

Genesis Metropolis

জেনেসিস মেট্রোপলিস

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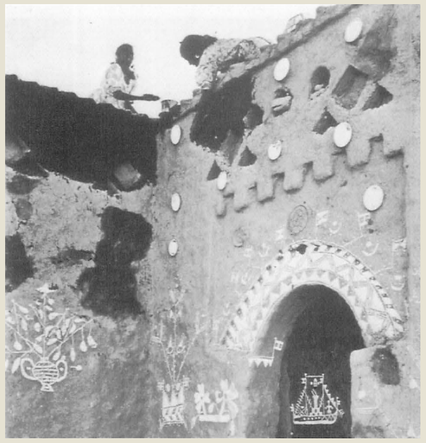
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Photo by Joëlle Steendam

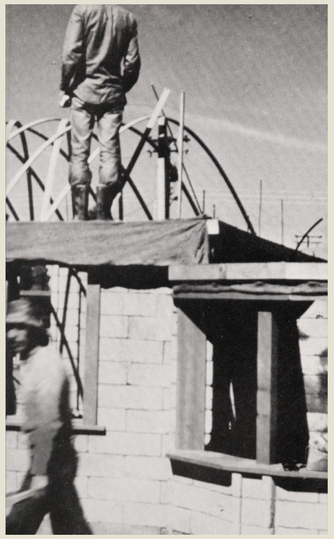
More even than the work of great
architects, I loved buildings that
had grown silently with the centuries,
catching the best of each generation,
while time curbed the artist's pride
and the philistines vulgarity, and
repaired the clumsiness of the
dull workman.

- from "Brideshead Revisited" by Evelyn Waugh





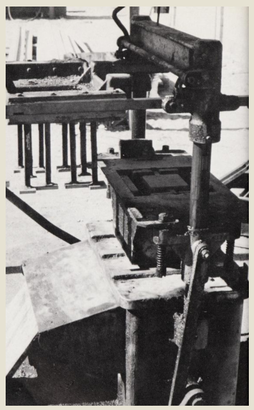




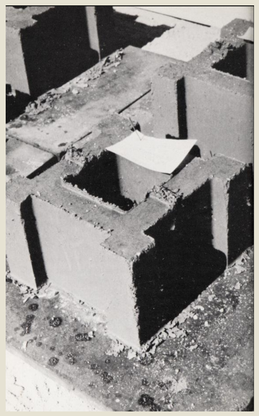

Prestone


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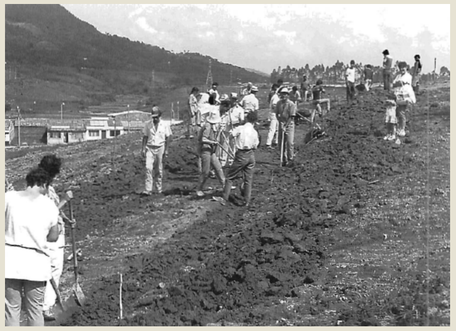










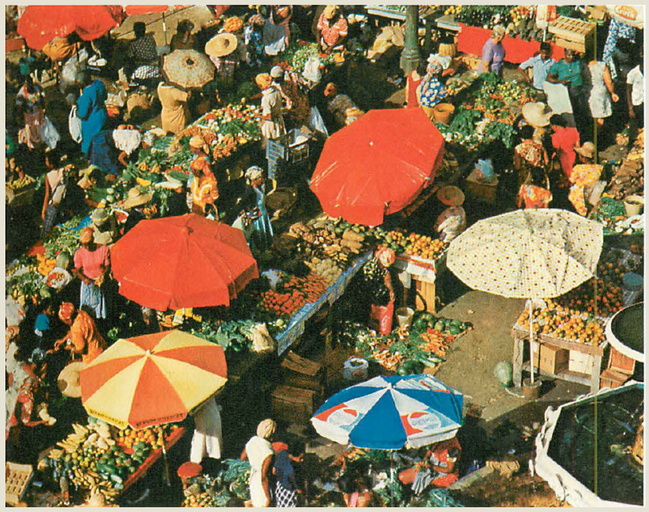


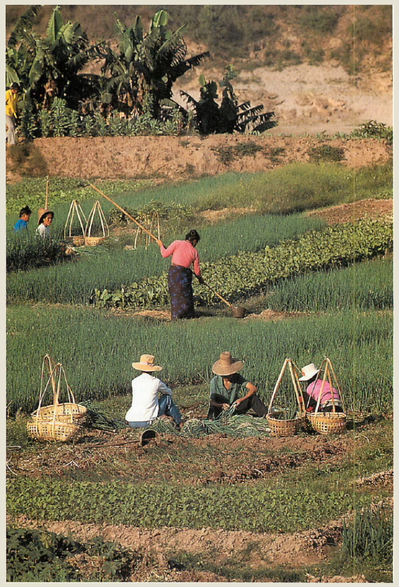






















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Sylhet


Nepal
Bhutan
India
Sylhet
Dhaka
India
Chittagong
Myanmar
Bay of Bengal

Sylhet

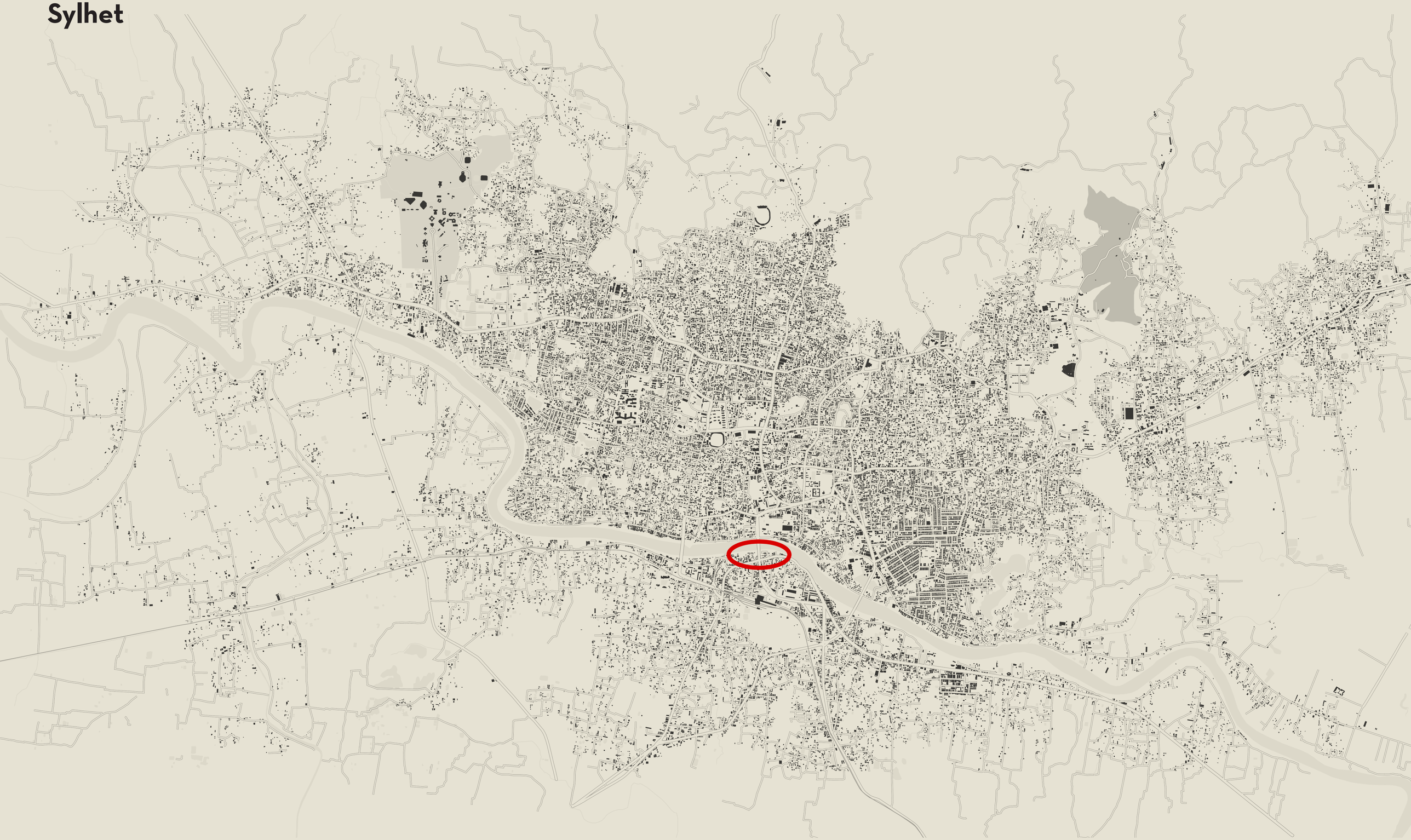


Population 659.138 people
Area 26,50 km²

GLOBAL HOUSING

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Sylhet



Population 659.138 people
Area 26,50 km²

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Selfie Bridge
Keane Bridge
Site

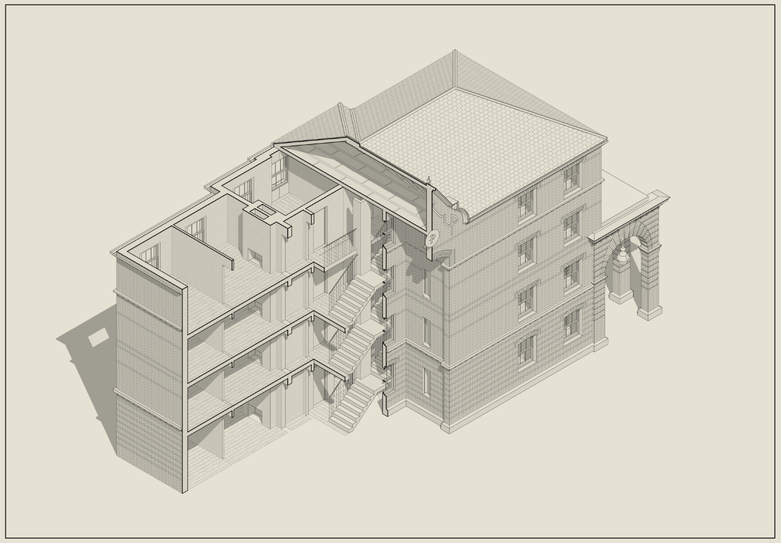


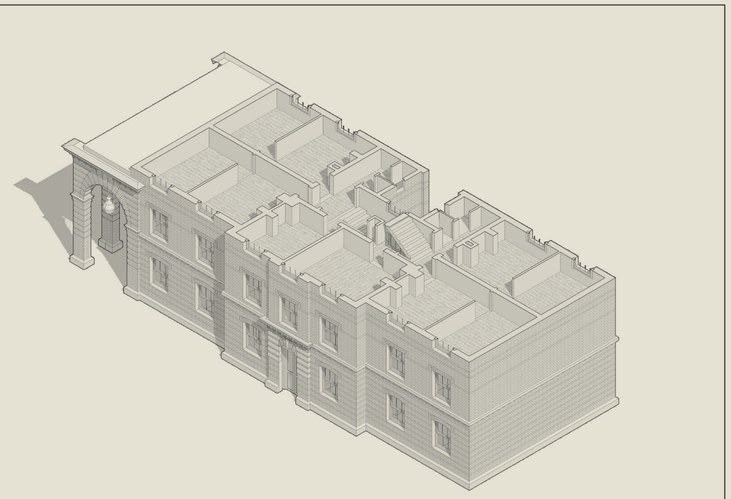
Pilot Projects

Peabody Square, Blackfriars

Designed by: Henry A. Darbishire
Location: London
Completed: 1871







Peabody Square in Blackfriars was completed in 1871 for the Peabody Trust. It consisted of sixteen blocks of buildings, enclosing two quadrangles connected to one another.

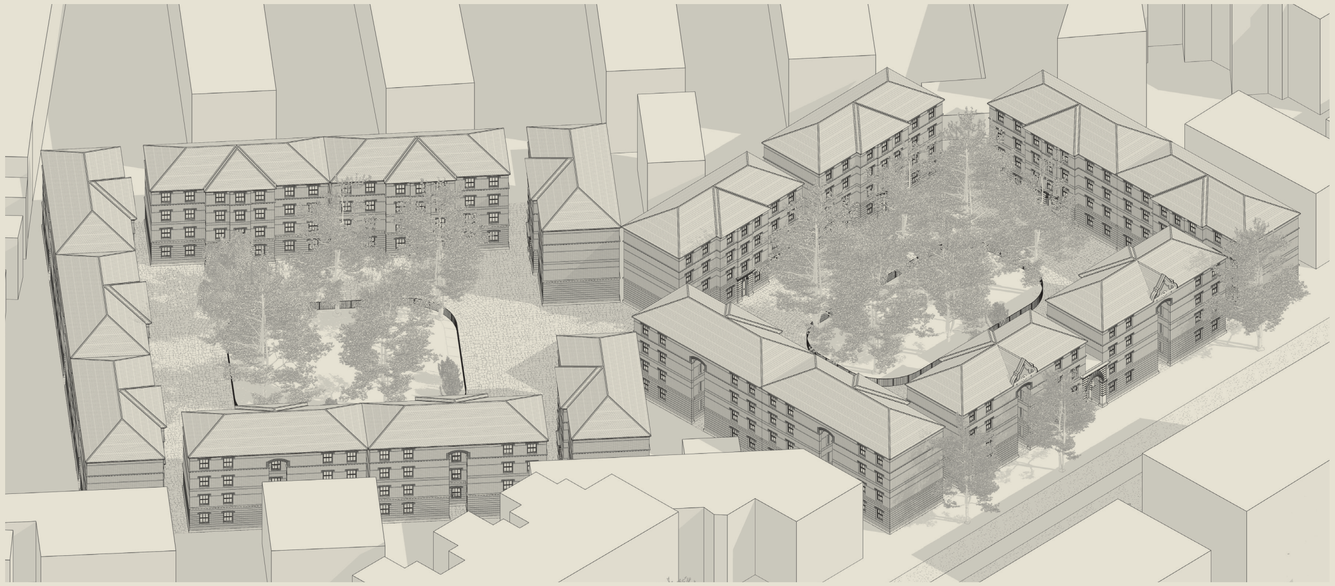
The Peabody Trust was founded in 1862 by George Peabody (1795-1869), a London-based American investment banker. His affection for London led him to donate a sum of £150,000 to benefit 'the poor and needy of this great city, and to promote their comfort and happiness'. This was an almost unheard of sum at the time (and grew to £500,000 by the time of his death).

The design of this estate was created by Henry Astley Darbishire (1825-1899) who built around 20 of the Peabody estates between 1863 and 1885. In this time he evolved the iconic block type that is commonly associated with Peabody housing. This particular scheme was the first to do away with the shared internal corridors that were part of earlier designs. All residences and shared facilities could be accessed directly from the stair landings. This created a more efficient layout that was little changed in subsequent schemes.

At the time Darbishire's estates were decried as too monotonous. Nikolaus Pevsner, for instance, described them as 'gloomy and barrack-like' and 'ever repeated design...at its worst and in all too familiar form'. However this standardisation helped keep down costs and could be understood as an early example of rationalism.

The scheme refelcted the Victorian attitude that physical and moral degradation were directly linked and thus that moving the poor out of unsanitary slums into clean, solid new dwellings would improve their wellbeing and character.

Peabody Square, Blackfriars





Learning Outcomes

Henry Darbyshire's approach to affordable housing focused on designing standardised building blocks, the essential design of which could be reused in many different contexts.

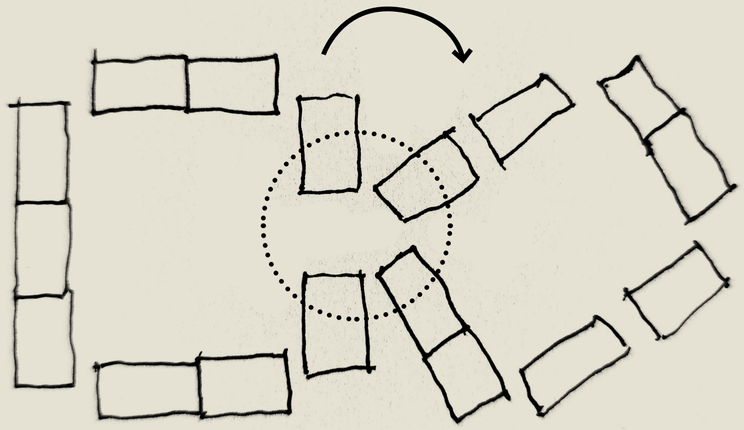
In order not to have to adapt the blocks to different site conditions, Darbyshire focused on careful arrangement in the masterplan, with blocks either being separate or connected in a line. By abandoning overly rigid or symmetrical configuration where necessary, Darbyshire could fit his masterplans even within in awkward site outlines. By not connecting blocks at corners, he could pivot to any desired angle, without it affecting the internal layout of the blocks. This can be seen in the Blackfriars scheme, where two rectangular courtyards meet at a skewed angle.

At the same time the open corners provide smaller transition spaces in the public realm which can help to activate streets and courtyards.

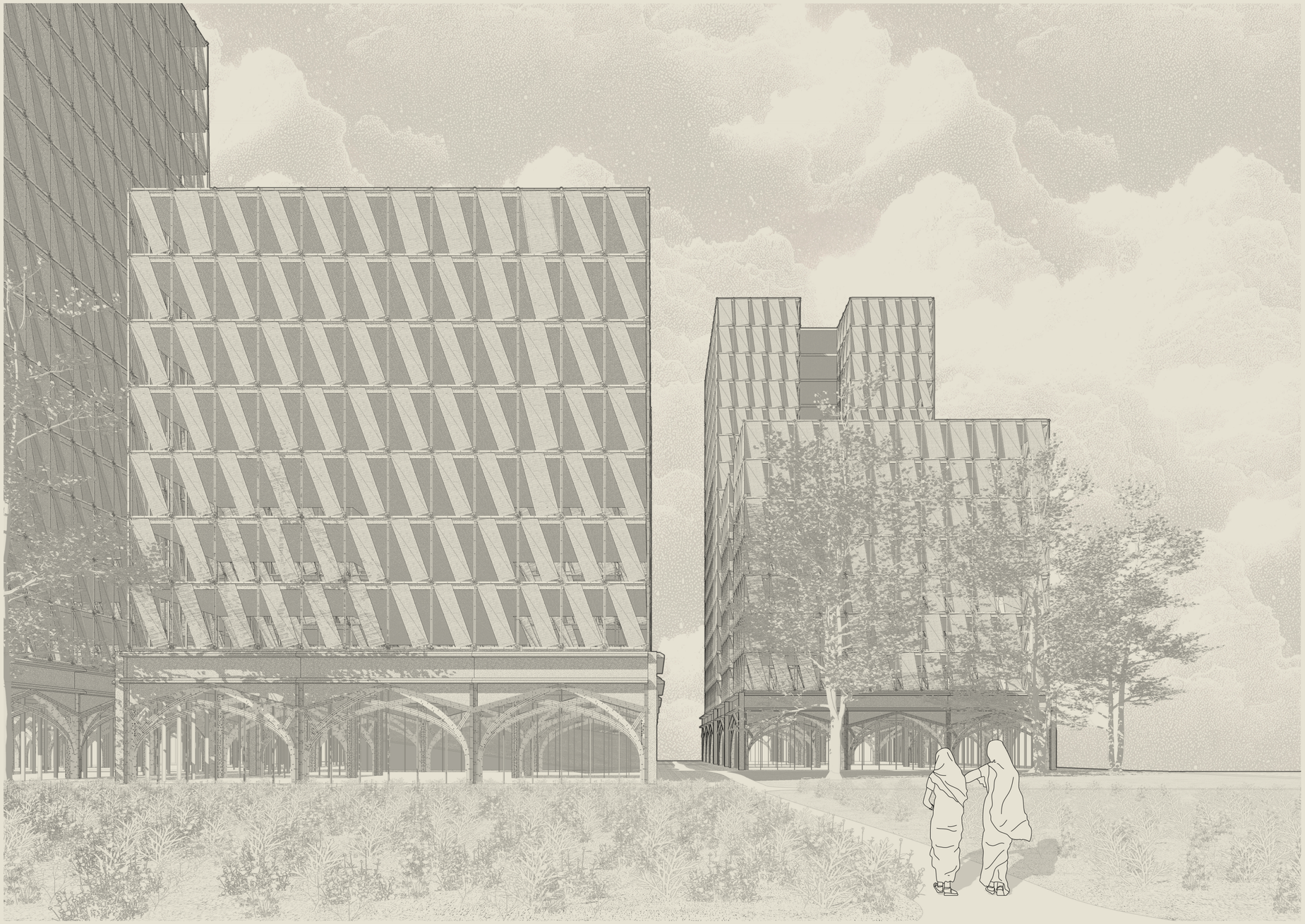
1. Standardisation

2. Flexibility in the masterplan facilitated by open corners

3. Durable construction with common materials

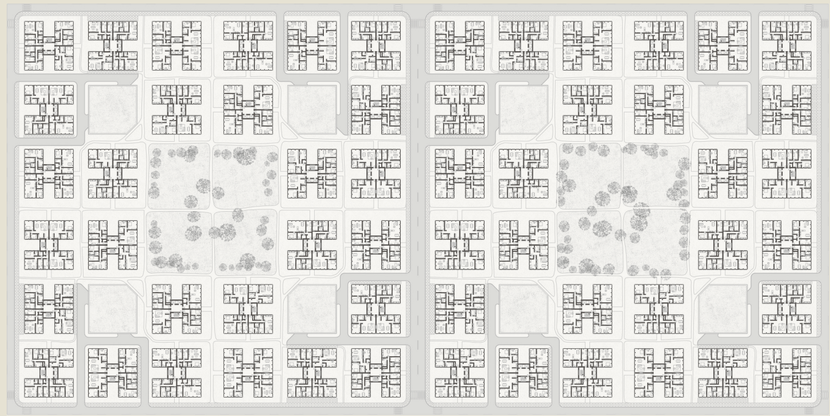


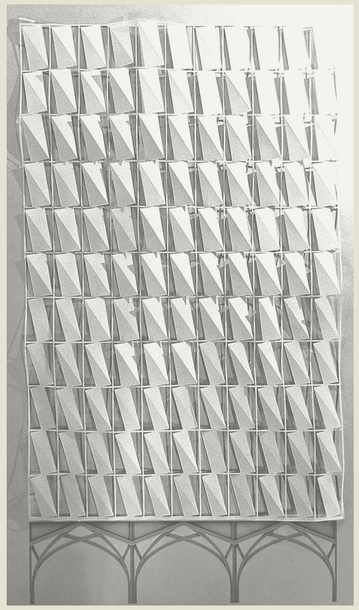
Density Challenge

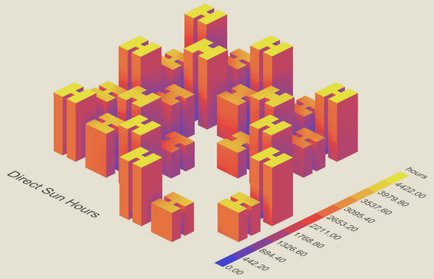


Density Challenge









Learning Outcomes

The density challenge provided an opportunity to explore the use of standardised blocks but at a much higher density than the Peabody scheme.

By designing a hireachy of open spaces it was possible to create a high density while also ensuring well defined and appropraite open spaces. From the smallest defined by the building footrprints to the intermediate defined by a cluster of buildings and the largest, created in the space between clusters. The gradient in scale also reflected a gradient in publicness

Arranging the building heights in an alternating pattern with a gradient down towards the main public space created better access to light and views for all apartments. To mitigate the resultant solar gain risk, the facade panels were designed and arranged to have a solid-to-glazed ratio based on the total sun hours on each part of the facade,

1. Standardisation

2. Hierachy of open spaces

3. Responsive solar shading

Research Plan

1. Introduction

Bangladesh is a country experiencing rapid change. It is one of the most densely populated countries in the world (BBS, 2022) and its economy is rapidly growing with an average GDP growth rate above 6% in the last ten years (World Bank, 2024) (despite a slowdown during the COVID pandemic). There is a continued steady population growth rate, currently at 1%, and not predicted to fall below zero until around 2060 (United Nations, 2024). Bangladesh achieved status as a lower middle income county in the World Bank Income Classification in 2014 (World Bank, 2022). Its agricultural sector is increasingly mechanised while other areas of the economy such as the garments industry have experienced skyrocketing demand for labour. All these factors combine to produce strong pressures of rural-urban migration in Bangladesh.

Furthermore, climate change is adding to migration pressures in Bangladesh. Approximately half of its landmass is actively deltaic and prone to flooding in the monsoon season (Hays, 2022). Agriculture heavily relies on the annual monsoon rains and any extreme variations in their timing and magnitude can be devastating. The southern part of Bangladesh is also directly vulnerable to sea level rise with a rise in one meter potentially affecting 17% of the landmass and approximately 20 million people (Rahman, 2012). Beyond the direct threat to life through flooding, the ingress of salinity from seawater turns fertile agricultural land into land that is unusable for most agricultural purposes. Coastal erosion and the backwater effect are further significant risks (Ali, 1999). Bangladesh is also periodically affected by intense cyclones including, historically, some of the worlds strongest (Ali, 1999, p.111), and may face an increased threat from cyclones due to climate change (Ali, 1999).

We can see that various forces, some positive, some negative and some ambivalent, are involved in the migration of populations in Bangladesh. Many of these lead to increased rural-urban migration. It is predicted that by 2050, 56% of the population will be living in urban areas (Roy, 2021, p.2), compared to only 5% in 1960 (World Bank, 2018) (when Bangladesh was still part of Pakistan). This is perhaps the most significant demographic trend in Bangladesh in the last 50 years, going back even to before its independence in 1971.



Satellite images of the Padma River from top left: 1990, 1992, 1998, 2000, 2004; showing the extent to which it can move and change over time (NASA, 2018)

2. Problem Statement

Rural-urban migration has brought new opportunities but also significant challenges to Bangladesh. Attaining lower-middle income status in 2014 (World Bank, 2022) as well as its imminent graduation from the UN list of least developed countries (LDCs) in 2026 (United Nations, 2021) are significant markers of progress for the country. They suggest that at least in economic terms, the downsides related to this demographic trend are outweighed by the benefits.

Of course, urbanisation is a large and multi-faceted subject — a global phenomenon affecting not only Bangladesh — and its merits and demerits are hotly debated across multiple disciplines. For instance an investigation into the relationship between urbanisation and living standards by the International Institute for Environment and Development concluded, perhaps unsurprisingly, that "[t]here is no simple linear relationship between urbanization and economic growth, or between city size and productivity" (Turok & McGranahan, 2013, p.1). It is clear that, when even the economic benefits are hard to establish clearly, questions of a more qualitative nature, such as how urbanisation impacts people's wellbeing, cannot be answered simply.

However, in architectural terms, Bangladesh faces some very clear and present challenges from urbanisation. Whereas rural societies have handed down the skills for people to construct their own homes and shape their surroundings for themselves, modern cities rely on new materials and construction techniques, that require different skills and training to master. At the same time many of the jobs on offer in urban areas are of a different nature to those in agricultural areas. Often they do not require manual labour skills.

Thus while modern construction is becoming more reliant on technology and specialised skillsets the knowledge of traditional construction techniques as well as basic construction competency that comes with manual labour and agricultural practice is being lost. Additionally, shifting public perceptions play a role. For instance, traditional materials such as adobe have come to be associated with poverty (Monzur, 2018 p. 326).

A survey by the Commonwealth Association of Architects (CAA) shows that in Bangladesh there is only one trained architect per 50,000 of the population (CAA, 2018, p.19), with only Uganda having a significantly lower figure among the 15 countries surveyed. It found that the most significant shortfalls of trained building professionals were occurring "in many countries of the Commonwealth which are also urbanising most rapidly" (CAA, 2018, p.18). This shows that while a similar challenge is faced in other parts of the world, it is a very pressing problem in Bangladesh.

With the loss of traditional building knowledge and the small pool of building professionals able to deliver constructions to high modern standards, many in Bangladesh find themselves in less than ideal housing situations. Most obviously there are the number of people living in slums, who generally have no choice but to build for themselves. This still comprises around 50% of all people in Bangladesh (World Bank, 2024). However it may also include housing that meets adequate (if not high) technical standards in terms of durability, service provision, safety, etc.., but where little thought has gone into the qualitative ('subjective') aspects of the design, for instance where an architect has not been involved.

The dangers to health and wellbeing of housing that does not meet technical standards are generally well documented and their mechanisms understood. These can also be termed 'quantitative' standards in that they are based on measurable criteria (such as durability of materials, floor area provision, heating capacity, etc.). Such a standard could be, for instance, the provision of an adequate sewage system, which, when not present (as in most slums) predictably leads to increased risk of disease.

