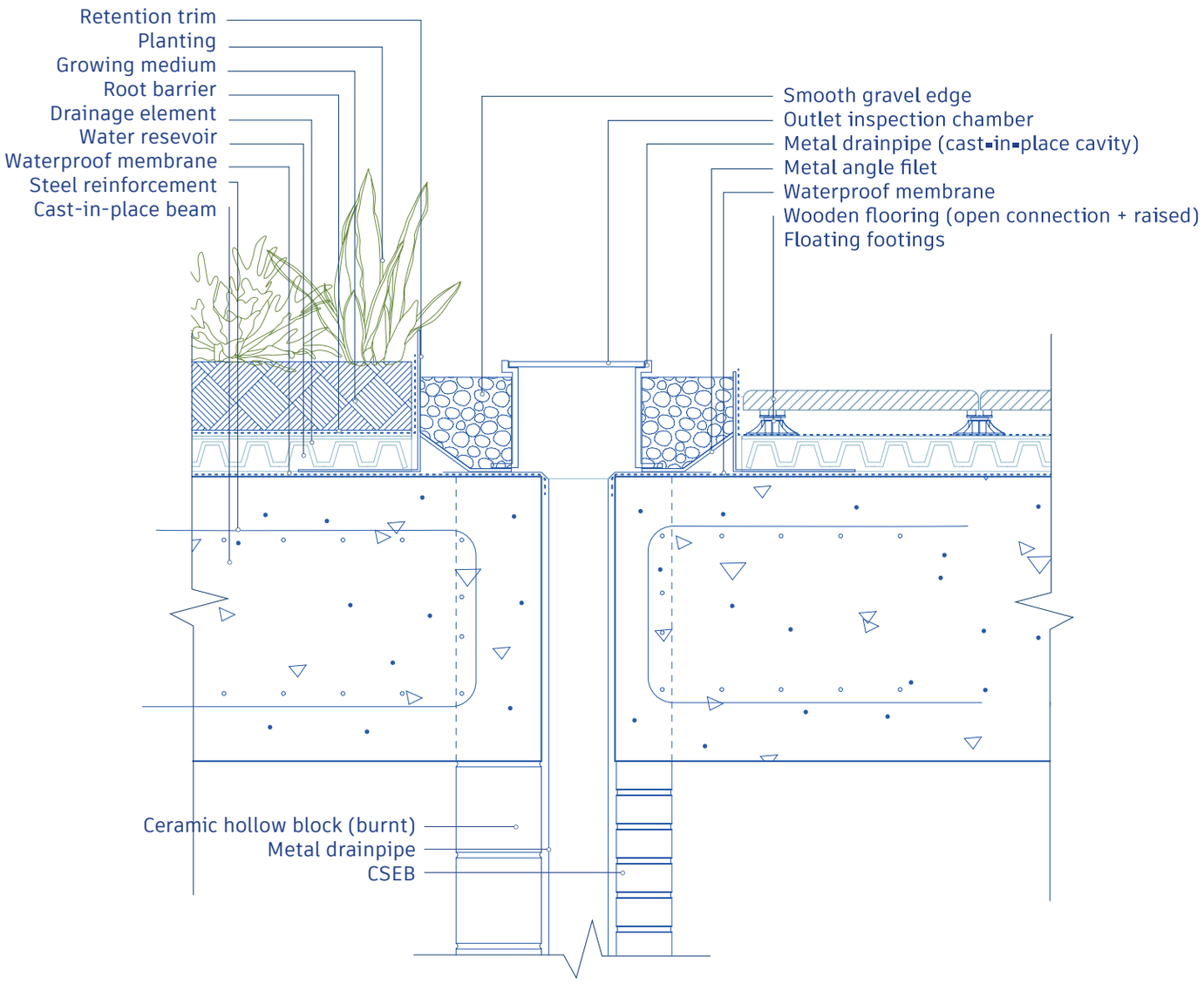




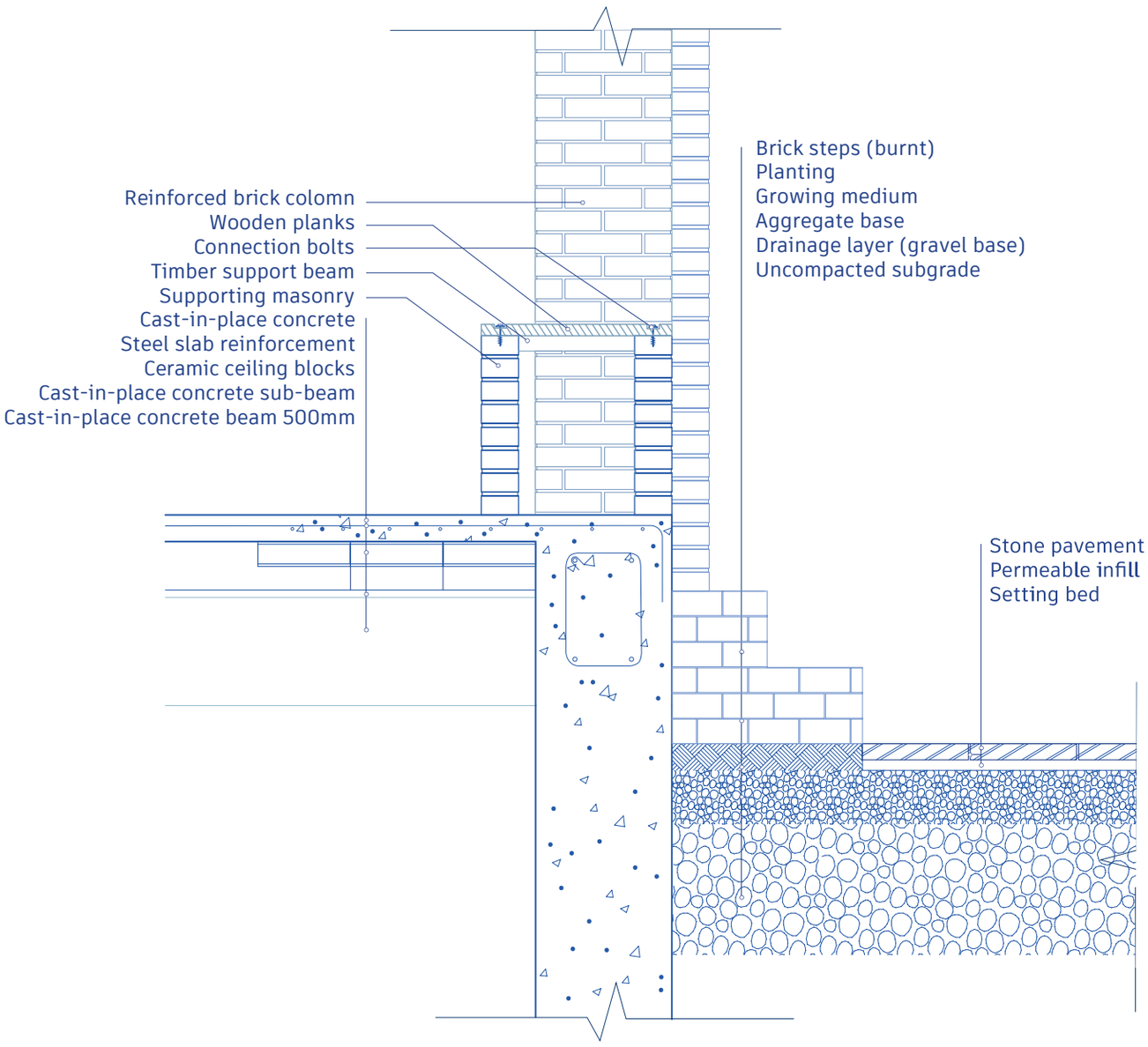
Detail 1: facade openings



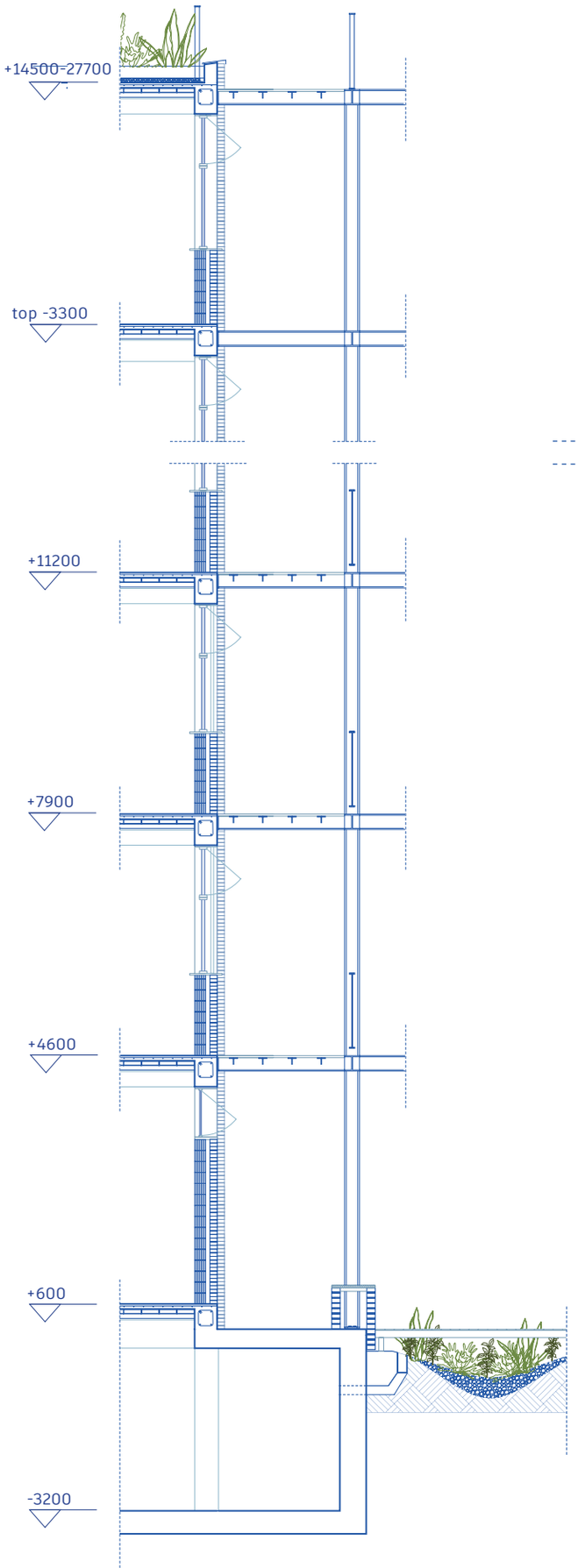
Detail 2: drainage

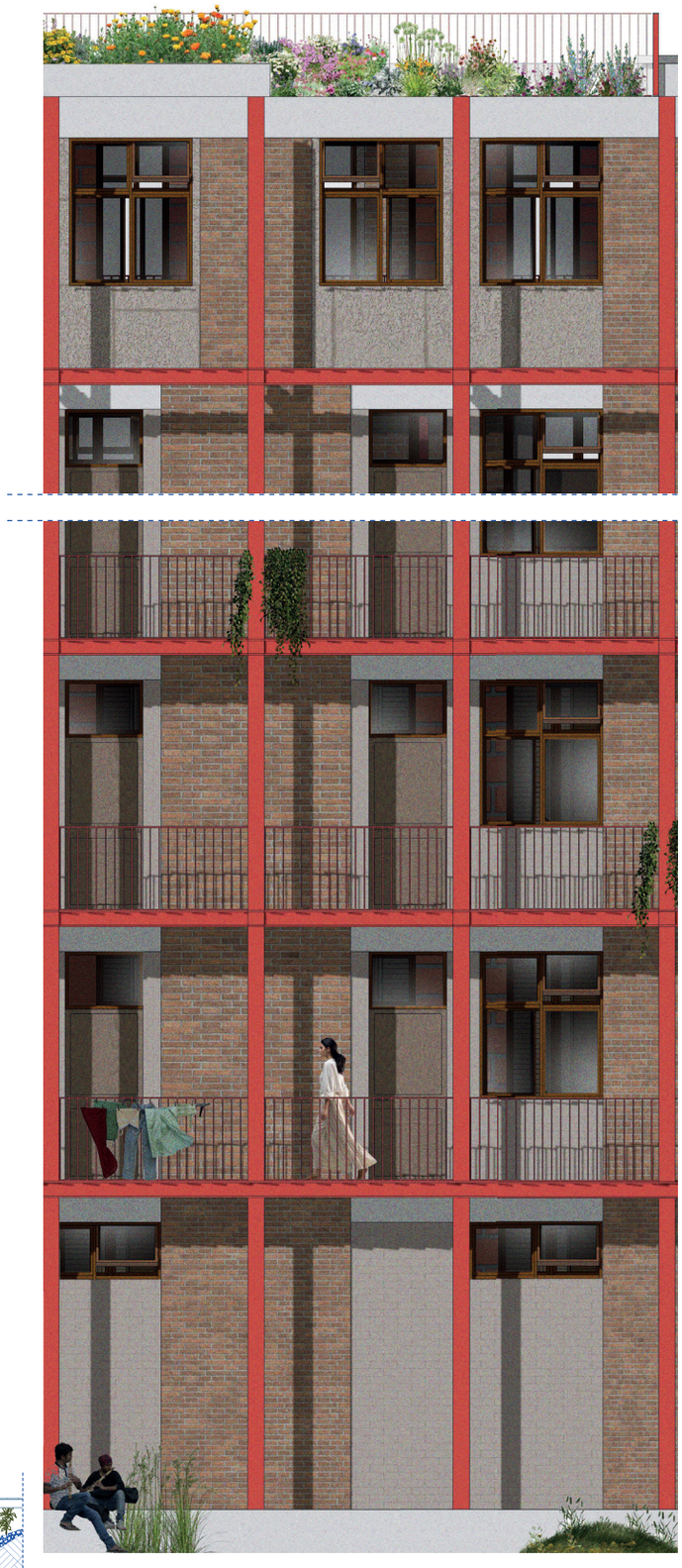


Detail 3: arcade

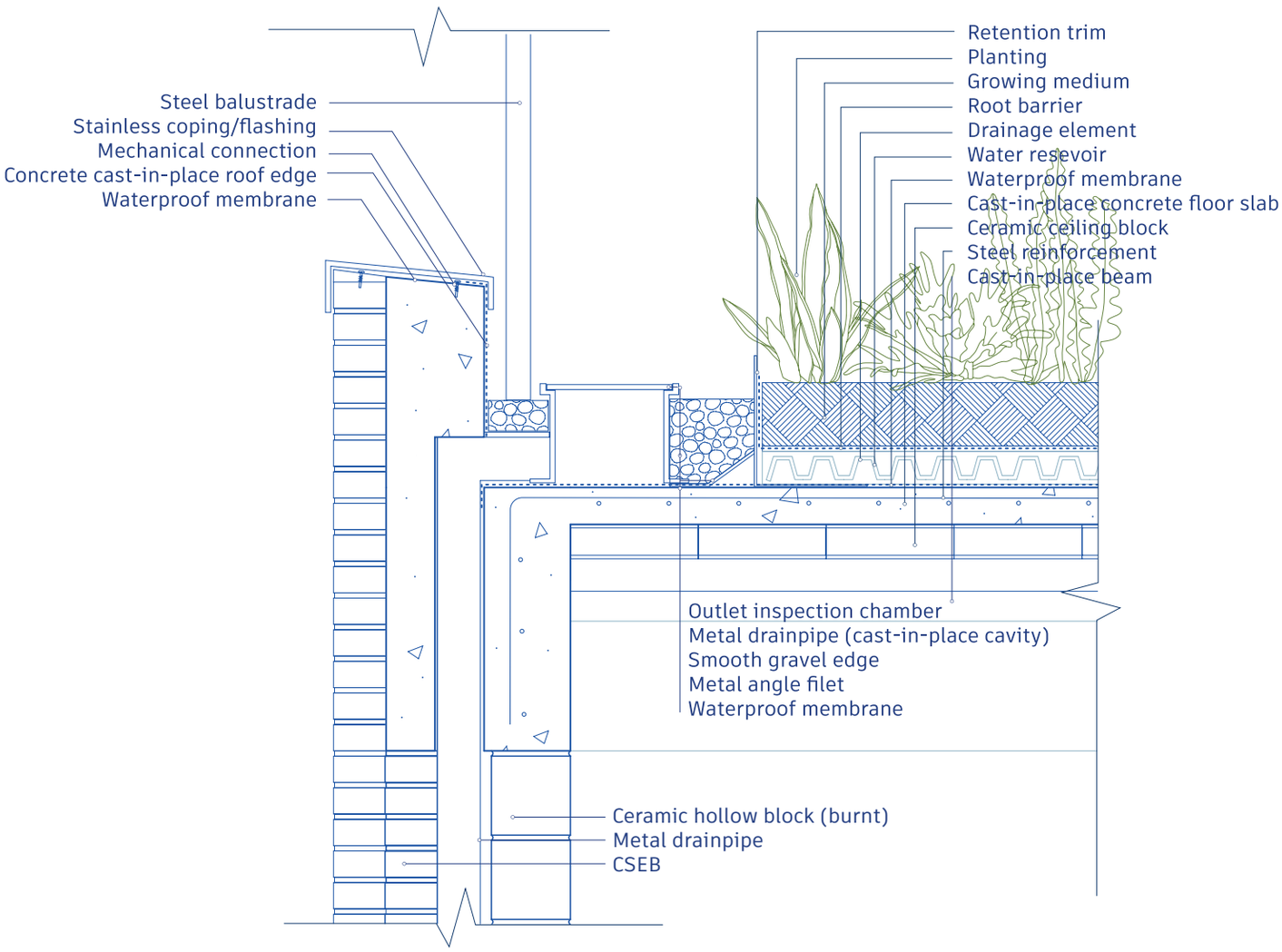


Fragment 2: walkway

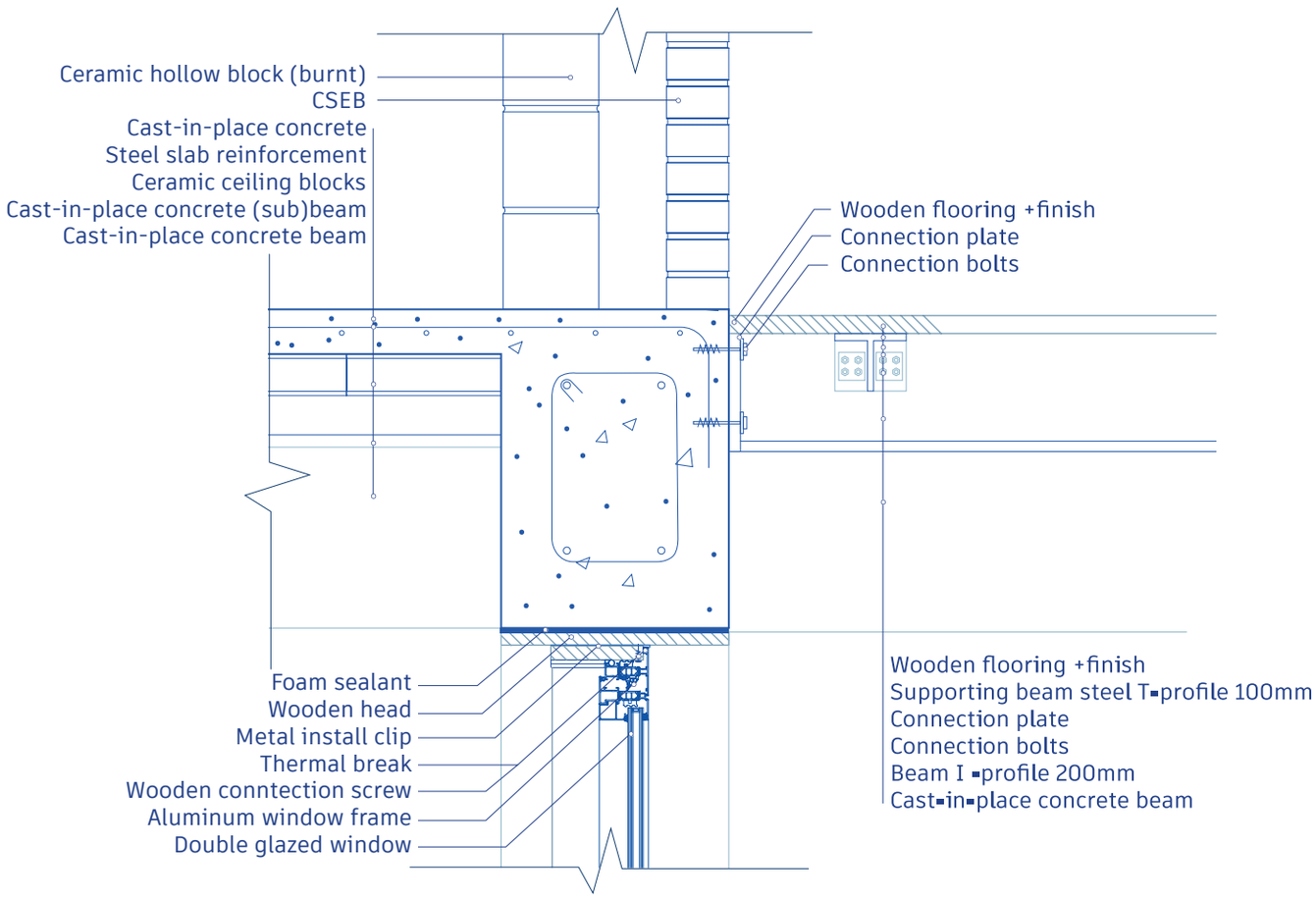




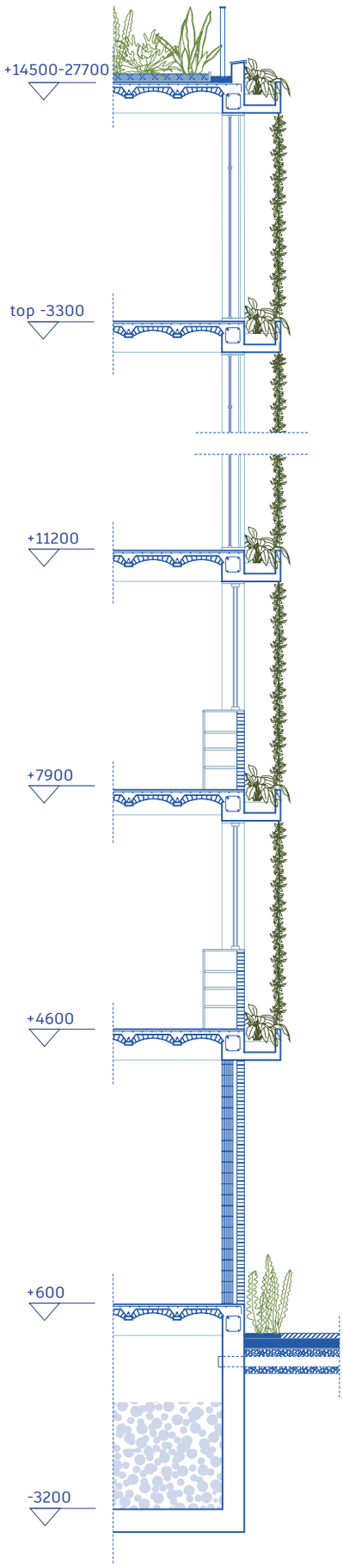
Detail 4: drainage



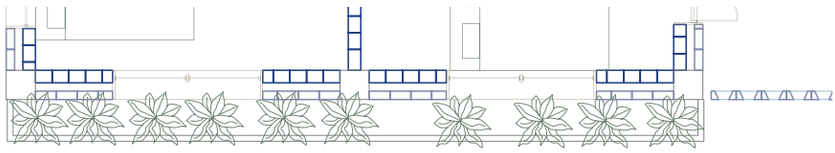
Detail 5: walkway connection



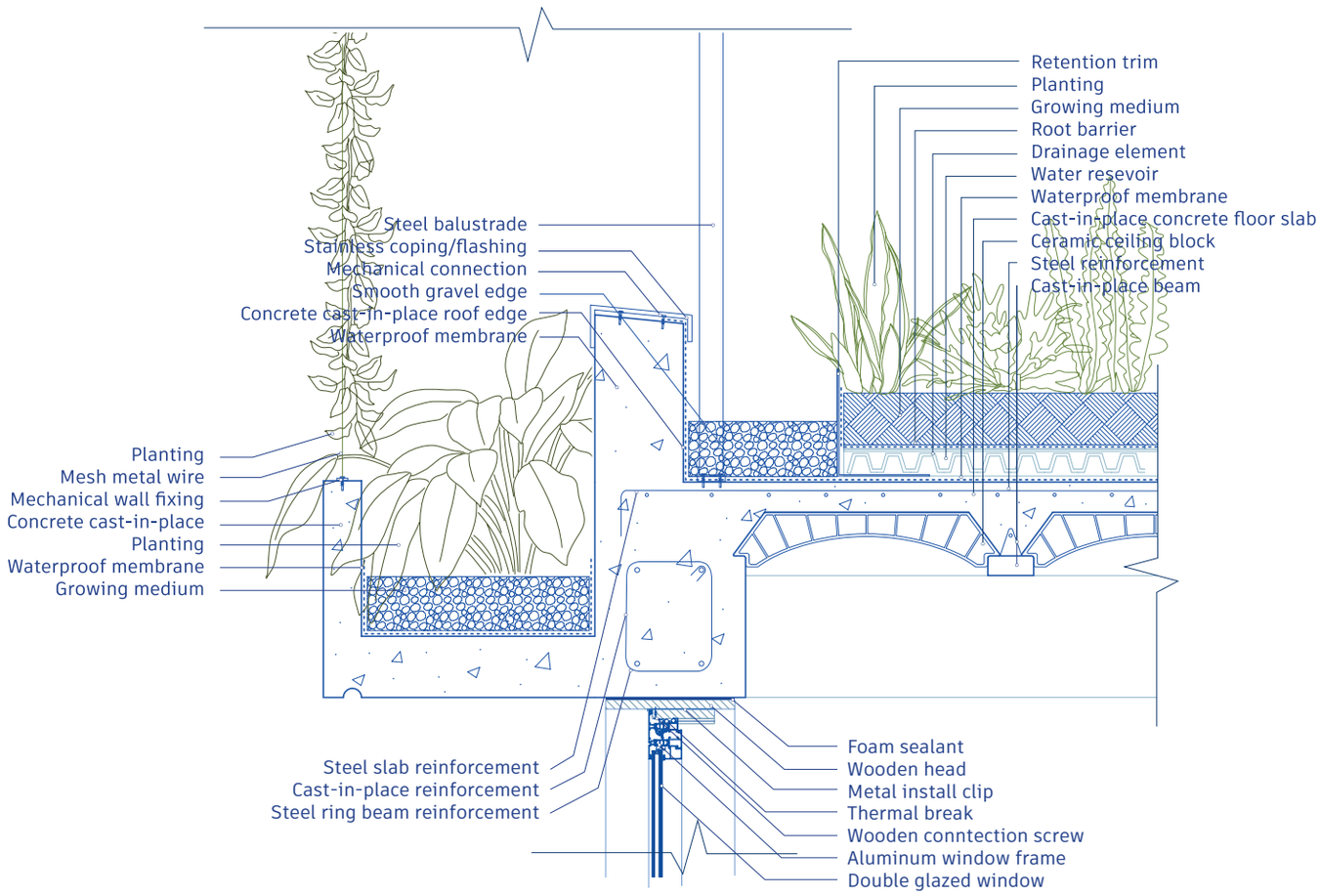
Fragment 3: overhang



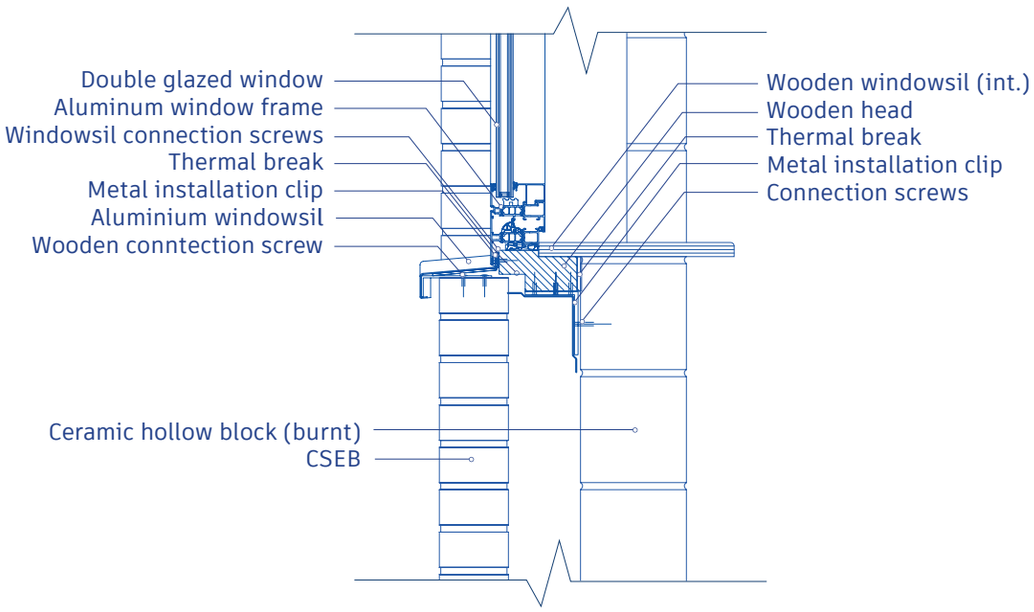




Detail 6: roof overhang

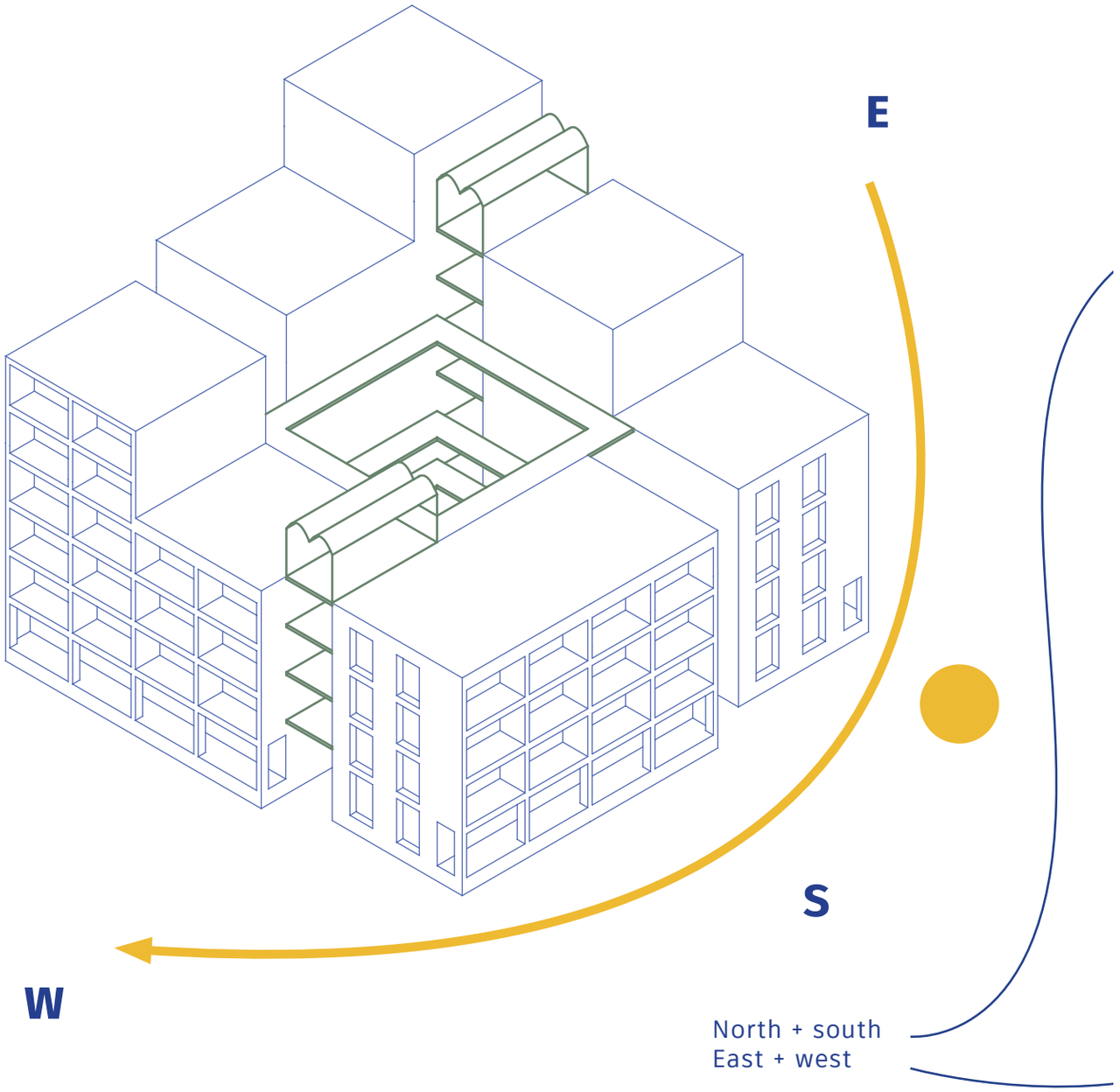


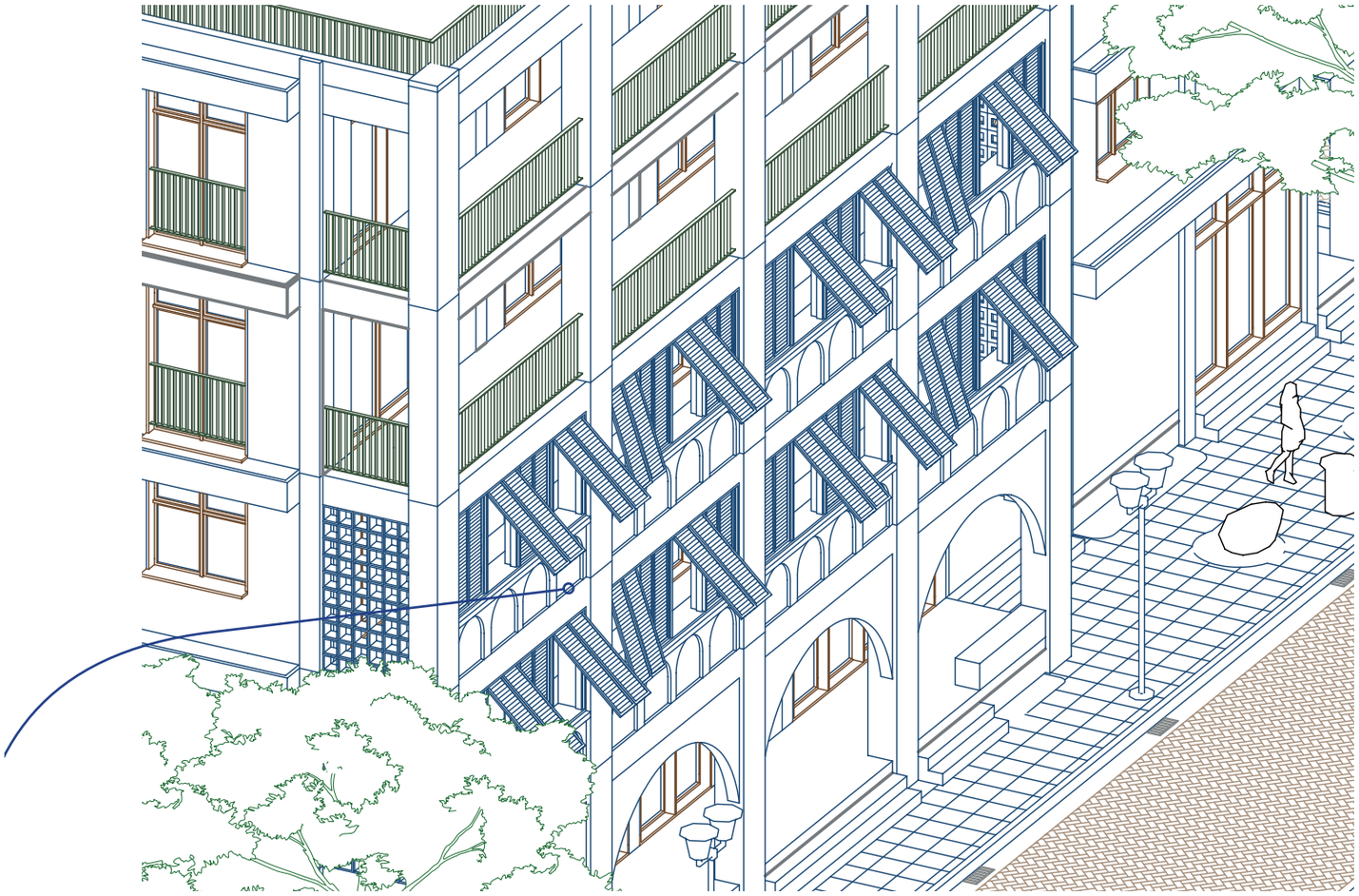
Detail 7: facade opening

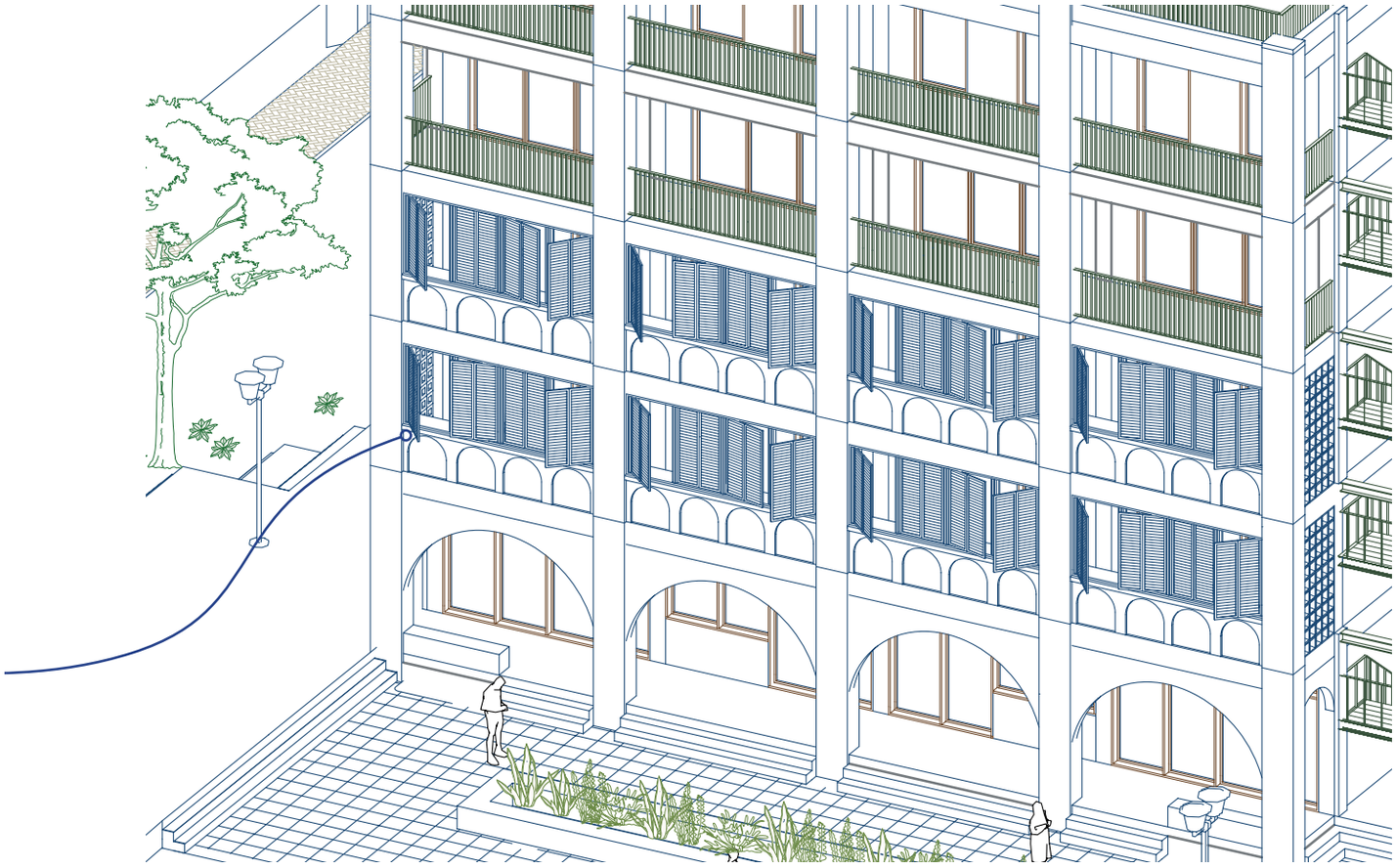


Sun
& shading

The balconies and walkways cover most of the buildings. These act as deep overhangs and protect the windows from sun radiation. These balconies and walkways are also good shaded buffer zones (exept the top walkway floor) and are almost always in a prevailing wind direction (exept the west-facing balconies). These spaces extend the living and working areas if comfortable.

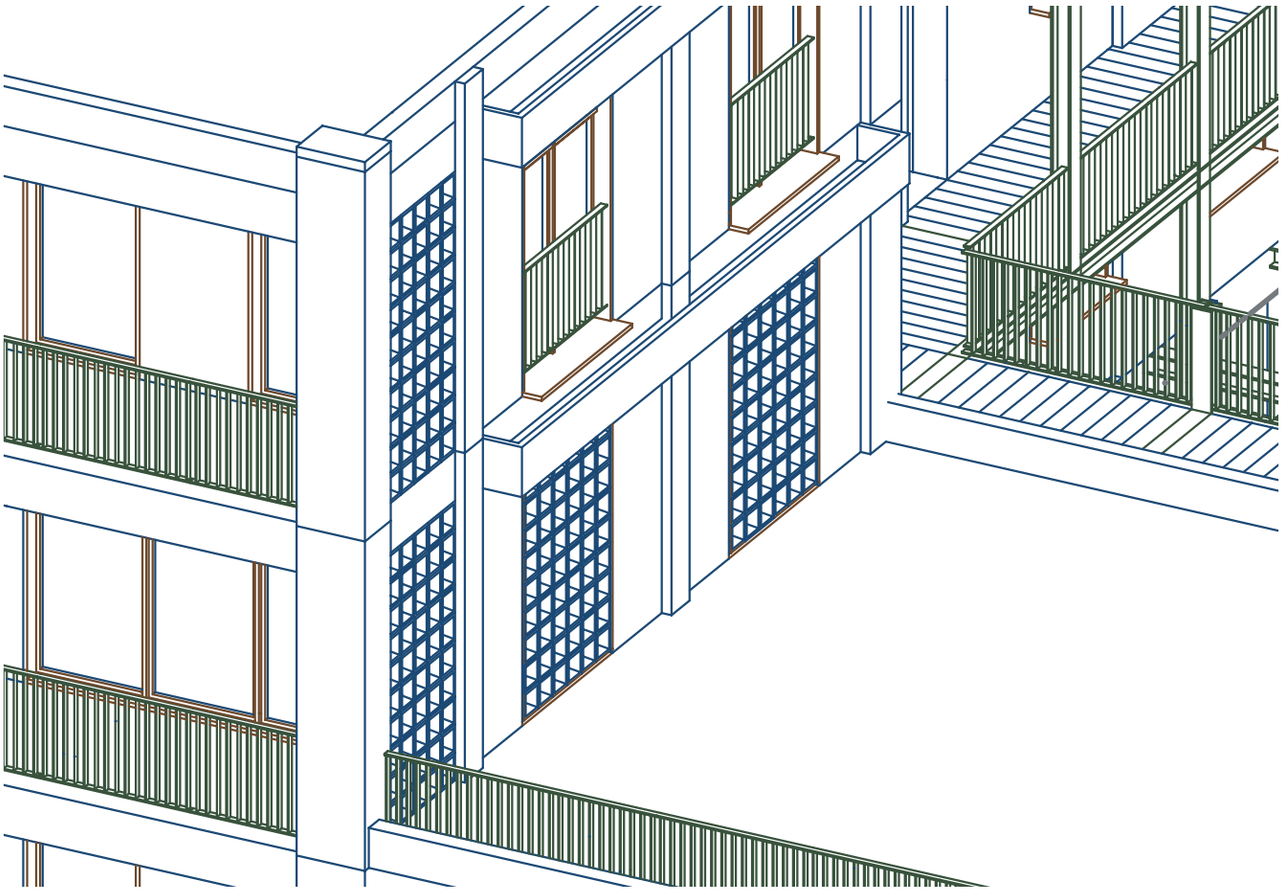






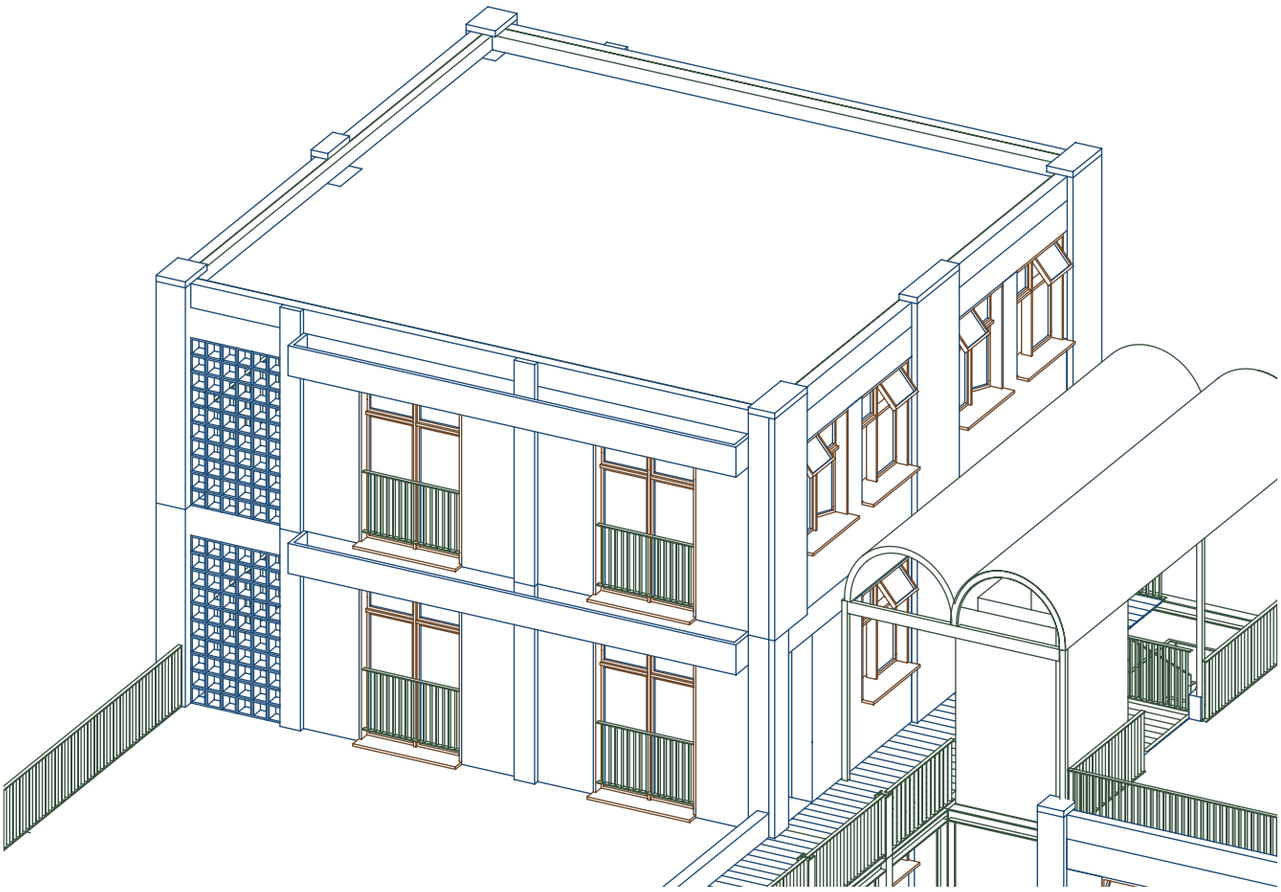
Light
& privacy

The eggcrate shading will allow natural lighting and privacy



The openings in the facades with no balcony or walkway, have an additional overhang, separated from the construction. This is made of concrete overhang, with in between a mesh where plants can grow.

The highest points of the buildings (9 floors) are orientaded in the north, so the rest of the building is not in its permanent shadow.



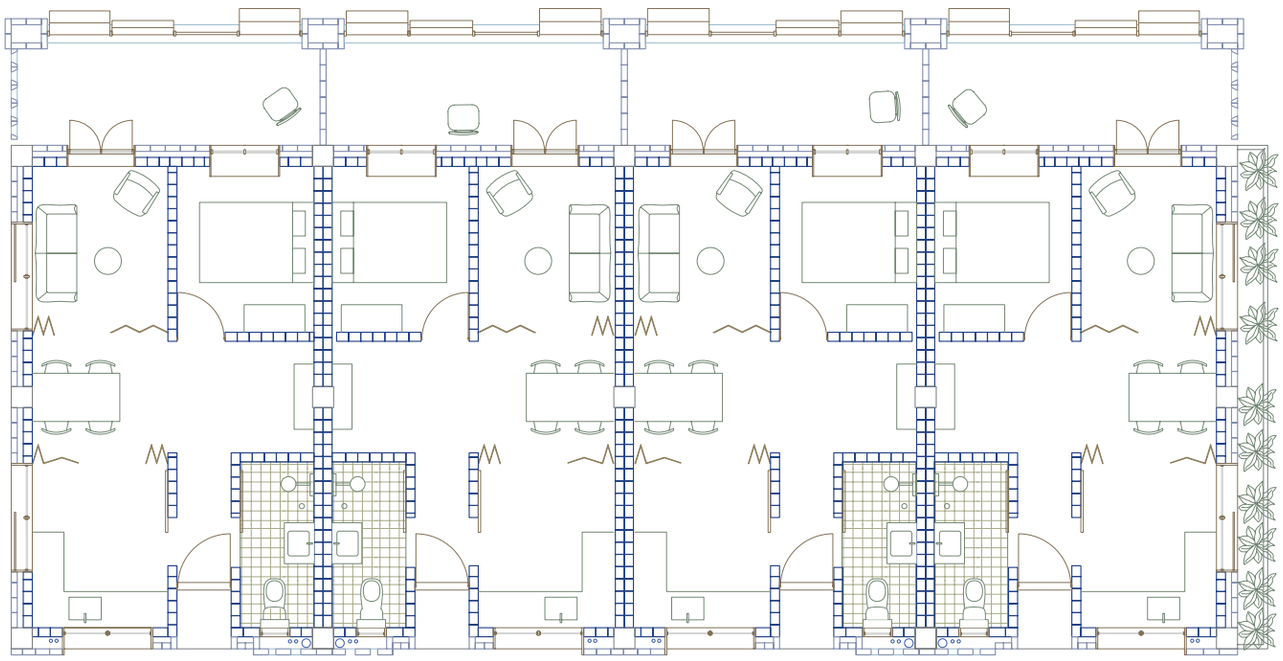
Every facade opening, including doors have operable sunshades in the shape of louvers. It depends on the orientation of the window which way the louvers are places.

Cooling & ventilation

A long and narrow floorplan help maximize cross ventilation in hot and humid climates. North is one of the prevailing wind directions in Sylhet and can have therefore larger facade openings to stimulate even more cross ventilation. This will be harder to apply in the east (also a prevailing wind direction), because of the low-hanging sun in the morning.

The floorplans are open to also promote ventilation. Rooms that need more privacy and but no noise insulation, have louvered doors.

To stimulate cooling between the different balconies, they are divided by open stacked brick pattern. This way the heat will not be trapped in one balcony pocket.



The door and windows of the units are on opposite sides, to facilitate cross ventilation

To hide the rain, toilet and sink drainage pipes, a semi open masonry bond is used to still allow light, ventilation and privacy.

Ceiling fans can help cool the room by air motion. A room can almost feel 5 degrees Celcius cooler.

In some units (with two floors) is stack ventilation possible. Open stairwells make it possible that air flows between two facade openings if there is height difference between the air inlet and outlet.

When the windows are only opened when the temperature drops in evening and night, and stay closed during the day, warm air can not enter the building. By this method the thermal masses will be cooled at night and absorb heat during the day. This is only possible when the walls are insulated by a mass wall or air-layer. This type of passive ventilation is possible because of the high, small window openings and stack ventilation. There needs to be an open floorplan and walls and floors have to be exposed (no coverings like carpets, cupboards or ceiling panels).

High ceiling plus high operable windows.

The wet rooms (bathrooms, toilets, and kitchens) have always acces to the outside by an operable window. This is to prevent humid, hot, and smelly rooms.

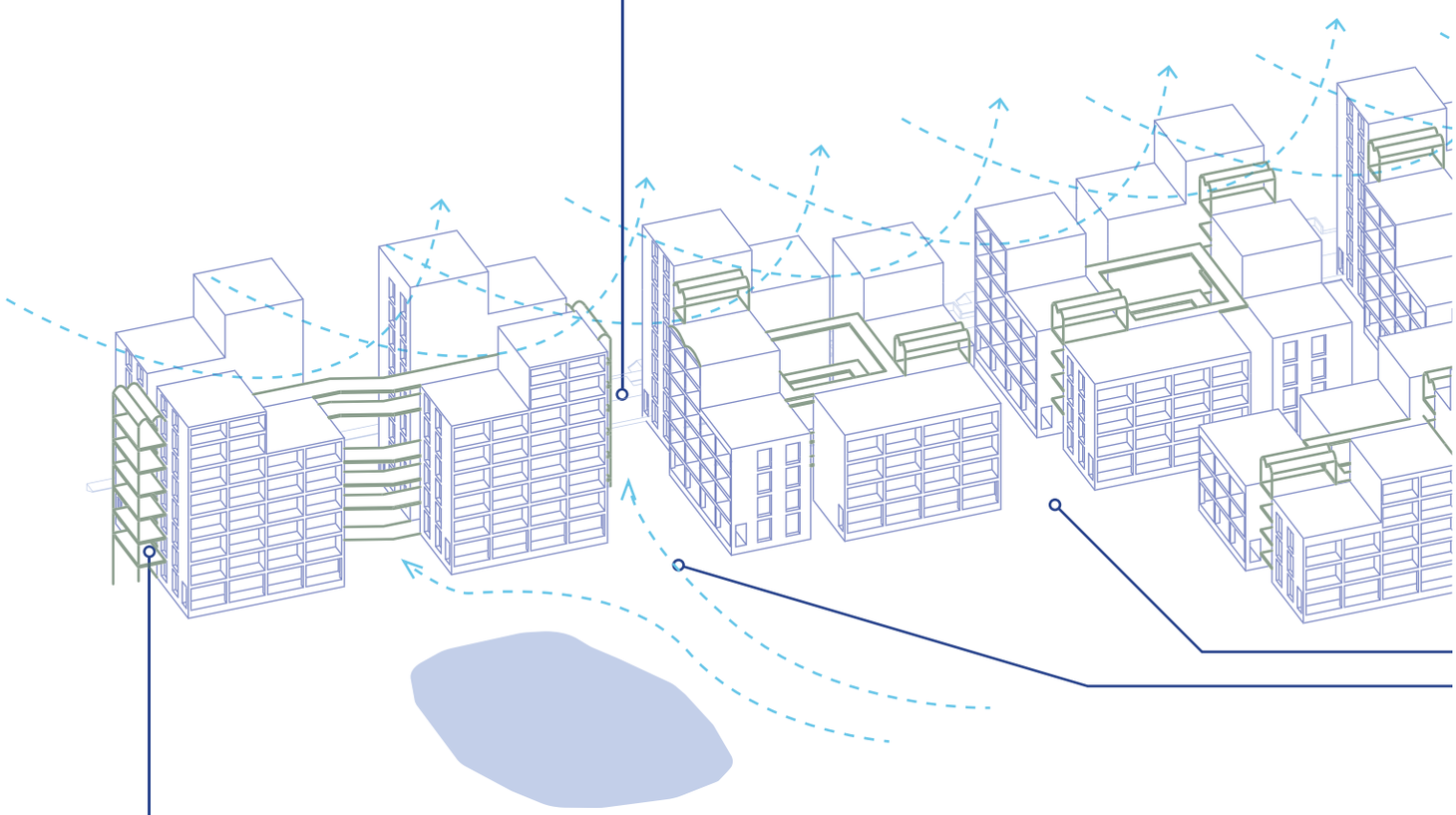
Night flushing is only suitable for climates with significant large temperature change from day to night. Nighttime temperatures should ideally be under 20°C (68°F).