It is also widely understood, and increasingly supported by evidence, that there are qualitative criteria in the design of houses that can affect the wellbeing and even the health of inhabitants. However solid evidence and precise mechanisms of action are much harder to establish (than with quantitative criteria), since the effect of qualitative aspects of design excert themselves in the minds of users. Nevertheless the growing body of evidence in support of biophilic design principles exemplifies that it is possible to investigate qualitative aspects of design and to establish probable causation, if not mechanism of action. Among other things, biophilic designs have been found to provide



Turkish family sitting on their verandah drying and sorting food. Though perhaps limited in means, the family have exercised their freedom to shape and use the space exactly as they wish and seem to be happier as a result.
(Alexander, 2002, p.106)

psychological restoration (Berto and Barbiero, 2017; Gillis and Gatersleben, 2015; Lee et al., 2015; Yin et al., 2018), reduce stress (Browning et al., 2014), increase healing rates (Abdelaal and Soebarto, 2019), enhance positive emotions (Mandasari and Gamal, 2017) and encourage physical activity (Korpela et al., 2017; Wallmann-Sperlich et al., 2019).

Indeed it is a fundamental justification of the role of architect, or lead designer, that they are able to deliver quality in a design that goes beyond technical performance (such as can be delivered by engineers) to address the feelings of the user. By understanding, not just what they need to survive, but what makes them comfortable, not just what make a shelter but what makes a home.

Therefore it is believed by the author that meeting the housing challenge in the context of Bangladesh and its rapid urbanisation requires broadly three things to ensure success: firstly achieving scale (i.e. building sufficient numbers of dwellings); secondly meeting quantitative standards (e.g. durability, sanitation, services, safety ect.); and thirdly meeting qualitative standards (e.g. connection to nature, sensitivity to context, sense of community etc.). Classically today, this task falls to the architect. However, the impossibility of this challenge becomes apparent when we consider that each architect in Bangladesh would need to design for approximately 50,000 people. At least if they personally want to ensure a good standard of design.

While it may conceivably be possible for the architect, (with the help of engineers, contractors etc.) to build for 50,000 people, they will surely not be able to respond to any individual requirements or preferences. One family might prioritise education and want big bedrooms for the kids where they have room to study (at the cost of having a smaller living room). Another might be keen gardners and need a space to propagate seeds. One might love music and need a space that can be soundproofed. These might be considered more qualitative needs, beyond the basic functional necessities. But in order to build sufficient units, the architect will have to focus on standardisation and repetition. They will have to largely ignore qualitative needs.

Alternatively the architect can relinquish design control to the user(s). The extreme scenario of this is the slum, where users must build for themselves and there is no oversight of an architect or, often, any building professional at all. While these dwellings fall far below adequate technical standards and the terrible living conditions in slums must be acknowledged, many slums also posses a strong sense of community and a vitality that may be missing from more formal settlements. Could this be because in slums, while very limited in means, people nevertheless have the freedom to build for themselves? That they therefore have the means to address at least some of their felt, qualitative needs, as well as the basic needs of survival?

Investigating and systematising the qualitative requirements of good housing is a challenging task, since it is a very difficult subject area to study empirically. This is because it is a topic that deals largely with human psychology. Furthermore, the built environment contains a vast number of variables which might have an impact on people's health and wellbeing. Many are hard if not impossible to isolate for the purpose of study. Therefore, while this research will touch upon empirical findings, it will focus on theoretical frameworks as well as non-empirical approaches. It will seek to establish, through assessing the coherence of theoretical arguments on the one hand, and weight of consensus on the other, where the starting points of a systematic and empirical approach to qualitative design of housing may lie. Simultaneously, it will seek to justify through this process, that a systematic approach to achieving qualitative design standards is a necessary part of solving the wider problem of designing housing for the greater number.

3. Research Question

Main Question:

How can we build housing for the many in Sylhet, especially <u>rural-urban migrants</u>, while ensuring <u>technical</u> and <u>qualitative</u> standards?

Sub 3.3 *Sub 3.2* *Sub 3.1*

Sub-Questions:

3.1
What is the right balance between control by the architect and by the end user to allow for building at scale while also ensuring build quality?

3.2
Is there a systematic way to achieve qualitative standards in design, which can be scaled, since relying on the experience and intuition of the architect cannot easily be scaled?

3.3
What can we learn from traditional rural Sylheti practices that might ensure qualitative design standards for housing of rural-urban migrants in Sylhet?



Kampung Kali Cho-de, Yogyakarta, Indonesia. Recipient of the Aga Khan Award for Architecture in 1992. This project involved the upgrading of squatter dwellings and was built by the families who live there themselves. The design process required few drawings and no construction documents.
(Aga Khan Development Network, 2023)

4. Hypothesis

4.1 A form language, such as existed in traditional rural cultures in Sylhet, is needed to achieve housing design at scale while ensuring design quality.

4.2 Form languages allow communities to build for themselves and achieve both high technical and qualitative standards.

They can achieve a high technical standard without formal training, by giving rules and principles that avoid technical mistakes while otherwise allowing freedom of choice. The freedom of choice as well as the way form languages are rooted in the community means they can achieve high qualitative standards as well.

Formally trained professionals can still play a role in this system, but are free to focus on particularly ambitious designs and unusual challenges, they do not need to guide individuals through every step of a design. Furthermore the professional can focus on preserving and evolving the form language itself.

However the knowledge and skills of traditional form languages are being lost as society changes and people migrate from rural to urban areas. This is because the knowledge largely does not exist in explicit, codified, form, but is passed down within the master apprentice tradition and through word of mouth as well as within customs and rituals and local art forms.

4.3 Therefore this knowledge needs to be made explicit so that it can continue to be shared and also, so that it can adapt and incorporate modern materials and techniques.

4.5 The best way to create this new form language for Sylhet is with a pattern language approach, it must be open source and easily accessible, so that the knowledge can be shared and, when necessary, evolved, in a peer-to-peer manner.

4.6 It is not possible for architects to design sufficient quantities of dwellings without sacrificing either technical standards or qualitative standards. Therfore a systems approach is needed.

4.7 Local social and cultural traditions need to be incorporated into a pattern language for Sylhet, to make it a 'good fit' for the context and thereby improve people's sense of belonging and wellbeing in neighbourhoods designed using this language.



Street view showing painted designs
(Aga Khan Development Network, 2023)

5. Goal/Aim

Main Goal:

Goal of the research is to develop a systematic approach to the problem of supplying housing for the greater number in Sylhet.

Research Aims:

To explore theoretical approaches to the problem of housing for the greater number with the aim of synthesising a theoretical framework.

To explore building traditions in Sylhet which have allowed people to build homes for themselves without the need of architects (in particular in the rural traditions to which most people belonged) with the aim of:

1) Preserving this knowledge and making it explicit so that it can be passed on, rather than being lost in the process of modernisation and as part of the rural-urban demographic shift
2) Allowing rural culture and traditions to be translated into the urban context so that it can adapt and incorporate modern techniques

3) To create a building system that empowers people to build for themselves

4) To create a building system that incorporates local social and cultural patterns in order to be a 'good fit' for the people and improve their subjective wellbeing and sense of belonging

6. Literature Review

Part I: Background and Justification
Theoretical Approach

In the 20th century, there was a growing awareness of the challenge facing the architecture profession internationally, in seeking to build for the many people in need of housing.

Notably, it became a topic for discussion at the Team 10 meeting at the Abbaye de Royaumont in France in 1962, as can be traced in the ***Edited Transcript of Congress Tapes Full Version*** (Woods, 1964). Team 10 (a.k.a. Team X) was a visionary grouping of international architects and theorists that inherited the mantle of representing the international modernist movement from the Congrès Internationaux d'Architecture Moderne (CIAM). Indeed, Team 10 were originally younger members of CIAM who had been brought in to rejuvenate the organisation, but who gradually became critical of it to the point that their desire to take over evaporated. Instead they encouraged its dissolution and started a new grouping, under the nickname 'Team 10' that had been coined when they were within CIAM (van den Heuvel & Risselada, 2005).

In fact, as described in ***CIAM IX: discussing the charter of habitat*** (Pedret, 2005) divisions that foreshadowed the eventual split first emerged clearly at the CIAM IX meeting in Aix-en-Provence around its theme of "La Charte de l'Habitat". Older and younger members could not seem to agree on a definition of 'habitat' to the frustration of both groups (Pedret, 2005). In particular the younger members called into question the notion of functional zoning such as represented in the "Four Functions of the City" defined in the Athens Charter as part of CIAM IV (these are: work, dwelling, recreation and transportation). The younger members were also particularly drawn to a presentation by George Candilis and Michel Ecochard of a project in Morocco titled "Habitat for the Greatest Number" by ATBAT-Afrique. This project emphasised understanding the sociological and cultural conditions of the people for whom it was being designed (Pedret, 2005).

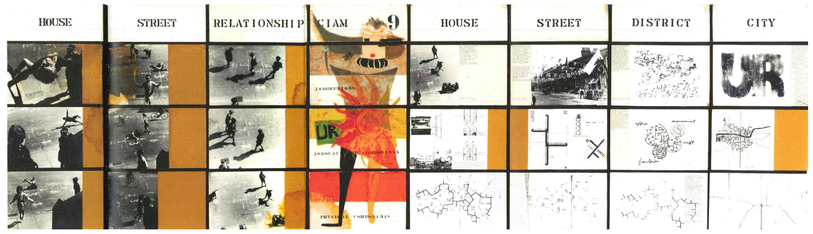
Another project that received widespread interest was the Alexanderpolder project presented by Jaap Bakema for the Dutch CIAM group Opbouw. It was based on the idea of integrating functions, in opposition to the functional zoning approach of earlier CIAM thinking (Pedret, 2005).

Finally, the Smithsons also presented work, which though receiving less attention at the time, was later emphasised by Alison Smithson in her accounts of Team 10 (Pedret, 2005). Their "Urban Re-Identification Grid" sought to abolish the CIAM four functions (originating in the Athens Charter). It was presented in a deliberately provocative manner by emulating the earlier "CIAM Grid" that had been developed out of CIAM V and presented by CIAM VI in 1949 by ASCORAL led by Le Corbusier. It utilised the CIAM four functions to help categorise and compare urban projects (Wannathepsakul, 2020, pp.3-5).

The Doorn Manifesto, written in 1954 is one of the foundational documents of Team 10 (Smithson & Team 10, 1968/1974). Its opening statement reads: "It is useless to consider the house except as part of a community owing to the inter-action of these on each other". This shows the emphasis on dwelling as an interconnected part of the city. It hints at an understanding of dwelling not only as a set of technical/quantitative functions, but also of qualitative functions as an interconnected part of the life of the city. It is a rejection of the purely functional approach, the house as "machine-à-habiter" (or "machine for living in") (Corbusier, 1923). It should be noted that Team 10 remained a loose organisation and can not be considered to have one overarching theory or school of thought (van den Heuvel & Risselada, 2005). Nevertheless the Doorn Manifesto can be considered about as close to a shared statement of intent for Team 10 as was possible for this diverse grouping which also changed significantly over the years.

Eric Mumford argues in ***The Emergence of Mat or Field Buildings*** that Team 10 sought to replace the CIAM function of 'dwelling' with the idea of 'habitat' which was understood as the entire life-world of the dweller rather than just the housing unit (Mumford, 2001).

In the ***Edited Transcript of Congress Tapes Full Version*** (Woods, 1964) of the meeting of Team 10 at the Abbaye de Royaumont in 1962, we see the question of how to build for the many being debated. Firstly, there



The Smithsons "Urban Re-Identification Grid" (above) (Wannathepsakul, 2020, p.5), as opposed to the Ciam Grille (below right) (Wannathepsakul, 2020, p.4), note the figure in the middle: a prehaps tongue-in-cheek reference to Le Corbusier's Modular Man



is significant debate around where the line should be drawn between the architect's right to decide based on technical knowledge and greater building experience, versus the end user who, after all, should be the expert when it comes to how they like to live. There was a feeling among Team 10 members that users would feel happier in an environment that they were able to shape and/or choose themselves. Moreover there was also an awareness that traditional techniques were being lost and in the process, the ability of societies to build for themselves. Aldo van Eyck for instance posed the question: "If society has no form, can architecture build the counterform?" By

This can very much be considered as a discussion around 'qualitative' aspects of dwelling (as the term has been described above) namely: what are the emotional or cultural aspects of housing design, that make people feel happy where they live?

Several of the participants at Royaumont, including Giancarlo de Carlo, José Coderch, Jaap Bakema and Christopher Alexander, made arguments strongly in favour of inhabitants' freedom to choose their environments. Indeed Aldo van Eyck and the Smithsons could be added to their number, though they were more ambivalent about what constituted meaningful choice.

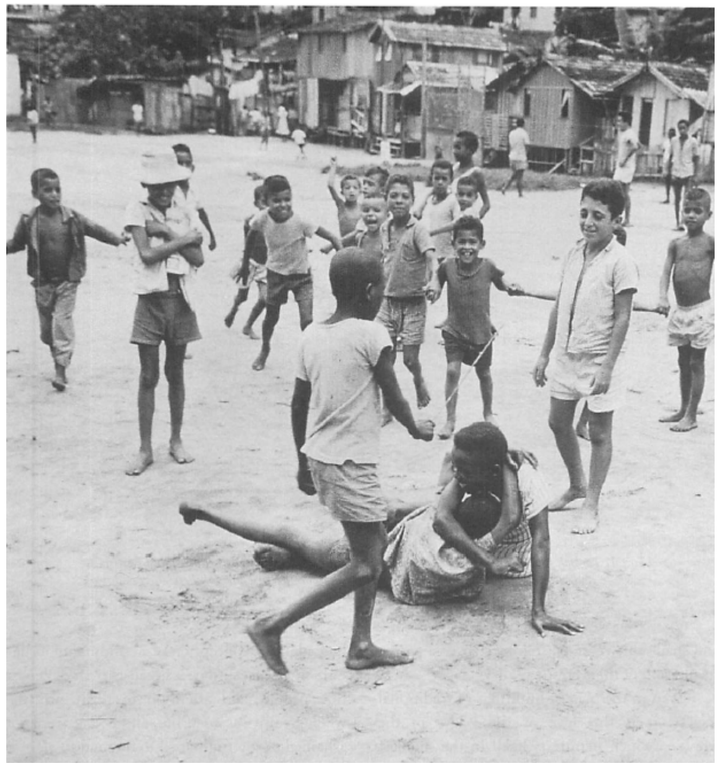
Christopher Alexander, who presented his study for a ***Village for Gujarat, India*** (Alexander, 1962) at Royaumont went on to publish a landmark essay in 1965 titled ***A City is Not a Tree*** (Alexander,1965/2015). It was praised for instance by Charles Jencks and Karl Kropf (Alexander 1965/2015, pp.180-181). The essay may have been in part a response to Aldo van Eyck's presentation at Royaumont in which he makes poetic comparisons between house and city, tree and leaf. This was based on his ***Tree-Leaf Statement*** made in1961, as a visiting Professor at Washington University in St. Louis (van Eyck, 2008). Alexander responded at the time that "[y]ou know damn well that a tree is not a big leaf – that it is useless in that respect to bring the parallel image" (Woods, 1964, p.237). However, the essay does not refer to the Team 10 meeting or directly to ideas presented there. It focuses on a distinction that exists within mathematics between two types of sets known as a 'tree' and a 'semi-lattice'. It explains that mostly when we are dealing with architecture and the city the systems we are dealing with are semi-lattices and not trees. The difference being, essentially, that in a tree elements of the system can not belong to multiple categories (i.e. subsets) of it but in a semi-lattice they can. So for instance, if we consider the street as a system, a traffic light can be considered to belong to both the 'road' and the 'pavement' at the same time because it affects both, therefore the system has a semi-lattice structure.

Building up from this distinction, Alexander explores ways in which a failure to understand the city as a semi-lattice structure causes bad planning, wasted resources and missed opportunities. This essay very strongly criticises the practice of mono functional zoning that was favoured by CIAM because this is a 'tree-like' way of organising the city. A house is not only part of the 'dwelling' function, it is also part of systems of working and recreation, transportation, retail, entertainment etc.. As such while not explicitly referring to Team 10, ***A City is Not a Tree*** provides an important parallel to, and theoretical underpinning of, their thinking.

Both Christopher Alexander and Team 10 were preoccupied with the problem of building for the many in need of housing. Team 10 introduced the theme of "Habitat for the Greater Number" at CIAM X (Deyong, 214, p.226). Christopher Alexander noted at Royaumont the problem that "you can't really serve three thousand million people, because there aren't enough designers" (Woods, 1964, p.36). He felt the only possible answer to the problem was creating "organizational protoypes" by which he did not mean "plastic prototypes" i.e. specific shapes, but general layouts and relationships.

Given the parallels in thought, there was perhaps a great missed opportunity for further collaboration between Christopher Alexander and Team 10, which may have been highly fruitful in the challenge of building for the 'greater number', given the combined building experience and proven capacity to work on a large scale of Team 10 and the methodical, systems oriented approach of Alexander, to find broadly applicable solutions.

The reason why there was no further collaboration may have been partly due to the friction between Alexander and van Eyck and more broadly because Alexander at this point had little built work to his name. Alison



Favela in the hills above Rio de Janeiro. Despite the density of dwellings, the love of children and their life has made it possible to keep this empty space clear so they can enjoy the freedom to play. Thus despite severely limited means, the community have made a sophisticated design decisions, requiring a significant act of organisation and self-coordination, that improve the quality of their collective living environment (subjectively).
Photograph by Ken Hayman (Alexander, 2002, p.176).

Smithson wrote that: “Team 10 are all builders by nature and tend to be nervous – if not suspicious – of those who proceed from one research to another” (Smithson & Team 10, 1975, p.677).

Alexander went on to publish ***A Pattern Language*** in 1977 (Alexander et al., 1977) which fleshed out the ideas of *A Village for Gujarat, India*. It was a hugely influential book dealing with architecture and urban design, becoming an immediate and perennial bestseller. It spawned the ‘design patterns’ movement in the software design, which inspired the technology behind Wikipedia and wikis in general, Apple’s Agile methodology for software development, games such as SimsCity and more.

Rather than identifying specific building forms and arrangements, *A Pattern Language* lists common problems that occur in the built environment and the necessary relationships or ‘patterns’ needed to solve them. For instance how a building should be placed on site to make best use of land, where windows should be placed to ensure good natural lighting, how to shape the volume of a building to make best use of light externally etc.. It also seeks to introduce a hierarchy of patterns, so that at each step of the design process, you know which design problem(s) to focus on and which ones can be solved later. An obvious example might be that the orientation of a building should be decided before the placement of windows in the facade. It bases patterns on felt, psychological, needs of building users, not only basic needs of survival.

Another important document in relation to the topic of housing for the greater number is the ***Habitat Bill of Rights*** which was presented by the Government of Iran at the first United Nations conference on Human Settlement (Habitat I), held in Vancouver 1976. This document attempts to “define the qualitative issues connected with the design of houses and their grouping into new communities as a supplement to other codes and regulations which have attempted to define quantitative issues relating to building” (Ekistiks, 1976, p.302). One of its co-authors was George Candilis, a core member of Team 10. It bears some resemblance to *A Pattern Language* in that it has a list of recommendations to address common problems, specifically of a qualitative nature. For instance: “The interior and exterior layout of new dwellings should incorporate a contemporary reflection of the cultural values and living patterns of the prospective residents”(Ekistiks, 1976, p.303).

This document represents an important step in the international approach to the question of housing for the greater number, focusing perhaps for the first time, exclusively on qualitative aspects of housing. It also represents a link between Team 10 and the emergence of critical regionalism in architectural theory. As described in ***A Return to the Beginnings of Regionalism*** (Mozaffari & Westbrook, 2015), the *Habitat Bill of Rights* emerged out of the earlier Second Iran International Congress of Architects (IICA), held in Iran in 1974 (and attended by George Candilis and Jacob Bakema of Team 10). This congress also called for the construction of exemplary settlements that would serve as models for future housing (Mozaffari & Westbrook, 2015,p.2). The S*hushtar New Town* project by DAZ Architects, was one of the results of this. It was considered exemplary, winning the Aga Khan award, and also labelled as a ‘Critical Regionalist’ project (Mozaffari & Westbrook, 2015, p.6). Both the IICA and UN Habitat I conference (and the *Habitat Bill of Rights* document that emerged from it) are described as “instrumental [...] in shaping the discourse on the notion of regionalism in the design for human habitats” (Sedighi & Varma, 2018). Young Iranian architects sought to resist large-scale housing designed by foreign agencies which ignored local context and to emancipate their country form oil-led Cold War geopolitical interference (Sedighi & Varma, 2018). In the 1970’s Iran also faced a problem of rapid rural urban migration due to modernisation which lead to squatter housing and problems with urban slums (Mozaffari & Westbrook, 2015).

The Habitat Bill of Rights and critical regionalist thinking reflect Team 10 philosophy in their approach to housing for the greater number. They reject ‘naive functionalism’ (Mozaffari & Westbrook, 2015, p.2) and emphasise the need for design to be rooted in cultural and social context (Mozaffari & Westbrook, 2015, pp.2-7, 12). Moreover, there was a concern with giving inhabitants the agency to shape their own environments (Mozaffari & Westbrook, 2015, p.12). In this context, at the congress in Iran, George Candilis referred to the ***Proyecto Experimental De Vivienda (PREVI)*** architecture competition in Lima, Peru.

This competition involved internationally renowned architects, including Team 10 members George Candilis, Alexis Josic, Shadrach Woods and Aldo van Eyck, as well as Christopher Alexander and Charles Correa. Not only was it a high profile, large scale project (a 40 ha site with 1,500 planned dwellings), but the brief stipulated that the design should be modular and expandable (Mateo, 2016), thus allowing for individual adaptation.

Not only does this competition give an opportunity to see the evolved thinking of Team 10 and Christopher Alexander put into practice, but also to trace emerging ideas in critical regionalism. This is moreover significant, because critical regionalism was influential on Indian and Bangladeshi architecture. Architects such as Charles Correa (who took part in the PREVI competition), Raj Rewal, Balkrishna Doshi and Muzharul Islam "sought to overcome the dominance of modernism that they had themselves inherited through their Western education. They began incorporating the ideas of critical regionalism in their works to counter the homogenisation of architecture resulting from modernism" (Sanyam Bahga & Raheja, 2018).

The successes and failures of international modernism are the subject matter of a much wider debate, but it is interesting to note that these influential architects in India and Bagladesh all turned to critical regionalism for possible answers. Might this be further evidence for the importance of qualitative aspects of design, especially when it comes to rooting buildings in their place and cultural context? After all, this is an intuition that seems to have been shared by many experienced and influential architects internationally: from the members of Team 10, to young Iranian architects seeking their own language, to Correa, Rewal, Doshi and Islam investigating critical regionalism, to Christopher Alexander empowering communities to self-build with *A Pattern Language*. Indeed the critique of international modernism as blind to cultural and historical context is embedded in critical regionalism and even Post-Modernism.

While India and Bangladesh embraced many works of modernism, controversy over high profile megaprojects such as the City of Chandigarh also come to mind. It is too broad and complex a subject matter to be dealt with here and critiques of Chandigarh (as well as praises) are many and varied, but a characterisation by historian Ravi Kalia is perhaps enlightening: "Chandigarh was meant to be something beyond a new state capital. But it lacks a culture. It lacks the excitement of Indian streets. It lacks bustling, colorful bazaars. It lacks the noise and din of Lahore. It lacks the intimacy of Delhi. It is a stay-at-home city. It is not Indian. It is the anti-city" (Fitting, 2002, p.75). Would it be that surprising that a city, planned along functional lines with little regard for history and specific cultural context, would end up feeling not wholly of its context? Not truly Indian?

Part II: Application to Context

The above research gives extensive backing and context to the assertion that successful housing for the greater number requires a systematic approach to qualitative as well as quantitative aspects of design. It also suggests that *A Pattern Language* approach may be the best way to tackle this challenge. The final part of the research seeks to identify key social and cultural practices in Bangladesh and Sylheti rural traditions specifically, that would be integral to a pattern language for Sylhet.

Firstly, research in ***Identification of Archetypical Vernacular Architectural Form of Bengal*** (Tabassum, 2019) and ***Architecture Within the Folk Tradition: A Representation from Bangladesh*** (Saif-ul-Haq, 1994) give us a broad overview of traditional architectural practices in Bangladesh. From these comprehensive works, we can trace several architectural forms and practices that have a long tradition in Bangladesh. ***Sustainability and Eco-Adaptability in Vernacular Housing in Bangladesh*** (Fatemi & Islam, 2011) supplements this information, as well as describing the sustainability and suitability of traditional typologies to the local context. These documents highlight how the relationship with water and the large areas of the country that are deltaic and flood prone have shaped architectural practices. Where high land is not available, construction begins with excavating areas around the site to obtain earth to create a mound two to three metres high on which the first homestead or *bari* can be built (Fatemi & Islam, 2011). The excavations are also used to create ponds or canals for agricultural purposes. The *bari* can then incrementally develop into several *ghors* (dwellings and ancilliary structures) to form a hamlet or small village. Thus, a conciousness

of shaping the external or 'negative' space between and around buildings is present in these architectural practices. The relation with water and possibility of flooding gives a very literal and visceral understanding of the ways in which the 'negative' space in and around buildings affects the 'positive' of the buildings themselves. The carving of the 'negative' empty space out of the ground, to create channels and bodies of water in times of flood, helps support and preserve the built-up area of housing.

The treatment of 'negative' space is an important theme in many patterns of *A Pattern Language* and the later work by Christopher Alexander ***The Nature of Order*** (Alexander, 2002), which seeks to elaborate on and deepen the ideas of *A Pattern Language*, while addressing its perceived shortcomings (this will be further explored as part of the theoretical framework). Therefore it is an excellent starting point to investigate the unique patterns and pattern variations that may exist in the Bangladeshi context.

An important feature of traditional Bengali architecture, and a type of 'negative' space, is the Bengali courtyard or *uthan* [উঠান] and its related semi-outdoor spaces such as the *verandah*. Climatically, outdoor and semi-outdoor spaces are useful because during hot and humid times of the year being in a shaded open space where there is a breeze may be more comfortable than indoors. Furthermore, these spaces can serve almost as extra rooms of the house for domestic functions to spill out into, while also serving agricultural functions such as threshing grain and in-between functions such as drying laundry.

Study of built forms and knowledge of building practices, but also the wisdom and attitudes contained within other forms of culture, inform the design of appropriate patterns for Sylhet. For instance, medieval poet and astrologer Khana (also known as Lilavati) handed down in her poetry the *Khanar Bachan* [খনার বচন] (meaning 'khana's words') which contains many practical maxims which still inform agricultural society today, such as:

Duck in the East,
Bamboo in the West,
Banana in the North,
Left empty in the South

[দক্ষনি দুয়ারী স্বর্গ বাস
উত্তর দুয়ারী সবগনাশ
পূর্বগ হাঁস
পক্ষরি্ বাাঁশ
পূর্ব হাঁস, পক্ষরি্ বাাঁশ
উত্তর্র ববর্ (কলা),
দক্ষরি্ বর্ে,
ঘর কর্র্রা বপাতা জুর্ে ।।].

This short proverb contains several good practices for rural architecture in Bangladesh. The pond in the East allows it to heat up quickly with the morning sun and by evaporation help to cool the surroundings, further aided by wind from the southeast (Saif-ul-Haq, 1994, p.64). Bamboo in the West helps to provide evening shade to the home (when the outdoor work is done). A profitable plant like banana can be grown in the North, it is also not too tall and does not obstruct the prevailing south-north winds. The South is left empty or only planted with very low-growing crops such as radish, so that the winds from the South can flow unobstructed and cool the home. This is also a good place for the entrance to the home (Tabassum, 2019, pp.113-114).

This is an example of how a poem or work of art can sometimes be a more direct guide to good local practice, than a study of built form alone, especially before first-hand research is possible. Values and attitudes are often conveyed most clearly in artistic traditions and inform the key priorities of an appropriate (and pattern based) architectural language. The picture of happy rural life can be conveyed with a few words or an image, more quickly than with pages of technical guidelines. For instance Saif-ul-Haq describes this picture in Bangladesh as: "a storehouse full of rice, a pond full of fish, and a house full of relatives" (Saif-ul-Haq, 1994, p.64). This again reveals in a few short words many elements of rural Bangladeshi culture. The importance of water in agriculture, the staple food (rice), the emphasis on intergenerational living, the need for self-sufficiency and forward planning, etc..