This method will be suitable for the months of January, February, March, April, November, and December. However, the winds can be too cold for the residents in the months of January, February, and December.

The best months are:
March, April, and November, where de nights are less cold, but the days hot.

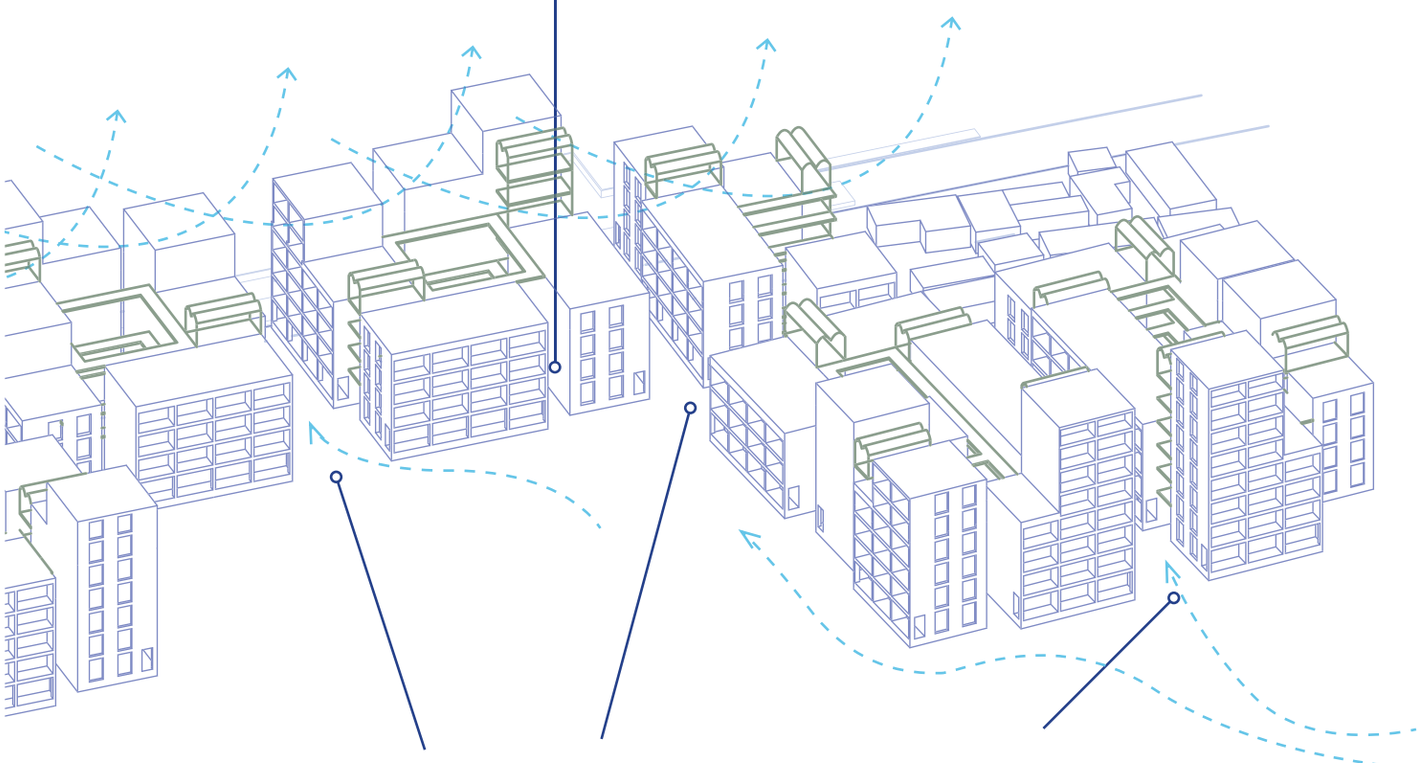
Good natural ventilation reduces or even eliminates air conditioning in warm weather, if windows are well shaded and oriented to prevailing breezes. To capture natural ventilation, wind direction can be changed up to 45 degrees towards the building by exterior wingwalls and planting.

The slope of the riverbank is kept as empty as possible to let wind flow to the buildings. The constructions that can cause wind obstruction are strategically placed on the extension of the streets, instead of infront of a building. Therefore, wind can cool the north-facing facade.



The stairwells are open to avoid accumulating heat.

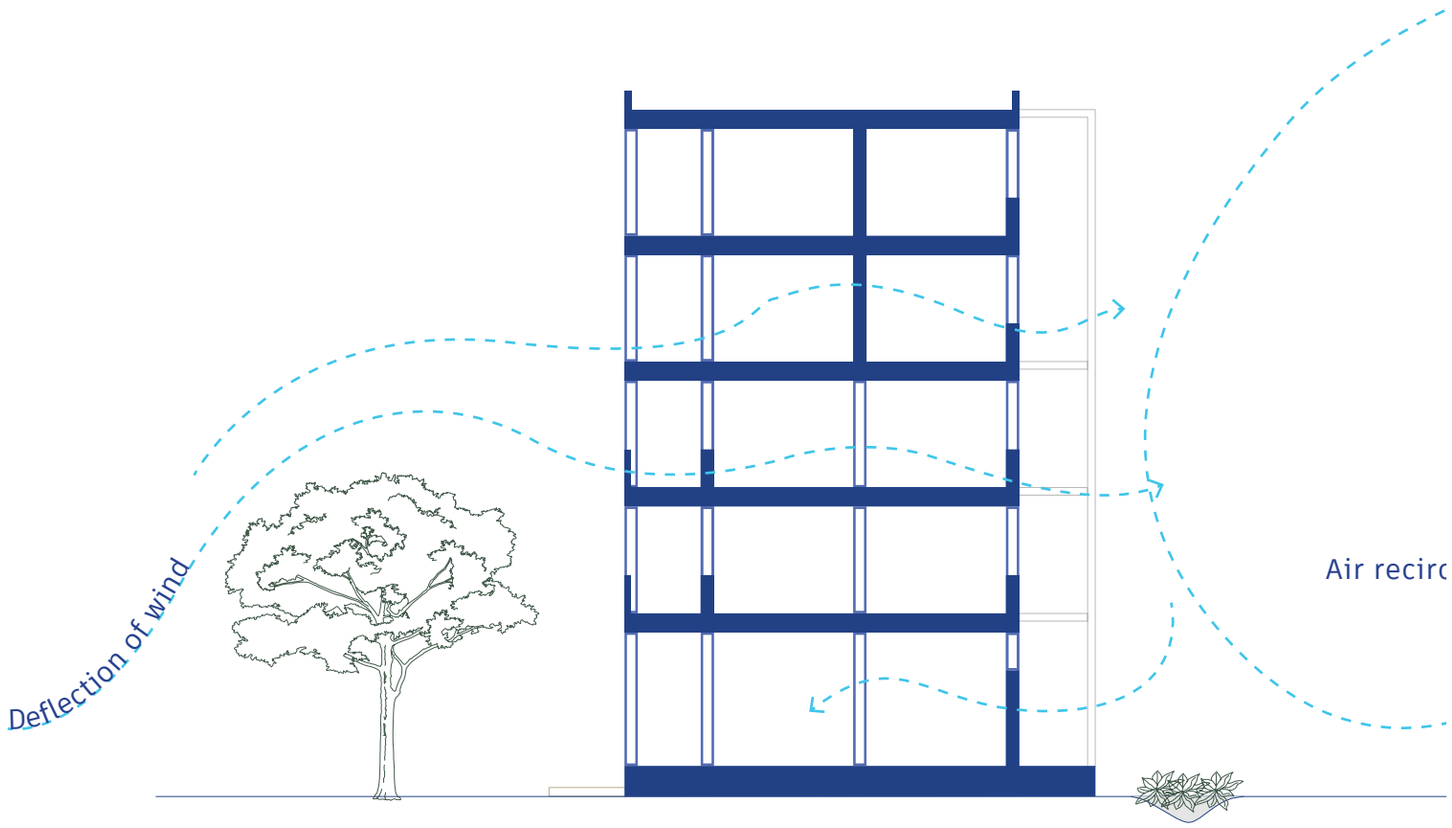
The openings between the cluster to enter the courtyard, are not directly facing each other, so wind is stimulated to cover more area in the courtyard. Therefore, the courtyard is also cooled by unristricted air movement.. This is important for evaporative cooling by the plants that are placed inside the courtyard.

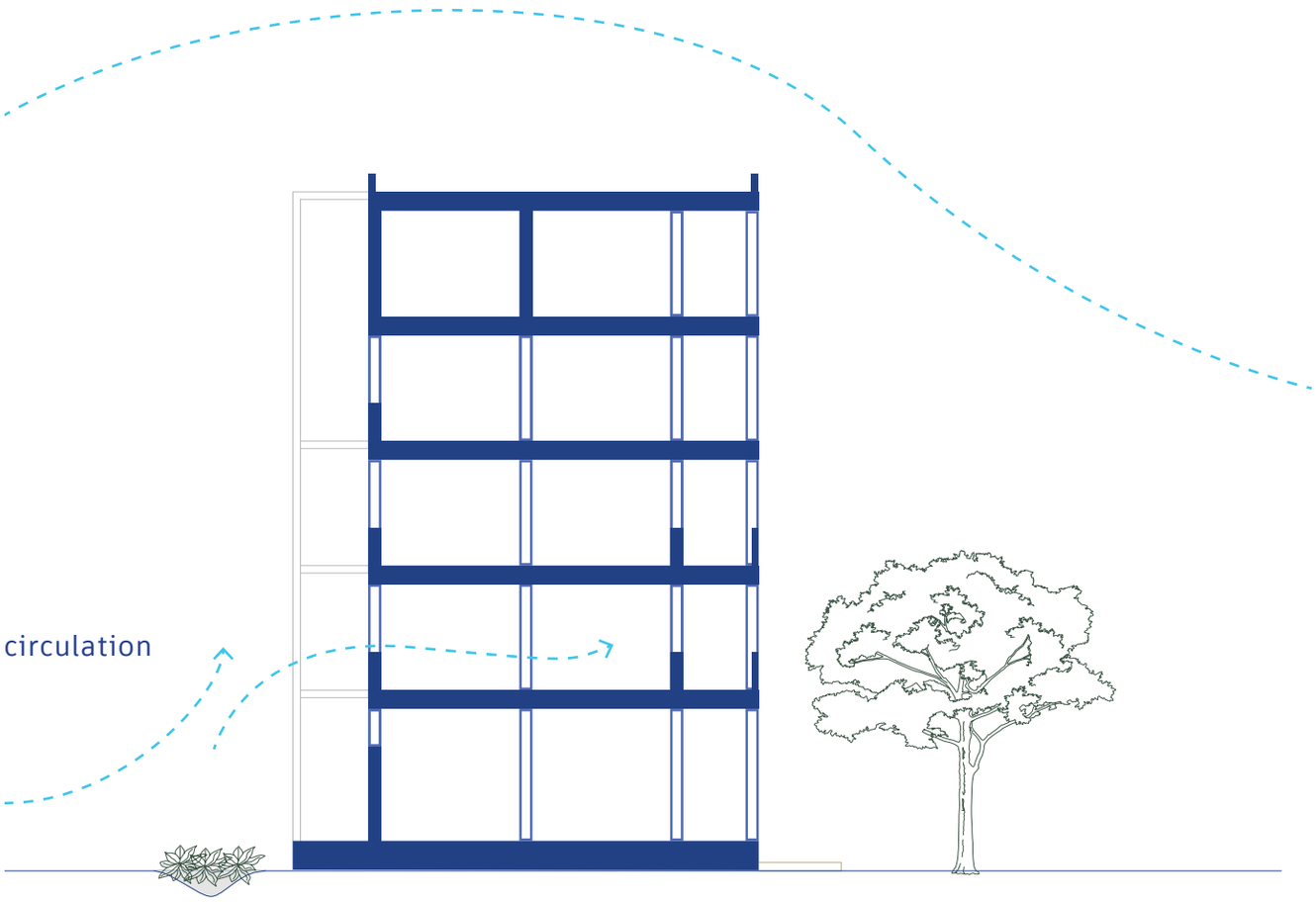


The vertical streets are in the prevailing wind direction (window of 30 degrees) for optimal ventilation through the streets towards the river.

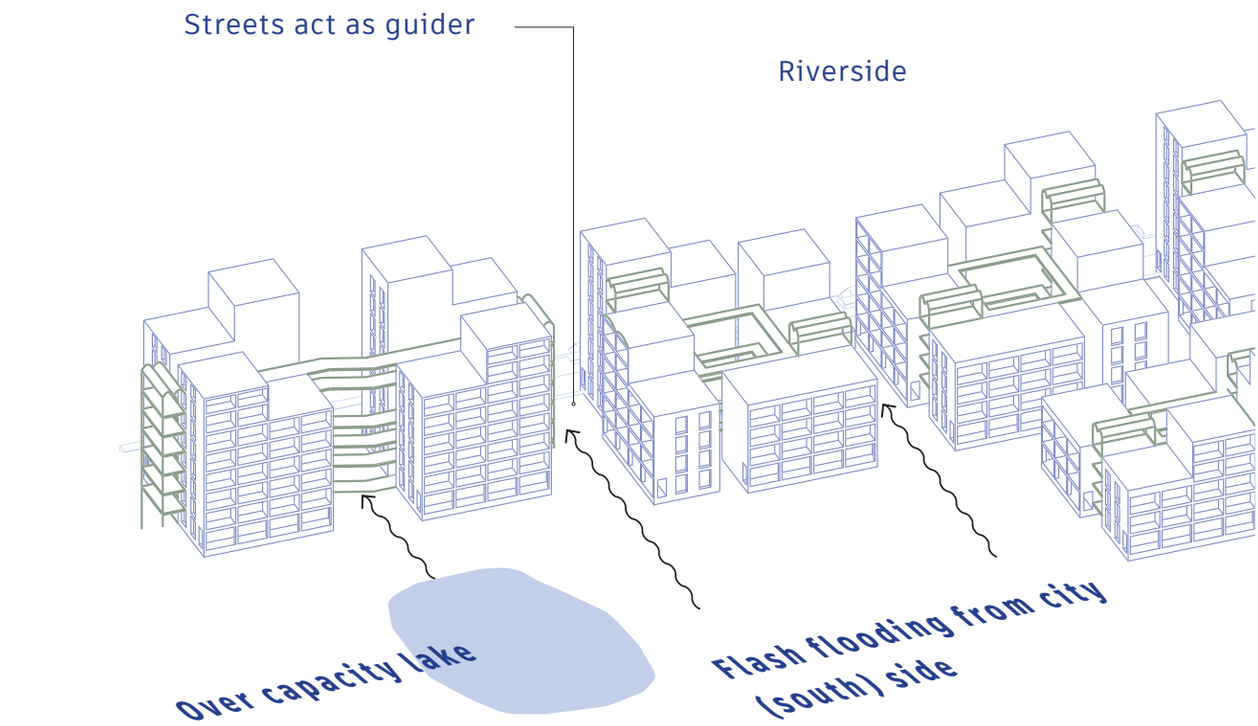
There are no obstructive buildings on the north and south side of the clusters (exept the bottom right cluster). This way, the wind can reach the courtyards more easy.

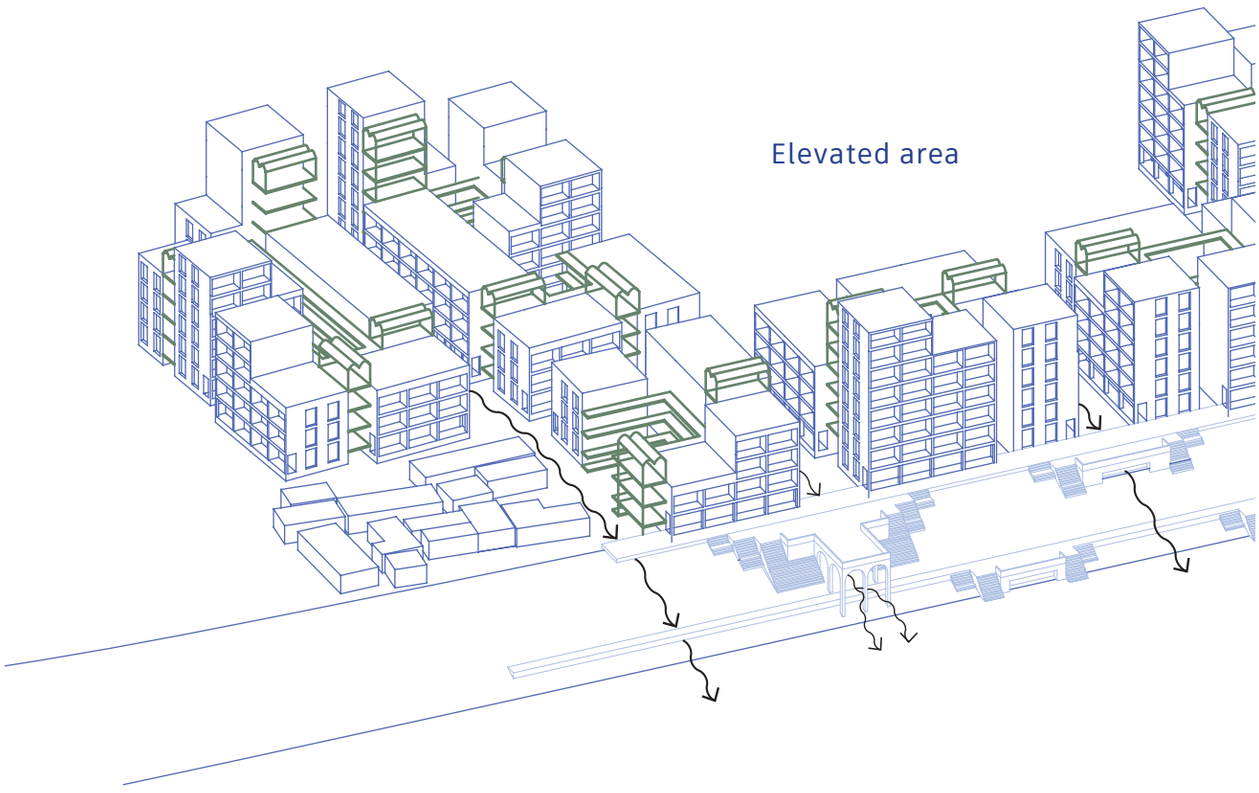
Windflow

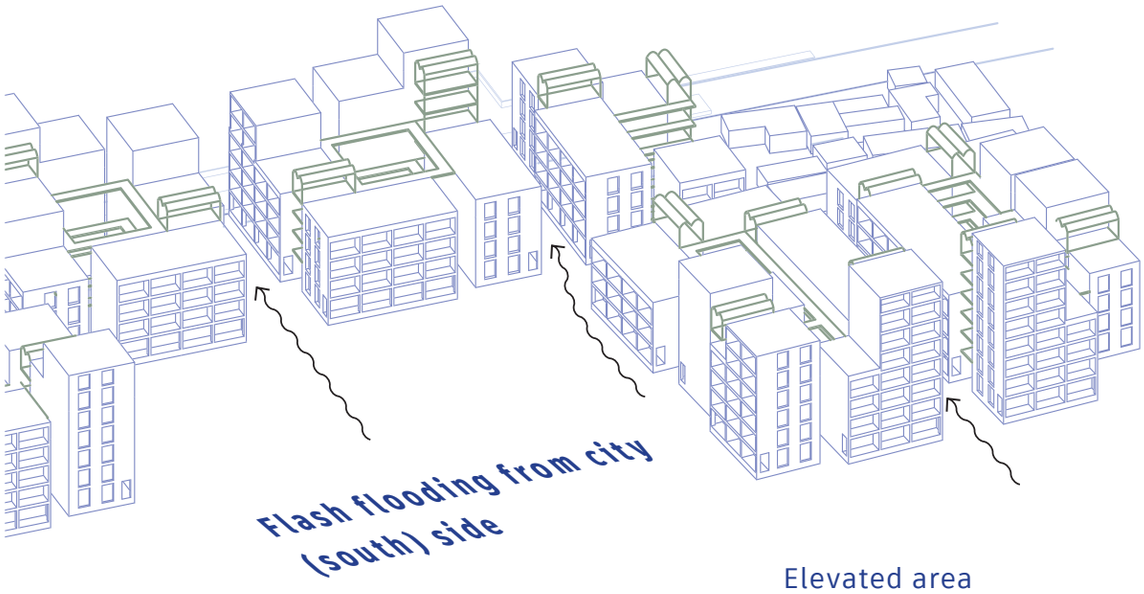



circulation

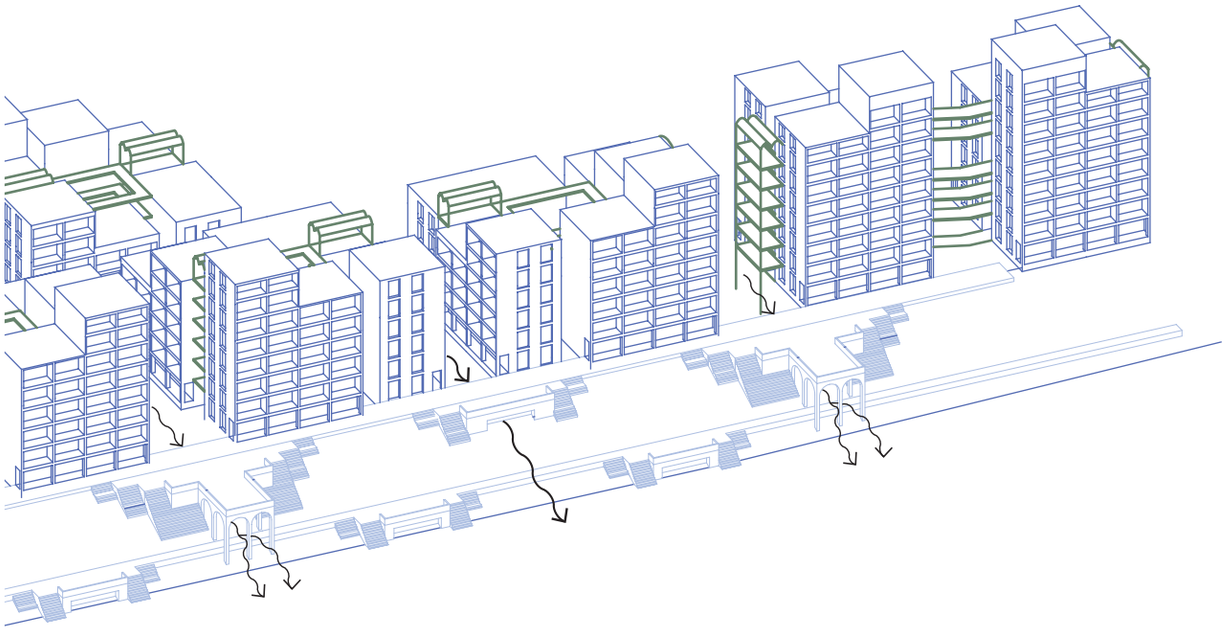
Water Management



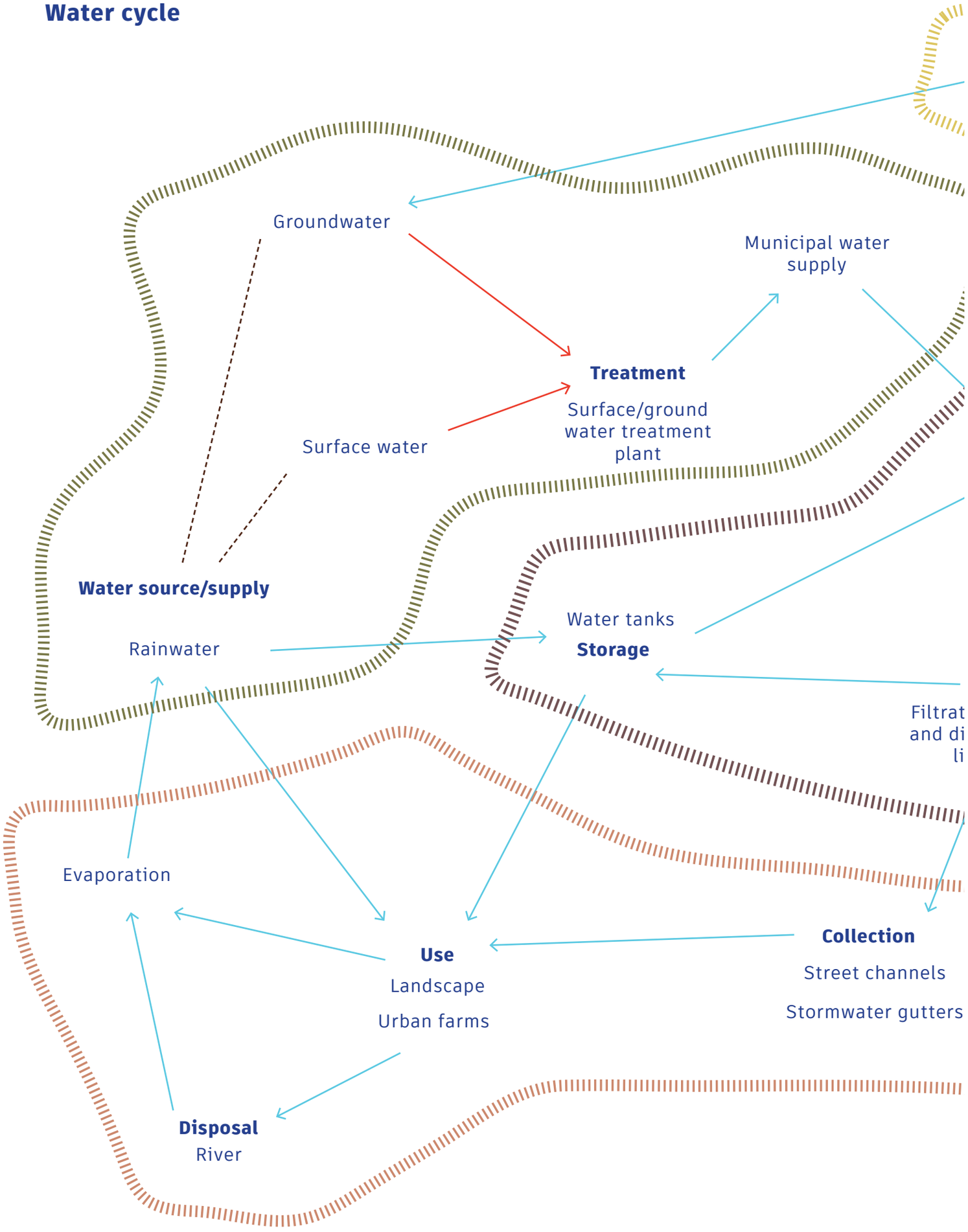


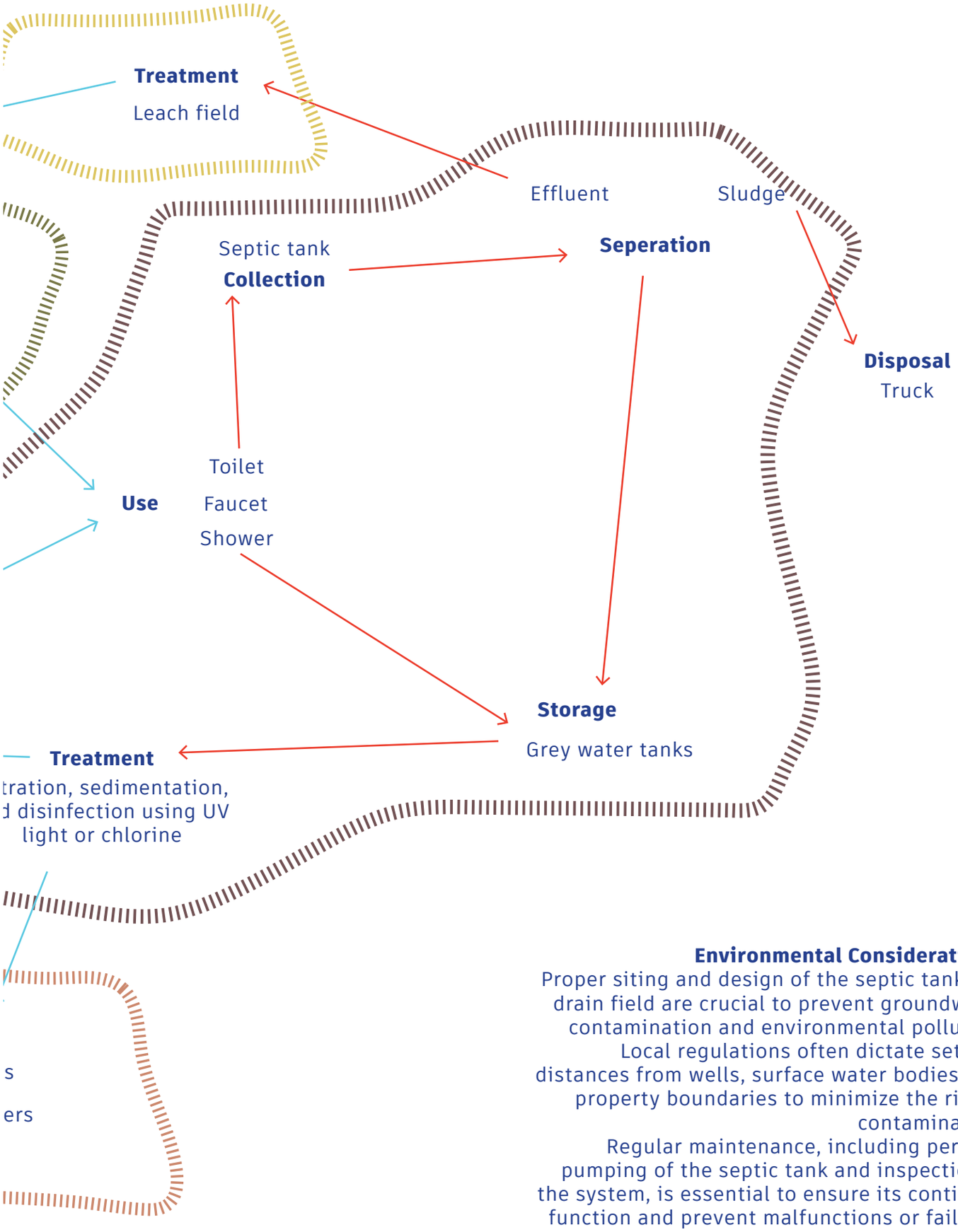


Elevated area



Water cycle


Groundwater
Municipal water supply
Treatment
Surface/ground water treatment plant
Surface water
Water source/supply
Water tanks
Storage
Rainwater
Filtrat
and di
li
Evaporation
Collection
Use
Street channels
Landscape
Stormwater gutters
Urban farms
Disposal
River