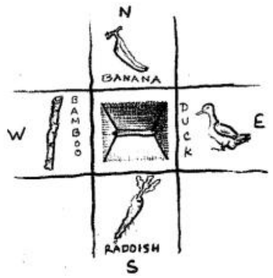
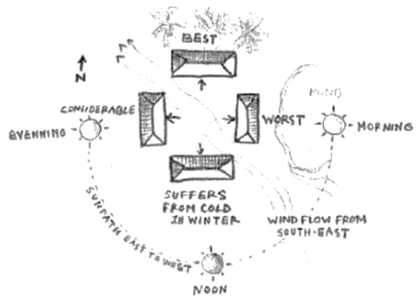
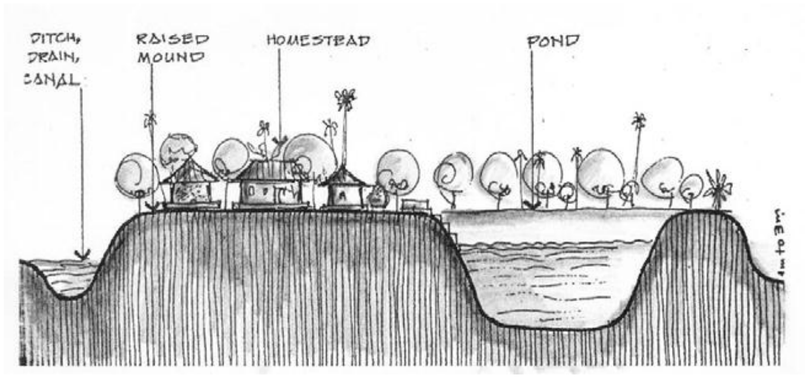


Diagram of the Khana poem layout
(Tabassum, 2019, p.113)



Entries from for directions according to another Khana maxim (Tabassum, 2019, p.114)



Rural settlement characteristics and built form
(Tabassum, 2019, p.116)

7. Theoretical Framework

The theoretical framework aims towards a systematic approach for providing housing for the greater number in Sylhet. It seeks in particular to translate the traditional practices of rural architecture in Bangladesh, where communities were able to build for themselves into increasingly more urban settings, to reflect the large rural-urban migration pattern of recent years and the remarkable demographic change form a 95% rural population in 1960 to 60% today (World Bank, 2018).

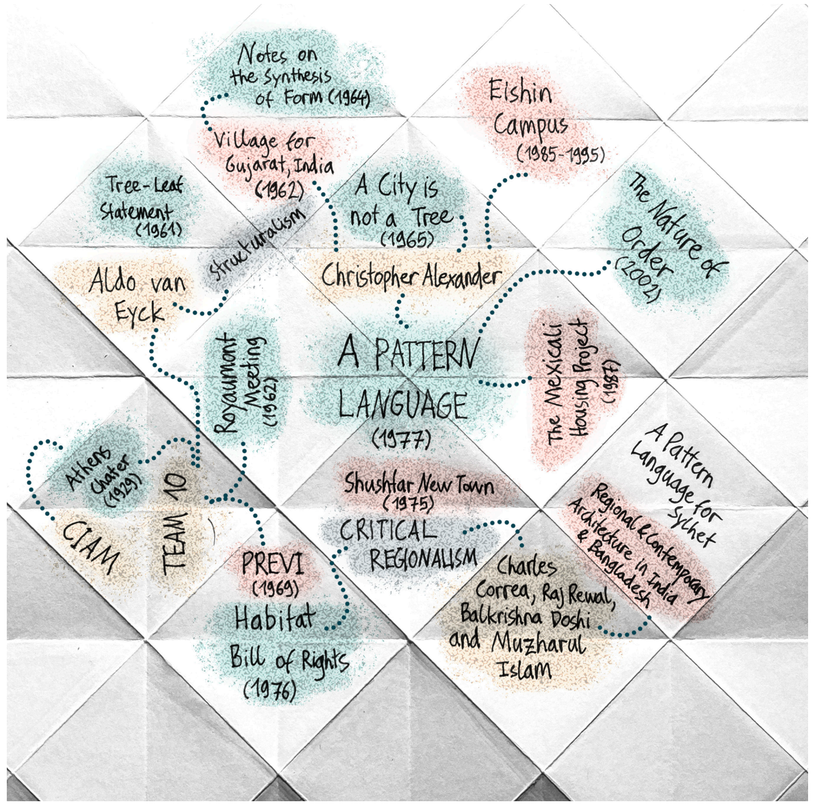
The key component of the theoretical framework is the pattern language approach. This has been justified above as one of the few or perhaps only approaches with the potential to facilitate construction on a massive scale without sacrificing either technical quality or 'subjective' ('qualitative') quality. It has also been justified as both influential in and of itself and as sharing key commonalities with the thinking of other influential architects (e.g. van Eyck and Correa), groupings (e.g. Team 10), and even movements (e.g. critical regionalism).

To further clarify the theoretical framework approach, the core methodology of the pattern language approach will be explored. Following this, the early critique from Team 10, especially Aldo van Eyck needs to be revisited. Finally, the perceived shortcomings of *A Pattern Language* by Christopher Alexander himself are addressed and the proposed course corrections in *The Nature of Order* briefly elaborated. One particular principle, of the treatment of 'negative' space, as described in multiple patterns of *A Pattern Language* and consolidated in *The Nature of Order* will be highlighted. This will then serve as a useful thematic and specific entry point into exploring what a pattern language for Sylhet could look like, which is an undertaking that in its full scope is beyond this research.

In Alexander's study *Village for Gujarat, India*, which he presented at Royaumont, he begins by talking about components (or elements) that make up a building system. He points out that most often it is the relationship between elements, more than the elements themselves, that determine the behaviour of the system. He gives the example of graphite and diamond: the difference is "very largely caused by the difference in the structure of their component building blocks. Both are pure carbon; but in the case of diamond, where the carbon atoms are arranged to form tetrahedral components, the ensuing structure is hard and brilliant, while in the case of graphite, where the atoms are arranged to form flat plate-like components, the resulting substance is soft and black and slippery" (Alexander, 1962, p.84). The city can be thought of in a similar way, each component of a city "is really a collection of smaller elements, and [...] each gets its character from the way these smaller elements are grouped. A house is a collection of bricks and heaters and doors and so on, grouped in such a way, and with the divisions between groups, and the relations between different groups arranged in such a way that we call the thing a house. If the bricks are arranged differently we get a wall; if less homogeneously, we get a pile of rubble, or a path" (Alexander, 1962, p.84).

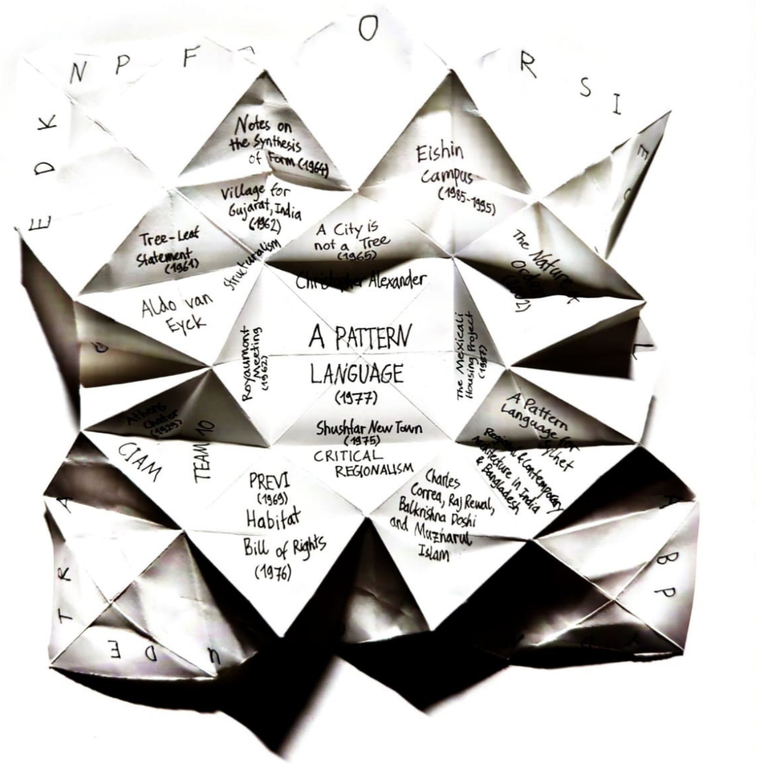
Next Alexander establishes that a city is a living system, meaning that it is an assemblage of components that is being changed and added to all the time (Alexander, 1962, p.85). Therefore the form of a city cannot be static, as it can be for a designed object such as a chair, because its needs and patterns of use are continually changing and the life-span of a city is much longer than "any one pattern of needs" (Alexander, 1962, p.85). This is a potential failing of cities like Brasilia and Chandigarh which were planned largely to meet a static pattern of needs (Alexander, 1962, p.85). Chandigarh, for instance, was originally intended to house half a million people, with capacity up to a million, but now accommodates more than a million even excluding satellite towns outside of the Union Territory (Fitting, 2002, p.75). Many of the civic buildings have been given over to private uses which were never intended (Sisson, 2017). Furthermore the split of the state of Haryana from Punjab in 1966 means that Chandigarh is now the joint capital of both. As a result Chandigarh Palace of Assembly, a showpiece of LeCorbusier's master plan, designed as a bicameral legislature, now houses a separate legislature in each chamber (Fitting, 2002, p.75). The Punjab reorganisation has had several other knock-on impacts.

Therefore, according to Alexander, in order for a city to be able to grow and adapt naturally, the problem for designers is "really to establish a kit of components out of which such a growing, ever-changing aggregate



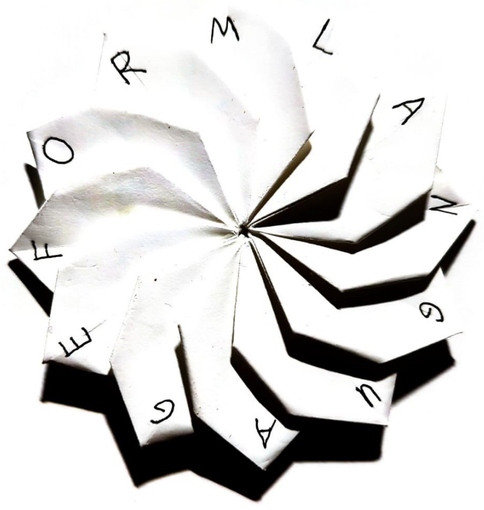


Creating the theoretical framework begins with reading as much relevant material as possible and absorbing many theories and ideas. However at this stage there are many ideas but no clear structure yet, as symbolised by the jumble of letters around the edge of the framework diagram.



As you begin to evaluate theories a tentative structure takes shape, some ideas are discarded ans some are kept, as symbolised by some text disappearing into shadow or out of sight.





As you begin to restructure more drastically to achieve clarity, you may end up leaving out too much or losing your way, however this is part of the process of reaching the essence of an idea.

Eventually, if you trust the process, you can arrive at a useful framework, the ideas that are superfluous to your approach or did not stand up to scrutiny are discarded. As we can see above the letters that only created an incoherent jumble have been folded out of sight and a clear concept remains. The above sequences also highlight the power of a generative approach. While the folding can progress step by step at relative ease, a full geometric description in one single step would be very complicated.

can be built up" (Alexander, 1962, p.86). This requires firstly, that new components of the system can be added to deal with new requirements, without compromising the existing and working parts of the system. Secondly, that components can be modified or replaced, without similar knock-on impacts. Essentially, the system must be adaptable.

Consider this scenario: a new type of electrical cable is invented with better capacity or high-speed internet capability. If the city relies on overhead cabling, installing this new cable type could be quite easy: trucks with cherry pickers could allow electricians to add the new cabling to the network. If the soil is easy to dig and there are no rocks or obstructions from other systems such as water pipes, replacing underground cabling could also be quite quick and cost effective. If not this could be quite difficult.

What if a new kind of centrally distributed piped heat becomes available (Alexander, 1962, p.87)? "With the city organised as is today, it would be impossible to install this new piped heat in existing neighborhoods, because of all the roads and gardens which would have to be dug up" (Alexander, 1962, p.87). Therefore the first task of designing an adaptive system is to understand the various needs, or functions, it serves and how they are interrelated. Then you can separate out the functions that are interconnected with each other from those which are (reasonably) independent of each other. Only after this analysis is it possible to design components which can address certain functions in a targeted way without compromising others. 'Dwelling' as one of the four functions of the city defined by CIAM in the Athens Charter in 1929 does not meet these requirements – it is not a truly independent function. For instance, most people watch TV in their homes, how then is 'dwelling' truly independent from 'recreation'? The popularity of ring roads in major cities, helping dense traffic to circumvent dense urban areas while improving connectivity, also suggests that work and transportation cannot really be treated as separate functions that do not interact (Alexander, 1962, p.86).

Thus the process in Alexander's Indian village study was first to identify a comprehensive list of needs of the villagers, requirements of any kind, which have a bearing on the physical shape of the village. These were gathered by surveying the villagers needs; assessing both national and local economic goals and social goals (for example removing the stigma around untouchability); and studying which needs were already met in the existing village (which villagers may have forgotten to mention). Finally, each pair of requirements in the list needs to be examined to determine if they are functionally linked, such that addressing one requirement positively or negatively affects the other, or if there is no interaction. Finally, a computational analysis can be performed on the list of requirements with interdependencies to determine which groupings of requirements are most strongly interdependent, while being maximally independent from other groupings. This analysis was performed on the IBM 7090 computer which was cutting edge at the time. The full list of requirements will be reproduced here (see right) because the list, for a rural setting in Gujarat in India, will likely have some overlap with the Bangladeshi context and can serve as precedent for surveying rural-urban migrants in Sylhet on their dwelling needs.

This is the core theory underlying the later development of *A Pattern Language* and describes the methodology needed to initiate the creation of an explicit (and specific) pattern language for Sylhet. Nevertheless, the shortcomings of this approach must also be examined, not least because Alexander himself came to view *A Pattern Language* as somewhat of a failure.

The critique from the Team 10 perspective came, on the one hand, from the lack of built work at the time by which to assess Alexander's approach (as mentioned). The other critique came primarily from Aldo van Eyck. Alexander and van Eyck criticised each other's approaches at Royaumont and van Eyck later responded to his essay in the ***Team 10 Primer*** (Smithson & Team 10, 1968/1974), dismissing the mathematical argument as "neither a valid negation or valuable affirmation of the truth in mathematic terms" (Smithson & Team 10, 1968/1974, p.98). Van Eyck's poetic approach at the time aimed at challenging the (apparent) rationalism of international modernism. Van Eyck seems to have seen in Alexander's mathematical arguments from set theory and reliance on computational analysis an overly rigid and rationalist approach, such Team 10 were positioning themselves against. He was concerned with

Religion and Caste
1.Harijans regarded as ritually impure, untouchable, etc.
2. Proper disposal of dead.
3. Rules about house door not facing south.
4. Certain water and certain trees are thought of as sacred.
5. Provision for festivals and religious meetings.
6. Wish for temples.
7. Cattle treated as sacred and vegetarian attitude.
8. Members of castes maintain their caste profession as far as possible.
9. Members of one caste like to be together and separate from others, and will not eat or drink together with them.
10. Need for elaborate weddings.

Social Forces
11. Marriage is to person from another village.
12. Extended family is in one house.
13. Family solidarity and neighborliness even after separation.
14. Economic integration of village on payment in kind basis.
15. Modern move towards payment in cash.
16. Women's gossip extensively while bathing, fetching water, on way to field latrines, etc.
17. Village has fixed men's social groups.
18. Need to divide land among sons of successive generations.
19. People want to own land personally.
20. People of different factions prefer to have no contact.
21. Eradication of untouchability.
22. Abolition of Zamindari and uneven land distribution.
23. Men's groups chatting, smoking, even late at night.
24. Place for village events- dancing, plays, singing, wrestling.
25. Assistance for physically handicapped, aged, widows.
26. Sentimental system : wish not to destroy old way of life. Love of present habits governing bathing, food, etc.
27. Family is authoritarian.
28. Proper boundaries of ownership and maintenance responsibility.
29. Provision for daily bath, segregated by sex, caste and age.

Agriculture
30. Efficient and rapid distribution of seeds, fertilizer, etc., from block HQ.
31. Efficient distribution of fertilizer, manure, seed, from village storage to fields.
32. Reclamation and use of uncultivated land.
33. Fertile land to be used to best advantage.
34. Full collection of natural manure (animal and human).
35. Protection of crops from insects, weeds, disease.
36. Protection of crops from thieves, cattle, goats, monkeys, etc.
37. Provision of storage for distributing and marketing crops.
38. Provision of threshing floor and its protection from marauders.
39. Best cotton and cash crop.
40. Best food grain crop.
41. Good vegetable crop.
42. Efficient ploughing, weeding, harvesting, levelling.
43. Consolidation of land.
44. Crops must be brought home from fields.
45. Development of horticulture.
46. Respect for traditional agricultural practices.
47. Need for new implements when old ones are damaged, etc.
48. Scarcity of land.
49. Cooperative farming.

Animal Husbandry
50. Protected storage of fodder.
51. Improve quality of fodder available.
52. Improve quantity of fodder available.
53. Upgrading of cattle.
54. Provision for feeding cattle.
55. Cattle access to water.
56. Sheltered accommodation for cattle (sleeping, milking, feeding).
57. Protection of cattle from disease.
58. Development of other animal industry.
59. Efficient use and marketing of dairy products.
60. Minimize the use of animal traction to take pressure off shortage of animals.

Employment
61. Sufficient fluid employment for laborers temporarily (seasonally) out of work.
62. Provision of cottage industry and artisan workshops and training.
63. Development of village industry.
64. Simplify the mobility of labor, to and from villages, and to and from fields and industries and houses.
65. Diversification of village's economic base-not all occupations agricultural.
66. Efficient provision and use of power.

Water
67. Drinking water to be good, sweet.
68. Easy access to drinking water.
69. Fullest possible irrigation benefit derived from available water.
70. Full collection of underground water for irrigation.
71. Full collection of monsoon water for use.
72. Prevent famine if monsoon fails.
73. Conservation of water resources for future.
74. Maintenance of irrigation facilities.
75. Drainage of land to prevent waterlogging, etc.
76. Flood,control to protect houses, roads, etc.

emphasising the ability of forms and images to carry "multi-meaning" (Woods, 1964, p.218) and rejecting binary opposites as existing in isolation from each other (e.g. inside/outside, large/small, many/few), but rather as giving meaning to each other (this view was likely inherited from Sigfried Giedieon (Deyong, 2014, p.235)).

In reality, a large part of Christopher Alexander's arguments actually supported van Eyck's positioning and vice versa. However neither seemed to appreciate this, perhaps because they were approaching similar conclusions from opposite directions. Van Eyck, proceeding from artistic appreciation of design to critique the overly simplistic "one-sided rationalism" of CIAM (Deyong, 2014, p.227). Alexander proceeded from rational, mathematical arguments, towards a similar critique of CIAM functional zoning in which he saw "the mania every simple-minded person has for putting things with the same name into the same basket" (Alexander, 2017, p.36). The key conclusion from *A City is Not a Tree* emphasises the fact that the constituent parts of the city can belong to multiple systems at once. A street is simultaneously as space for circulation, the access to houses, a means of bringing light and air to buildings, a place to run services and to drain excess water during rainstorms, a place of communication between neighbours, etc.. This is essentially the same argument van Eyck makes when he stresses that forms can carry 'multi-meaning' and without this understanding we will not be able to design successfully. When Alexander rejected the multi-meaning of his tree/leaf image he said: "As long as he [Alexander] doesn't know that [a tree is a leaf] he won't be able to make a house – he won't even be able to make a chair, and he won't know how to sit on it. I'm sorry for you. The poetic reality that you do [sic] is discarded if you think a tree is not a leaf" (Woods, 1964, p.237).

Perhaps van Eyck's poetic comparisons were too inaccessible to the uninitiated. Architectural historian and theorist Dirk van den Heuvel suggests that they can be understood in the 'ludic tradition', involving poetic riddle-making that can only be answered with equally poetic formulations (van den Heuvel, 2006, p.98). The same might be said of Alexander's mathematical arguments, which in front a group of mostly actively practicing architects like Team 10, may have been unconvincing without real buildings to show the theory in practice.

As Alexander's career progressed he came to increasingly emphasise what can be considered the poetic side of the design process. While he felt that *A Pattern Language* could be enlightening for readers, it had not "really put generative power in people's hands" as he had hoped. This was because while it had given people a useful kit of patterns with which to build and solve problems, the way these patterns need to be combined to create truly successful design was "very rudimentary" (Hopkins, 2010). It required a more artistic, or poetic understanding, to do this. While there is a brief passage titled "The Poetry of the Language" (Alexander et al., 1977, pp.41-44) in the book, about this process, it was to be greatly elaborated in *The Nature of Order*.

The Nature of Order is a truly extensive work comprising more than two thousand pages and split into four volumes: *The Phenomenon of Life*, *The Process of Creating Life*, *A Vision of a Living World* and *The Luminous Ground*. It covers a vast range of subject matter touching on almost all aspects of design in the built environment, from the city scale to the design of interiors; it studies examples ranging from cathedrals, to paintings, from bridges, to molluscs. Christopher Alexander regarded this as his magnum opus, he felt that writing this book was "in a way" something he had "spent his whole life doing" (Kohn, 2002). While it still builds upon rational argument and rigorous empirical research, it is a much more philosophical and spiritual work than earlier publications.

It emphasises in particular, that in order for design to be well adapted to its environment, it must be understood as a process, rather than a static form. "Architects are much too concerned with the design of the world (its static structure), and not yet concerned enough with the design of the generative processes that create the world (its dynamic structure)" (Alexander, 2002, p.4). So for instance the idea that an architect can make a set of drawings for a building design and these can be used as the template for construction, without further changes, is flawed. In reality there are always unforeseen hurdles and opportunities that arise, and without an adaptive design process, mistakes will inevitably be made. Maybe the designer only realises when they are on site and the rooms are laid out on

Material Welfare
77. Village and individual houses must be protected from fire.
78. Shade for sitting and walking.
79. Provision of cool breeze.
80. Security for cattle.
81. Security for women and children.
82. Provision for children to play (under supervision).
83. In summer people sleep in open.
84. Accommodation for panchayat records, meetings, etc.
85. Everyone's accommodation for sitting and sleeping should be protected from rain.
86. No overcrowding.
87. Safe storage of goods.
88. Place to wash and dry clothes.
89. Provision of goods, for sale.
90. Better provision for preparing meals.
91. Provision and storage of fuel.
92. House has to be cleaned, washed, drained.
93. Lighting.

Transportation
94. Provision for animal traffic.
95. Access to bus as near as possible.
96. Access to railway station.
97. Minimize transportation costs for bulk produce (grain, potatoes, etc.).
98. Daily produce requires cheap and constant (Monsoon) access to market.
99. Industry requires strong transportation support.
100. Bicycle age in every village by 1965.
101. Pedestrian traffic within village.
102. Accommodation for processions.
103. Bullock cart access to house for bulk of grain, fodder.

Forests and Soils
104. Plant ecology to be kept healthy.
105. Insufficient forest land.
106. Young trees need protection from goats, etc.
107. Soil conservation.
108. Road and dwelling erosion.
109. Reclamation of eroded land, gullies, etc.
110. Prevent land erosion.

Education
111. Provision for primary education.
112. Access to a secondary school.
13. Good attendance in school. ,,
114. Development of women's independent activities.
115. Opportunity for youth activities.
116. Improvement of adult literacy.
117. Spread of information about birth control, disease, etc.
118. Demonstration projects which spread by example.
119. Efficient use of school; no distraction of students.

Health
120. Curative measures for disease available to villagers.
121. Facilities for birth, pre- and post-natal care (birth control).
122. Disposal of human excreta.
123. Prevent breeding germs and disease starters.
124. Prevent spread of human disease by carriers, infection, contagion.
152. Prevent malnutrition.

Implementation
126. Close contact with village level worker.
127. Contact with block development officer and extension officers.
128. Price assurance for crops.
129. Factions refuse to cooperate or agree.
130. Need for increased incentives and aspirations.
131. Panchayat must have more power and respect.
132. Need to develop projects which benefit from government subsidies.

Regional, Political and National Development
133. Social integration with neighboring villages.
134. Wish to keep up with achievements of neighboring villages.
135. Spread of official information about taxes, elections, etc.
136. Accommodation of wandering caste groups, incoming labor, etc.
137. Radio communication.
138. Achieve economic independence so as not to strain national transportation and resources.
139. Proper connection with bridges, roads, hospitals, schools proposed at the district level.
140. Develop rural community spirit: Destroy selfishness, isolationism.
141. Prevent migration of young people and harijans to cities.

*NB: The list headings are for clarity and do not represent functional groupings

the ground that there is a particularly nice view from a certain standpoint in one of the rooms and a window should be placed to frame it; maybe after construction the clients want to extend the property; maybe the ground conditions on site are not as predicted; etc.. The books, in particular book two *The Process of Creating Life* seek to define how a design process can be adaptive and generative rather than descriptive and static.

While the full argumentation cannot be easily summarised a description by the developmental biologist Lewis Wolpert, which is quoted by Alexander in book two (Alexander, 2002, p.176) gives a useful insight into the difference between the descriptive process and the generative process:

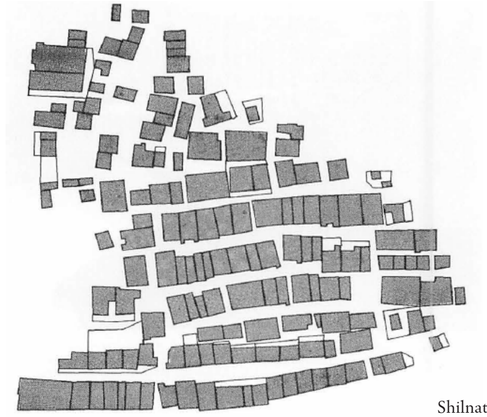
"All the information for embryonic development is contained within a fertilized egg. So how is this information interpreted to give rise to an embryo? One possibility is that the structure of the organism is somehow encoded as a descriptive program in the genome. Does the DNA contain a full description of the organism to which it will give rise? The answer is no. The genome contains instead a program of instructions for making the organism — a generative program — in which the cytoplasmic constituents of eggs and cells are essential players along with the genes like the DNA coding for the sequence of amino acids in a protein. A descriptive program, like a blueprint or a plan, describes an object in some detail, whereas a generative program describes how to make an object. For the same object the programs are very different. Consider origami, the art of paper folding. By folding a piece of paper in various directions, it is quite easy to make a paper hat or a bird from a single sheet. To describe in any detail the final form of the paper with the complex relationships between its parts is really very difficult, and not of much help in explaining how to achieve it. Much more useful and easier to formulate are instructions on how to fold the paper. The reason for this is that simple instructions about folding have complex spatial consequences. In development, gene action similarly sets in motion a sequence of events that can bring about profound changes in the embryo. One can thus think of the genetic information in the fertilized egg as equivalent to the folding instructions in origami: both contain a generative program for making a particular structure" (Wolpert et al., 1998, p.21).

Book one, *The Phenomenon of Life* also defines 'Fifteen Fundamental Properties' which govern successful design. They are somewhat like patterns but more abstracted and can occur in the built environment or in nature. They simultaneously are properties we can recognise in static forms and ways in which forms can be transformed in an adaptive manner. The properties are:

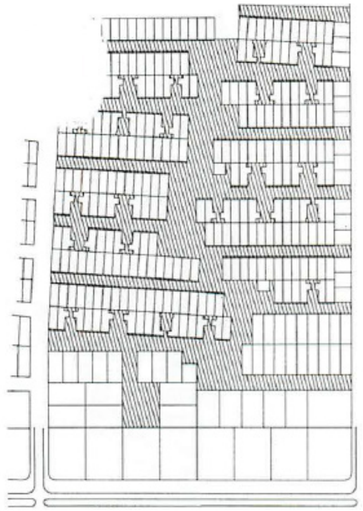
1. Levels of scale
2. Strong centers
3. Thick boundaries
4. Alternating repetition
5. Positive space
6. Good shape
7. Local symmetries
8. Deep interlock and ambiguity
9. Contrast
10. Gradients
11. Roughness
12. Echoes
13. The void
14. Simplicity and inner calm
15. Not-separateness

Among these 'positive space' will be described in detail to give insight into the nature of these properties and as a thematic 'guiding thread' which can be used to proceed into the analysis of building practices in the Sylheti context.

The definition of 'positive space' in an Alexandrian sense relies on a reappraisal of the concept of 'negative space' as understood in the wider architectural discourse. Generally, positive and negative space are most simply understood as solid and void in the built environment. For instance, in a city plan, all buildings and solid constructions could be considered as positive space and all the empty spaces in between buildings such as streets and public squares as negative space. In a figure-ground drawing this is represented by shading all positive space black and all negative space white. Framing the built environment in terms of positive and negative space helps to draw our focus and attention to the fact that whenever we shape buildings we also shape the empty space around (or inside) them. In theory it should help designers understand that it is important to pay attention to both. However, the very terminology of 'positive' and 'negative' while it should be clear in this



Shilnath Camp (Alexander, 2002, p. 182)



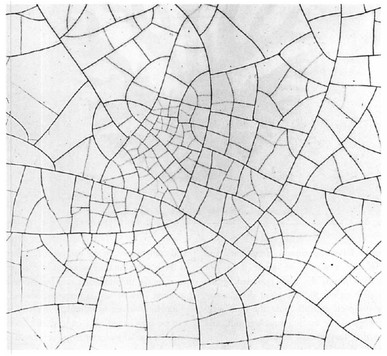
Designed by B.V. Doshi, Vatsu Shilpa, and built in Indore around 1989 (Alexander, 2002, p. 182)

Plans showing a difference between a settlement that has grown stepwise over time by a generative process (above), exhibiting lots of positive space; and one that has been planned in one go (below), that has less positive space.

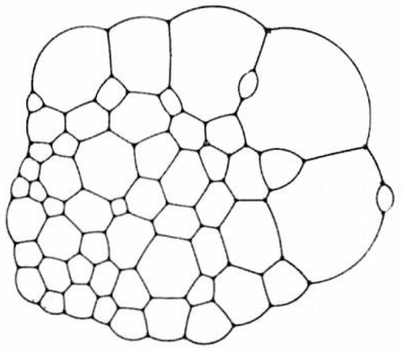
context that they have nothing to do with 'good' and 'bad', nevertheless may carry this subtle connotation in some people's minds. Furthermore, it implies that these two entities are fundamentally opposite and may be at risk of cancelling each other out as do positive and negative electric charges. It may also suggest a hierarchy where positive comes first and negative comes second, such that you focus on designing a building first and check whether the space around it is successful afterwards. Finally, it gives no actual direction as to what constitutes 'good' positive and negative shape.

Christopher Alexander elaborates on this theory by proposing firstly, that the negative space in between buildings is as important and sometimes more important than the positive shape of the buildings themselves. Secondly, that consideration of the negative space in urban planning often needs to come first. Thirdly, he makes clear that positive and negative space when carefully designed can complement and enhance one another, and are therefore not opposite in the sense of somehow being antagonistic. Finally he proposes principles to define what constitutes 'good' shape when it comes to positive and negative space. In particular: a) that the shape is roughly convex or itself made up of convex shapes b) that it is neither completely closed off nor open to its surroundings c) that the figure ground diagram should be interchangeable - it should be possible to imagine the solid as void and vice versa. He also does away with the term 'negative' altogether, to make it clear that both are equally important, proposing that 'positive space' can refer to either solid or void, so long as they have 'good' shape, according to the principles laid out.

While the concept of positive space is given only specific application in *A Pattern Language* in patterns such as 'Positive Outdoor Space' (Alexander et al., 1977, pp.517-523) which deals with the shape of space between buildings, in *The Nature of Order* it is broadened to a general design principle which can describe the design of outdoor space, the shaping of buildings, of interior spaces, even the principle by which bubbles cluster together, as each bubble presses outward, the equilibrium they reach creates positive shape.

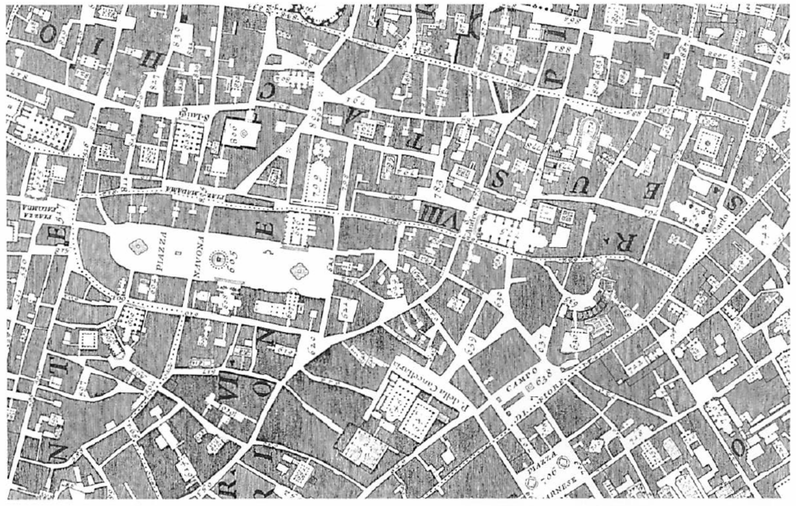


Crazing in a porcelain glaze: the way it works, the areas enclosed by cracks are always positive (Alexander, 2002, p. 261)



Soap bubbles and the positive nature of space they form (Alexander, 2002, p. 262)

Extract of the Nolli Plan of Rome by Giambattista Nolli, 1748 (Alexander, 2002, p. 173)



8. Methodology

The initial phase of research is to be conducted before visiting Bangladesh without access to first hand source material.

8.1 Establish a theoretical framework by precedent research

Study books, papers and other written materials on the topic of 'housing for the greater number'. Explore the historical development of ideas and identify strengths and weaknesses of different theories by comparative analysis and reading critiques. Evaluate case study projects to determine the success or failure of underlying theory.

8.2 Research architectural traditions in Bangladesh, particularly in the rural context

Study books, papers and other written materials on the topic of Bangladeshi vernacular architecture. This can include study of poetry and other artistic traditions that have shaped cultural and building practices and can involve analysis of photographic evidence, the drawing of diagrams to illustrate findings from written sources, analysis of social practices such as *purdah* and bathing rituals in the *Ghat* etc.

8.3 Compile questions in preparation of surveying locals in Bangladesh

Study precedent patterns from *A Pattern Language*, *Village for Gujarat, India*, and *The Production of Houses*. Consult contacts with first-hand experience of living in Bangladesh. Research in advance economic and social goals that will form part of the list of requirements for dwelling in the Sylheti context.

The second phase occurs on location.

8.4 Gather first-hand photographic evidence

Take as many pictures as possible of dwellings, exterior and interior (with permission). These can be analysed to obtain the implicit dwelling requirements of the inhabitants which may not be mentioned (see *Village for Gujarat, India)*

8.5 Conduct survey of locals

With the aim of obtaining a list of requirements for dwelling in rural and semi-urban contexts. Also to gain general insight into cultural and social attitudes. Include survey questions about material expression and preferences, since research indicates that traditional materials and techniques sometimes face prejudicial associations with poverty compared to modern materials. Also seek to establish where possible, interdependencies of different requirements in advance.

Final phase on return to The Netherlands.

8.6 Synthesise survey findings

Create a list of all requirements that have been identified, explicit, implicit and socially/economically driven. Establish interdependencies. Perform a computational analysis to find groupings. Use this as a basis for proposed patterns for the Sylheti context.

8.7 Produce example diagrams and drawings

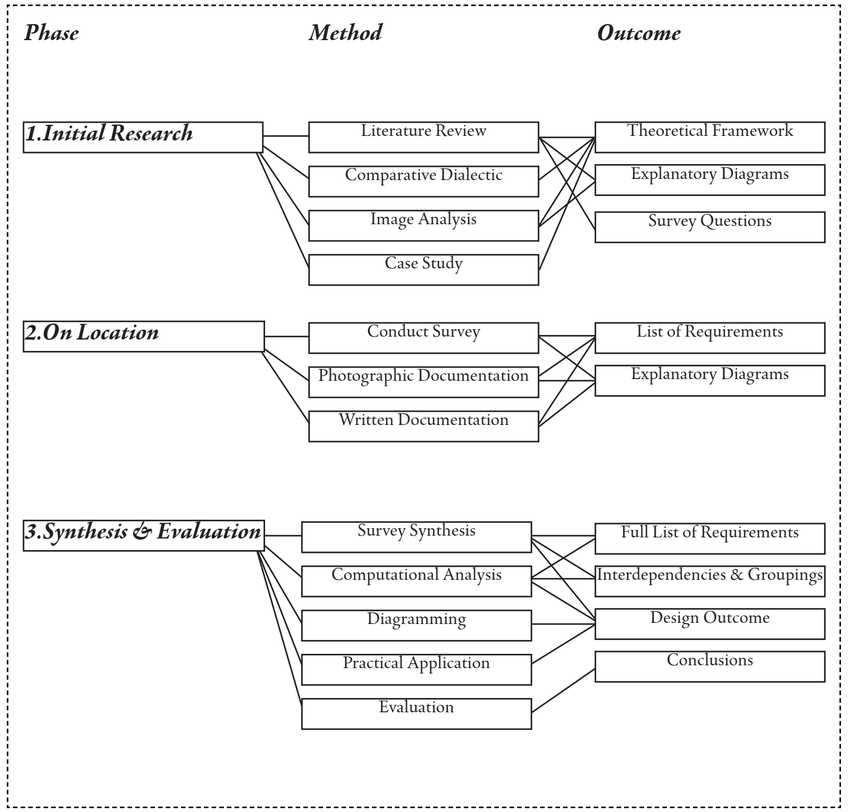
Having synthesised a set of patterns for Sylhet, format organise and illustrate them in a pattern language structure. Combine these where necessary with existing patterns to create a sufficient 'language' to construct a model of a sample dwelling.

8.9 Use this proto pattern language to inform the studio design project

Base design decisions and built forms on findings from the research. Inform the application of the patterns with principles for *The Nature of Order*.

8.10 Critical appraisal

Evaluate the successes and failures of the research.



9. Relevance

Generative processes tell us what to **do**, *what* **actions** *to take, step by step, to make buildings and building designs unfold beautifully, rather than detailed drawings which tell us what the* **end***-result is supposed to be.*

This idea, obvious to biologists, is not yet obvious to architects nor to most people in our society overwhelmed by 20th-century ideas of architecture.

- Christopher Alexander (Alexander, 2002, p.176)

While there is a growing awareness in many science disciplines that complex phenomena can be more easily understood as dynamic processes rather than static structures, this awareness is still uncommon in the architectural discourse.

However the complexity of the city and its dynamic processes mean that without this understanding design mistakes will inevitably be made.

Not only is it time for a more widespread understanding of the benefits of process oriented design thinking, but this may also be the only way to truly tackle the immense challenge of building on a huge scale that is faced by building professionals around the globe as populations grow and countries undergo rapid urbanisation.

A pattern language approach has the potential to form the basis of a successful generative design system that will facilitate the process of building dwellings on a large scale.

Furthermore it is democratic, as it is a process that can and should be made accessible to everyone. Similar to pattern-based technologies such as Wikipedia which acts as global repository of knowledge and can (in principle) be accessed, contributed to and edited by anyone with a working internet connection. The Peer-to-peer system allows for this and also ensures self-organised error correction. A pattern language system for Sylhet could ultimately be conceived of in the same way.

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Project Research



Figure 3

Number of architects/k population compared with number of architecture schools/M population.

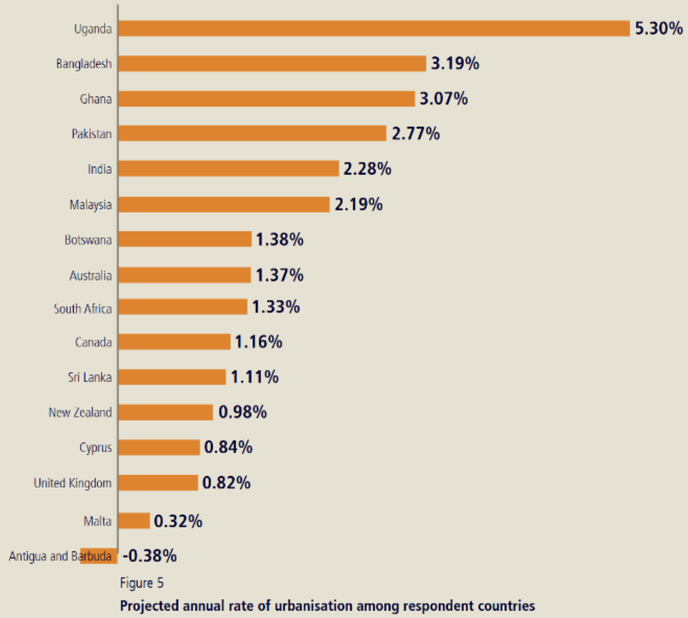


Figure 5

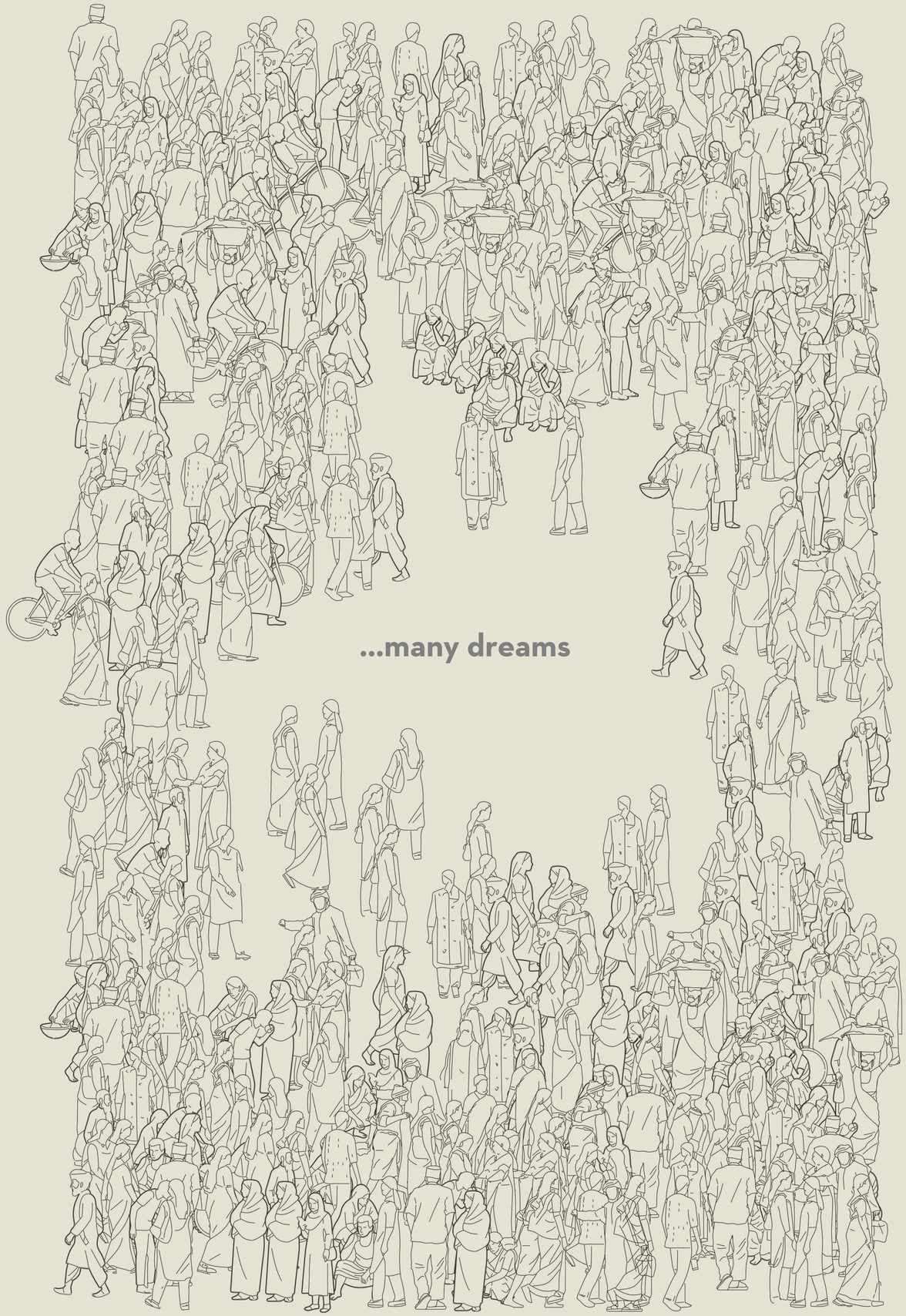
Projected annual rate of urbanisation among respondent countries

1 architect per 50,000 population





Many people...



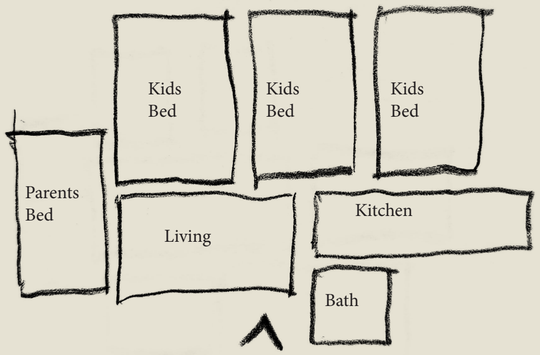
...many dreams

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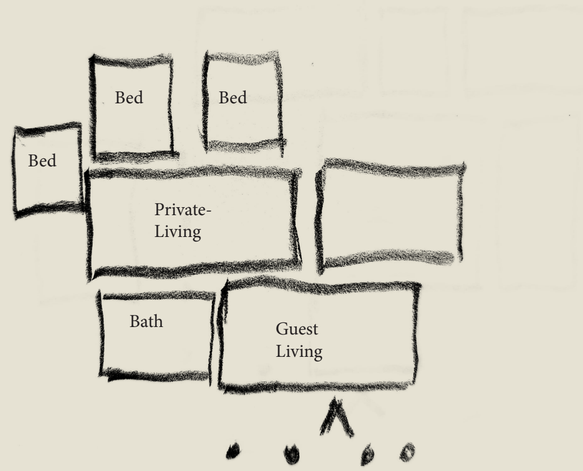
Children



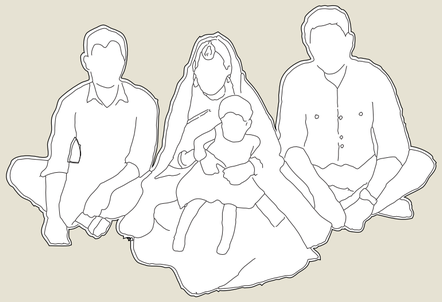


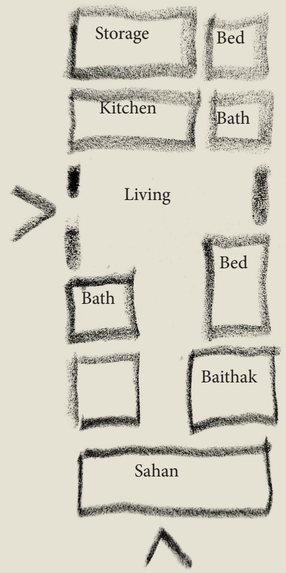
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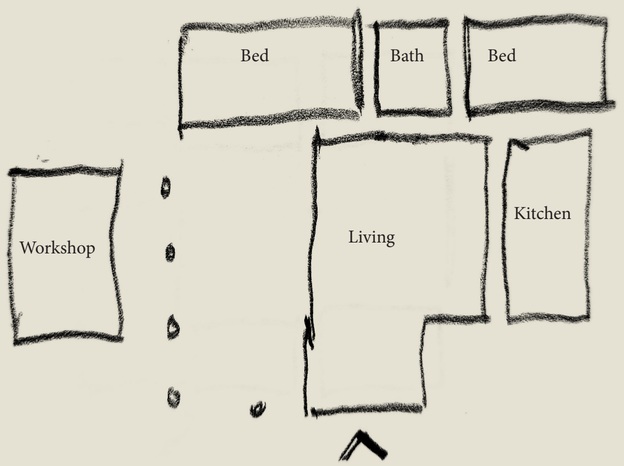
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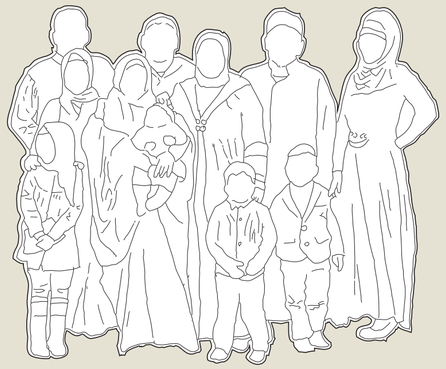


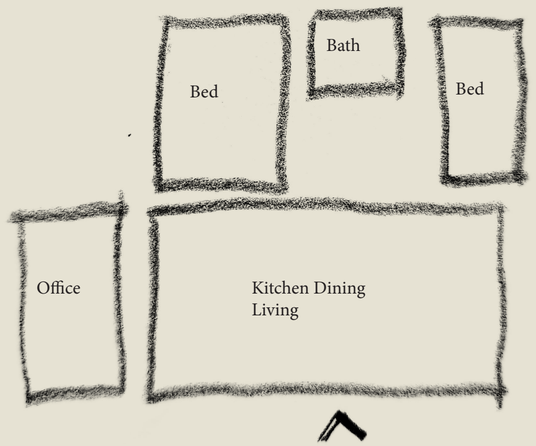
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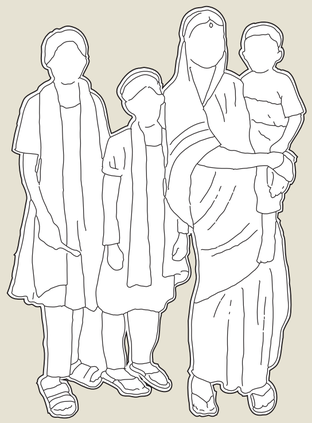


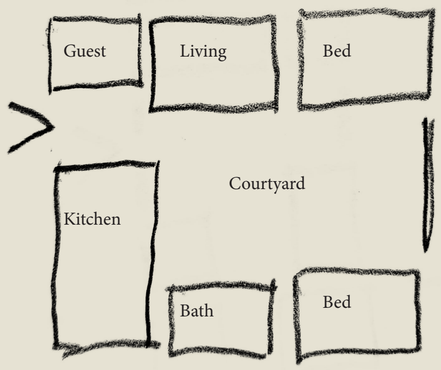
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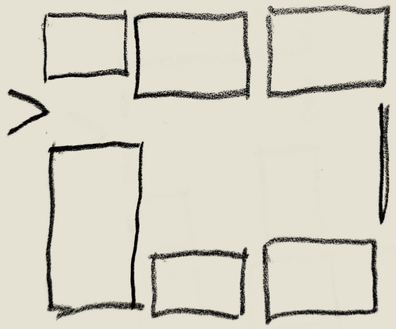


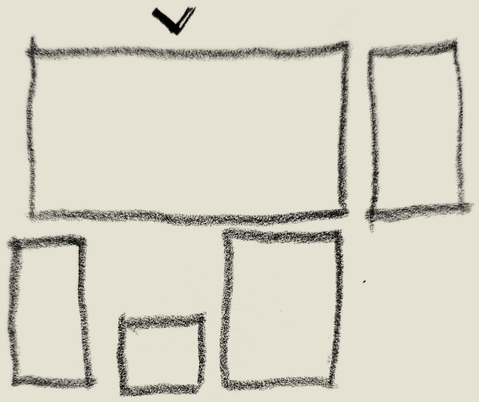


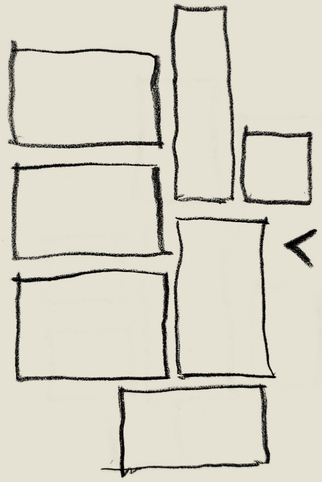
Courtyard



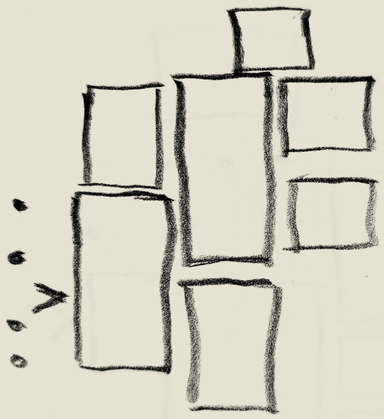


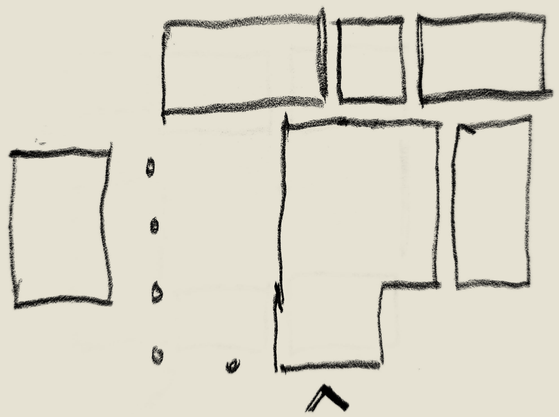


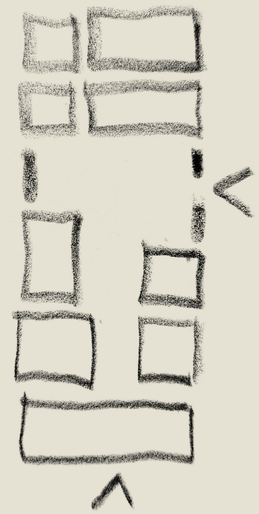


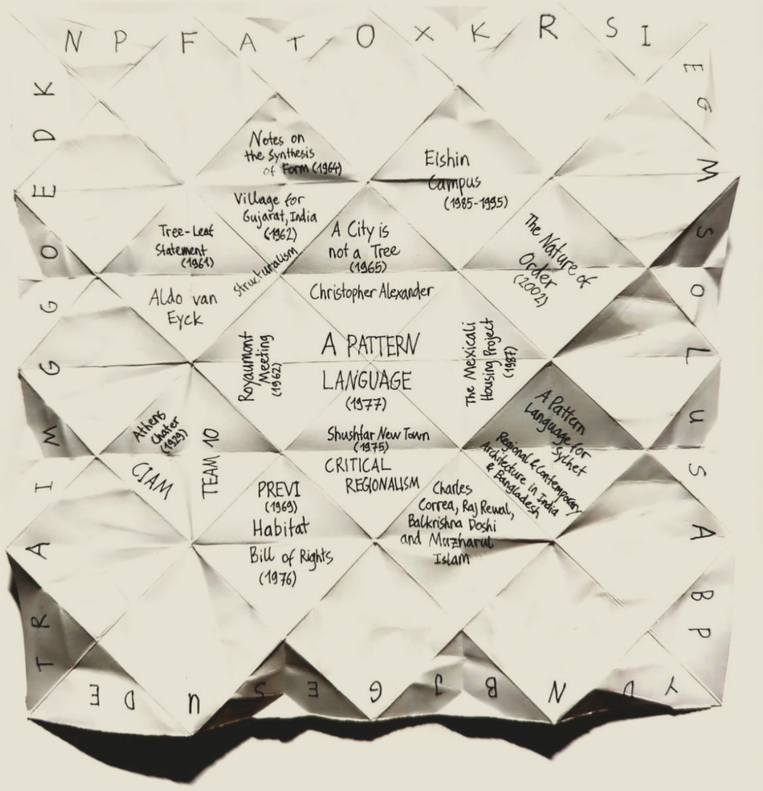


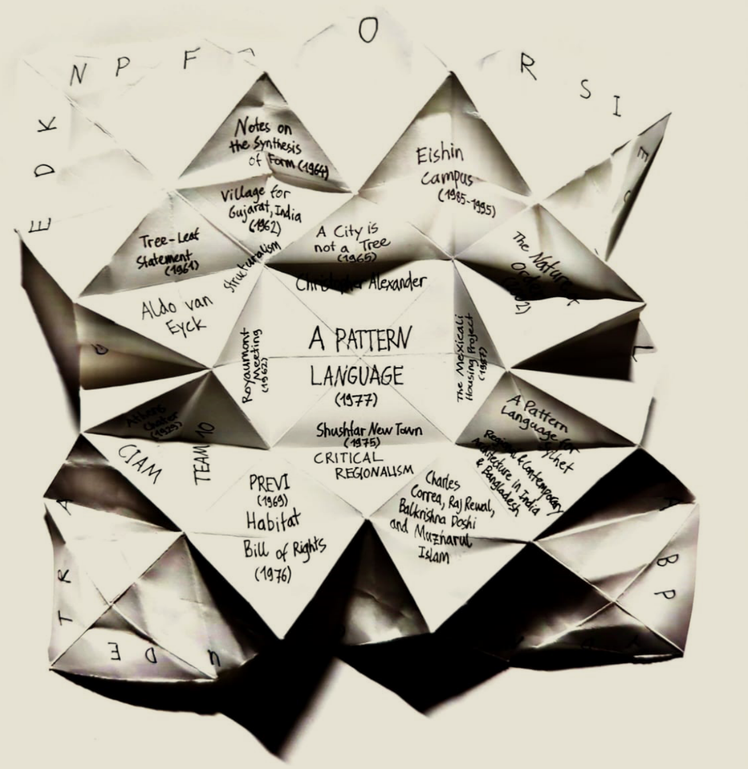
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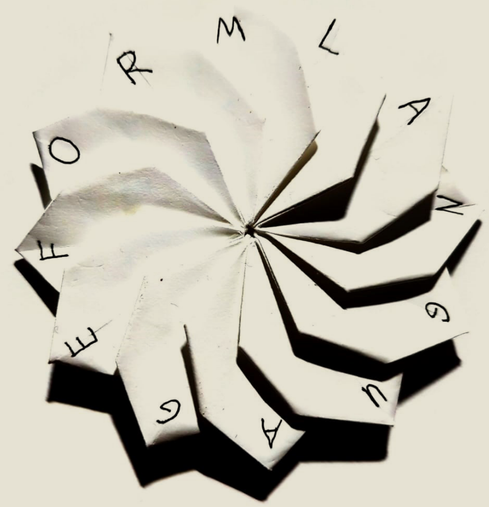