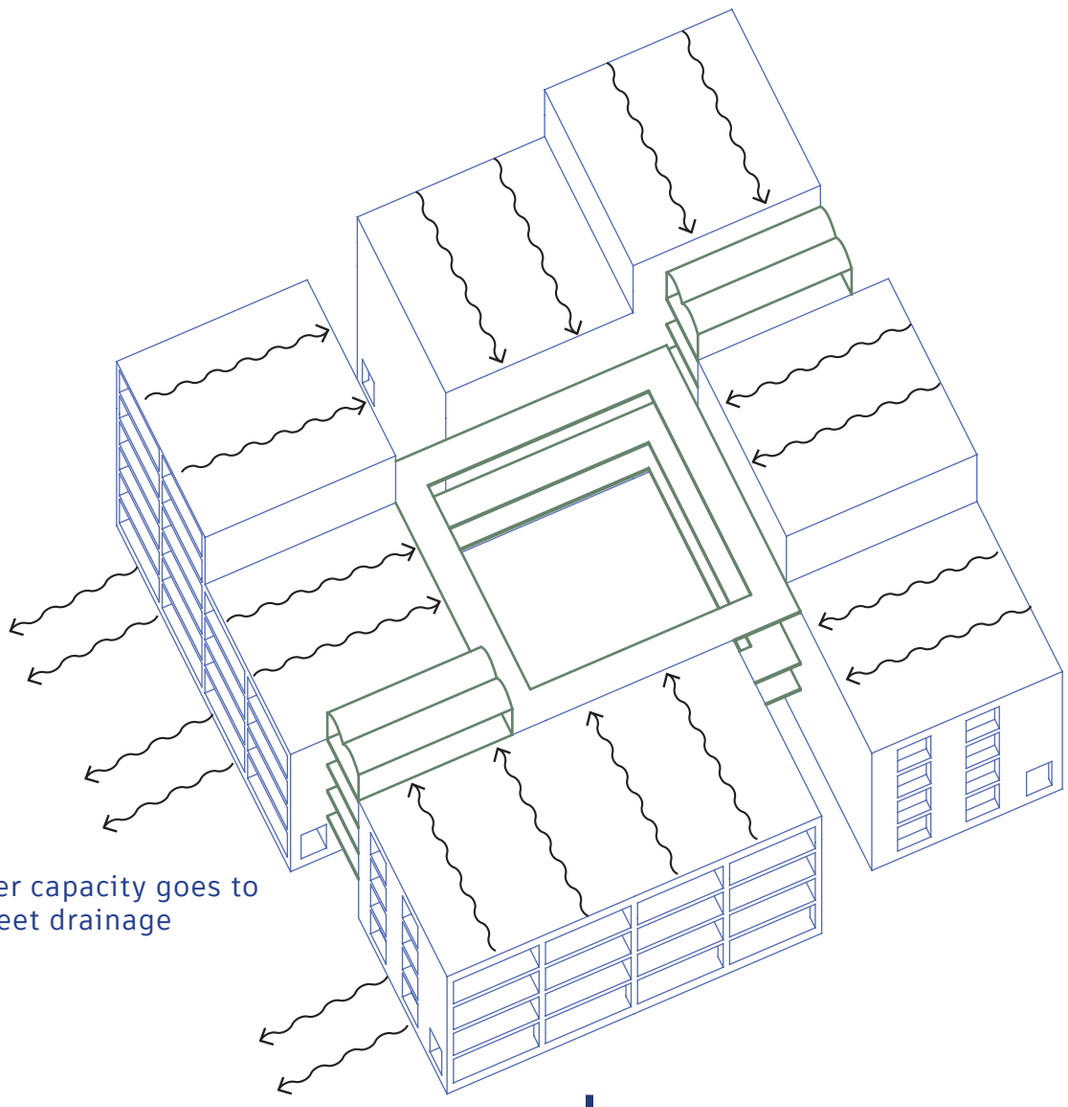
Environmental Considerations:
Proper siting and design of the septic tank and drain field are crucial to prevent groundwater contamination and environmental pollution. Local regulations often dictate setback distances from wells, surface water bodies, and property boundaries to minimize the risk of contamination.
Regular maintenance, including periodic pumping of the septic tank and inspection of the system, is essential to ensure its continued function and prevent malfunctions or failures.

Rainfall

Absorption green roof

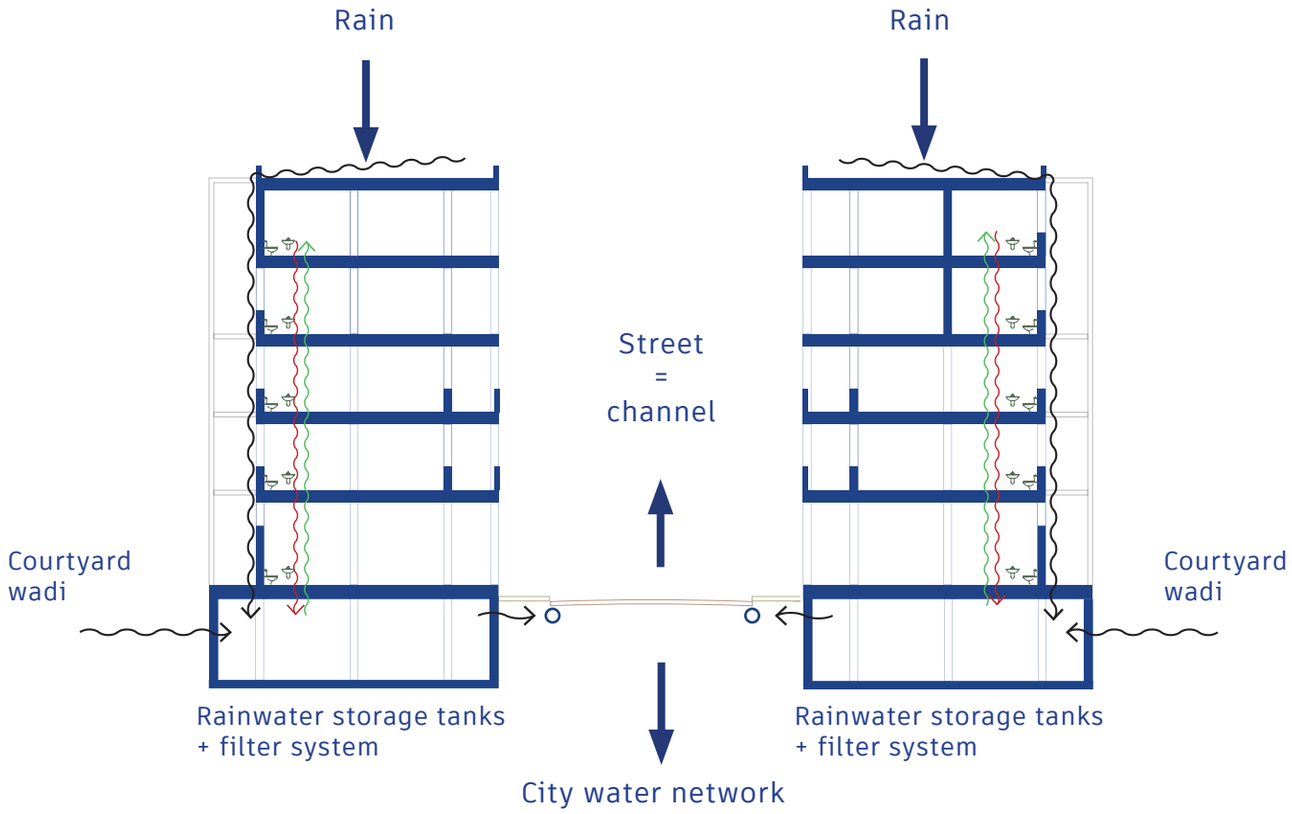
Water resevoir over capacity

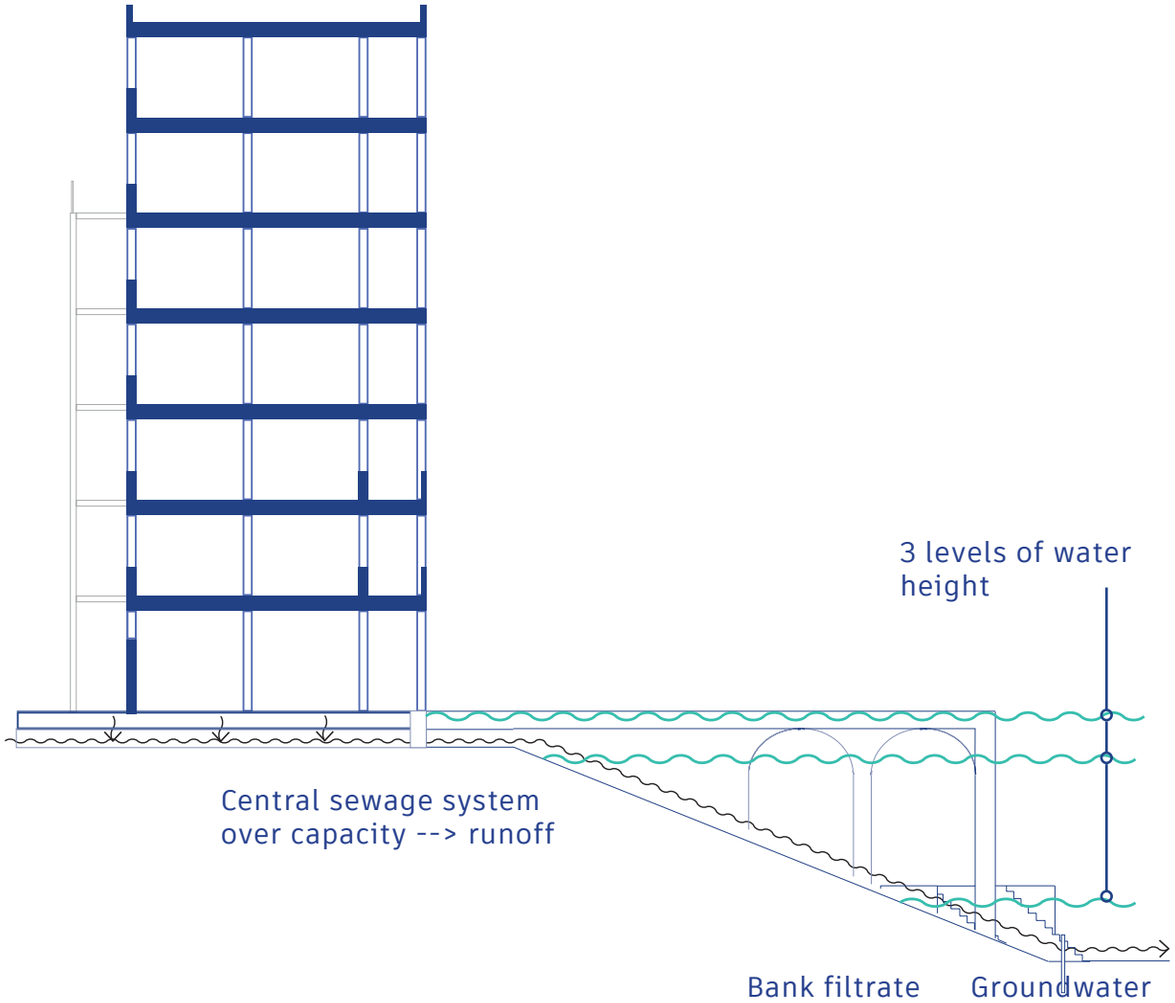
Rain pipes



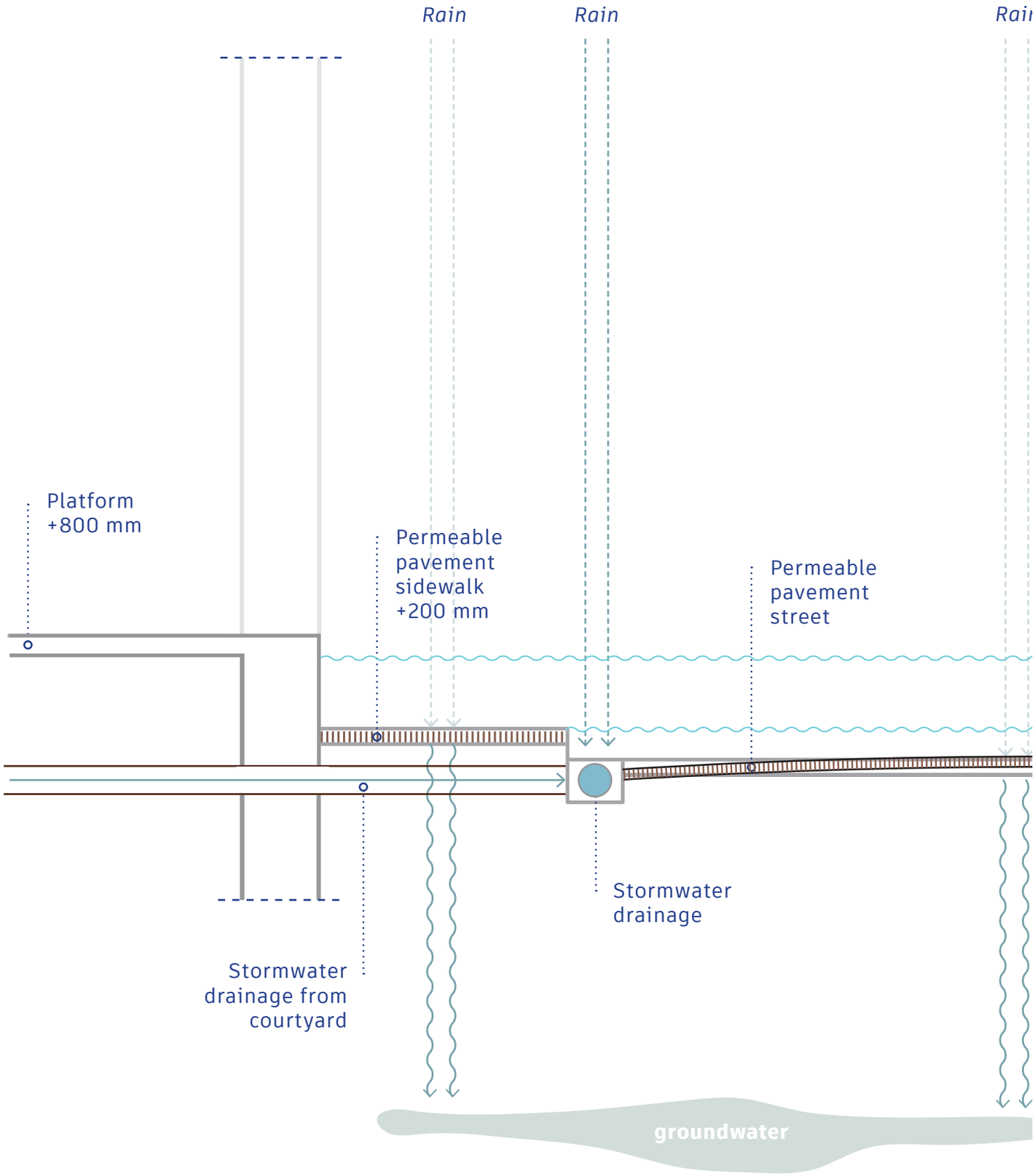
Over capacity goes to street drainage

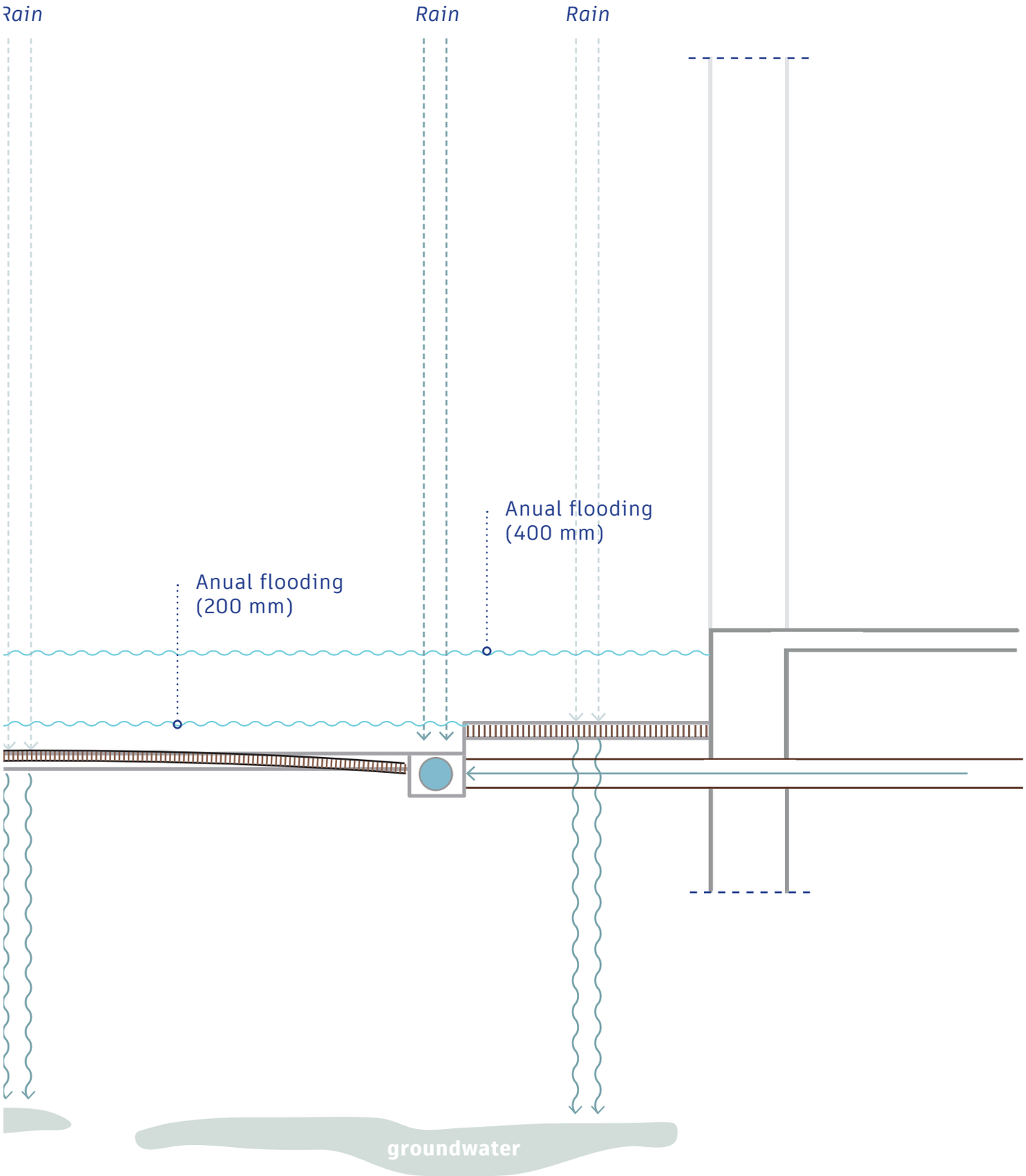
Rainwater storage tanks


Rain
Rain
Street
=
channel
Courtyard
wadi
Courtyard
wadi
Rainwater storage tanks
+ filter system
Rainwater storage tanks
+ filter system
City water network


3 levels of water
height
Central sewage system
over capacity --> runoff
Bank filtrate
Groundwater

Stormwater drainage

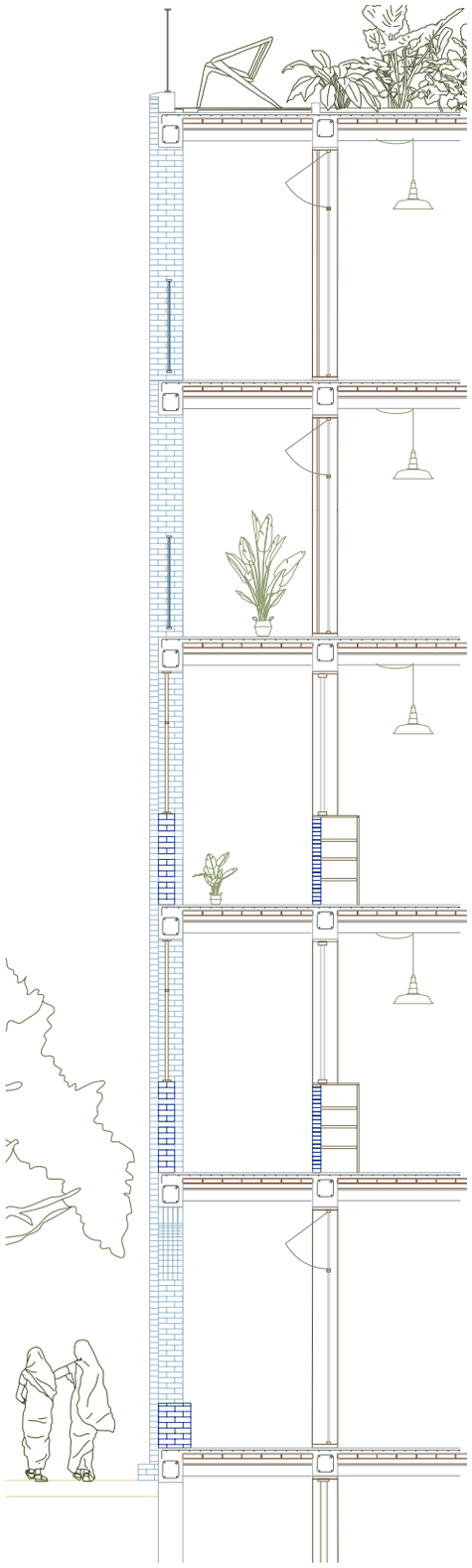



Rain
Rain
Rain
Anual flooding
(400 mm)
Anual flooding
(200 mm)
groundwater

Waterproofing



The CSEB will be protected in various ways. The short facades have no balcony or walkway, and are therefore protected by an overhang, connected with a mesh for plants to grow on (left image). There is no CSEB on the outer long facades who have a balcony. The exposed bricks are burnt, as seen on the right.



Landscape Management

Using native plants in an urban development has a lot of benefits for the urban ecosystem. It can provide several ecosystem and environmental benefits such as defenses against air pollution. Native plants help improve air quality by filtering pollutants and absorbing carbon dioxide. Their deep root systems enhance soil structure and water retention, reducing the risk of erosion and flooding.
Additionally, native plant species promote biodiversity by providing habitat for local insects, birds, and other wildlife. They encourage beneficial insects and pollinators, which play a crucial role in maintaining healthy ecosystems.
Urban vegetation using native plants reduces also the maintenance the plants require. Native plants are well adapted to local climate conditions, including drought, flood, and temperature fluctuations. As a result, they require less irrigation, fertilization, and pesticide use compared to non-native species.
These types of plants are also resilient to urban challenges, such as reflected heat, salr runoff, soil compaction, and high PH soils. Native plants have evolved to thrive in similar conditions, making them resilient to urban stressors.