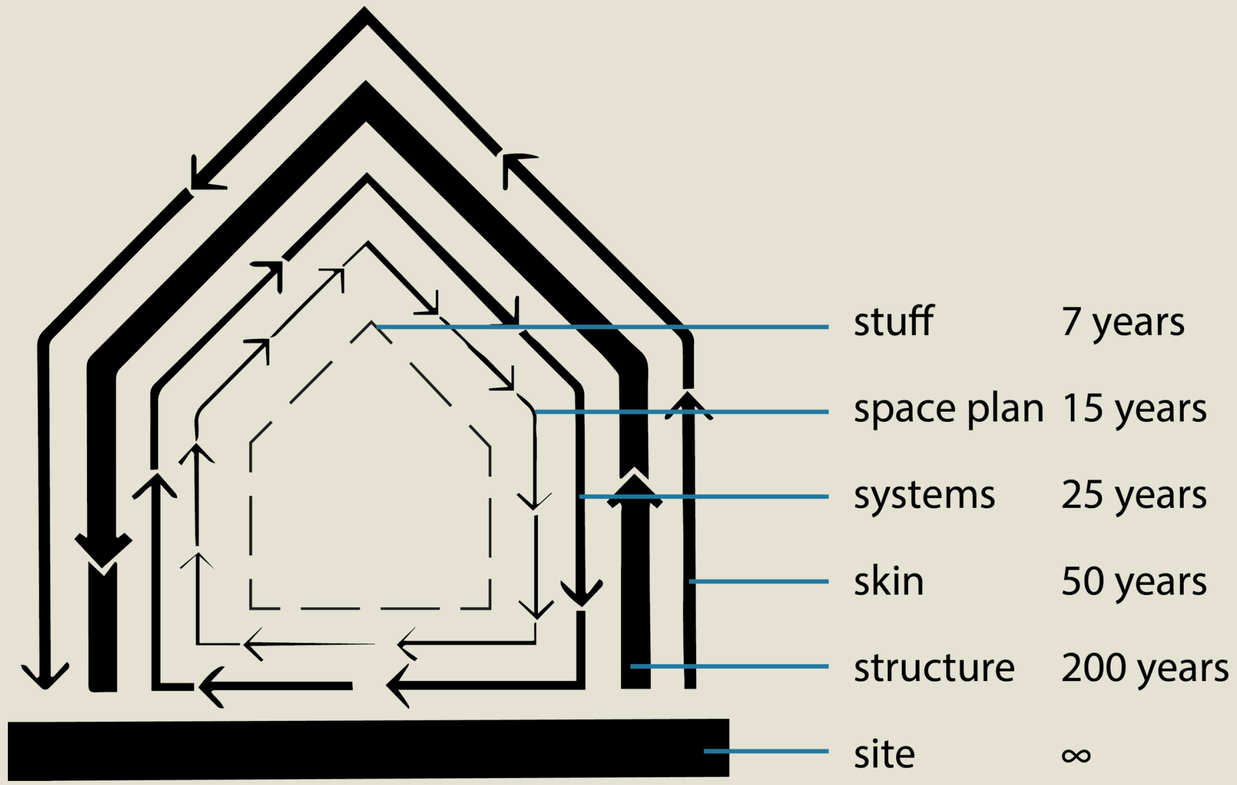



Notes on the Synthesis of Form (1964)
Village for Gujarat, India (1962)
Tree-Leaf Statement (1961)
Structuralism
A City is not a Tree (1965)
Christopher Alexander
Aldo van Eyck
Eishin Campus (1985-1995)
The Nature of Order (2002)
Royaumont Meeting (1962)
A PATTERN LANGUAGE (1977)
The Mexicali Housing Project (1987)
A Pattern Language for Sylhet
Regional & Contemporary Architecture in India & Bangladesh
Athens Charter (1933)
Shushtar New Town (1975)
CRITICAL REGIONALISM
CIAM
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Stewart Brand's "Shearing Layers of Change"

BANGLA BATON

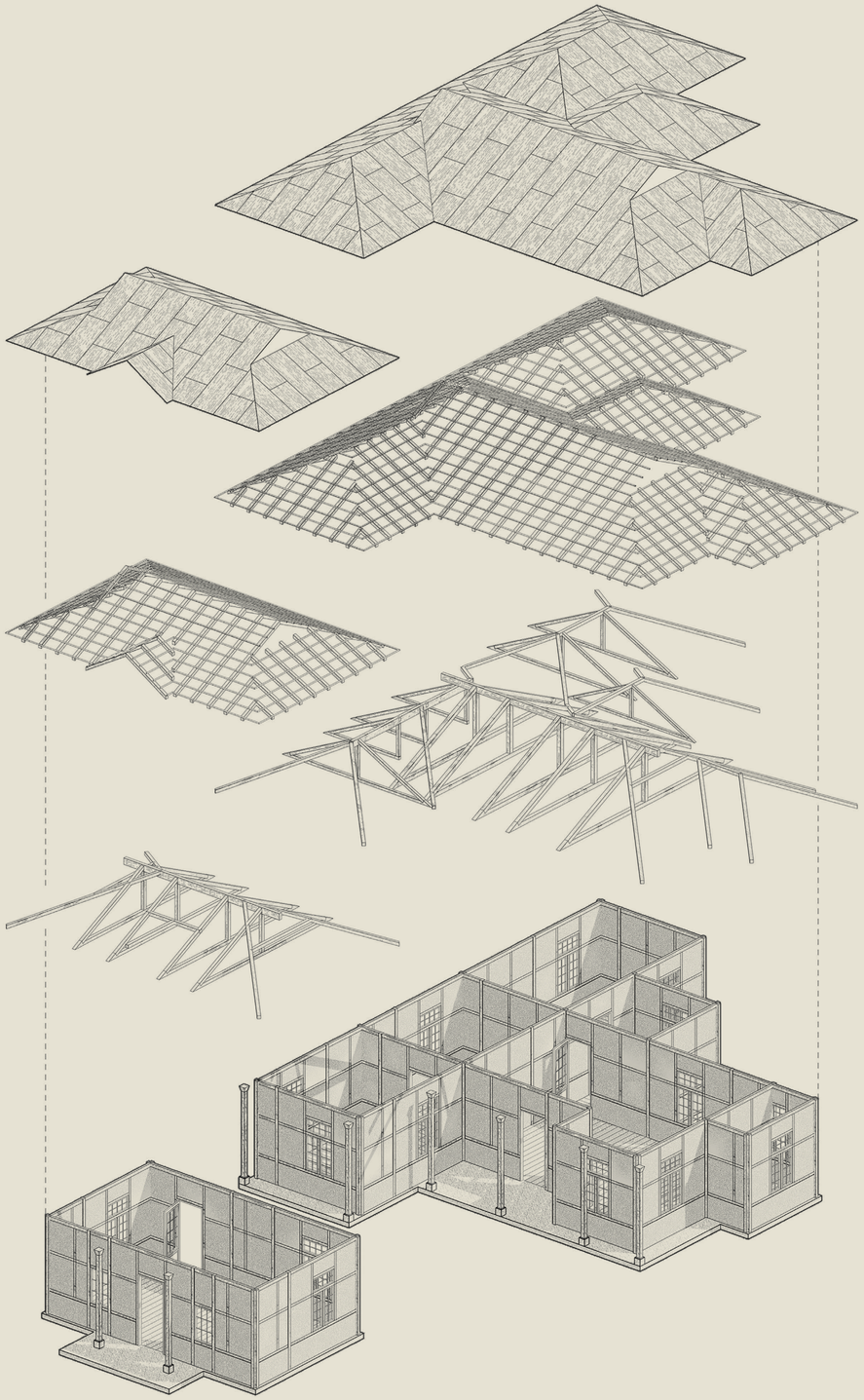
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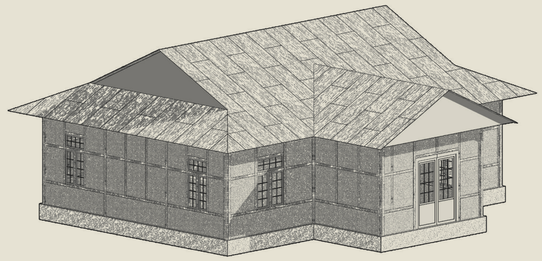
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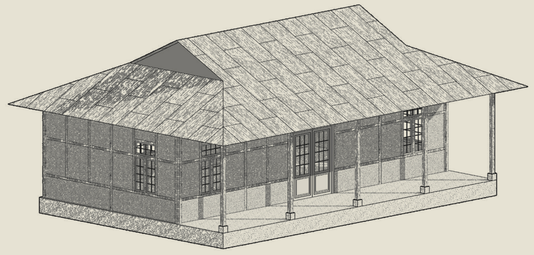


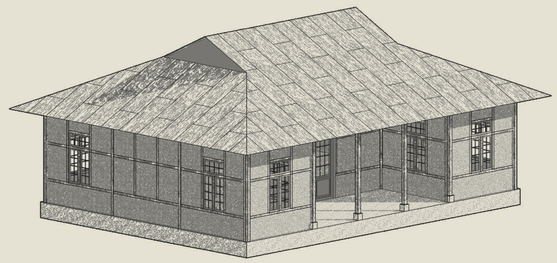


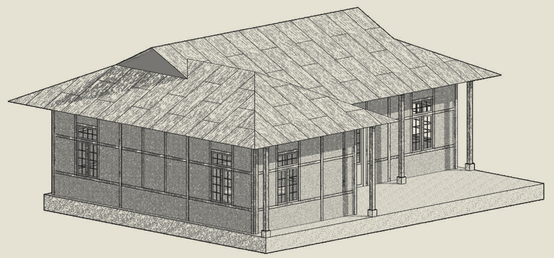


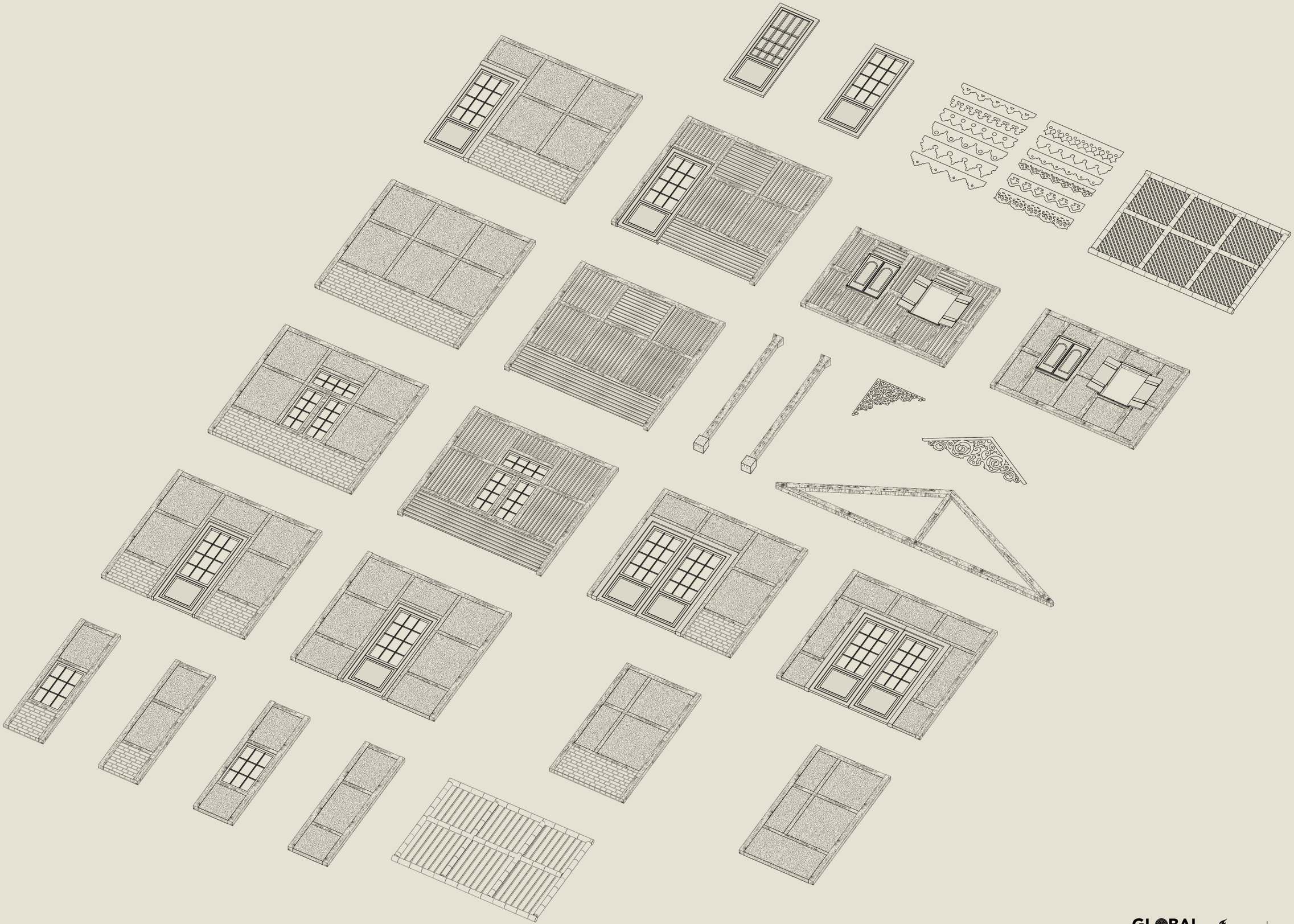






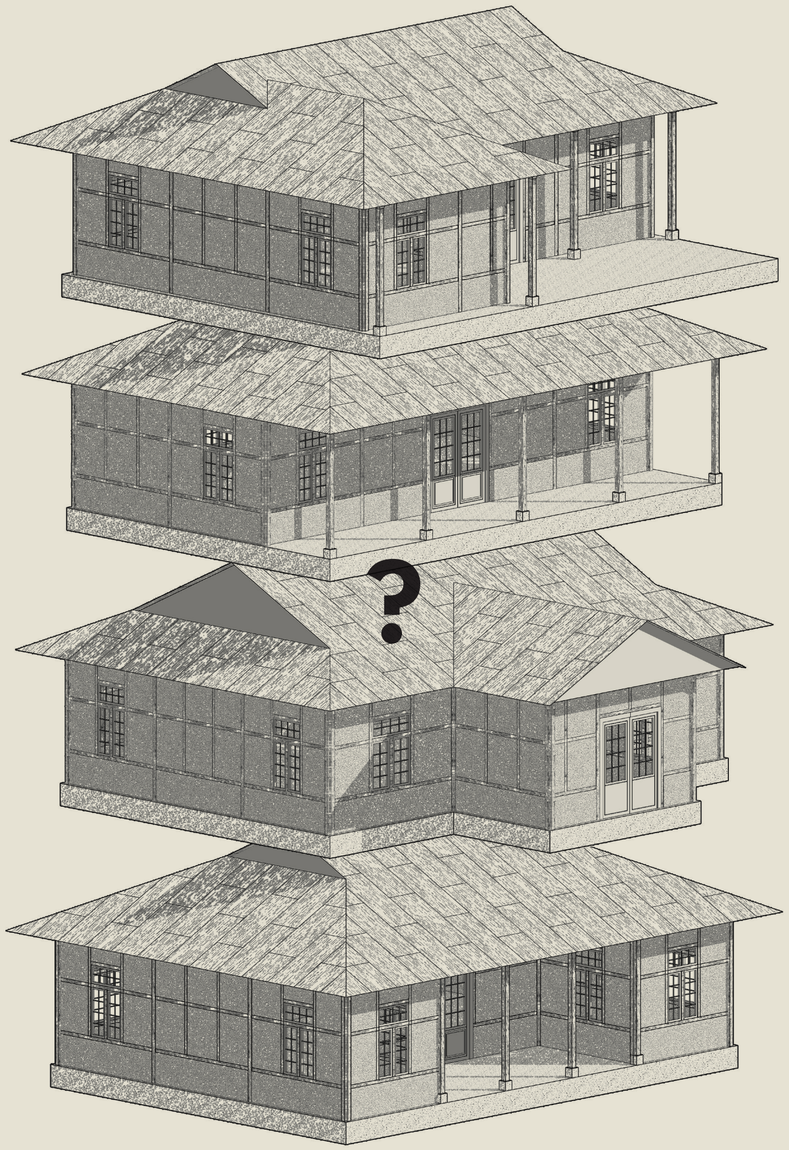






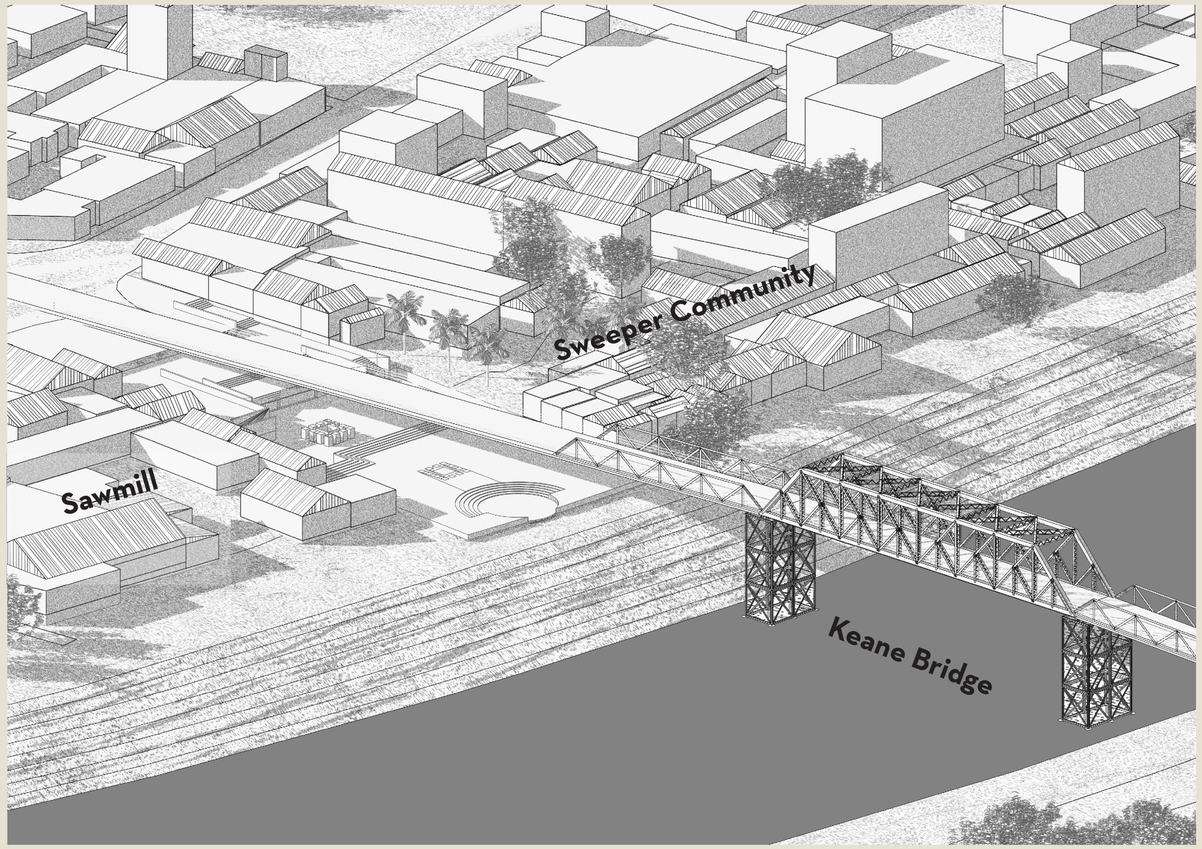
GLOBAL HOUSING

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The Site




Sweeper Community
Sawmill
Keane Bridge

The Keane Bridge





Photo by Joëlle Steendam



Photo by Joëlle Steendam



Photo by Joëlle Steendam

The Sweeper Community





Photo by Joëlle Steendam



Photo by Joëlle Steendam



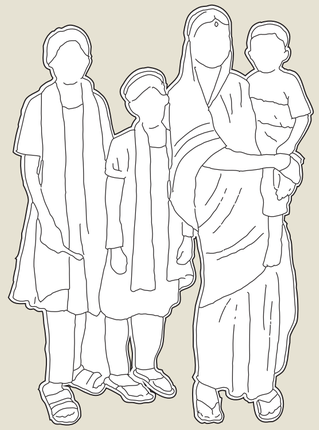
The Hindu Shrine



PROGRAM

Currently On Site

25 *Hindu "Sweeper" Families*



40 *Muslim Families*



Funding and Stakeholders

The construction cost per square meter is estimated at BDT 30,128 or $250. This is significantly lower than an equivalent single storey building due to economies of scale and given that much of the cost goes towards the foundation construction. This is because of the alluvial soil condition which has a low bearing capacity. Loans will be provided to low-income families by Grameen bank which specialises is small loans without requiring collateral, something which no other major bank was prepared to provide and won it the nobel peace prize in 2006. Profit from the medium and higher income families will help to carry the costs of the low income families. Government subsidy will be provided in return for developing the riverbank, rehousing the sweepers and giving the area near the iconic Keane bridge a more 'metropolitan' character. A portion of the smaller units of the scheme can also secure revenue as student housing, of which there is a shortage in Sylhet, for local universities such as Shahjalal University of Science and Technology and Sylhet Agricultural University.

Stakeholders

The stakeholders are to include the existing occupants of the site who should have a significant say in determining the design of their future dwellings. The project will seek to attract further low- and middle-income families for the clusters and the riverbank development. High-income families will move into the apartments in the towers and their fincancial contribution will support the overall project. It is envisaged that the local government will also invest in the scheme, having an active interest in the development of a site central to the city and adjacent to the iconic Keane Bridge. Their support is contingent upon development of flood protections as part of the scheme. The project also requires collabration with the Bangladesh Railway Company and the local highway authority who are responsible for the upkeep and maintenance of the Keane Bridge.

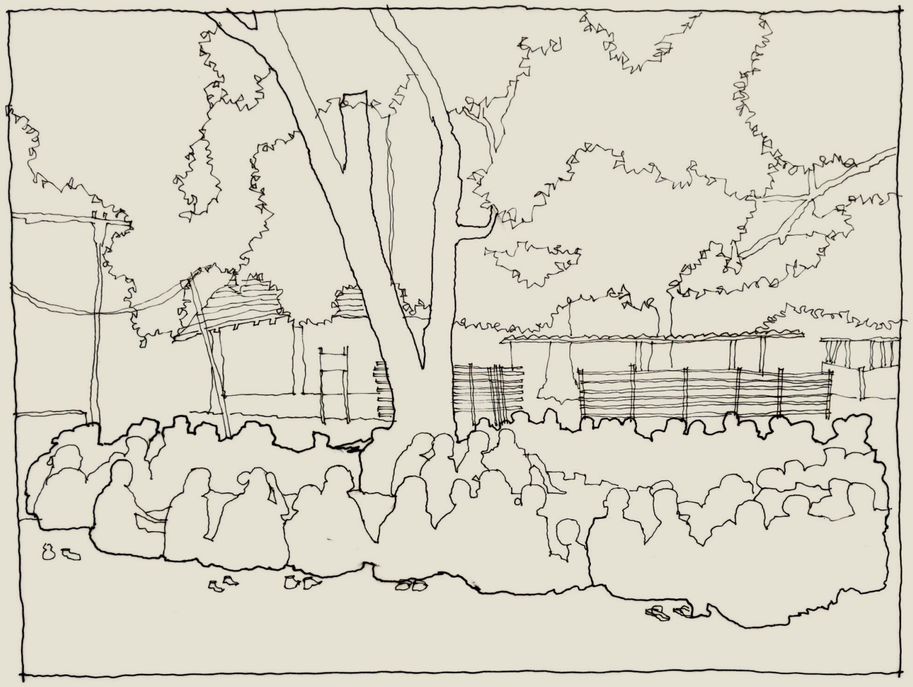
GSI and FSI

40 sqm per 'single' unit
804 units => 32160 sqm
Ground Floor and Mezzanine 32 sqm per 'single' unit
160 units => 5120 sqm
Total: 37280 sqm

Site Area: 22500 sqm

FSI = 1.67

GSI = 0.13



সালিস **Shalish and Uhtan** (69, 115, 126, 168, 171)



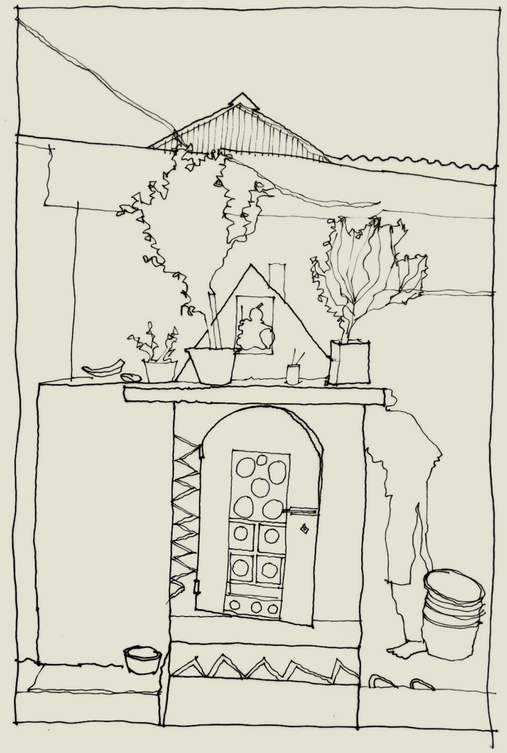
Self-Governing Workshops (41, 80, 83, 146, 157)



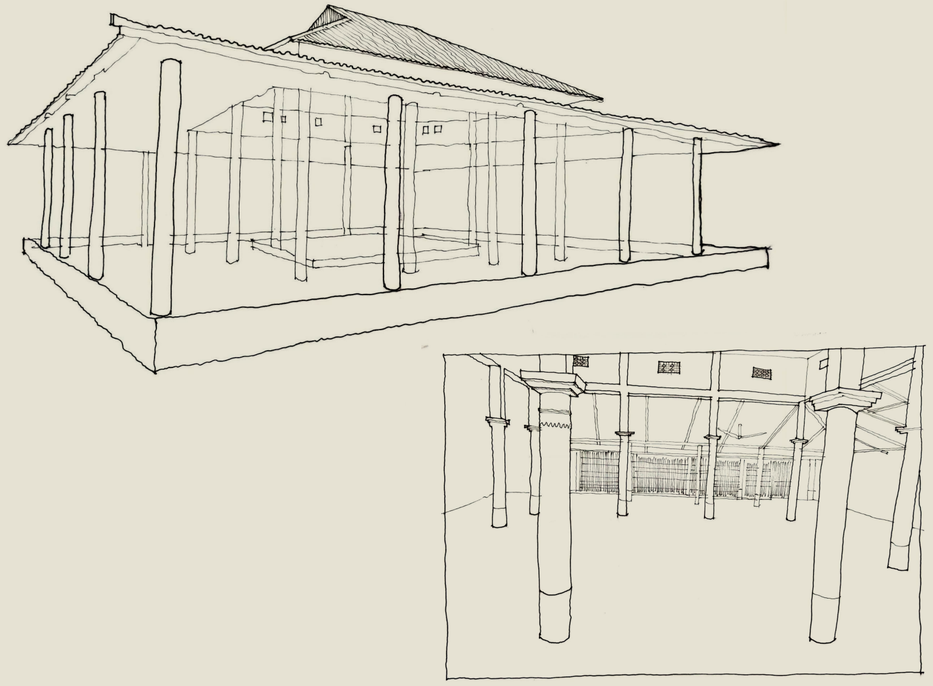
Children's Realm (18, 57, 68, 86, 137)