Resilliency

Sun shading

Flood relieve

Generating income

Well being

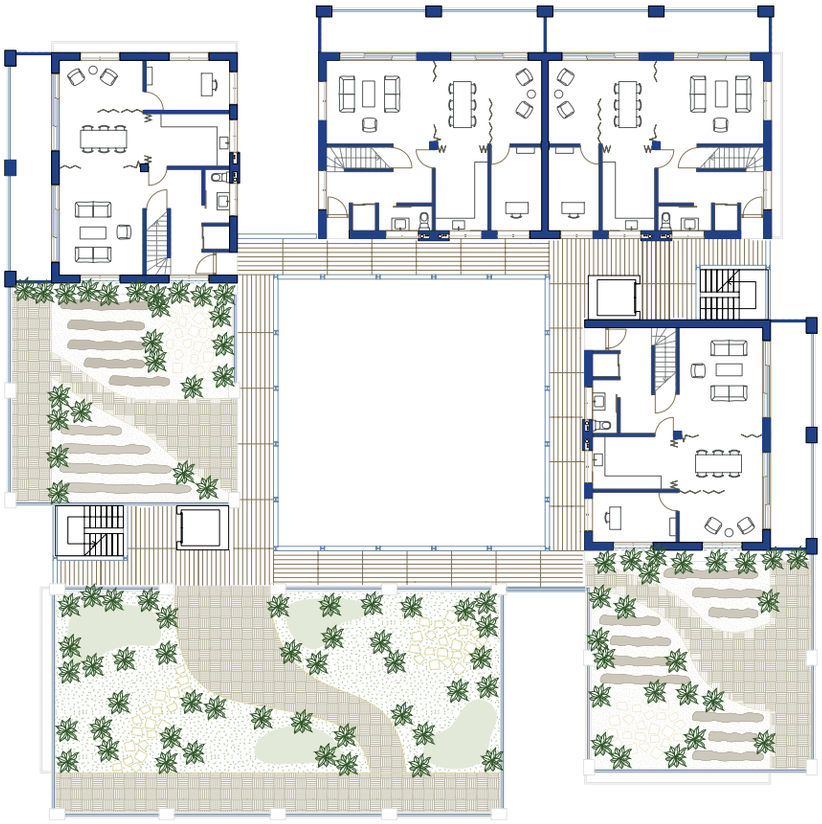
Privacy

Defense against noise pollution

Defense against air pollution

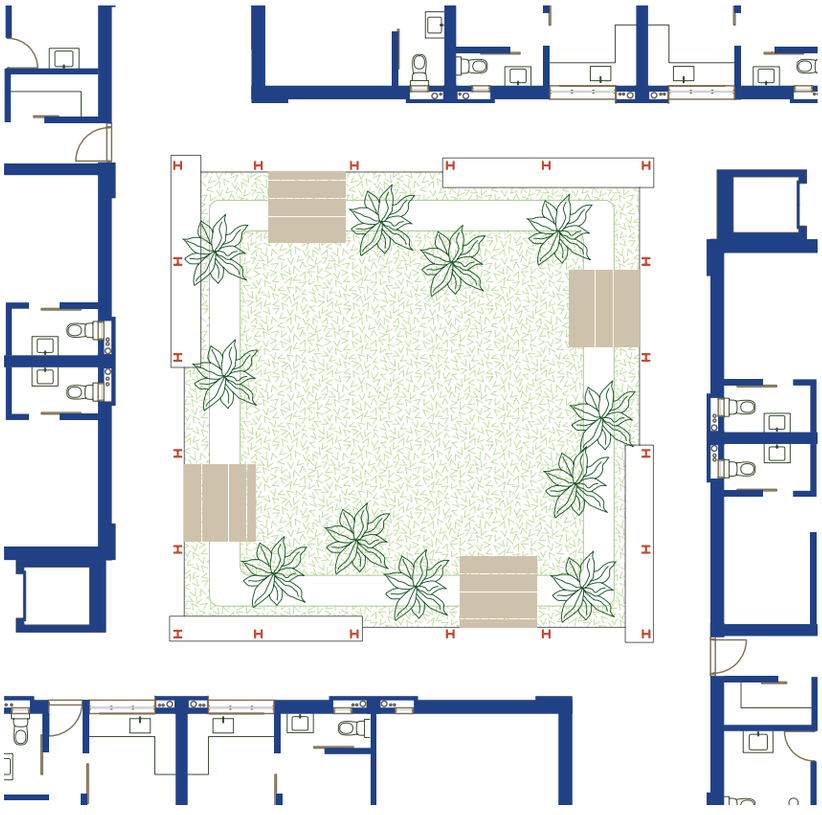
Conservation of biodiversity

Rooftop vegetation



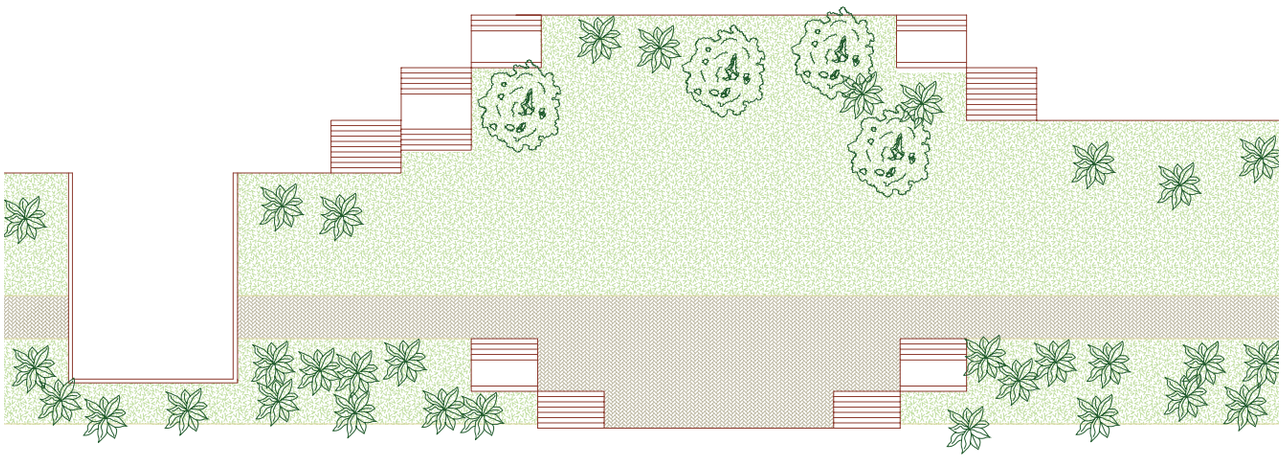
These rooftops hold different types of vegetation. Besides stimulating green for its benefits, is there space for urban farming (left and right rooftop). The roof can hold smaller vegetation like bushes, but no trees.

Courtyard vegetation



The plants in the courtyard act as a micro-climate. They cool the courtyard by evaporative and transpirative cooling, helped by the wind. These plants control the humidity inside the courtyard. Strategically placed greenery is placed to direct the wind from their original direction (max. 45 degrees).

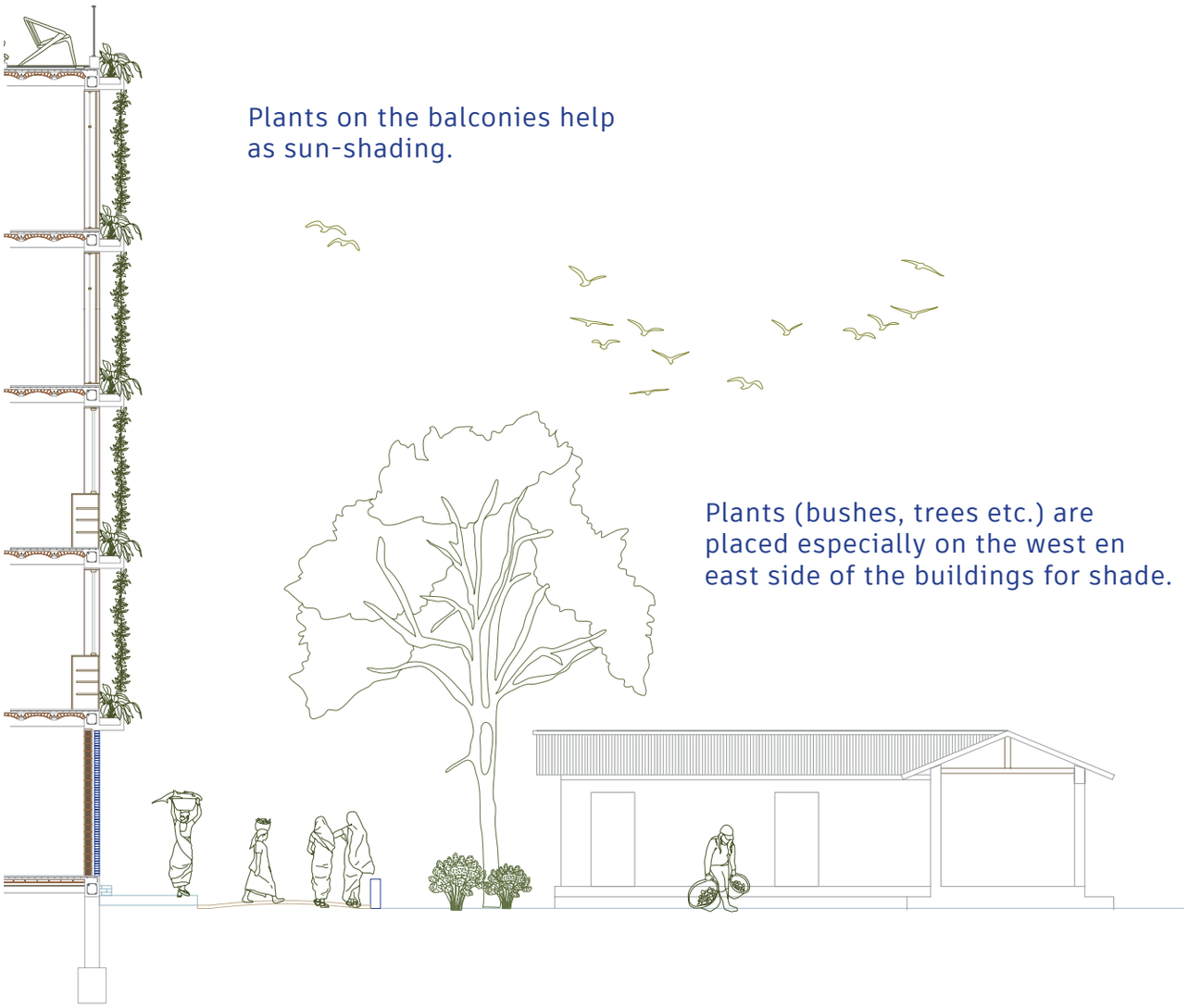
Riverbank vegetation



One plant that is effective in stabilizing riverbanks (preventing riverbank erosion) and providing protection against flooding in Bangladesh is the Vetiver grass (Chrysopogon zizanioides), also known as khus grass or ramie. Vetiver grass has a deep and dense root system that helps to bind soil particles together, preventing erosion and soil loss along riverbanks. Its extensive root system also enhances soil permeability, allowing water to infiltrate more easily and reducing surface runoff.

Additionally, Vetiver grass has the ability to withstand inundation and waterlogging, making it well-suited for flood-prone areas. Its tall, stiff stems and leaves can help dissipate the force of flowing water, reducing erosion and protecting the riverbank from damage. It is also very low-maintenance and can be propogated easily, making it cost-effecive and sustainable option for the riverbank stabilizaion of the Sweepers' Colony which is prone to flooding.

Street vegetation



Trees for carbon sequestration



Royna/Pithraj
(Aphanamixis Polystachya)
20 m

They can thrive in diverse soil conditions and are suitable for providing shade in residential areas.



Jural
(Lagerstroemia Speciosa)
20 m

adding beauty to residential landscapes. They are drought-tolerant and relatively low-maintenance.

Trees for urban farming



Jackfruit
(Artocarpus Heterophyllus)
10-20 m

Jackfruit trees are well-suited for residential areas, providing shade and large, nutritious fruits. They are relatively low-maintenance once established.



Starfruit
(Averrhoa carambola)
12 m



Telshur
(Hopea Odorata)
45 m



Mango
(Mangifera Indica)
3-5 m

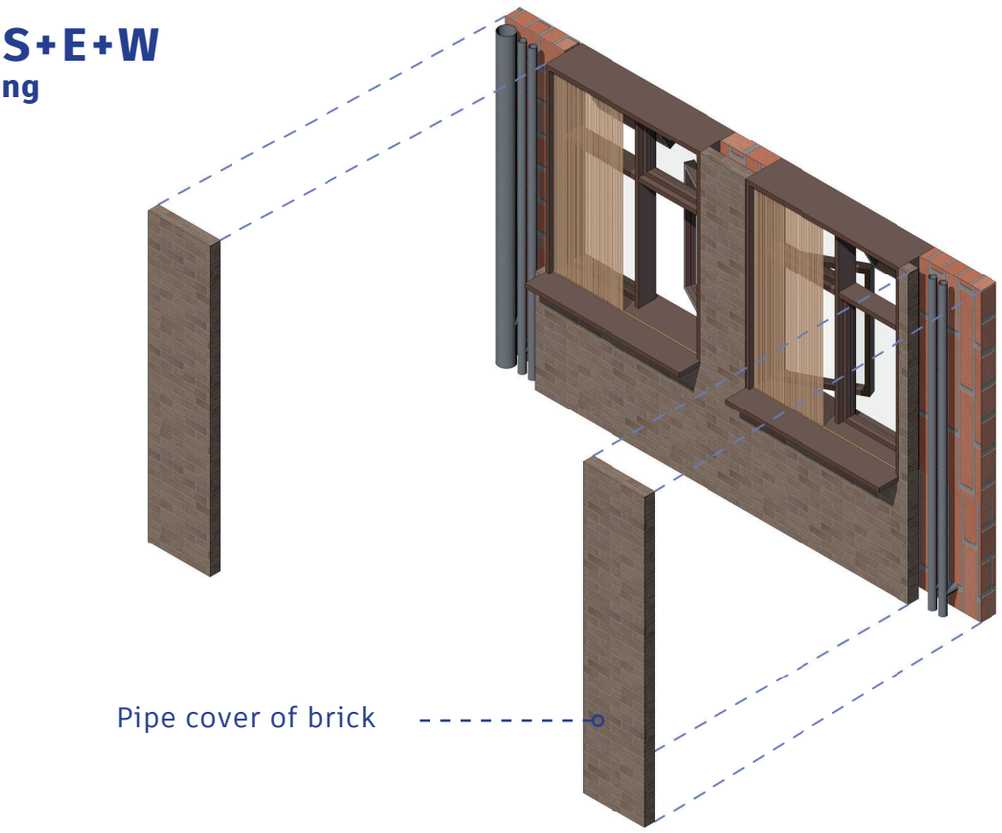
Image sources (left to right)
1. Project Vruksha Foundation
5. Project Vruksha Foundation
3. J. M. Garg (2007)

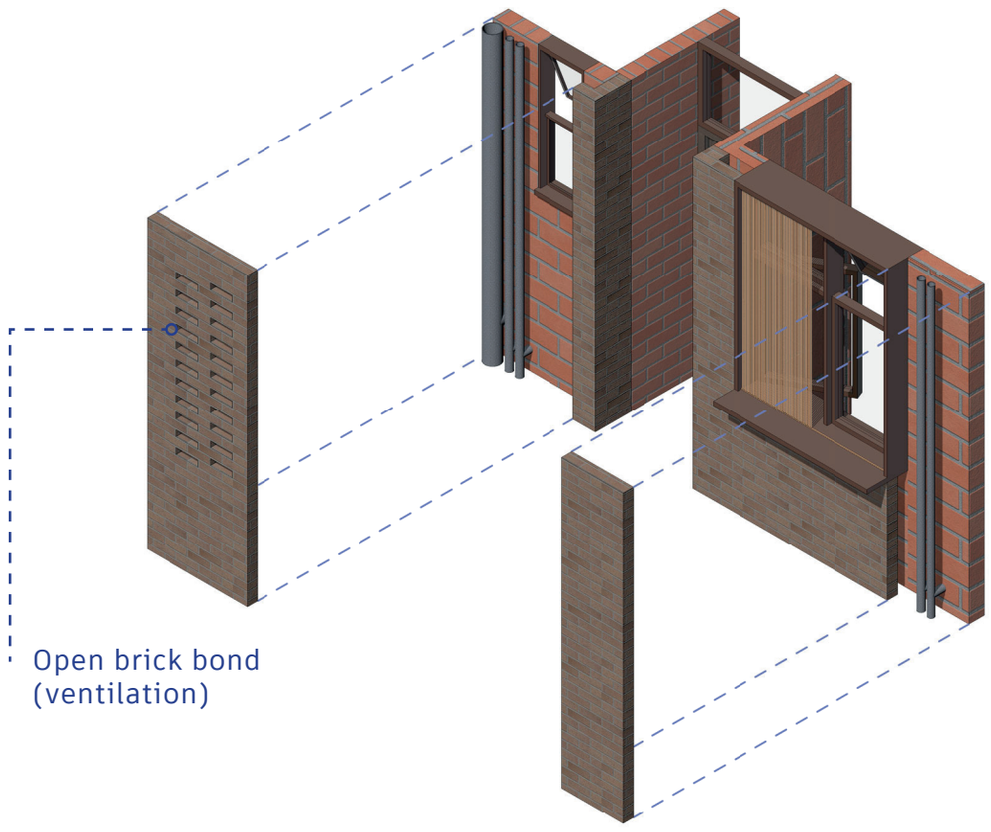
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1. M. Ali (2016)
2. R. Kumar (2017)
3. M. Galvis

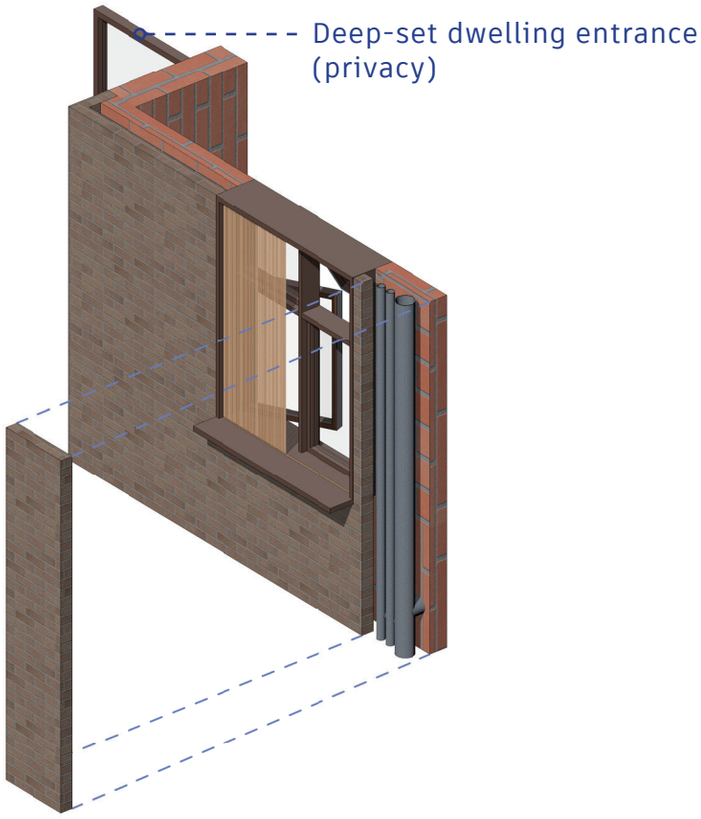
Facades - courtyard side
All floors

N+S+E+W
Facing



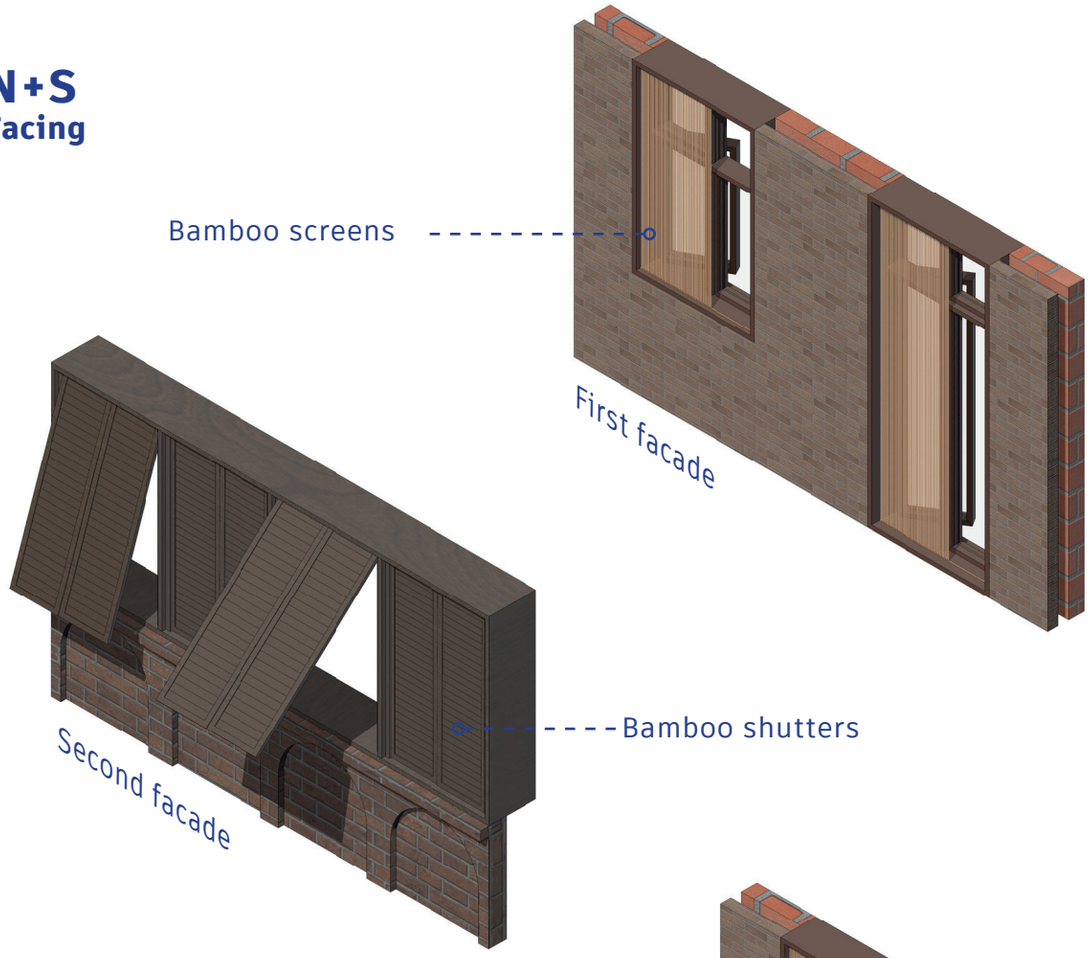


N+S+E+W
Facing



Facades - balcony side
First + second floor

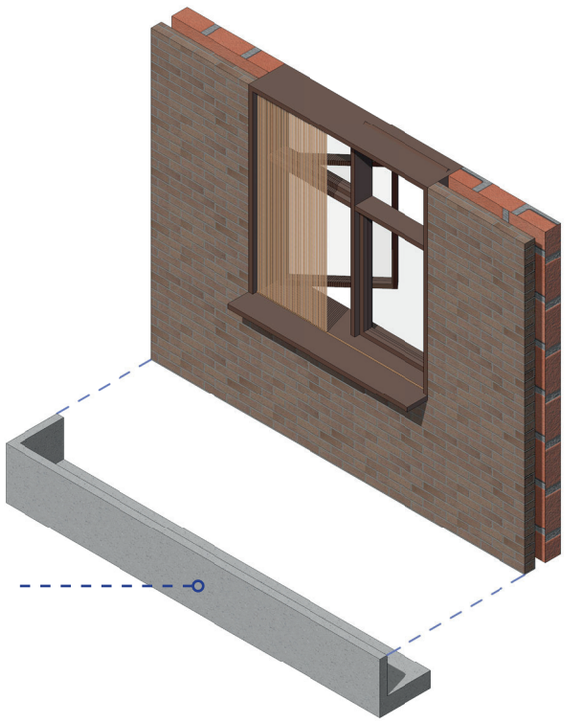
N+S
Facing



E+W
Facing



N+S+E+W
Facing

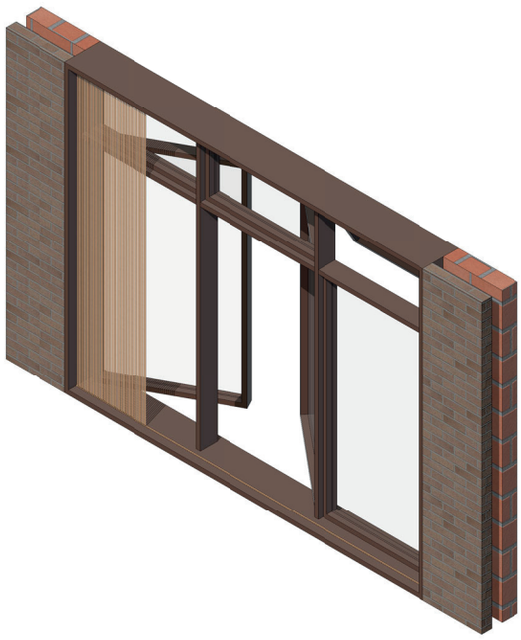


Concrete overhang
(planting)