Quiet Backs (36, 37, 38, 59, 69, 100)



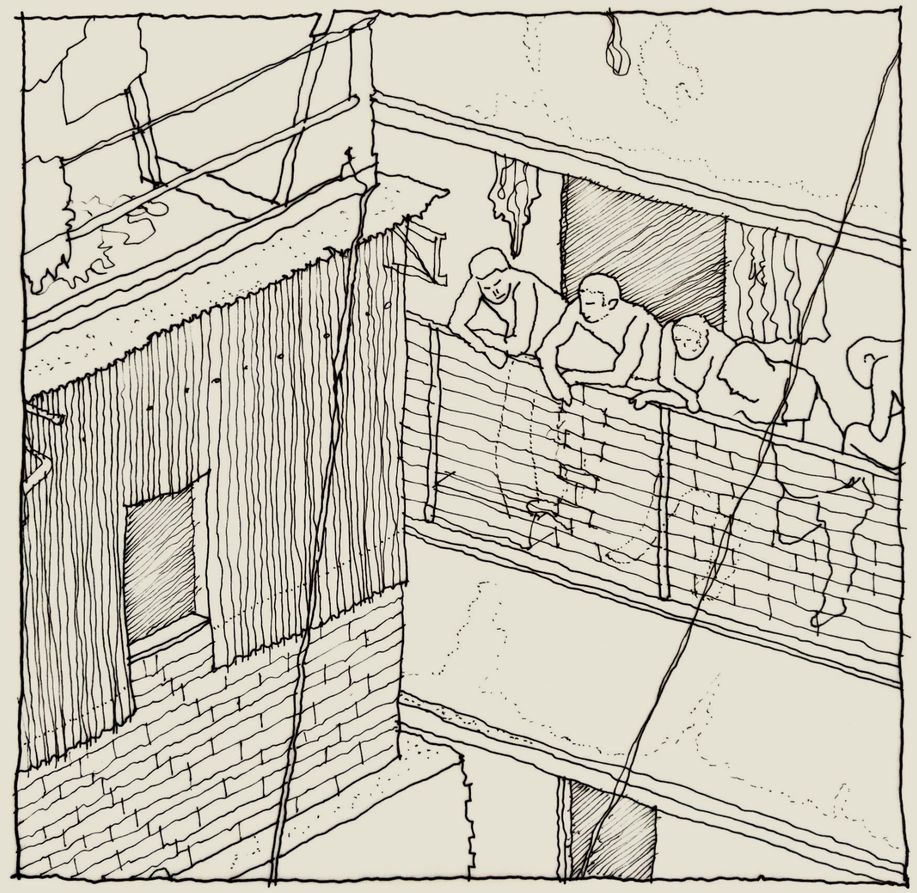
Sacred Place (24, 59, 66, 67)



Outdoor Room (67, 95, 108, 115, 126, 129, 163)



Open Staircases ()



Balconies ()



Access to Water ()

Principles

সালিস Shalish and Uhtan

The by creating successful courtyards (uhtans) the pattern of the Shalish can take place, it is supported by these patterns:

a. Roughly square shape

- This facilitates gatherings which tend towards a circle or semi-circle in shape
- In the rural context, the threshing of grain also often occurs in the uhtan where cows are made to walk in a circle on top of crops to separate grain from straw
- Square and rectangular courtyards are easier to work with when agglomerating buildings into clusters

b. Open corners

- Open corners improve ventilation through the courtyard which is crucial in the hot climate
- They can be hinge points allowing the angles of the courtyard corners to adjust without this directily altering the buildings
- A degree of openess is beneficial to the life of a courtyard, as it allows glimpses of the world beyond (see APL 115 Courtyards which Live)

c. Verandah or Arcade

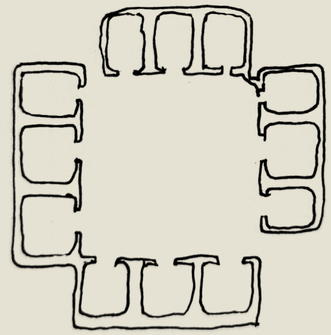
- Verandahs and arcades provide useful outdoor spaces for work and circulation that mediates between the interior and exterior of buildings. By being covered, they are shielded from extreme weather and by being open to the air, they benefit from natural light and ventilation. Connected to a home, they can become a kind of extended living room for inhabitants. Connected to a building cluster, they can activate commerce and facilitate circulation.
- Arcades help to connect buildings with each other so that it is easier and more pleasant to circulate between them (see APL 119 Arcades and 166 Gallery Surround)

d. Shops andWorkshops

- The shops and workshops in the community can benefit from the courtyard and vice versa. Workshop activities can spill into the courtyard giving them more usable space while increasing opportunities for interaction with members of the commnity which can result in trade, innovation and skillsharing simply better communication. Shop and workshop owners can also use the privacy of the courtyards for rest and recuperation
- The shops and workshops act as 'activity pockets' for the courtyard (see APL 124 Activity Pockets)

e. Focal point

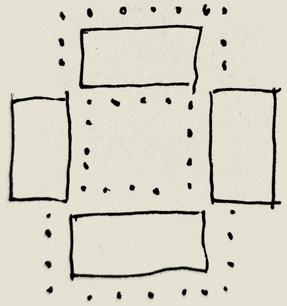
- The a shalish is typically held in the open under a large Banyan or Lychee tree, this provides shade and acts as a beautiful fulcrum to the gathering. A tree can serve this purpose, or a fountain, covered structure, or statue
- This object does not have to be exactly in the middle of the courtyard, rather it should be placed where lines of sight and circulation converge (see APL 126 Something Roughly in the Middle)



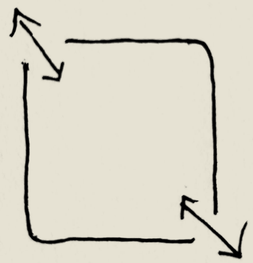
Activity Pockets



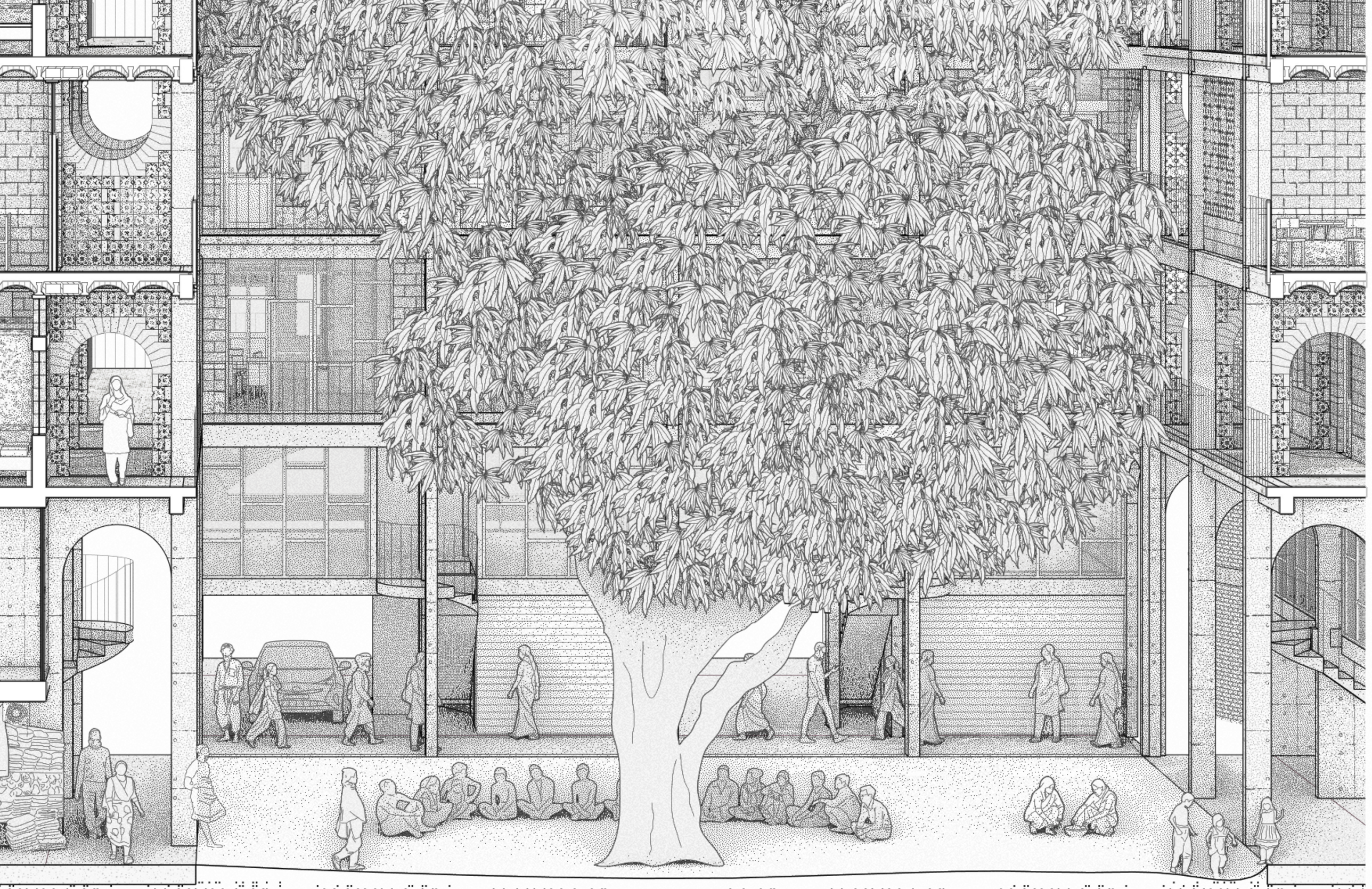
Focal point



Arcades



Open corners



Self-Governing Workshops

Creating a successful network of self-governing workshops in the community is supported by these patterns:

a. Working community

- Independent workshops benfit from clustering together into small communities of 10 or 20 at most, since if you are spending 8 hours or more at work, you want it to be as much of a community as home. These can be strengthend with the courtyard layout. (See APL 41 Work Community)

b. Courtyards and Arcades

- (see Shalish and Uhtan)

c. Self-Governing

- People can take pride in their work when they are responsible for the quality of the whole and understand it. Too often job opportunities in large organisations treat individuals like cogs in a machine. In Bangladesh for instance, the fabric and garment industry, while is in many ways outstanding, has a dark underbelly of mass-production and exploitation. Self-governing work stand against these dangers. Futhermore small self-governed work communites can adapt to changing circumstances quickly or make decisions that are out of the individual's hands in large organisations.

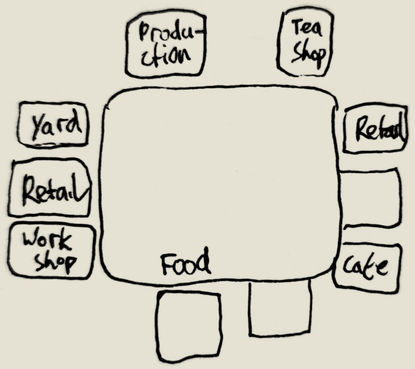
- Workshops within the community are also a great opportunity for younger members to see and learn about the trades of adults. This in turn facilitates master apprentice relationships which are a key way in which important traditional skills and knowledge can be kept alive

d. Close to home

- Work located close to home gives the worker more freedom and flexibilty over his time, especially in dense urban areas with traffic congestion.

e. Access to the street

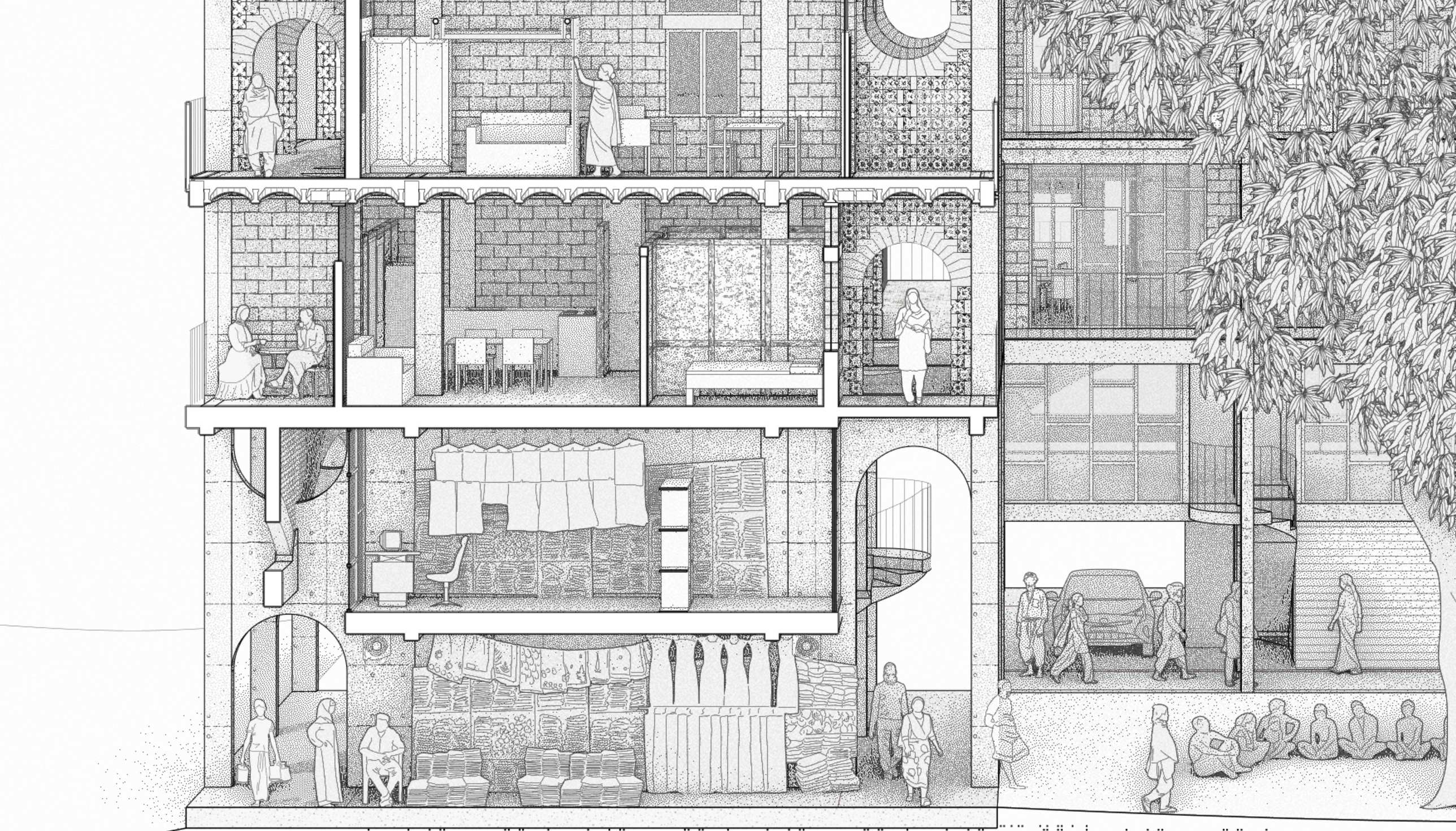
- Having a direct link to the street is important to facilitate commerce



Working community



Working community



Children's Realm

Creating a successful children's realm in the community is supported by these patterns:

a. Learning in the community

- Young people do not only learn in school. In fact the school setting can reinforce a passive mindset where the child is being taught without actively choosing to learn. By distributing learning opportinites in the community children can be more creative and active in learning. This is facilitated by *Self-Governing Workshops* in the community.

- Without being able to explore the world of adults, children cannot become adults, as such linking the childrens realm with the community and the wider city is important (see APL 57 Children in the City).

b. Neighbourhood watch

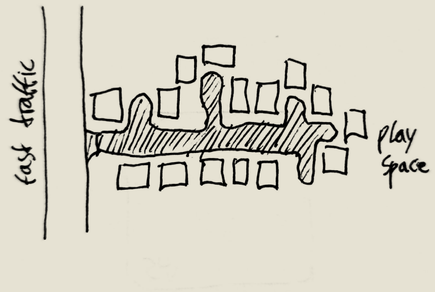
- To facilitate learning in the community, children must be able to move through it safely, yet their parents cannot accompany them at all times (and even if they could this would hamper their ability to develop independence). Therfore design of the community must involve plenty of opportunities for passive surveillance, so children are never without adult supervision. This can be facilitated by *Quiet Backs* and well defined *Uhtans.*

c. Connected web

- To futher enhance childrens ability to explore safely it is advisable to connect multiple homes by areas of common land, gardens, paths etc. that do not cross busy traffic routes



Neighbourhood watch



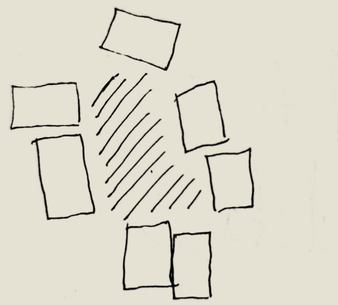
Connected web

Quiet Backs

Creating quiet backs where community members can feel at home, is facilitated by these patterns:

a. Clustering

- Having privacy in one's own home is one thing, but to feel truly comfortable most people desire to be able to control their immediate surroundings with neighbours who they know and trust. In a survey by Herbert Gans in *The Levittowners* (New York: Pantheon 1967), he found that in a typical neighbourhood block, all participants engaged in some pattern of visiting their neighbours and 93 percent of the visits were within the immediate cluster of the five closest dwellings. They survey appears to confirm not only the strong desire for neighbouly ties but also the markedly spatial nature of these social links. The immediate circle of dwellings is by far the most important when it comes to neighbourly ties. Therfore arranging dwellings into clusters of no more than 12 around shared spaces accessible to all helps to foster community. This clustering can be facilitated by well designed *Uhtans*. In the existing sweeper colony, the narrow alleyways serve this function. (See also APL 37 House Cluster).



Clustering

b. Galleries

- In high rise buildings the connection to the ground is not immediate enough for it to facilitate clustering as described above. But shared circulation spaces can serve this function similar to the alleyways in the sweeper community. The galleries benefit from similar design principles as the *Arcade*. They should be wider than what is necessary for circulation alone, providing seating and room for work and social activities to spill out of the home.

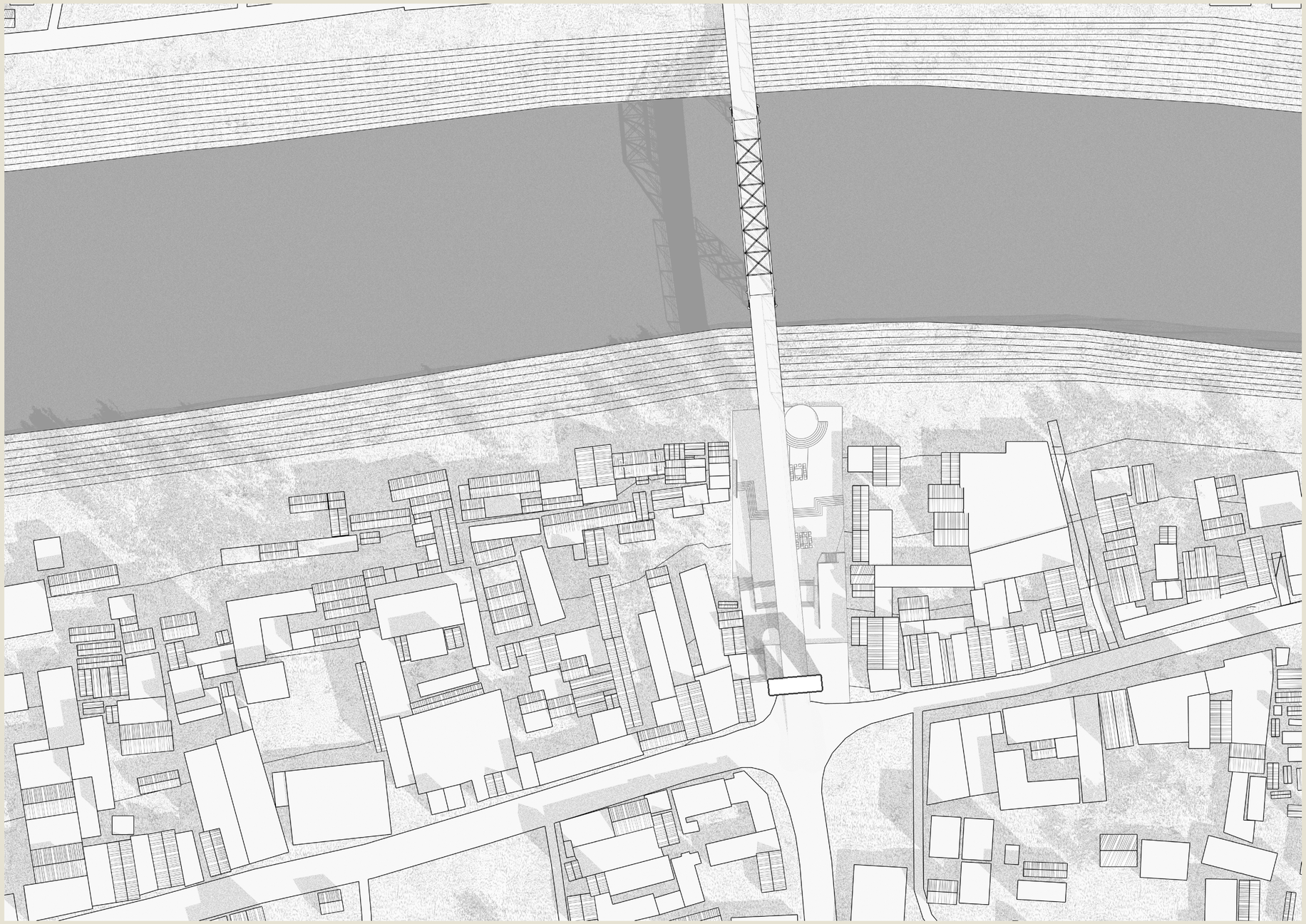


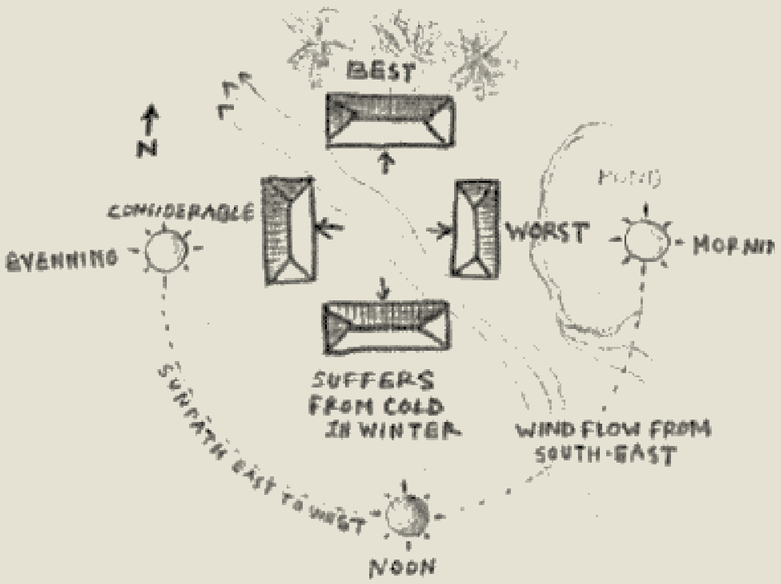
Galleries

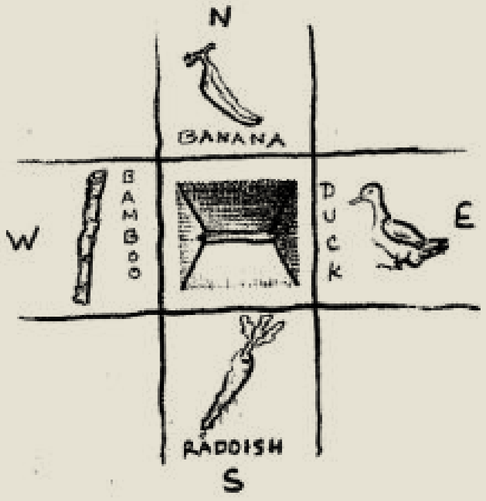
c. Shielding and privacy gradient

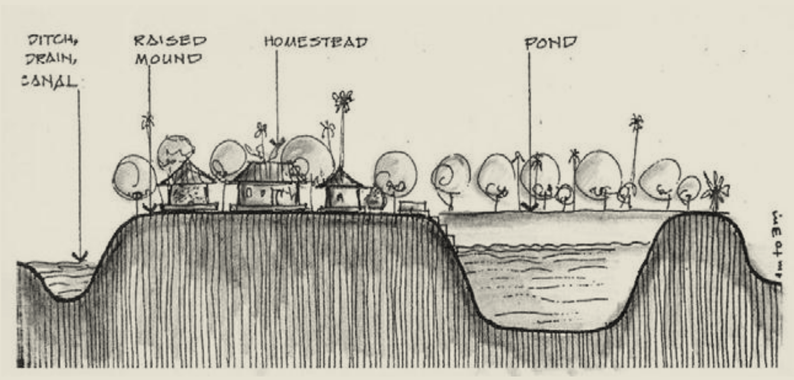
- To create communal areas where the inhabitants feel at home, they should be shielded from the noise and hustle and bustle of busy streets. Then they can serve as places of rest for workers or busy family members. The *Uhtans* can serve this function. Furthermore the design of the *Connected Web* which helps children to explore the community can also serve as *Quiet Back* spaces for the community.

- By creating a privacy gradient between the interior of the home, the galleries, the inner courtyards, the side alleyways and the roads and the open squares, the outer and inner worlds of the community can peacefully coexist.



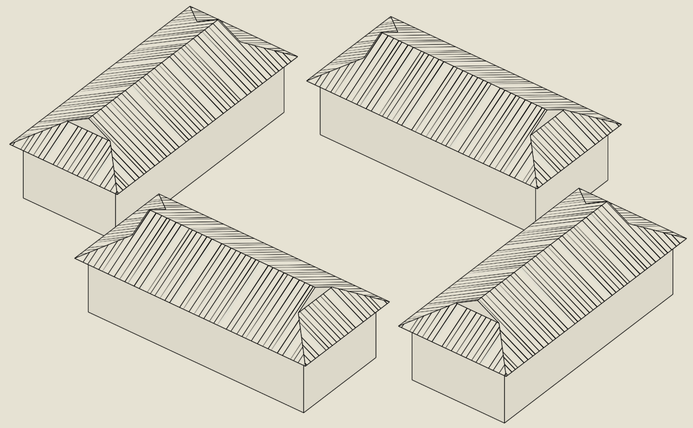


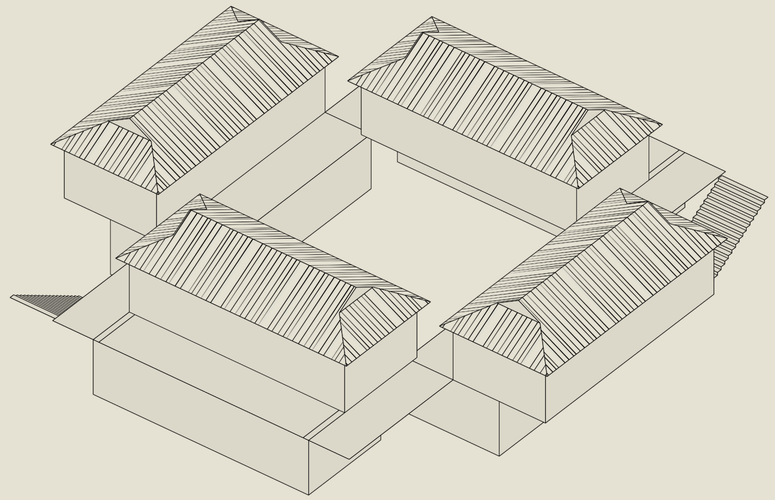


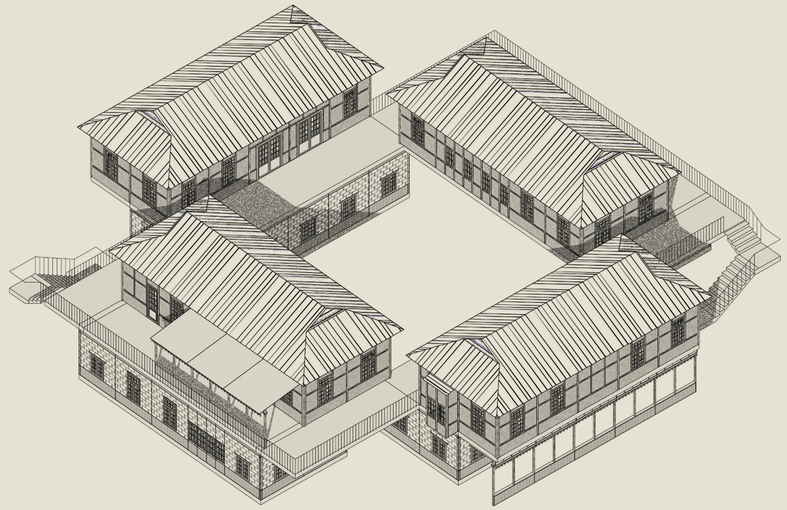


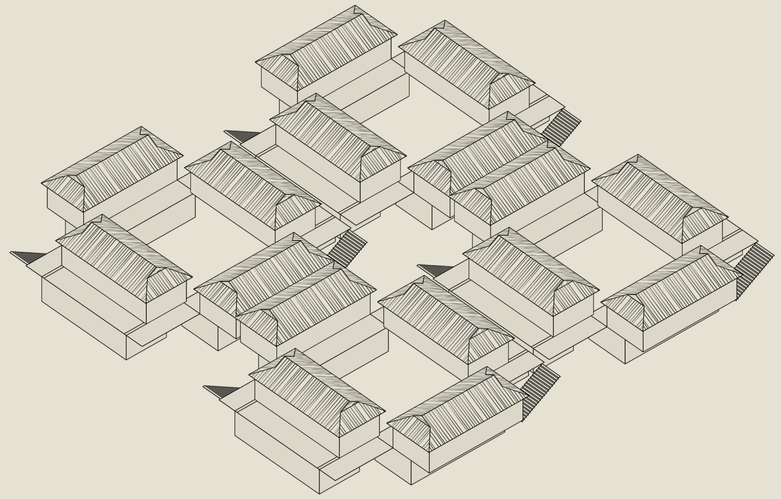
[দক্ষনি দুয়ারী স্বর্গ বাস
উত্তর দুয়ারী সবগনাশ
পূর্বগ হাঁস
পক্ষরি্ বাাঁশ
পূর্ব হাঁস, পক্ষরি্ বাাঁশ
উত্তর্র ববর্ (কলা),
দক্ষরি্ বর্ে,
ঘর কর্র্া বপাতা জুর্ ।।].