Facades - balcony side
Third floor and up

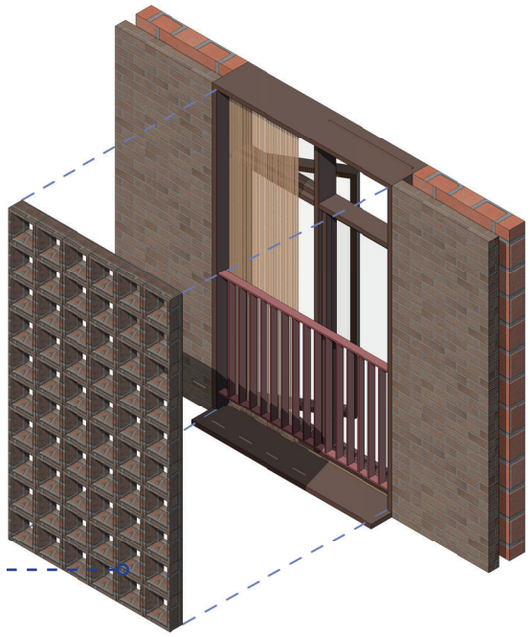
N+S+E+W
Facing



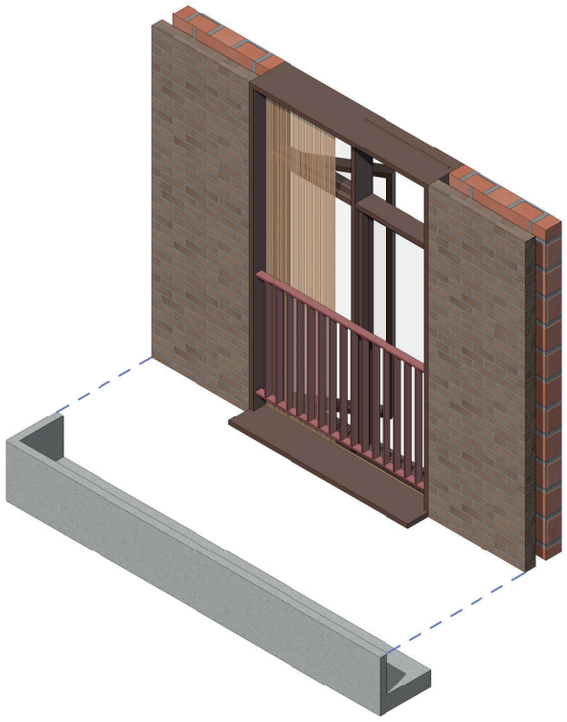


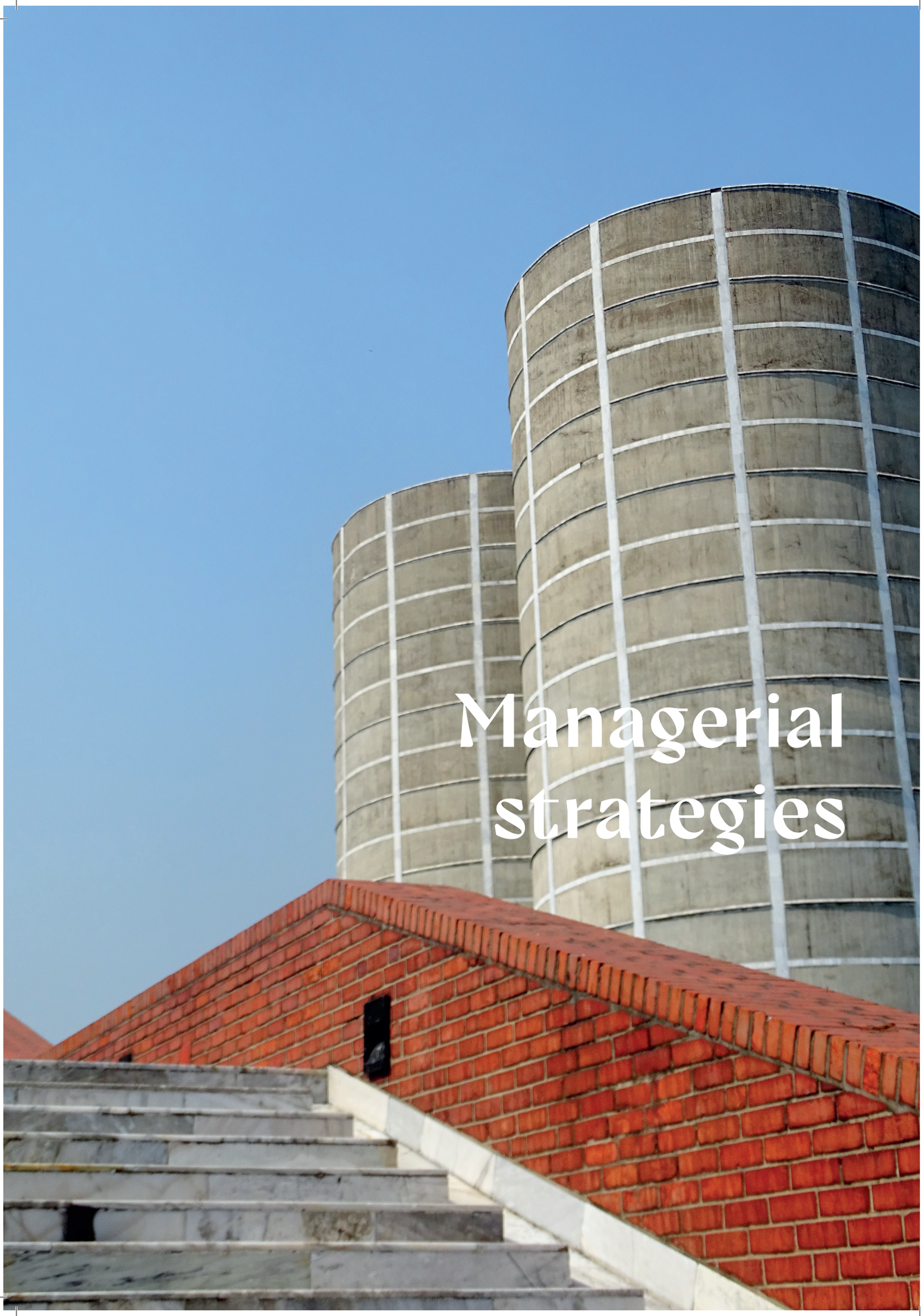
Facades - short side
Third floor and up

N+S+E+W
Facing



Brick privacy screen

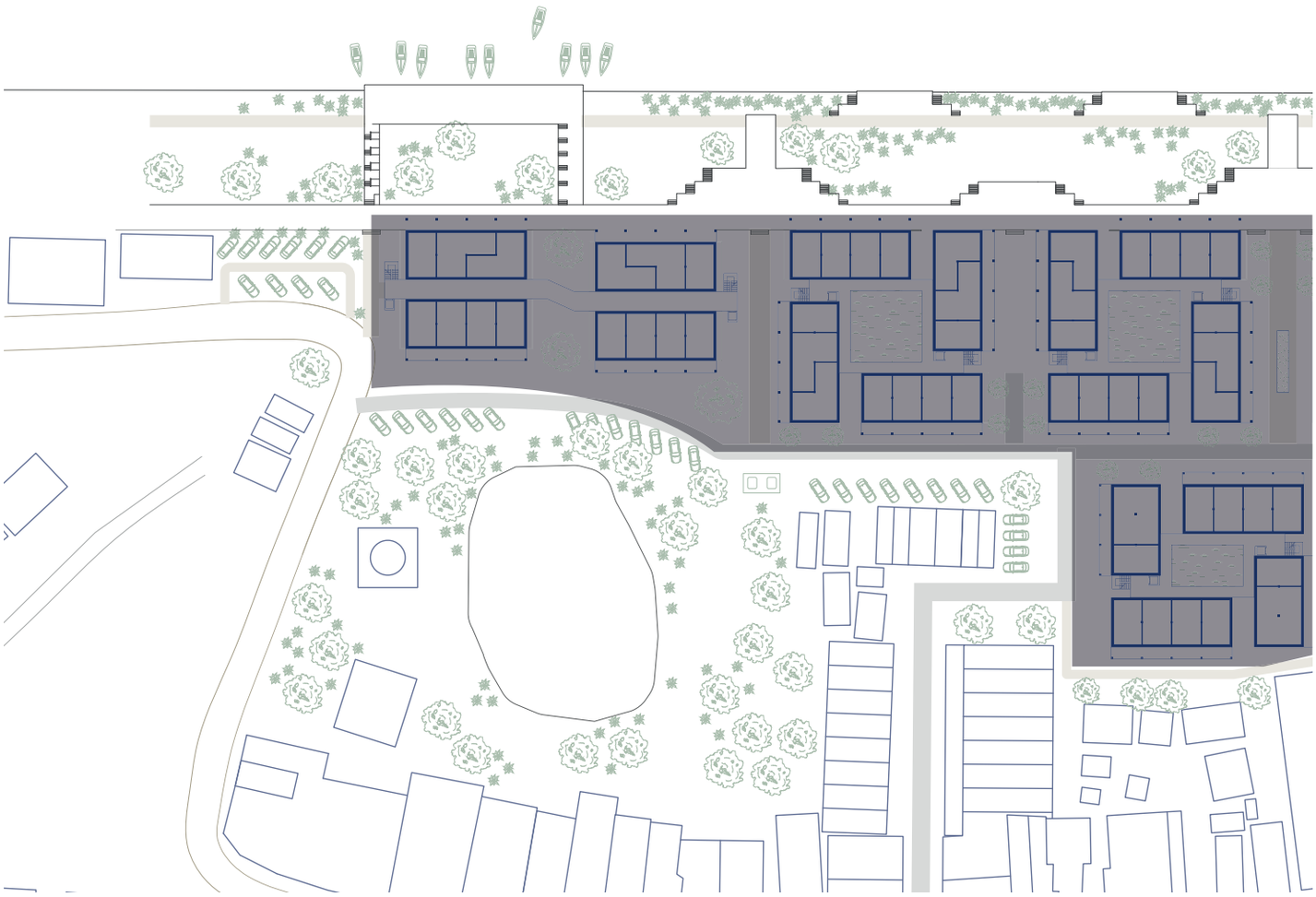




Managerial strategies



Spatial Data

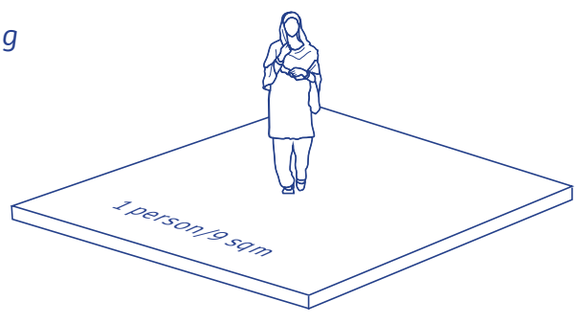


FSI/GSI

	All units	*Stairwells*	*Non dwelling*
Area [sqm]	38.000	682	6.422

Area of aggregation [sqm]	16.900 (1,69 ha)
Floor area [sqm]	7.560
Bruto floor area	45.104

FSI **2,67**
GSI **0,45**

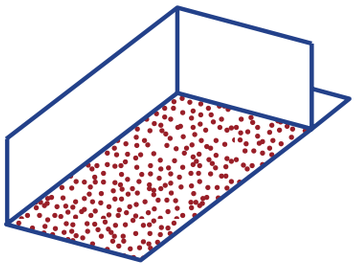




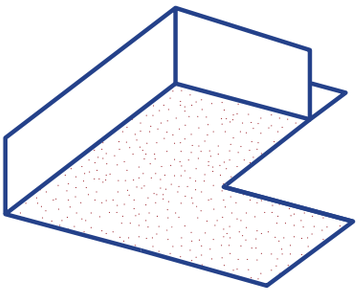
Amount of residents

Typology	*Low S*	*Low M*	*Low L*	*Middle S*	*Middle M*	*High*
Total amount	180	40	20	100	20	55
Family members	4	5	6	5	5	5
Total residents per typology 720	200	120	500	100	275	
Total residents	**1.915**					

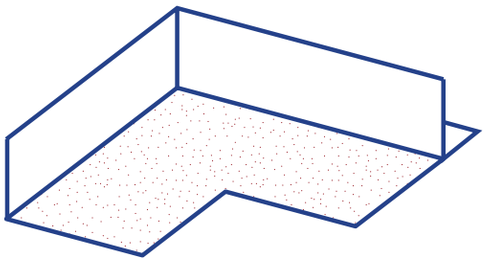
Residents/hectare **1.104**



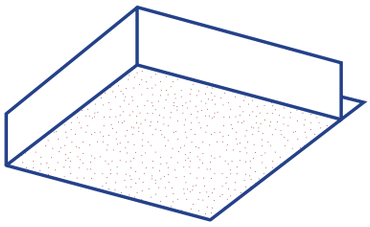
40 sqm interior
+
10 sqm exterior



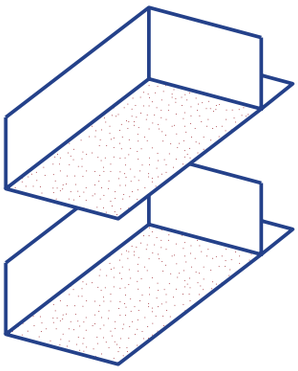
60 sqm interior
+
10 sqm exterior



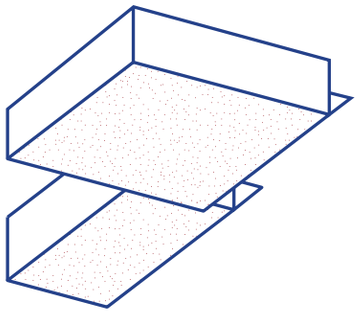
60 sqm interior
+
20 sqm exterior



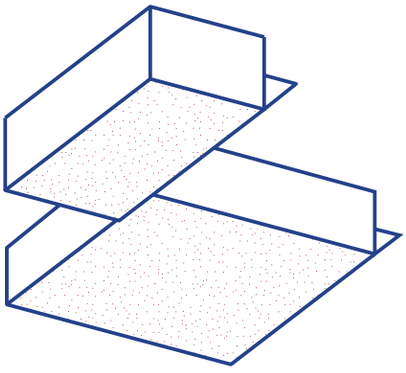
80 sqm interior
+
20 sqm exterior



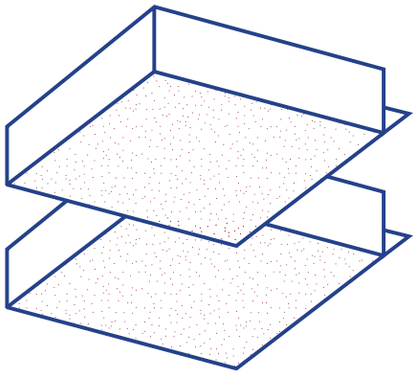
80 sqm interior
+
20 sqm exterior



120 sqm interior
+
30 sqm exterior



120 sqm interior
+
30 sqm exterior



160 sqm interior
+
40 sqm exterior

Ratio area per income

Typology	*Low S*	*Low M*	*Low L*	*Middle S*	*Middle M*	*High*
Area [sqm]	50	75	100	100	150	200
Total area	9.000	3.000	2.000	10.000	3.000	11.000
Total area per income			14.000		13.000	11.000
Total floor area [sqm]					38.000	
Percentage [%]			**0,37**		**0,34**	**0,29**

Amenities

Type of amenity	Amount
Parking space	*154*
Roof terrace	*23*
Courtyard	*11*
Riverbank platform	*8*
Shared spaces	*11*
Green parks	*1*
Storage unit	*176*

Total area of all amenities [sqm]	5935
sqm of amenities per resident	4,98

Unit Data

415 Total amount of units
6 Different typlogies (by type)
8 Different typology variations

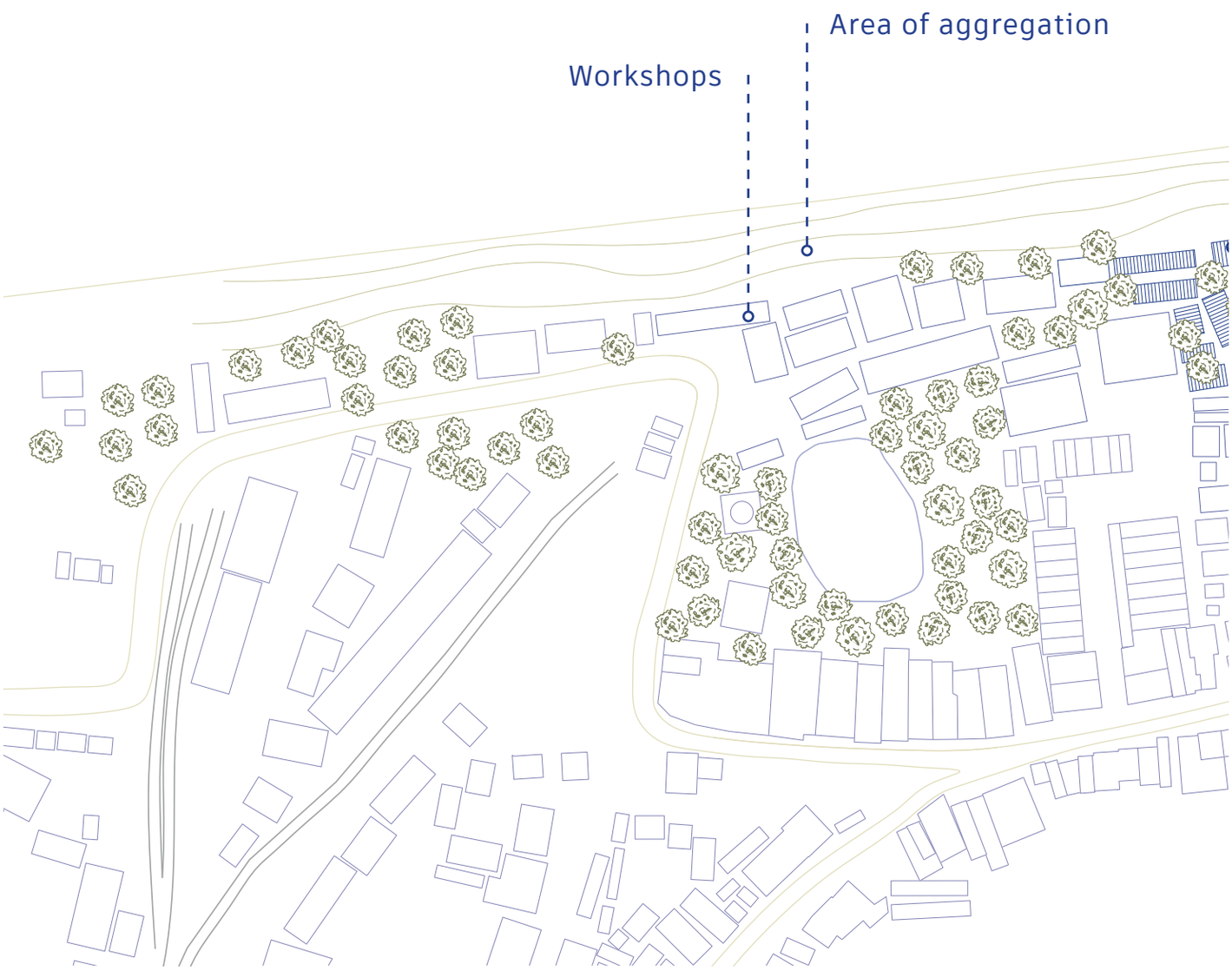


Amount of units

	Low S	*Low M*	*Low L*	*Middle S*	*Middle M*	*High*
Cluster A	22	4	2	24	8	6
Cluster B	16	8	2	6	4	7
Cluster C	16	0	2	11	0	6
Cluster D	16	8	2	6	4	7
Cluster E	24	4	2	14	0	6
Cluster F	16	8	2	6	4	6
Cluster G	10	0	2	8	0	1
Cluster H	31	4	4	12	0	9
Cluster I	29	4	2	13	0	7
Total	180	40	20	100	20	55
Total units	**415**					
Units/hectare	**245**					



Process & phasing



Function map

The phasing the redevelopment of an informal settlement with around 200 dwellings that need to be demolished requires careful planning to minimize disruption to the existing community while ensuring the efficient implementation of the project. For this redevelopment, only the Islamic part of the settlement is demolished. This is because of the cultural preservation of the Hindu community, the houses of this community are protected. The Islamic part is also in a worse shape, and are more in need of renovation. Besides dwellings, also existing commercial and workspaces will make place for the redevelopment. The urban strategy of this whole redevelopment makes sure they will me replaced for new commercial areas and workspaces.



Phase 1: preparation and Assessment

- In this pahse the exisiting settlement will be **analysed** (and visited), to **gather data** on housing conditions, infrastructure, and socio-economic profiles of residents.
- **Engage** with the community to understand their needs, concerns, and aspirations for the redevelopment project.

Phase 2: area 1

Step 1: demolotion and site clearence of commercial/workspace areas

- To make space for the first clusters
- Give current employes a compensation
- preparing the land (leveling, grading, basement excavation, removal of debris)



Step 2: infrastructure and services development phase

- Begin construction of essential infrastructure and services, such as roads, water supply, sewage systems, and electricity distribution networks
- This includes the construction of the basement/foundation work



Step 3: construction of new housing/commercial spaces

- Starting with the concrete frame
- etc.



Step 4: (re)housing the commercial areas and workshops

- There are some spaces reserverd for workshops/commercial for the owners of demolished buildings
- New renters of commercial spaces and workshop can move in



Step 5: relocating and temporary housing of all the current residents

- All the current residents of the Islamic community can temporarily house in the new dwelling buildings.



Phase 3: area 2

Step 1: demolotion and site clearence of commercial/workspace areas

- To make space for the second batch of clusters
- preparing the land (leveling, grading, basement excavation, removal of debris)



Step 2: infrastructure and services development phase

- Begin construction of essential infrastructure and services, such as roads, water supply, sewage systems, and electricity distribution networks
- This includes the construction of the basement/foundation work



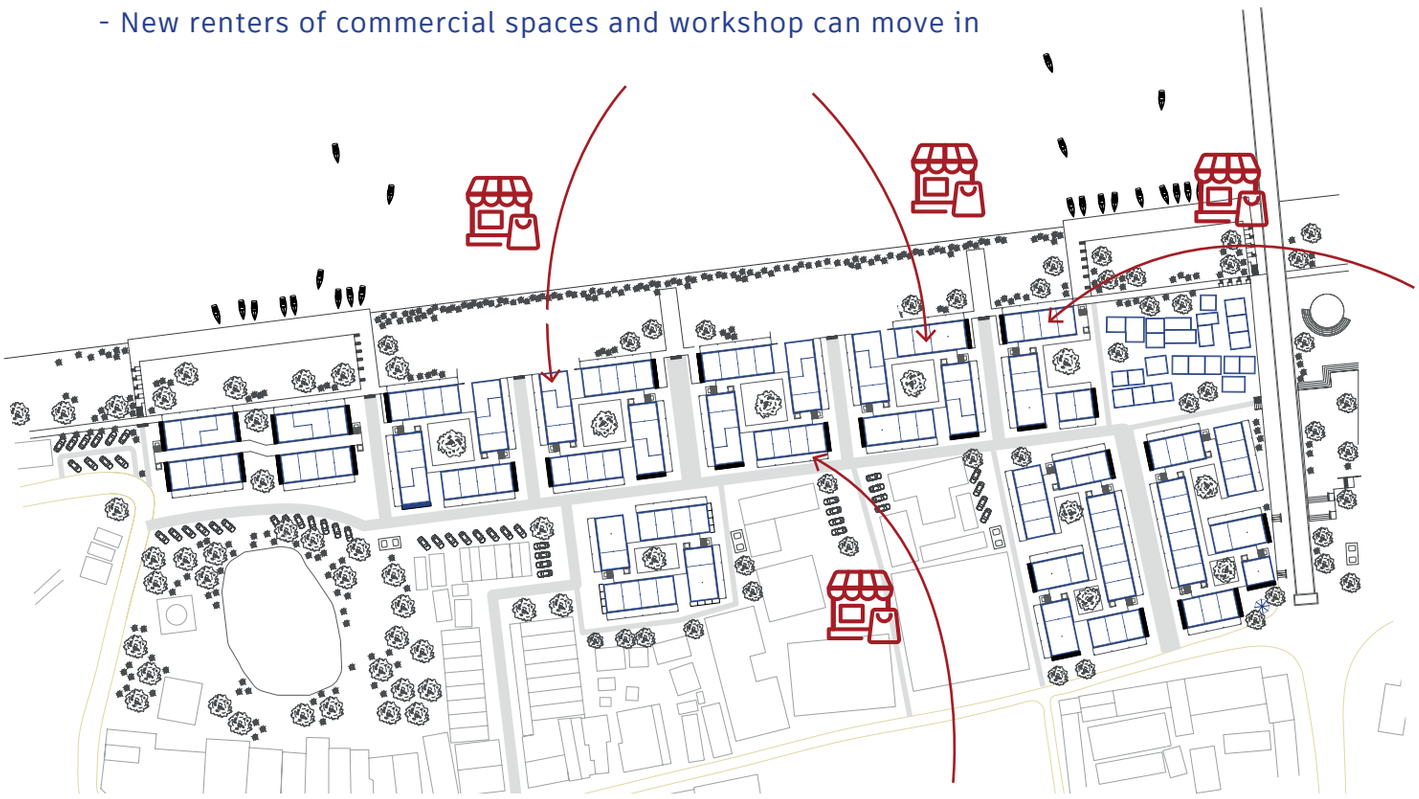
Step 3: construction of new housing/commercial spaces

- Starting with the concrete frame
- etc.



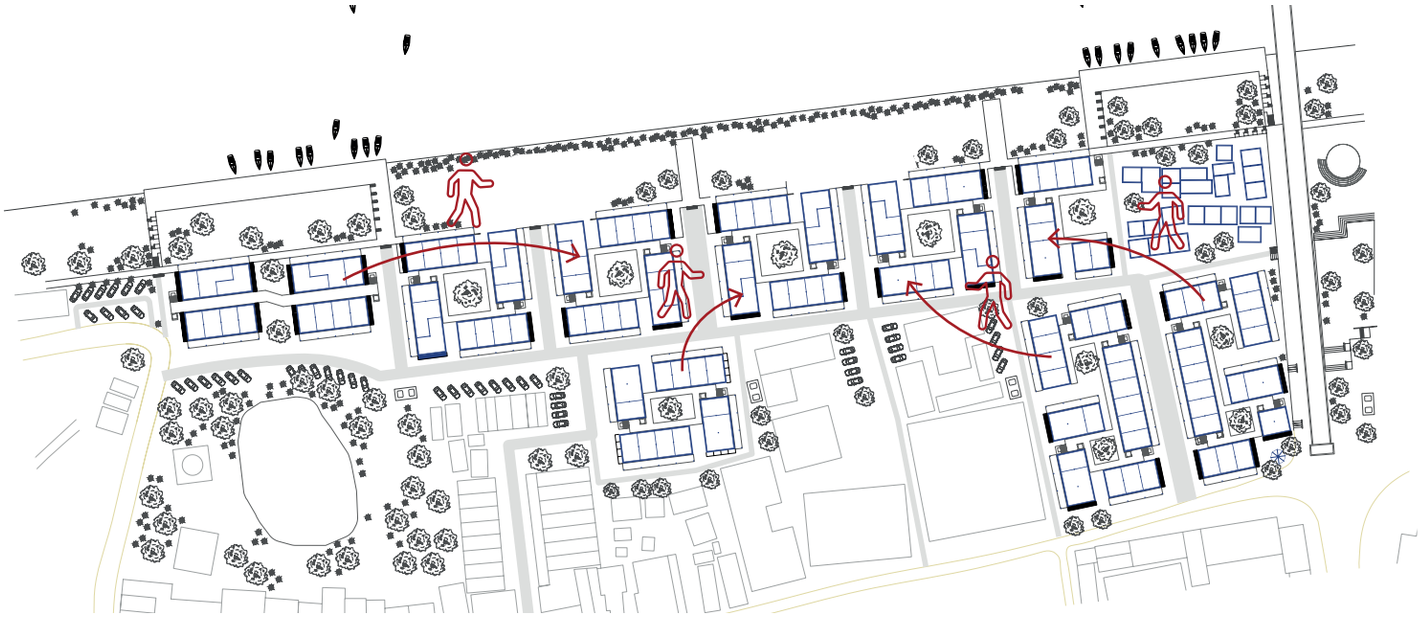
Step 4: housing the commercial areas and workshops

- New renters of commercial spaces and workshop can move in



Step 5: relocating and temporary housing of all the current residents

- All the current residents of the Islamic community that temporarily house in the new dwelling buildings, move to the first and second floor of the new bach of clusters. Some will remain in the first batch of clusters.
- New owners/renters can move in



Phase 4: slot

Step 1: community integration and support

Facilitate the integration of residents into their new homes and communities through orientation sessions, social events, and community-building activities.
Provide support services to address socio-economic challenges and promote self-reliance among residents, such as livelihood training, education programs, and healthcare services.Foster a sense of ownership and stewardship among residents by involving them in the management and maintenance of community assets and facilities.

Step 2: completion and handover phase

Finalize construction of housing units and infrastructure, ensuring that all works meet quality standards and regulatory requirements. Conduct inspections and certifications to verify compliance with building codes, safety regulations, and environmental standards.
Facilitate the formal handover of housing units to residents, providing documentation, legal assistance, and support for property ownership or tenancy agreements.

Step 3: monitoring and evaluation phase

Establish mechanisms for ongoing monitoring and evaluation of the redevelopment project's impact on the community, environment, and socio-economic indicators.
Solicit feedback from residents and stakeholders to identify areas for improvement and lessons learned for future projects. Ensure long-term sustainability and resilience of the redeveloped community through continued support, capacity building, and adaptive management.

Stakeholder Analysis

Community	Non-government organizations	Government organizations	Developers/ investors	Designers	Suppli
Religious Institutions (1)	BRAC (7)	Local government officials (11)	Centre for Urban Studies (16)	Architects (21)	Construc workers
JAAGO Foundation (2)	Shelter for the Poor (8)	Bangladesh Institute of Planners (12)	Coast Trust (17)	Technical specialist (22)	Constru companie
Community leaders (3)	Environmental and Conservation Groups (9)	National Housing Authority (13)	Academic and Research Institutions (18)	Infrastructure management (23)	Utility Pro (26)
Current residents of the Sweepers Colony (4)	BRAC University Institute of Educational Development (10)	Agencies and departments (14)	Grameen Bank (19)		Mater suppliers
Current residents of the neighbourhood (5)		National Urban Poverty Reduction Programme (15)	Business Owners (20)		
Civil Society Groups (6)					

Non-Governmental Organizations (NGOs): Organizations working in the region that focus on issues such as housing, poverty alleviation, community development, and human rights.

Developers and Investors: Entities involved in financing, designing, and constructing the low-income housing units and associated infrastructure.

1. Religious Institutions: Local mosques, temples, or other religious organizations that play a significant role in the community and may have interests or concerns regarding the redevelopment project.

2. JAAGO Foundation: JAAGO Foundation operates education and community development programs across Bangladesh, including in Sylhet. While their primary focus is education, they may also be involved in community development initiatives that include housing support.

3. Community Leaders: Individuals who hold influential positions within the informal settlement community and can represent the interests of residents.

4.Current residents of the Sweepers Colony: It is important to know what the current residents want etc.

5. Current residents of the neigbourhood: What is the need of the whole neighbourhood, do they need more green space? More commercial spaces etc?

6. Civil Society Groups: Advocacy groups, community-based organizations, and grassroots movements advocating for the rights and welfare of marginalized communities.

7. BRAC (formerly Bangladesh Rural Advancement Committee): BRAC is one of the largest NGOs in the world, with a wide range of programs including education, healthcare, microfinance, and livelihood support. They have various initiatives related to housing and community development.