Duck in the East,
Bamboo in the West,
Banana in the North,
Left empty in the South









Hindu Shrine
and Mature Tree

Lumberyard

Varthokhola Square

Local Mosque

Site Axes

Rigid Grid

Views to River Obstructed

Third cluster too close to mosque

Cannot define a strong facade to the street. Quality of this space undermined by noise and traffic

Cannot fit full cluster between bridge and Lumberyard

Cannot fit two full clusters beside Keane Bridge

Adjusted Grid

Views and breeze from
South unobstructed

Room for parking
near mosque

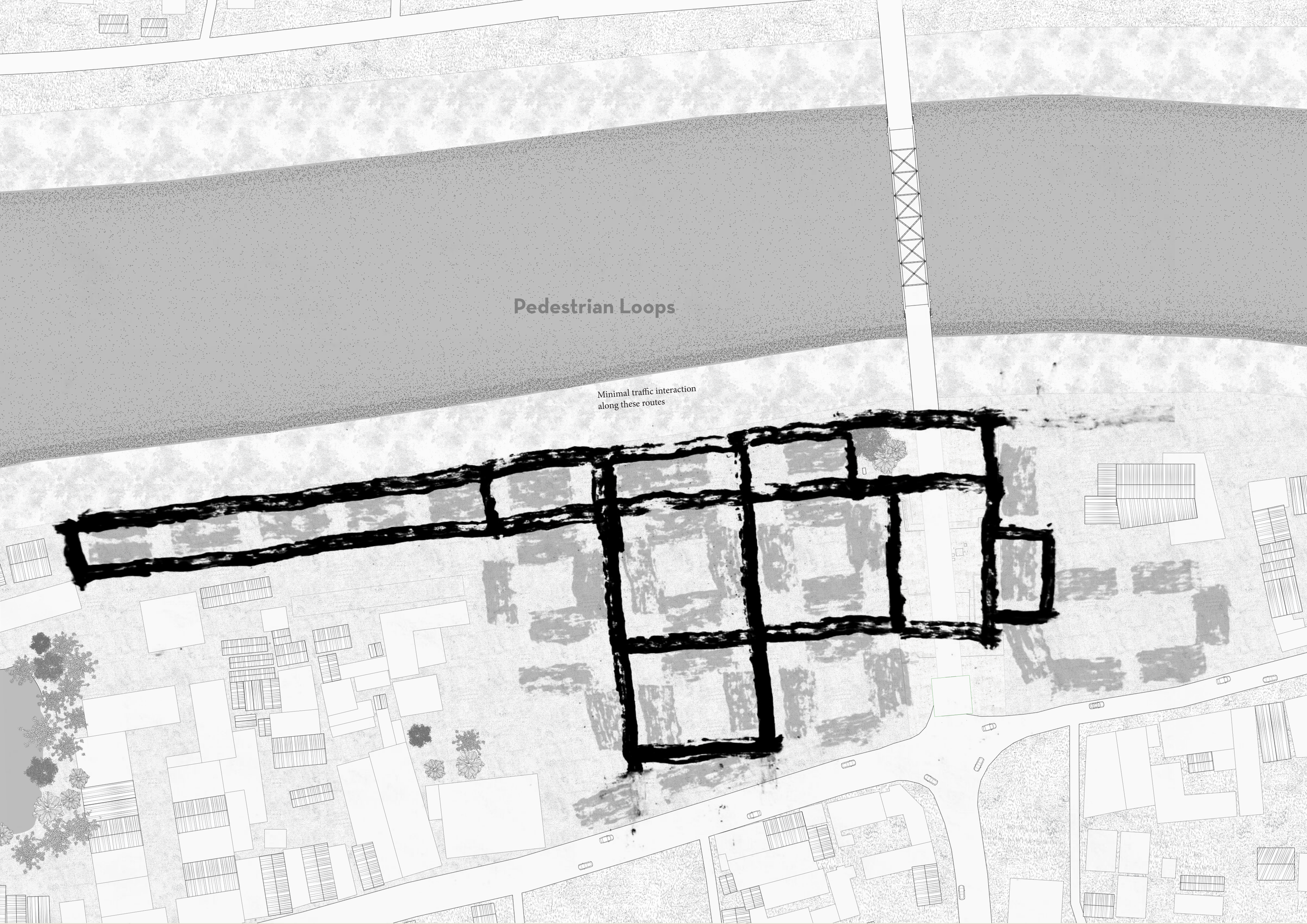
Adjusted angle allows for
better definition of street
facade w/o setbacks