8. Shelter for the Poor (SFP): SFP is an NGO in Bangladesh that focuses on providing housing solutions for low-income communities. They implement housing programs, including building affordable homes and providing housing finance options.

9. Environmental and Conservation Groups: Organizations focused on environmental protection and conservation efforts, as the redevelopment project may have environmental implications.

10. Local Government Officials: Representatives from municipal authorities, urban planning departments, and relevant government agencies responsible for overseeing urban development projects.

11. Bangladesh Institute of Planners (BIP): BIP is a professional organization of urban planners in Bangladesh. While not an NGO, they may collaborate with government agencies and NGOs on housing and urban development projects, including those in Sylhet City.

12. Centre for Urban Studies (CUS): CUS is a research-based nonprofit organization that works on urban issues, including housing, land management, and urban governance. They may provide expertise and advocacy related to urban redevelopment projects in cities like Sylhet.

13. Coast Trust: Based in Chittagong but operating nationwide, Coast Trust works on various development issues, including housing, livelihoods, and disaster management. They may provide support for housing programs in vulnerable communities, including those in Sylhet.

14. Academic and Research Institutions: Universities, research organizations, and think tanks conducting studies or providing expertise on urban development, housing, and social issues in the region.

15. BRAC University Institute of Educational Development (BRACU IED): BRACU IED conducts research and projects related to education, but they may also be involved in broader community development initiatives, including housing programs in urban areas like Sylhet.

17. Grameen Bank: Known for pioneering microfinance, Grameen Bank provides small loans to entrepreneurs, including those looking to improve their housing conditions or start small businesses related to housing construction or renovation.

17. Business Owners: Owners of businesses operating within or adjacent to the informal settlement, as the redevelopment may impact their operations or customer base.

24. Utility Providers: Organizations responsible for providing essential services such as water, electricity, and sanitation infrastructure in the area.

Cost Analysis

Cross subsidization by:
> 2/3 middle and high mortgage > pays for the low income
> low-income pays no construction costs (rental housing)
> middle-high own, mortgage monthly (owner occupied)

House owner association (cluster level)
> own a shop > pays for maintenance
> everybody pays per income a H.A. fee (monthly)
> saving money by making elevators skip floors

Profit and revenu

Total construction area [sqm]	52.664
Costs [TK/sqm]	27.000,00
Total costs	1.421.928.000,00

Income type	*Low*	*Middle*	*High*	*Shops*
Profit [%]	0	100	150	200
Profit per income [TK]	0,00	702.000.000,00	742.500.000,00	520.182.000,00
Revenu [TK]	**1.964.682.000,00**			

Total profit [TK]	**542.754.000,00**
Profit [percentage/costs]	**0,38%**

Demolition costs:

1. demolition of existing dwellings
    - labor costs (hiring workers, operators, and supervisors)
    - equipment rental (machinery like excavators, bulldozers, and trucks)
    - Waste disposal (demolished materials and debris, transportation fees by waste management facilities)
    - environmental remediation
2. permits and refulatory compliance
    - fees for needed permits for complying with regulations (environmental, building codes, health and safety standards etc.)
    - unforseen circumstances and additional expenses (administrative, site security, insurance etc.)
3. Consultant and professional fees
    - hiring (engineers, architects, specialists etc.)
4. Community support for relocation
    - providing support for affected residents or shop-owners (livelihood support, social services, transportation assistance etc.)

Infrastructure development costs:

1. material expenses, labor, equipment, permits, inspections, site preparation, land acquisition
2. Roads and pavements (materials, labor, equipment, drainage, sewage, manholes, septic tanks)
3. Water supply system (water distribution pipes, watertanks)
4. Electricity distribution
5. Solid waste management
6. Telecommunications and internet connectivity
7. Green spaces and public amenities (riverbank, parks, landscape)
8. Regulatory and Administrative Costs

Construction costs:

1. skilled and semi-skilled and unskilled labor employment
2. Foundation costs
3. structural frames
4. Exterior walls
5. Interior finishes
6. Mechanical, Electrical, and Plumbing (MEP) Systems
7. Elevators and Lifts

Cash flow expenses

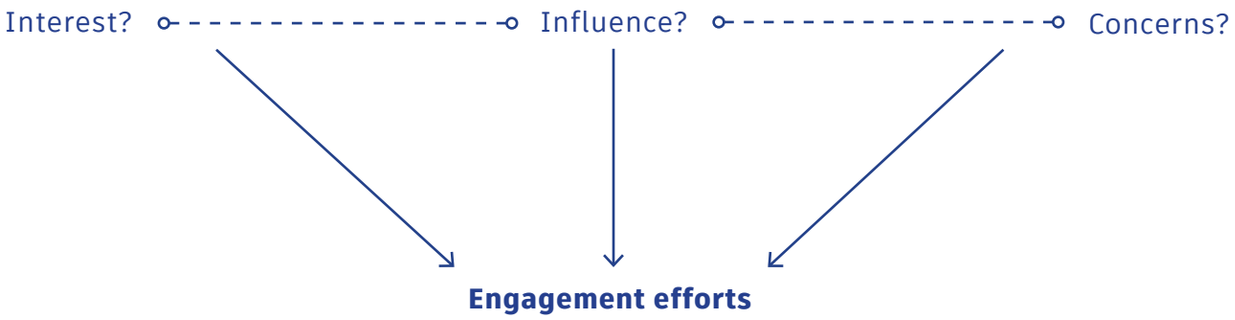
- Demolition costs
- Infrastructure development costs
- Construction costs
- Community support costs
- Maintenance and operation costs

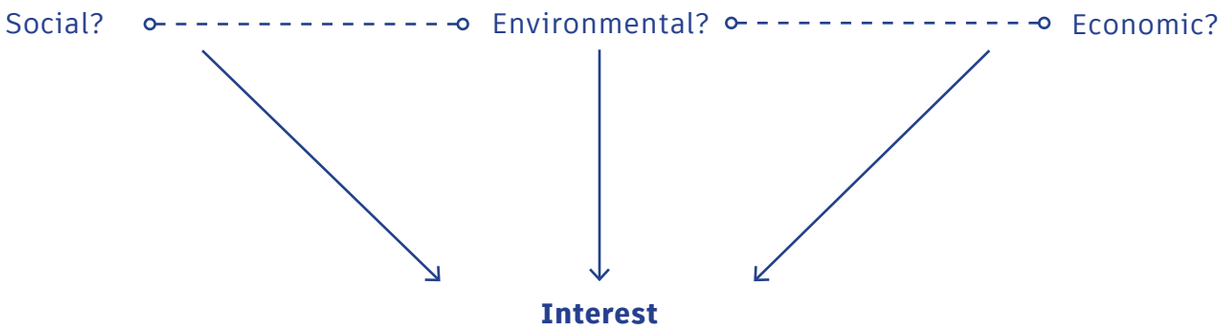
Cash flow income

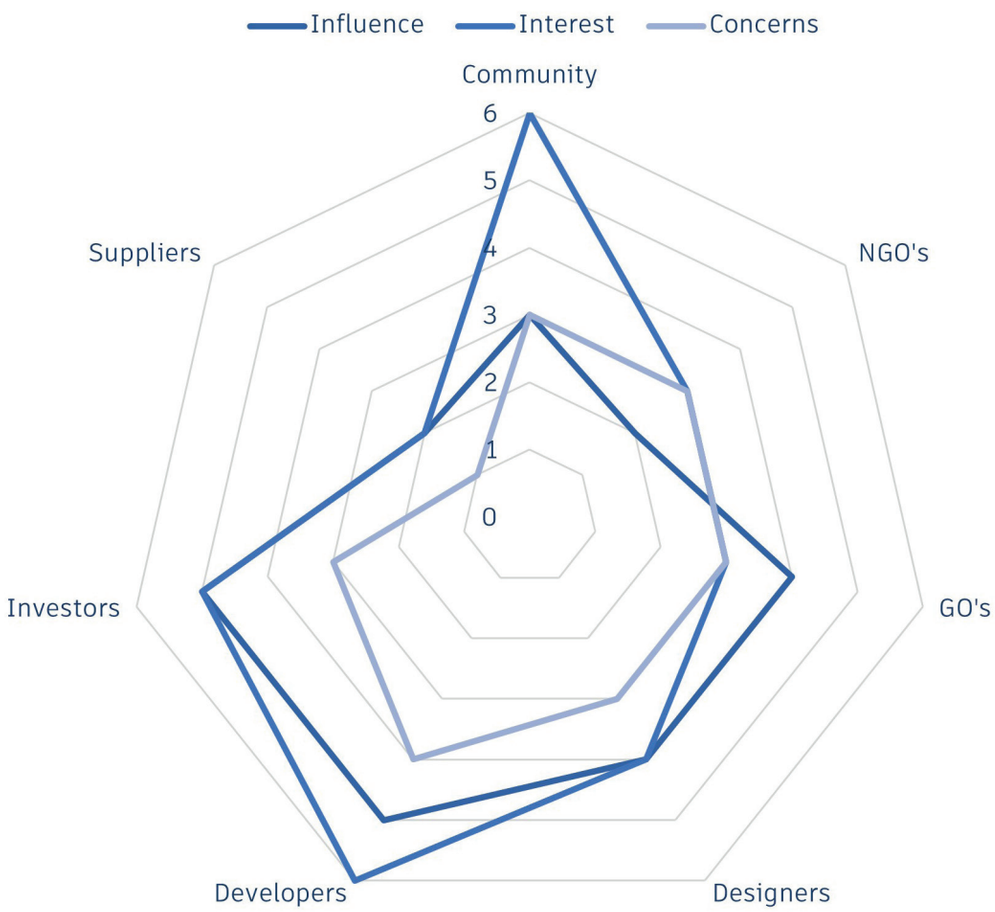
+ Investment bank
+ Fund NGO's
+ Fund GO's
+ Commercial monthly rent
+ Housing monthly rent
+ Housing mortgage
+ Housing Association fees



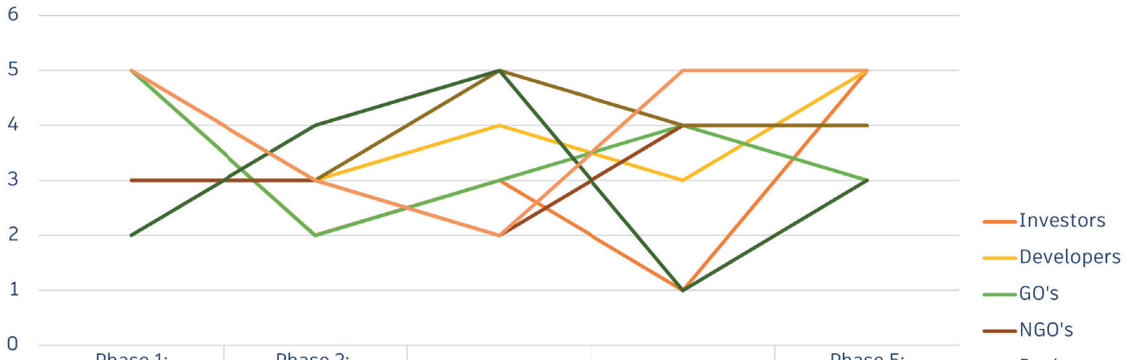
Stakeholders influence and interest





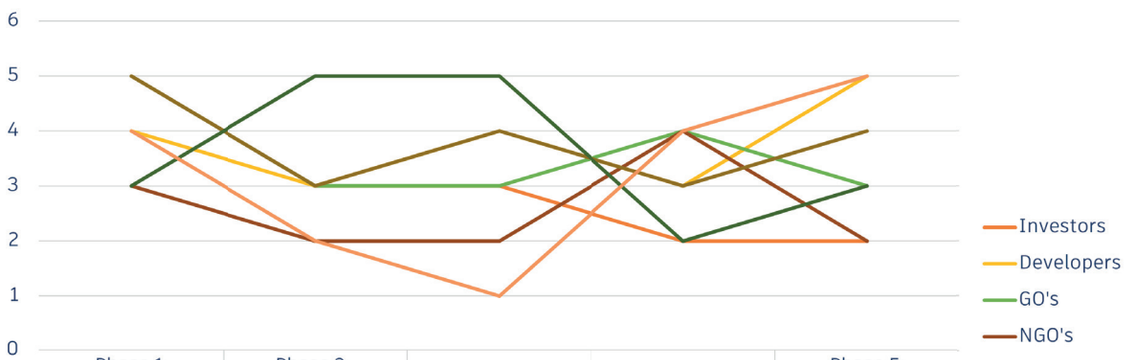


In timeline of redevelopment: interest



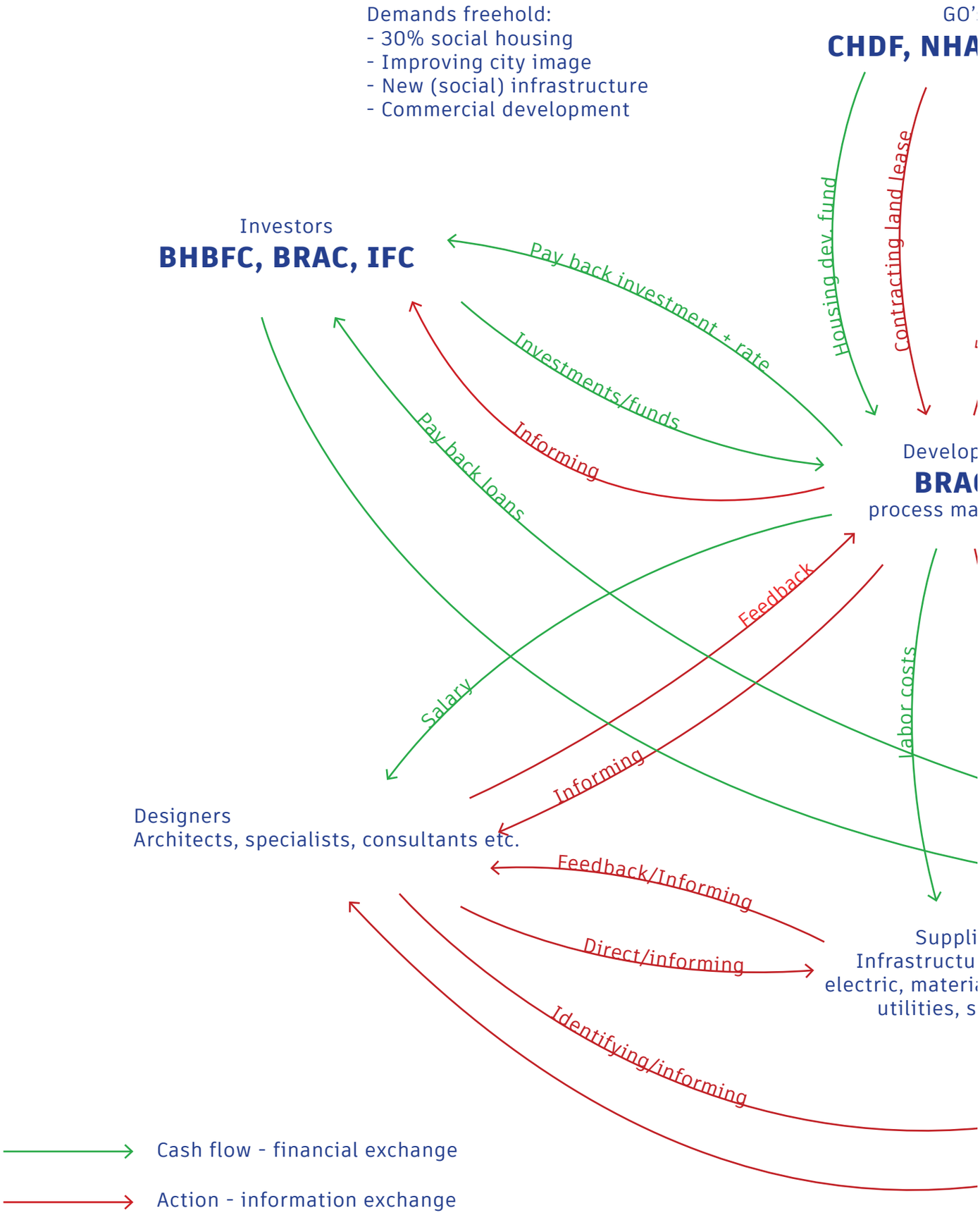
	Phase 1: Preperarion and assessment	Phase 2: Demolition and site clearence	Phase 3: Construction	Phase 4: Rehousing	Phase 5: Completion and monitoring
Investors	5	2	3	1	5
Developers	5	3	4	3	5
GO's	5	2	3	4	3
NGO's	3	3	2	4	4
Designers	5	3	5	4	4
Suppliers	2	4	5	1	3
Community	5	3	2	5	5

In timeline of redevelopment: influence

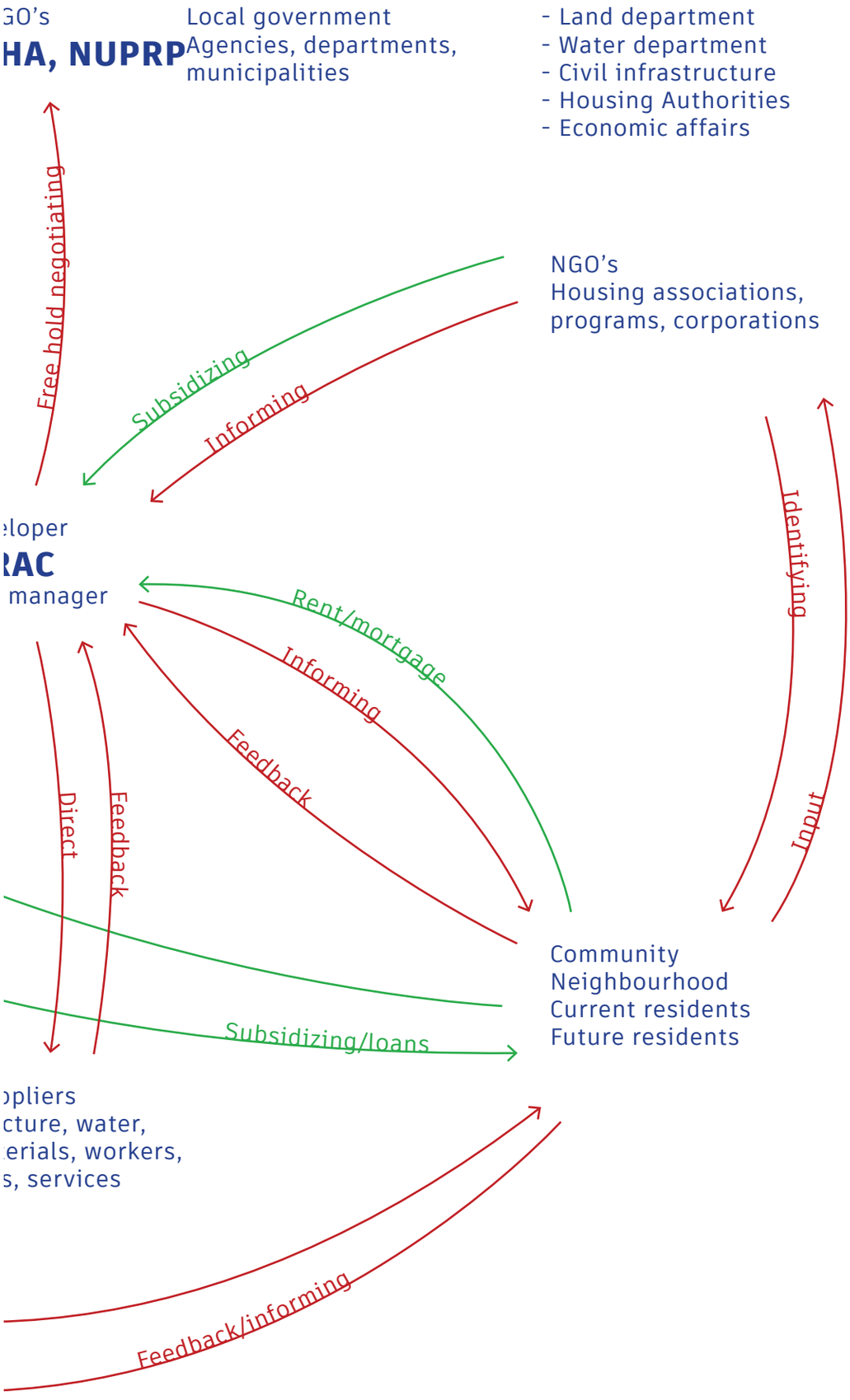


	Phase 1: Preperarion and assessment	Phase 2: Demolition and site clearence	Phase 3: Construction	Phase 4: Rehousing	Phase 5: Completion and monitoring
Investors	5	3	3	2	2
Developers	4	3	4	3	5
GO's	5	3	3	4	3
NGO's	3	2	2	4	2
Designers	5	3	4	3	4
Suppliers	3	5	5	2	3
Community	4	2	1	4	5

Stakeholder relati



ationship mapping



Synthesis



Impression: front view cluster





Impression: parking garage entrance





Impression: pedestrian street





Impression: front view riverside





Impression: platform riverbank (end of pedestrian street)





Impression: platform riverbank (end of vehicle street)





Impression: riverfront promonade



Reflection



The aim of this research and design is to recognize the topic (issue) of poor development of urban settlements in relation to architectural design and social impact. When it comes to redeveloping and finding a solution for crowded urban areas, environmental impacts, and socio-economic problems this country faces, an existing settlement is chosen. Of course, we as designers should look at suitable empty plots to improve its neighborhood on multiple levels, however, the existing problems should not be forgotten. There is an overall pressing need to explore architectural design solutions to improve housing and living conditions in this country. Besides these topics, the goal of this research is to incorporate this with an additional issue Bangladesh face, the loss of livelihood. The overarching goal is therefore to investigate the potential dwellings have on the livelihood of its residents. A building with commercial and dwelling spaces as well can be a tool for households to positively change their livelihoods and not affect their cultural values and beliefs. Because of this architectural approach, the aim is also to enhance the housing and living quality of the current residents. To achieve this, it is important to have a good understanding of the context, especially because it is

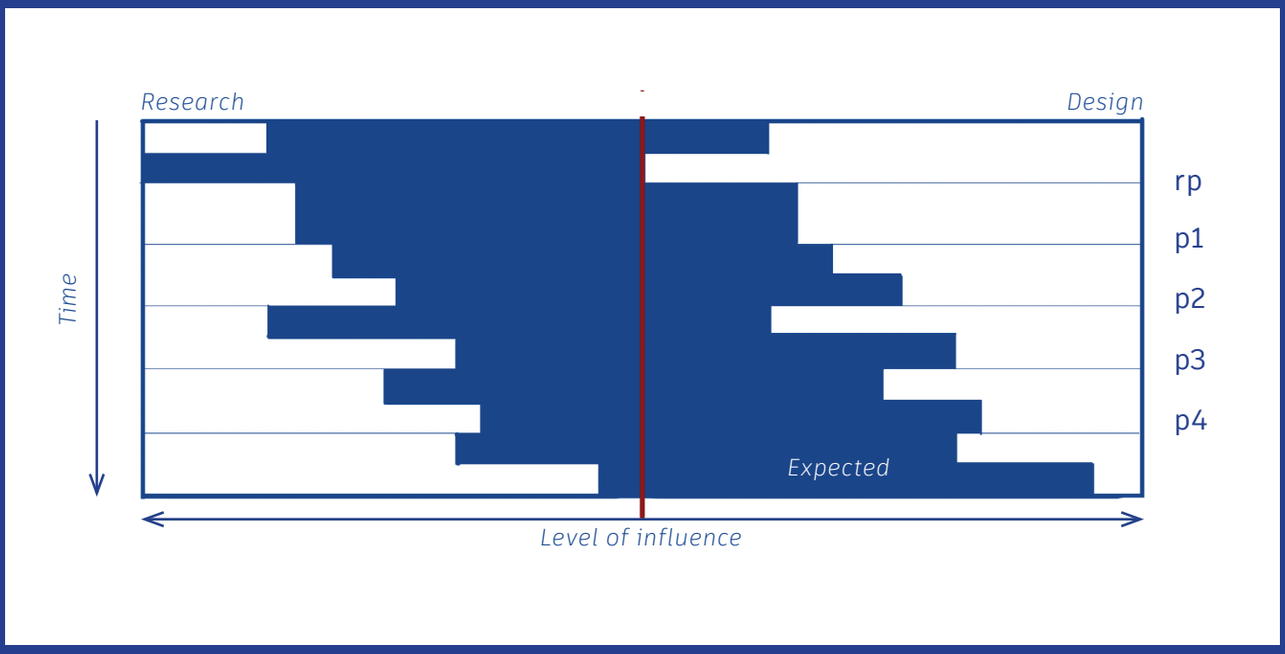


figure x: cooperative influence of research and design during each phase

an already existing settlement. Besides understanding the needed architectural principles of Bangladesh, this research will also identify the relation between design, people, and their life. How I see it, the results of the research have grown over the past year and really developed in the last few months. Of course, at the start of the graduation studio, the foundation for the scope of this research and design was with some level of unpredictability set, not knowing which topics you would come across during the upcoming months. In the first months of the studio, the research part of this studio was the main priority for setting a good starting point for the thereafter design phase. It was not until later, around the time we had our first design hypothesis presentation (P1), that the crucial design choices peeped around the corner. Starting from here, research and design were in conjunction with each other, and neither were able to be unseen. However, the ratio between the two altered every week. Overall, I occasionally had trouble with finding the right balance between the two and finding the right way to combine good structural research with the fast-changing design choices. Needles to say, it is not the assignment to hand in only a text-based thesis, but an extensive report with research and design combined. The exact interpretation of the research-based part has always been personally a little harder to structure and therefore I have treated the scientific research part of this assignment to a lesser degree. The starting topics I chose for the research plan at the beginning of the last semester had a more literature note and were less in a direct design matter. I would say that the research I conducted at the beginning of this studio was not always required for putting the presentations in order personally. Naturally, each of the final presentations products contained research, but I could have been more pleased with my own results if the research and design part accompanied each other in a better way (on my part). The large or small, less, or more important findings during this entire year have made me more enlightened in the context of this studio. Thorough and extensive research is available about this location, values, and normality, which is an important starting point. The direction the research was leaning into changed for me during the distinct phases of this year. I believe that the strong, active, and yet so different context than usual courses topics, could clarify the changing

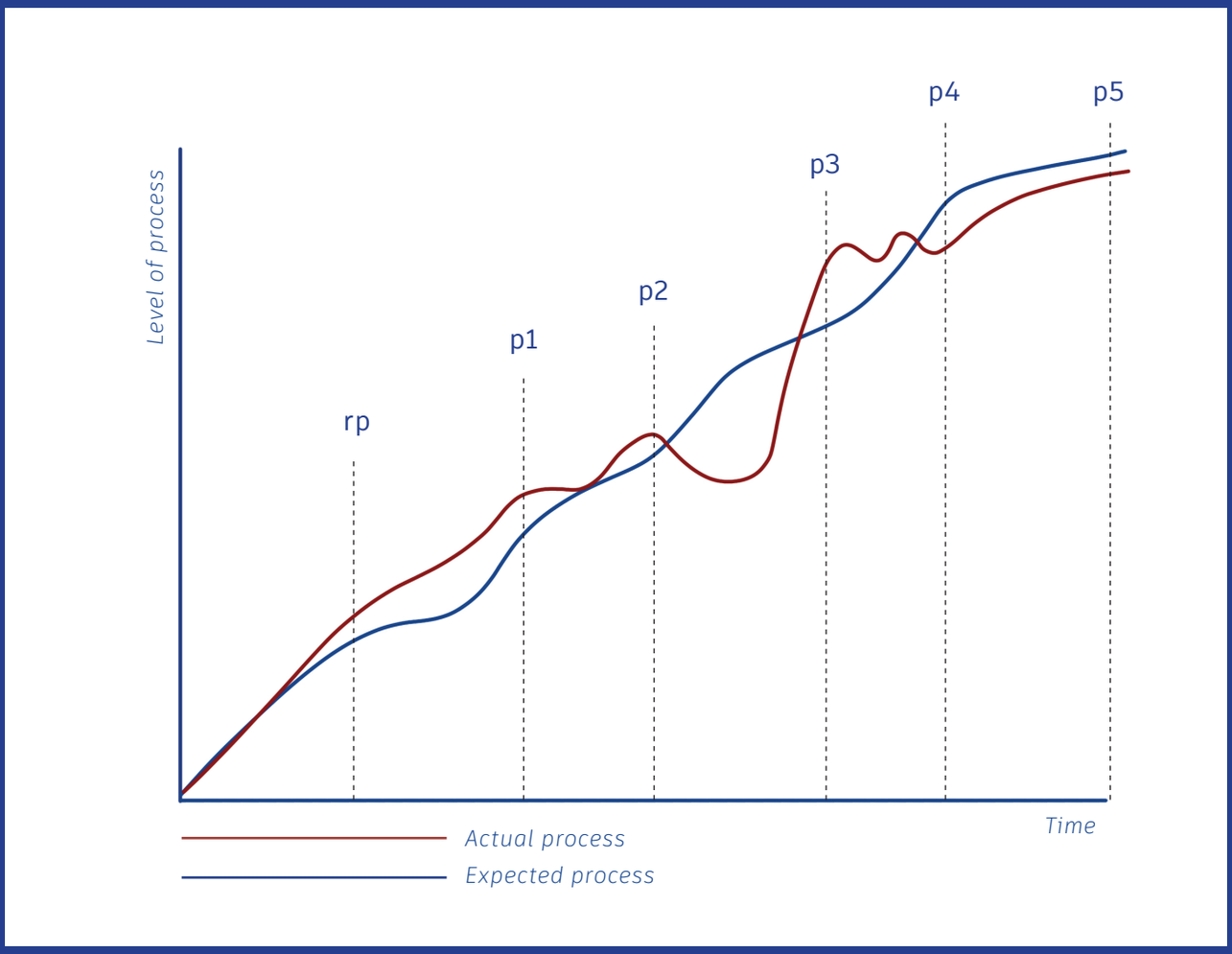


figure x: level of process during the whole studio

direction research approaches. A part of the approach for this project is to try to place yourself in a different context. This studio really allowed us to look outside our “Dutch” way of designing and kind of start over. My point by different research approaches is mostly explainable in the way research is conducted and the quantitative aspect. At some point it was needed to read comprehensive literature research, however every so often one Google image could give me an answer to my (simple) question. Nonetheless, research and design were in every phase (occasionally in different proportions) seen as shoulder-to-shoulder approaches and I expect to incorporate every relevant result and conclusion in question with me to the P5 final presentation.

As said before, we started with the research plan, an explanation of the background of this design assignment and the specific topics that were chosen to integrate in this plan. Before designing and doing the actual research, an explanatory booklet was made about the design location, Bangladesh, and in specific, Sylhet City. Additionally, I started with the first analysis of the research to understand more about the topics that are needed for this project. This allowed us to meet all the new topics of this world and prepared us for the field trip and the whole graduation year. To choose first the topic of your research plan, and after that visiting Bangladesh and finding all new sorts of topics that are important in this culture, really made me hesitant about my research topic. I chose to continue with the topic I first submitted as the research plan, not knowing it could change over the way and even more topics were going to be added. At this time, this approach I chose for myself slowed down the overall design process. I kept making little steps forward in designing, but every other week took a big step back. Knowing what I know now, I would have done things differently starting from the beginning. My research topic would have been more design related, to give my design project a more understandable and clearer topic. I think that having a great vision and clear starting point can benefit you in making critical design choices. This way, I believe that the “big step back” can be limited to a point where you do not have to abandon the whole initial design and accelerate the process because you can always fall back on your clear and strong starting point. My starting point was not that strong or clear in my head, and therefore making larger steps back was time consuming, but necessary to achieve what I produced till now. Also, I would have started sooner with constructing a better structure for my research and making a clearer list of my design goals. It has always been a bit scattered, and that slowed down my process. Yet I also believe that studying architecture can be like an obstacle course where you fall, but you always manage to get up.

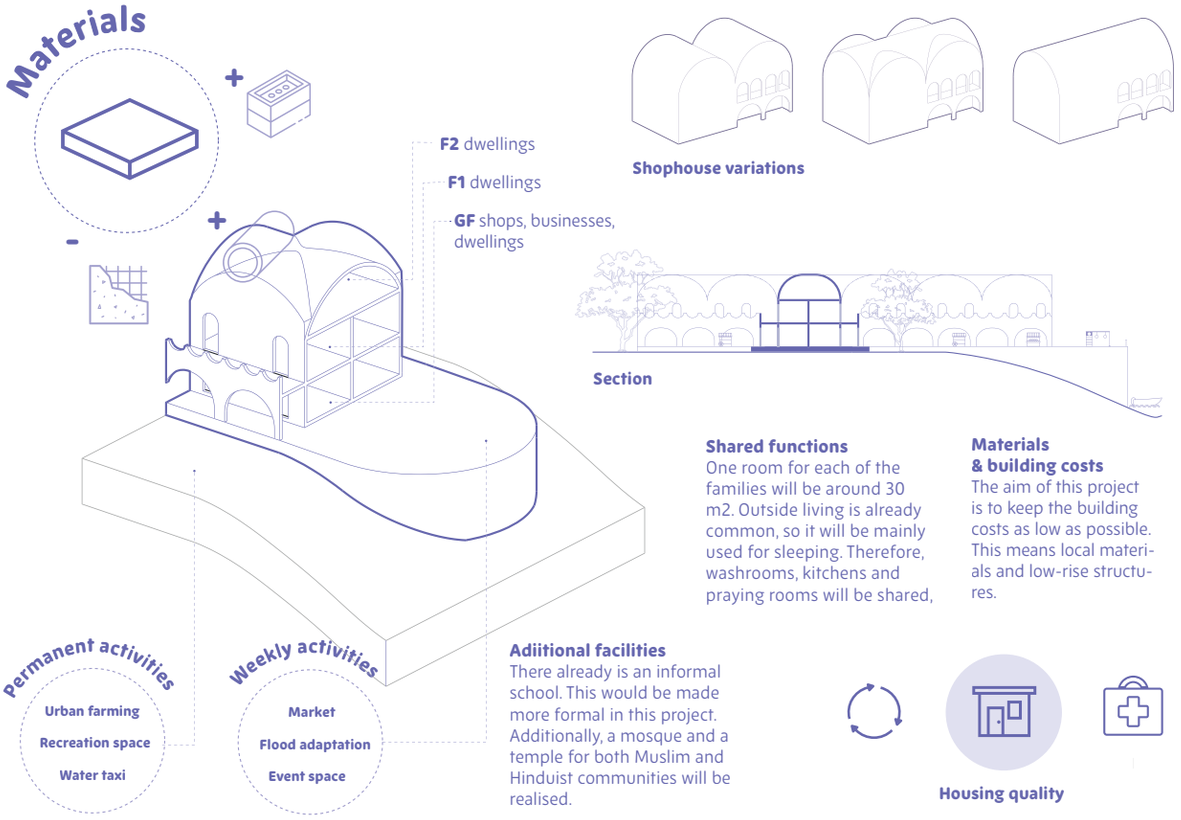
To look at the relationship between this graduation studio, the Master track and the overall master program is to also look at the differences. The context of this graduation studio is a globally important topic in the architecture field. The living conditions, the housing situation and the environmental aspects are not limited to Bangladesh only. Yet, in line with other courses of the Master track, adaptive strategies for designing and research are always a necessary condition, because not every assignment or context is the same. Therefore, the scale of this comparison is important to keep in mind when looking at the way courses are practiced. In every context, the whole master programmed allows students to confront pressing matters and design challengers no matter the context. This comparison is also relevant in the Architecture track, and the design studio.

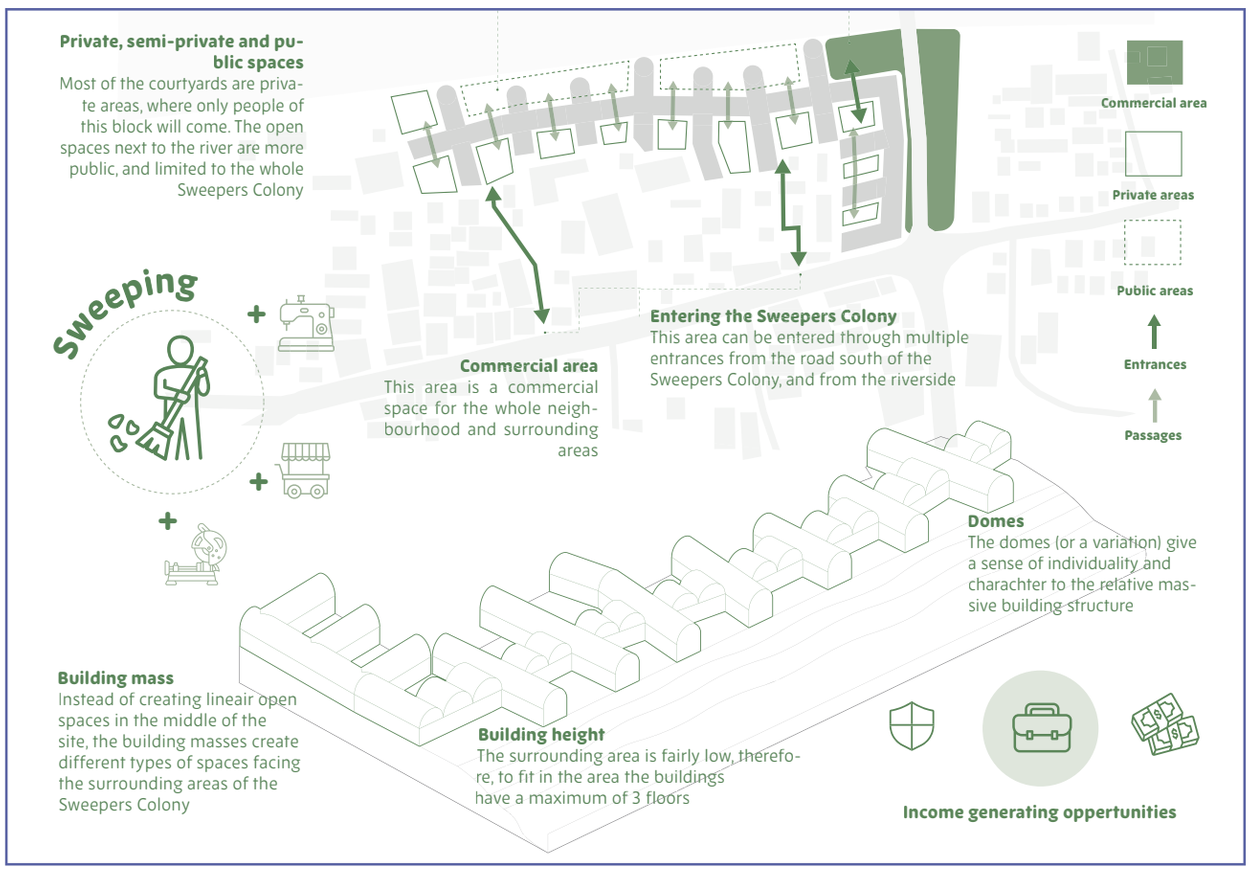
The transferability of this project can be translated to the potential to be adapted, replicated, and scaled in different contexts. One aspect that is important for the transferability of this design is the climate factors. The type of materials that are used, the configuration of the façade openings is adapted to this type of climate. Another aspect is the socio-economic conditions of this site. The cultural norms of this context have shaped some of the design choices and the way the several types of spaces are relating to each other. The four blocks surrounding the courtyard have a simple grid that can be modified to any site. The row-housing type can also be adapted to any size cluster. This way, the qualities of the different typologies and space configurations stay the same. In this project, the clusters are placed and are in line with the river, a contextual factor. The clusters can also be placed in a different grid, because of the accessibility on every side. Therefore, the scalability is flexible for this project. Also, the adaptability is easy, a simple and small adaptable grid is used. It also depends on the stakeholders, partnerships and networks can be established during the project (including housing regulations, policies and support the project can get). The value of the research was that by examining their

current living conditions and services can give an overview of what they need and value in a community. It addresses what is missing or is a lack of, but also what they already value and how to keep that tradition.

Several design choices were made because of constructive feedback from the tutors or were influenced by my own discoveries, big and small. The tutoring helped in a way that design goals or aspirations can be improved with the right implantations of cultural background a work experience students may lack. Personally, the tutoring helped most of the time with design choices, hesitating between two paths. Besides helping with integrating your idea into a realistic design, the tutors also produced a lot of helpful information about basic design implementations, material integration and other topics you sometimes forget to research or did not know it existed. However, good constructive feedback can also come with many useful design options, which sometimes contradicted my initial idea, but this was the way for me to come to what I have now. This way I learned to think critically about the choices I needed to make. Occasionally it was hard to hear that something you interpreted in a way and is not shared by the same opinion. I believe that students must learn what you take with you after a tutoring session and remember to still implement your vision without directly copying something you did not initially wanted. I noticed that that even till the end of P4, there were always several changes to be made, but the atmosphere and final foundation remained steadily the same. This research can contribute to an already rising issue everywhere in the world, which makes it quite relevant to research because poor urban (in)settlements are a global phenomenon. Hopefully, this will eventually contribute to cross-country learning and collaboration.

P1
Recap


Materials
F2 dwellings
F1 dwellings
GF shops, businesses, dwellings
Shophouse variations
Section
Shared functions
One room for each of the families will be around 30 m2. Outside living is already common, so it will be mainly used for sleeping. Therefore, washrooms, kitchens and praying rooms will be shared,
Materials & building costs
The aim of this project is to keep the building costs as low as possible. This means local materials and low-rise structures.
Permanent activities
Urban farming
Recreation space
Water taxi
Weekly activities
Market
Flood adaptation
Event space
Adiitional facilities
There already is an informal school. This would be made more formal in this project. Additionally, a mosque and a temple for both Muslim and Hinduist communities will be realised.
Housing quality

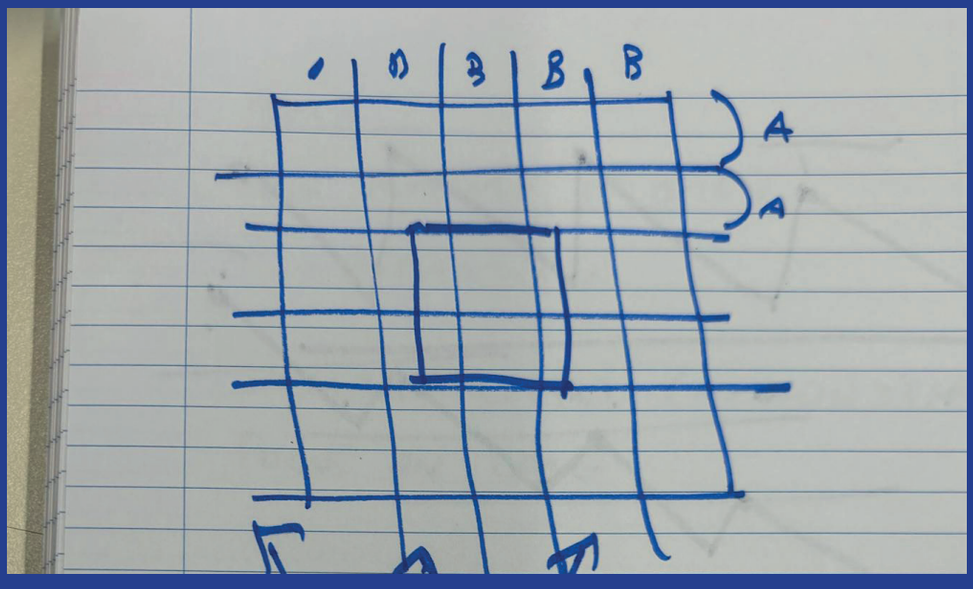

Private, semi-private and public spaces
Most of the courtyards are private areas, where only people of this block will come. The open spaces next to the river are more public, and limited to the whole Sweepers Colony
Commercial area
Private areas
Public areas
Entrances
Passages
Sweeping
Commercial area
This area is a commercial space for the whole neighbourhood and surrounding areas
Entering the Sweepers Colony
This area can be entered through multiple entrances from the road south of the Sweepers Colony, and from the riverside
Domes
The domes (or a variation) give a sense of individuality and charachter to the relative massive building structure
Building mass
Instead of creating lineair open spaces in the middle of the site, the building masses create different types of spaces facing the surrounding areas of the Sweepers Colony
Building height
The surrounding area is fairly low, therefore, to fit in the area the buildings have a maximum of 3 floors
Income generating oppertunities

Critical decisions after P1 presentation

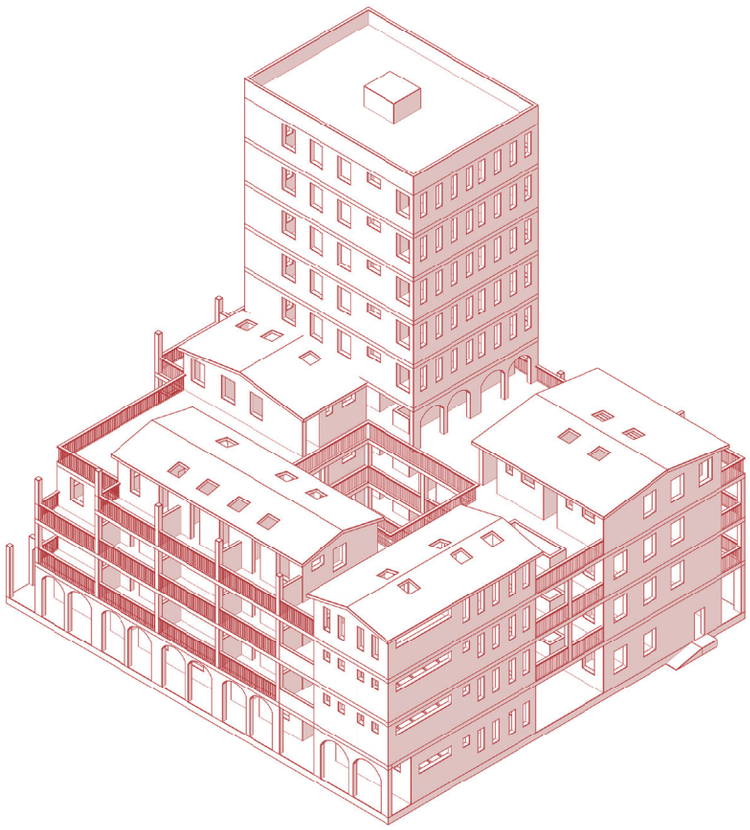
To achieve an increase in porosity and accessibility, the best way for me was to change the whole materplan grid. This meant that the whole design needed to be changed. Luckily, my starting points and vision for this redevelopment were possible to remain the same. This was also a critical moment where I really started to understood the site and the current residents way of living. Therefore, the start-over was a overall a much needed moment to have the final design I have now. I believe that the time before the P1 was more of an introduction for this design project, and really started to develop in a more specific and realstic way after.

Critical design moments before P2

- Structural foundation and material availability
- Exploring vernacular elements, implementations and materials



P2
Recap



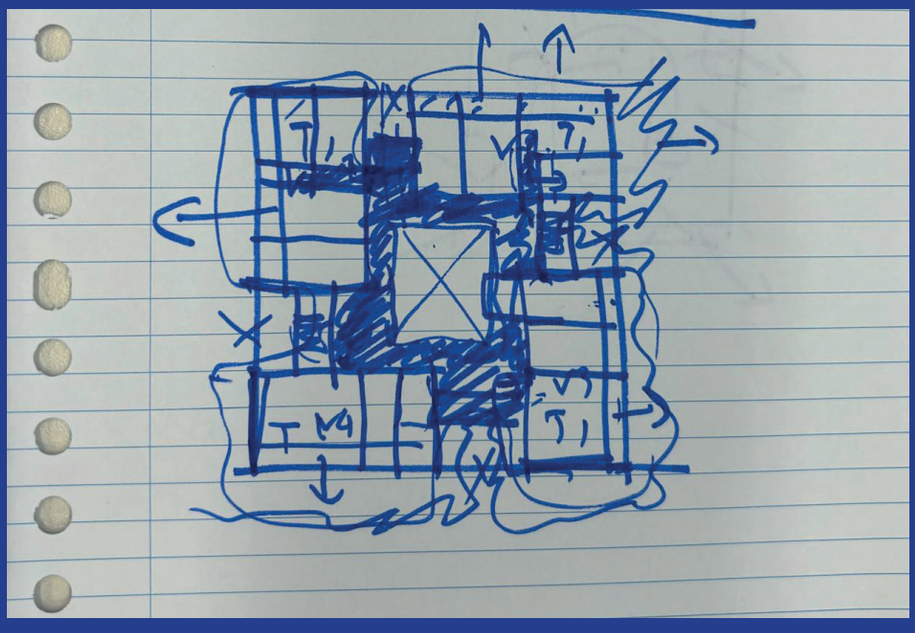


Critical decisions after P2 presentation

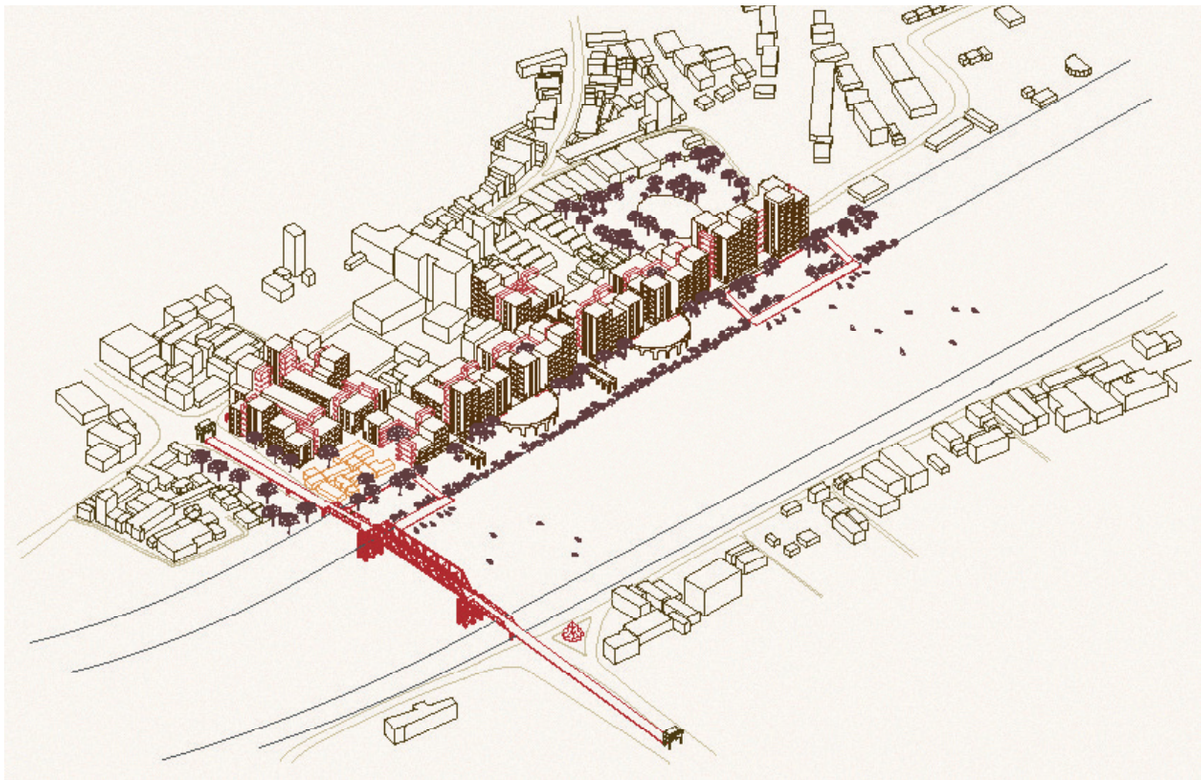
- Improve cross ventilation possibilities
- Wet rooms placed by outer facade
- Introduce duplexes and more typologies

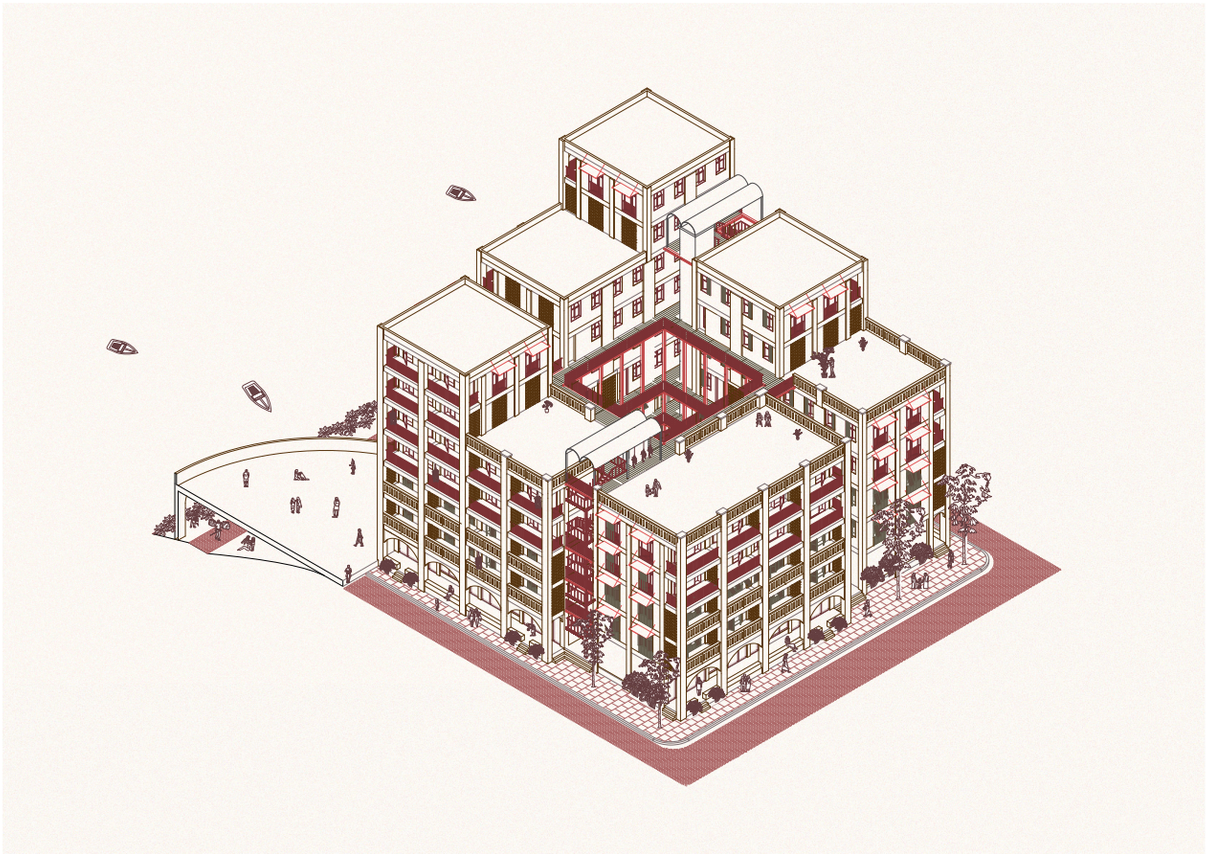
Critical design moments before P3

- Improve cross ventilation possibilities
- Wet rooms placed by outer facade
- Introduce duplexes and more typologies



P3
Recap





Critical decisions after P3 presentation

- Activate the rooftops
- Improve the riverbank
- Redesign the placement of the unit stairs
- Uniform the unit individual rooms

Critical design moments before P3

- Improve the circularity in the individueal units
- Parking basement integraded in structural grid
- Uniformity and materiality of the facade openings

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Images & figures

All full-page images are own made in Bangladesh, October 2023

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Figure 1: Qin, H. et al. (2012). Conceptual framework of rural out-migration in Society and Natural Resources
Figure 2: Ullah, A. Et al. (2021). Community household survey framework in Sustainability