Wider area beside
bridge at intersection

Vehicular Access

Access beyond this
line to the East only
on market days

Parking zones

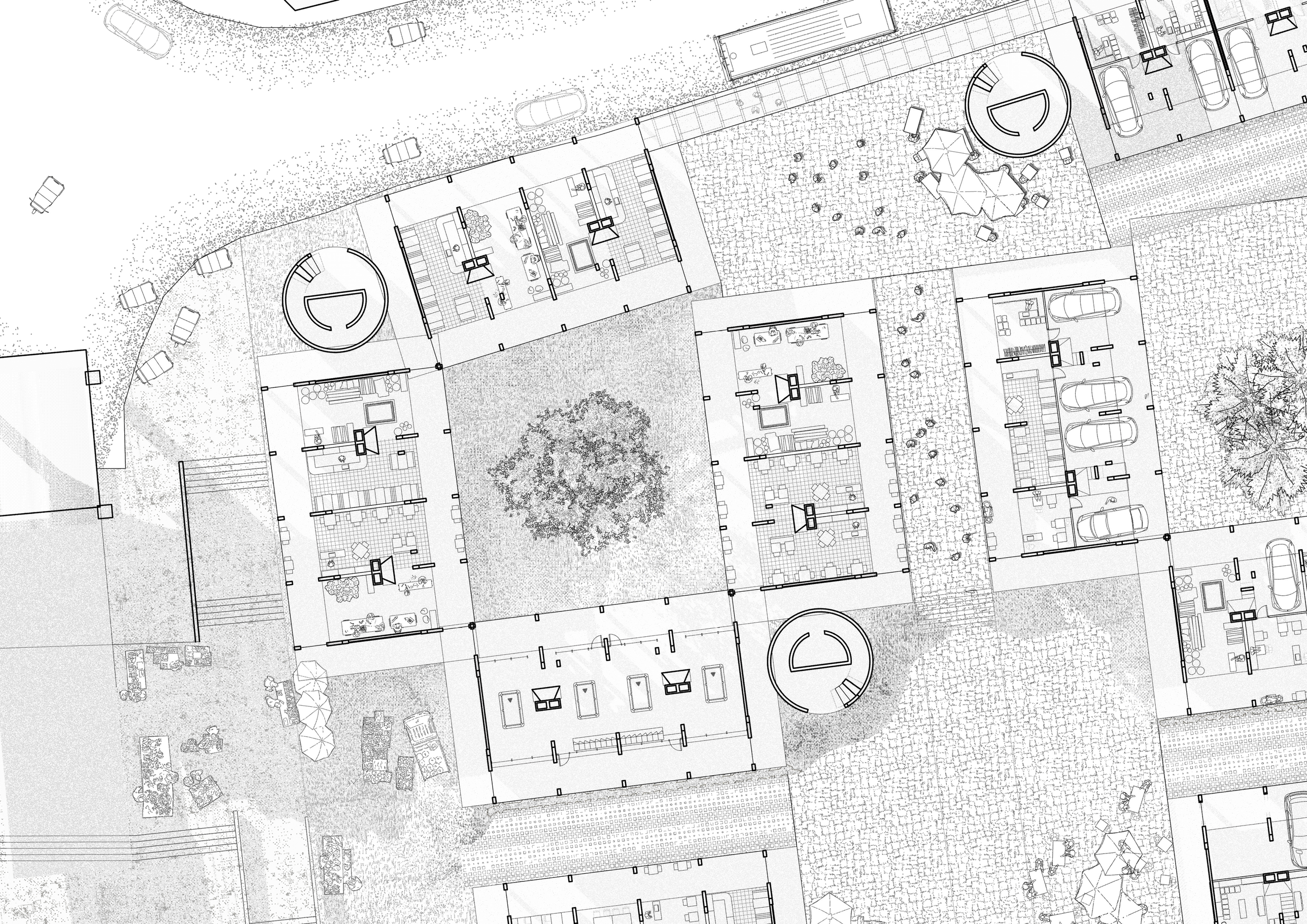

Pedestrian Loops
Minimal traffic interaction
along these routes

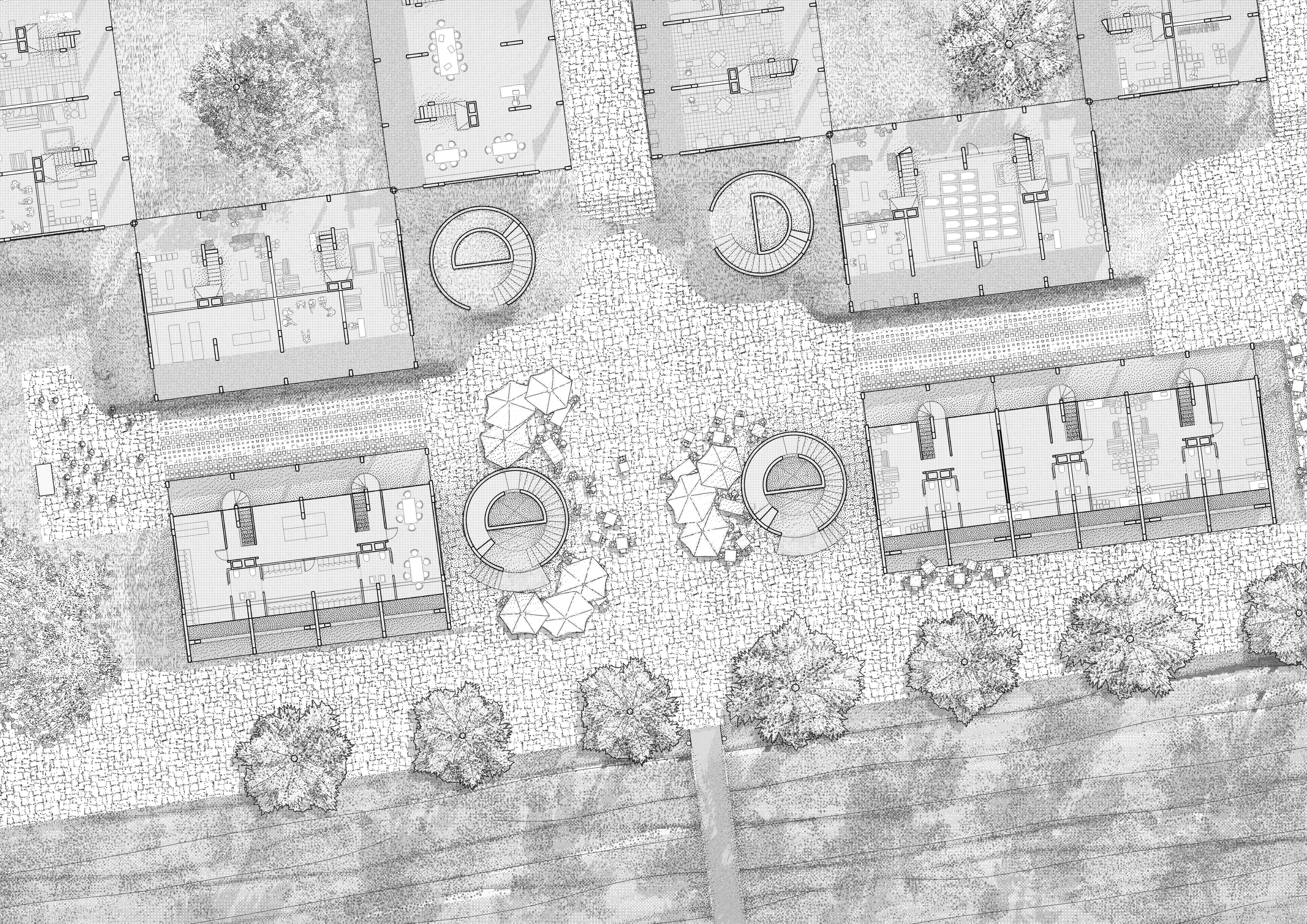


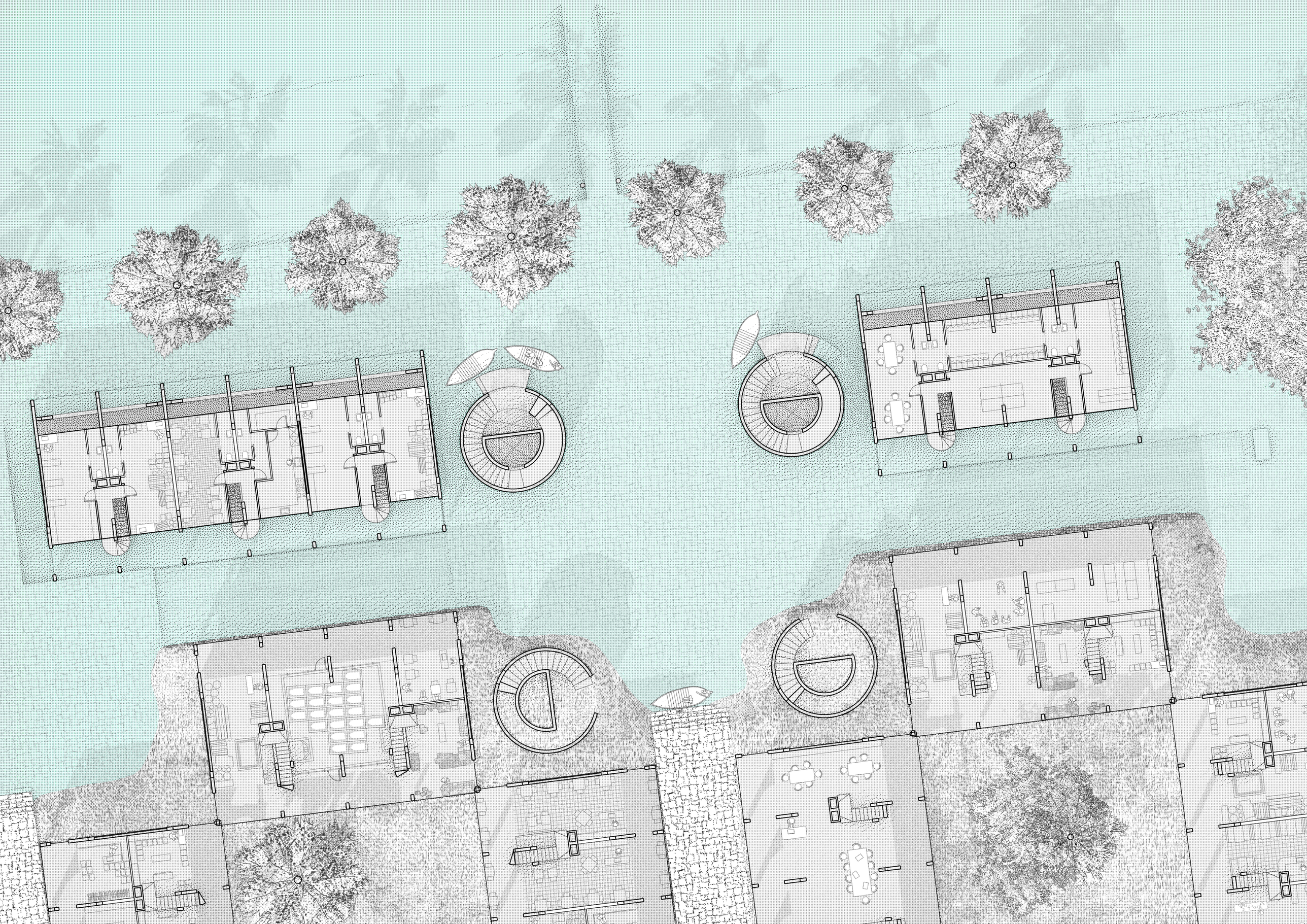


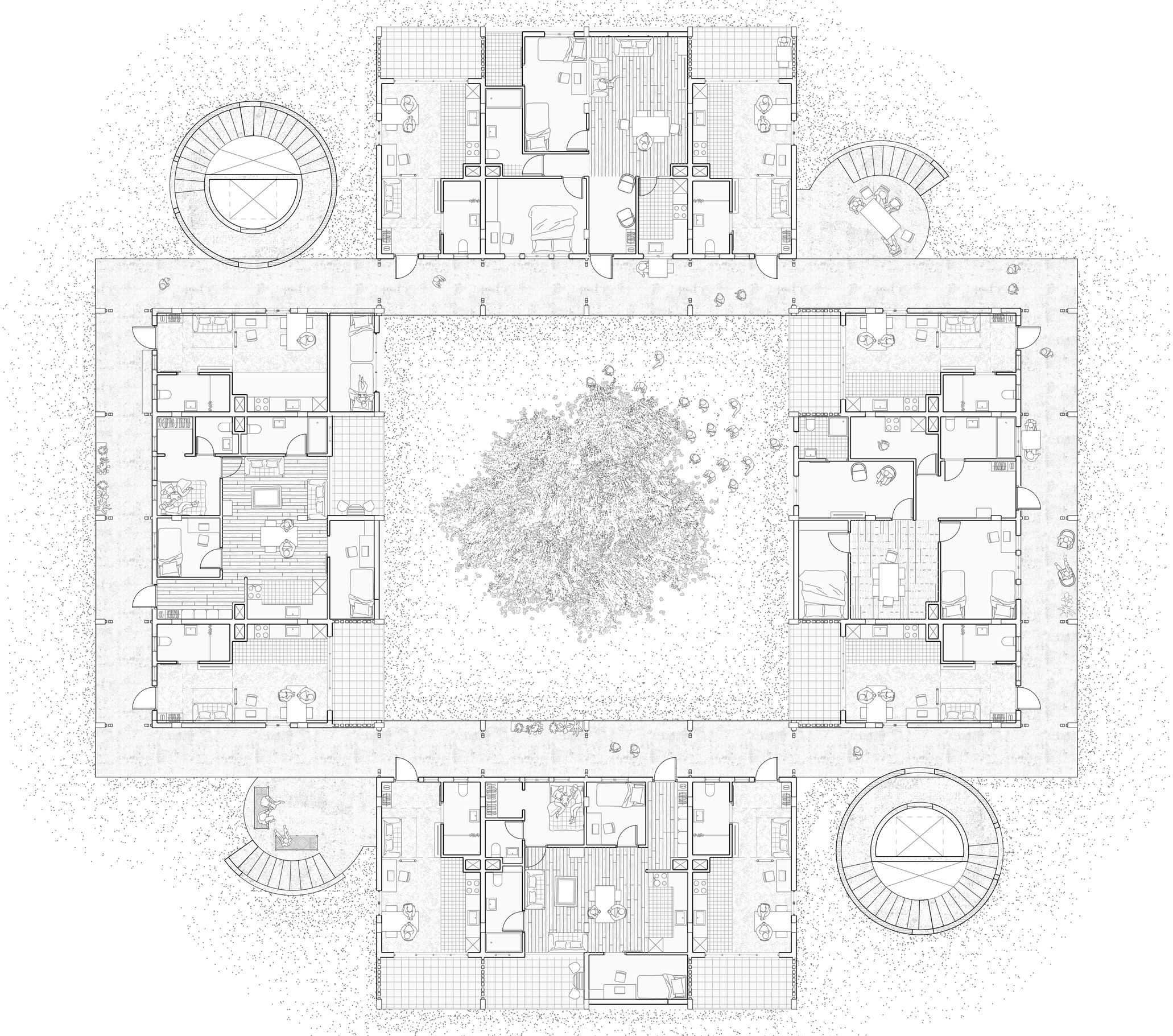


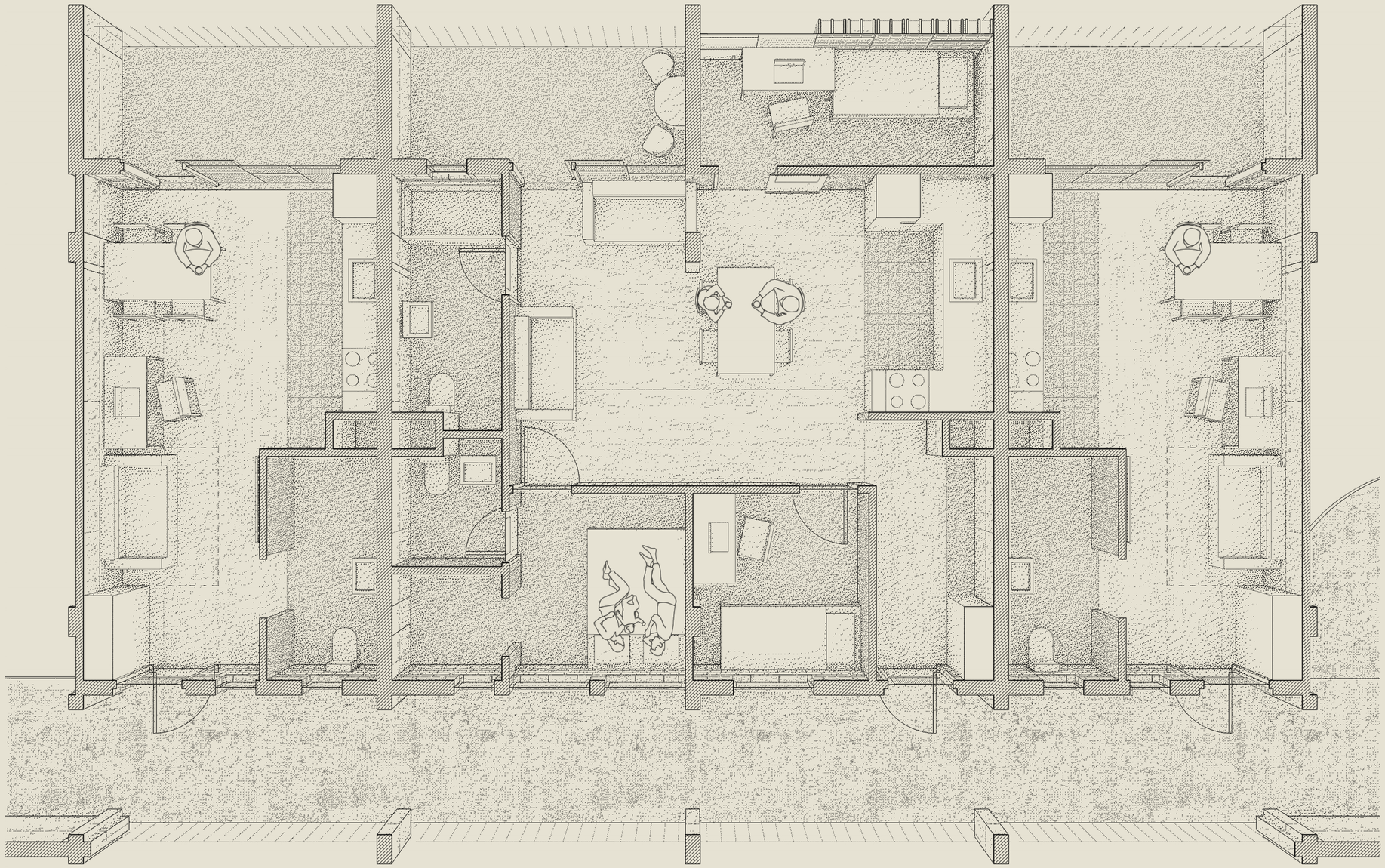


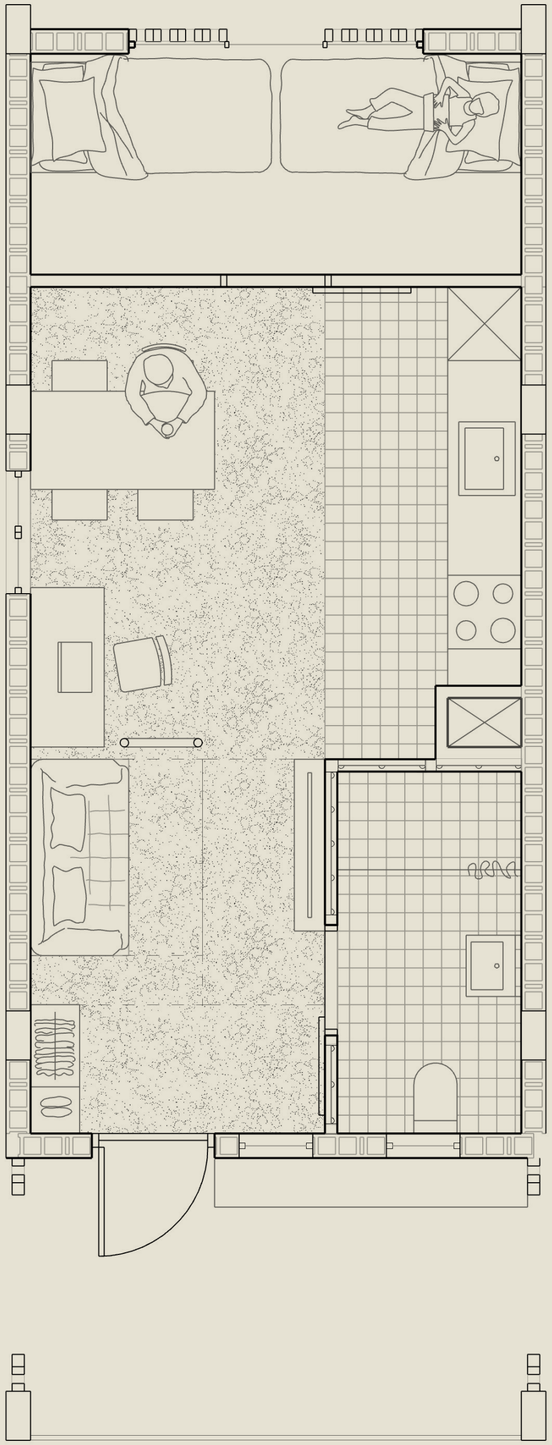


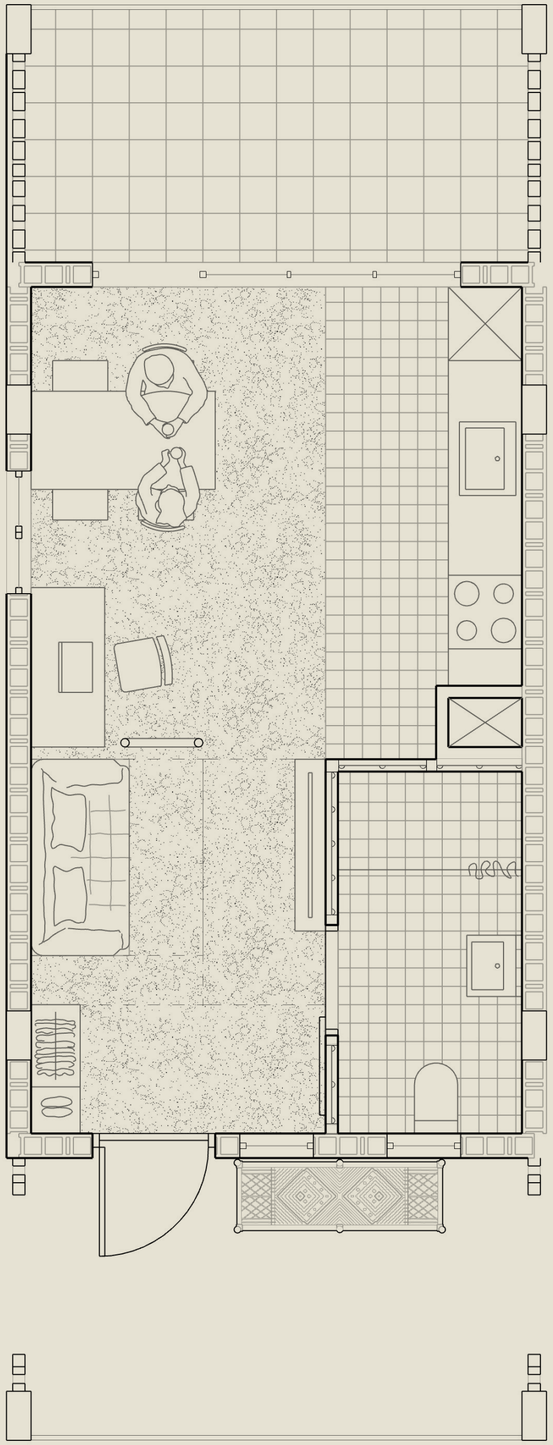






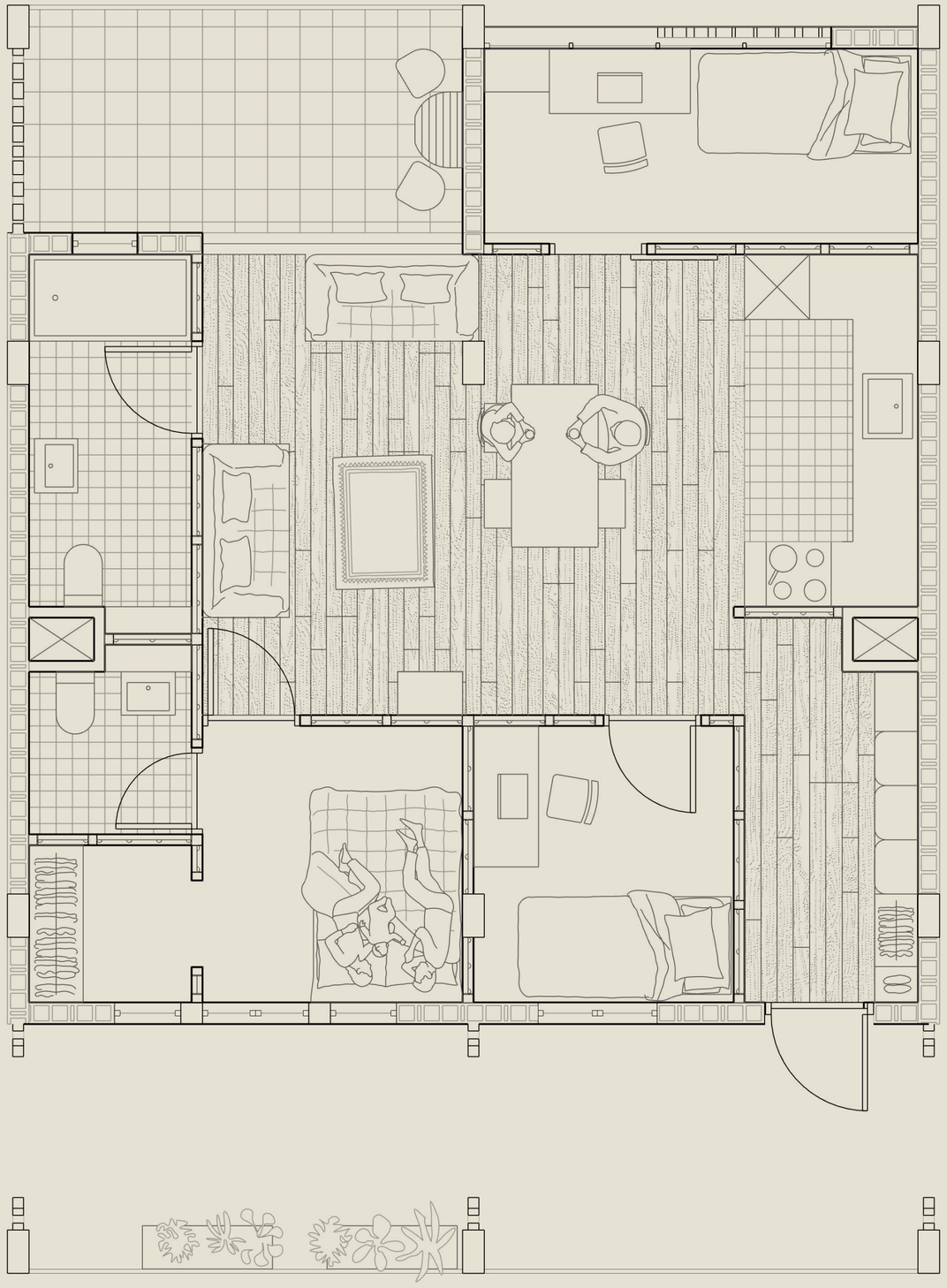






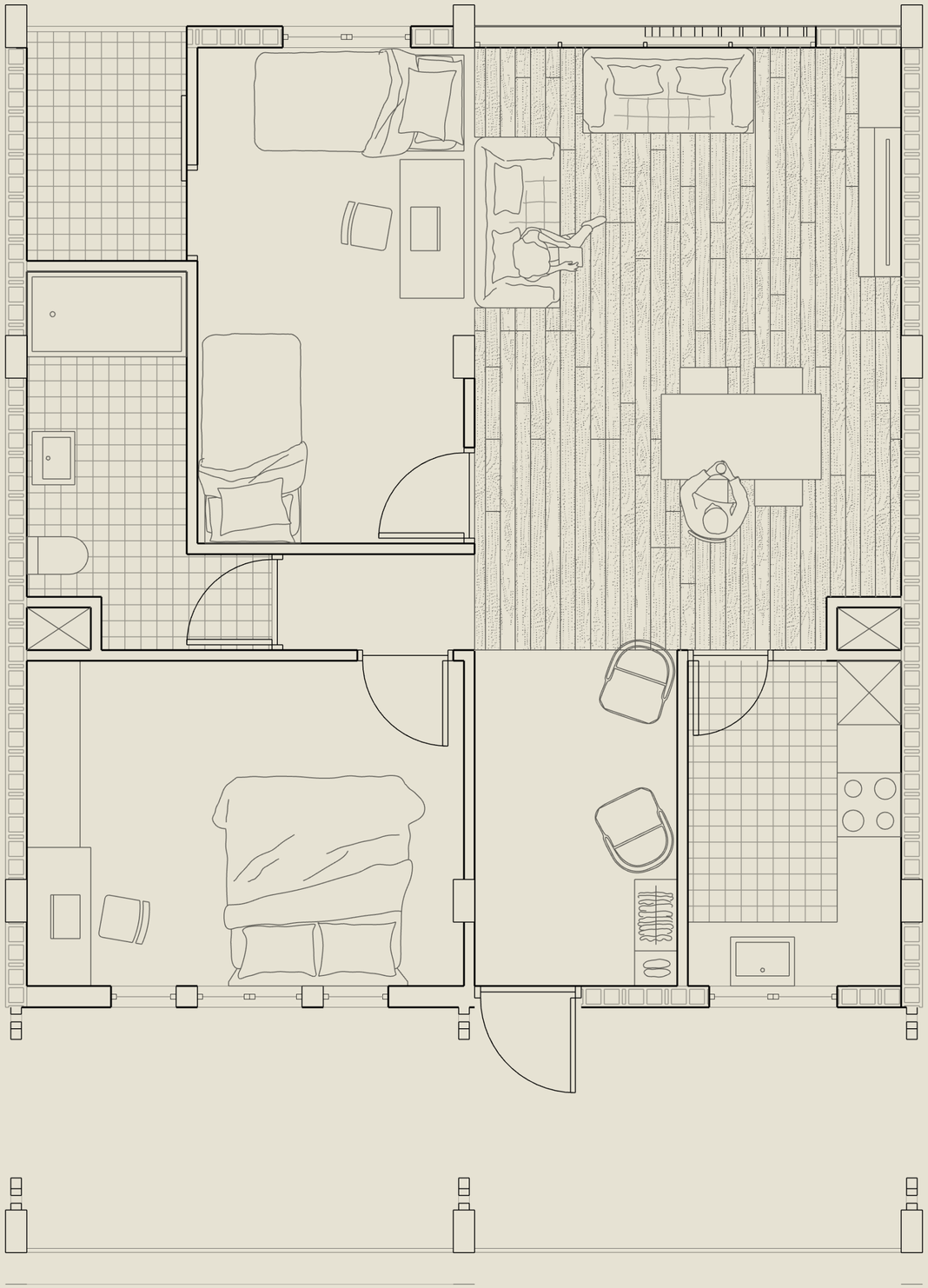
GLOBAL HOUSING

TUDelft | Architecture and the Built Environment



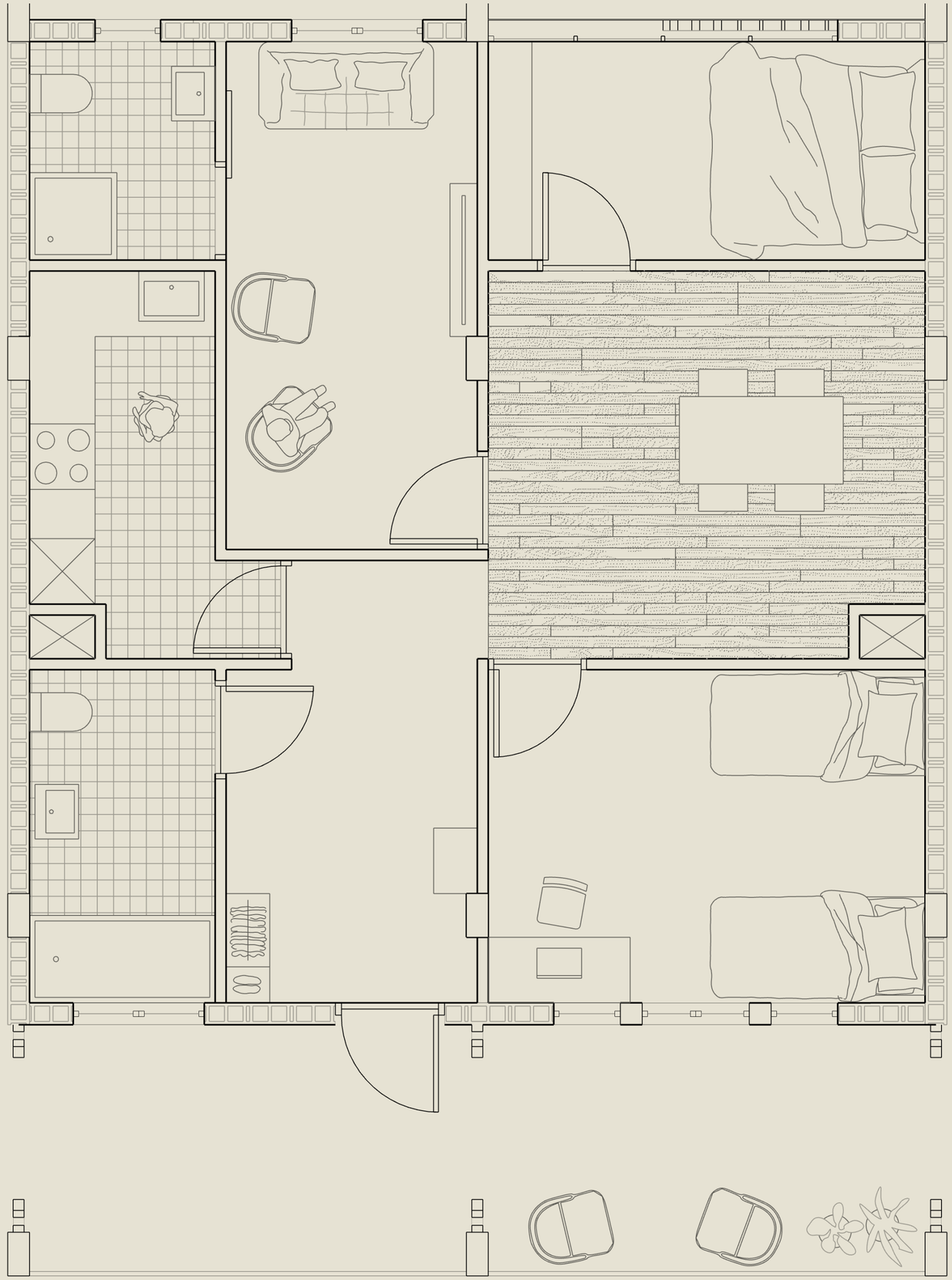
GLOBAL HOUSING

TUDelft | Architecture and the Built Environment



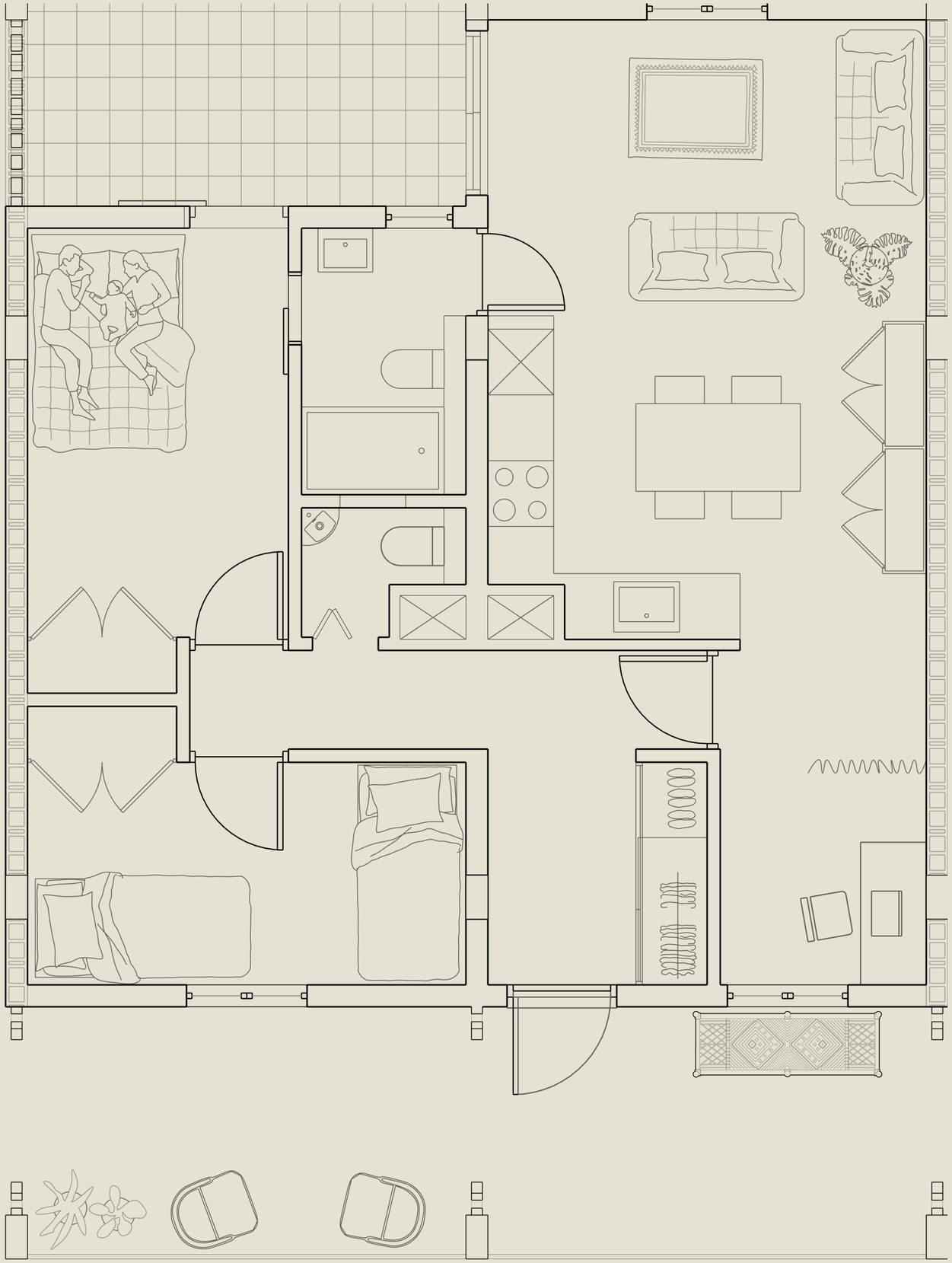
GLOBAL HOUSING

TUDelft | Architecture and the Built Environment



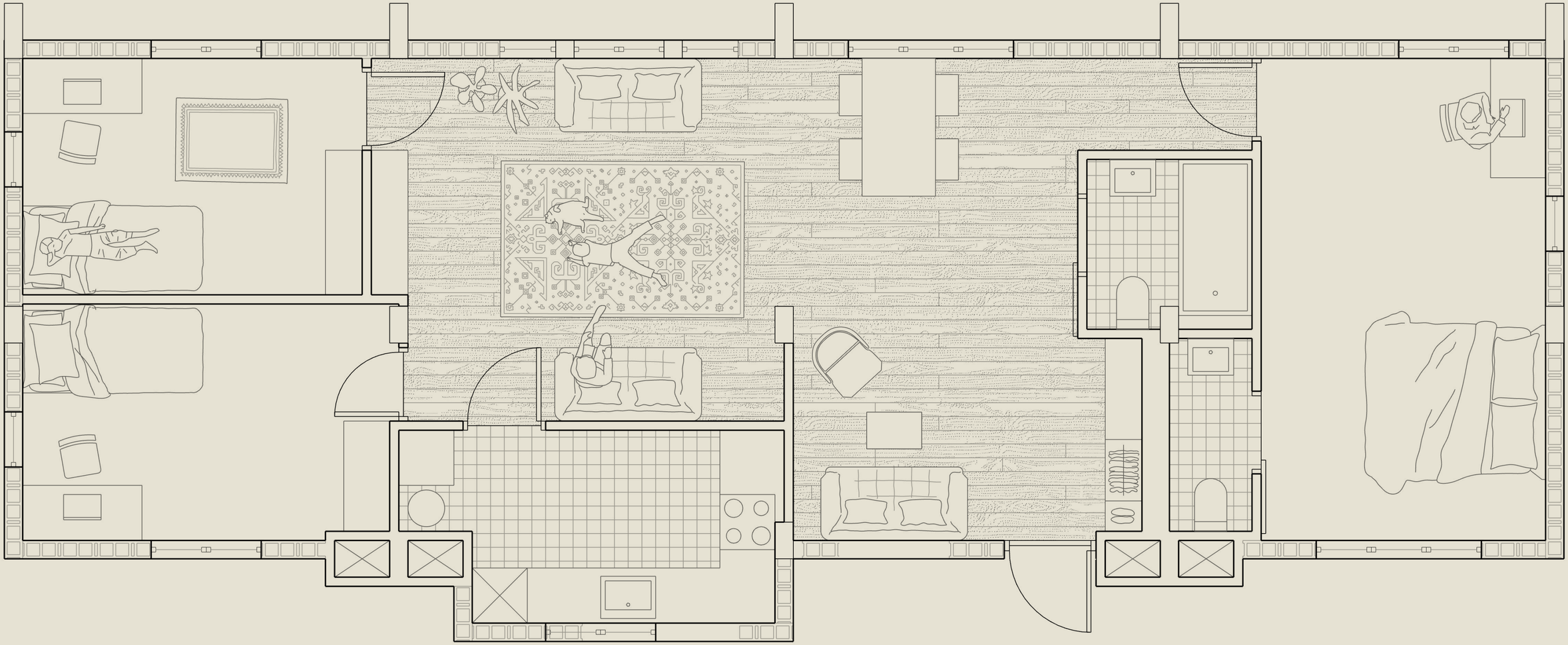
GLOBAL HOUSING

TUDelft | Architecture and the Built Environment



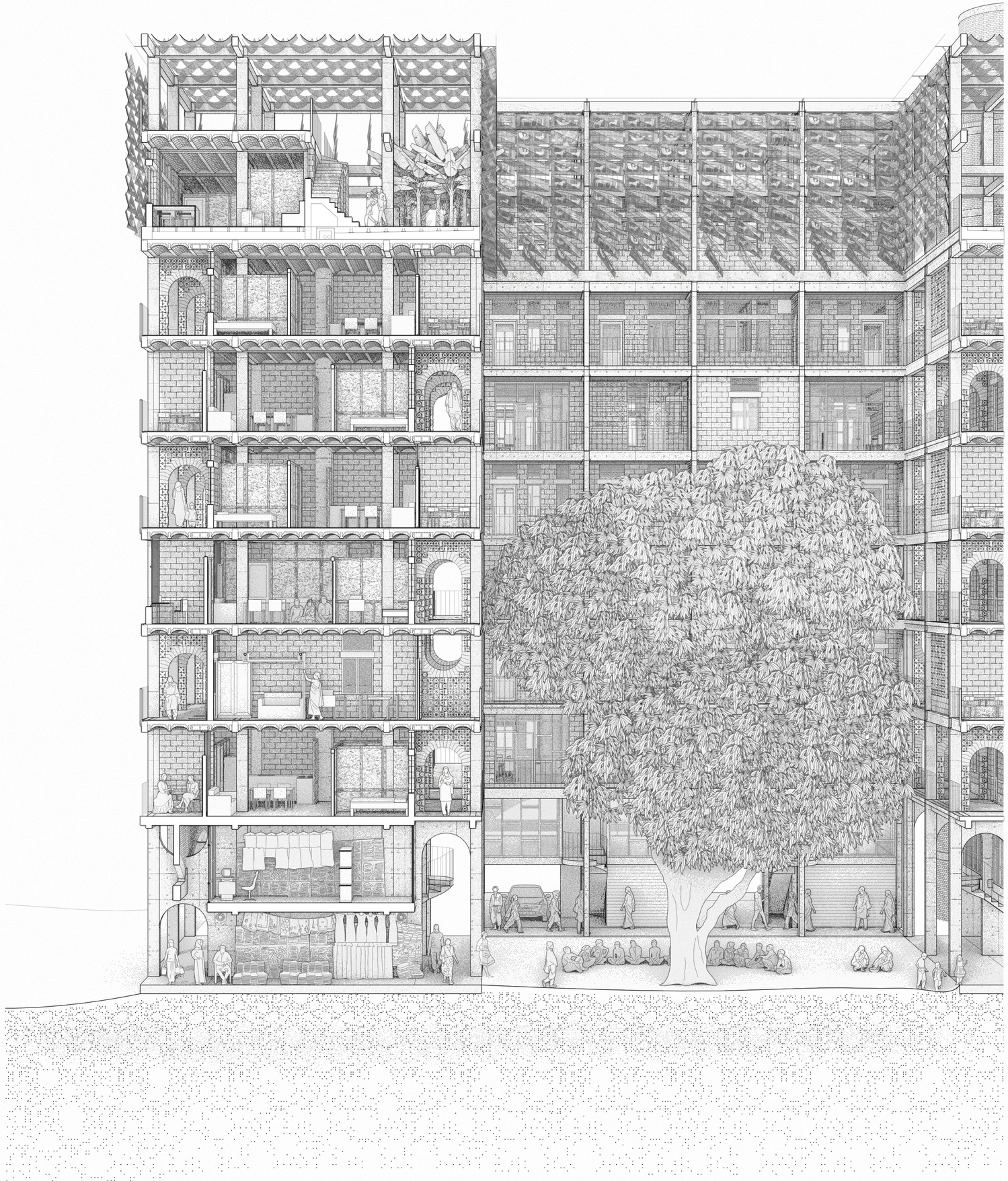
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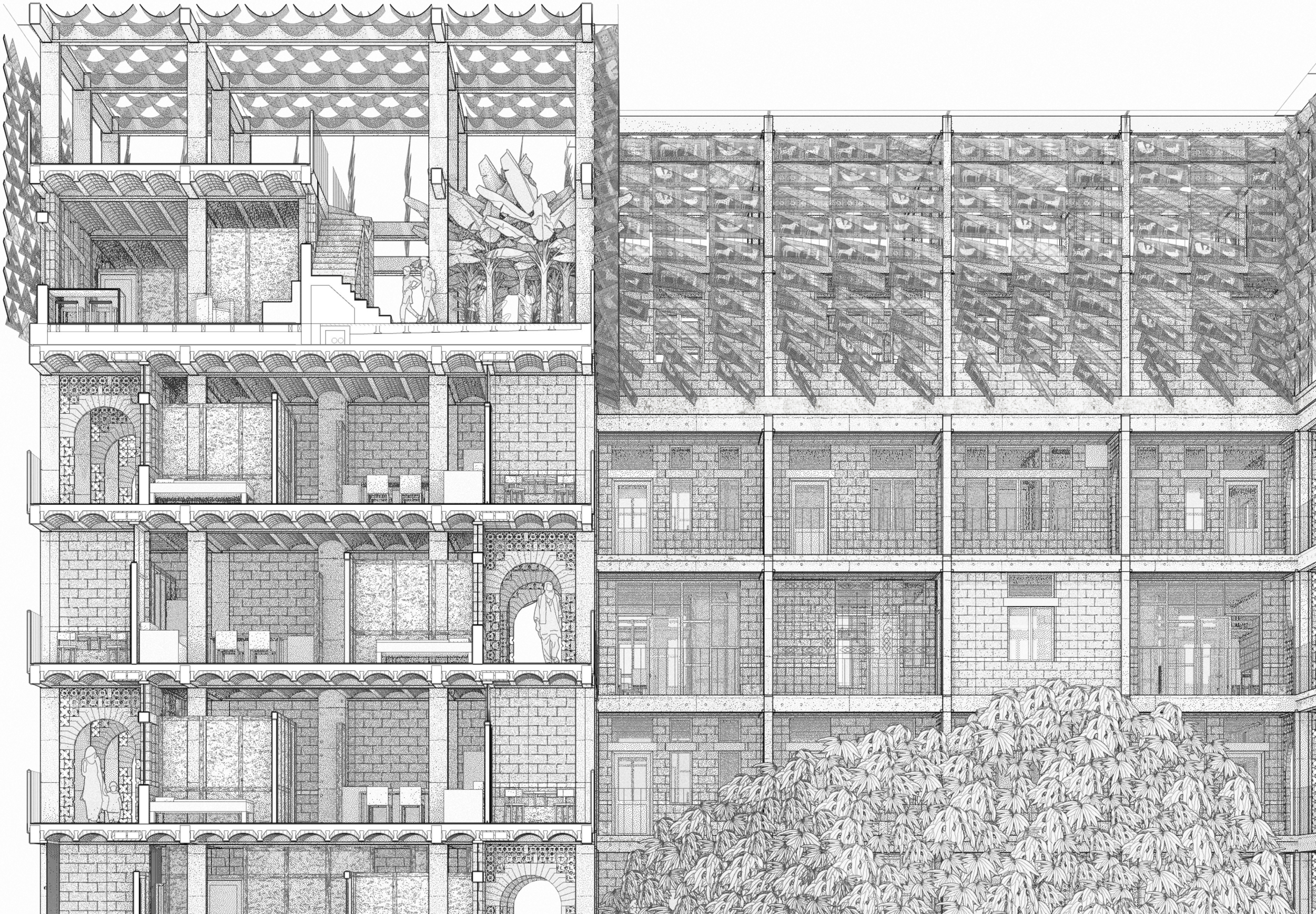
TUDelft | Architecture and the Built Environment



GLOBAL HOUSING

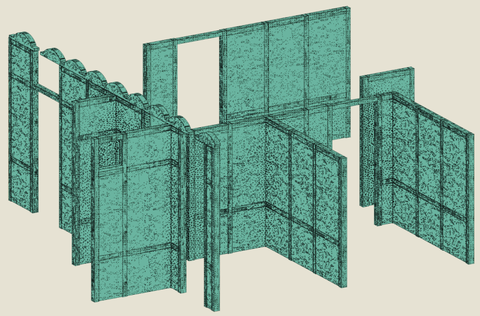
TUDelft | Architecture and the Built Environment



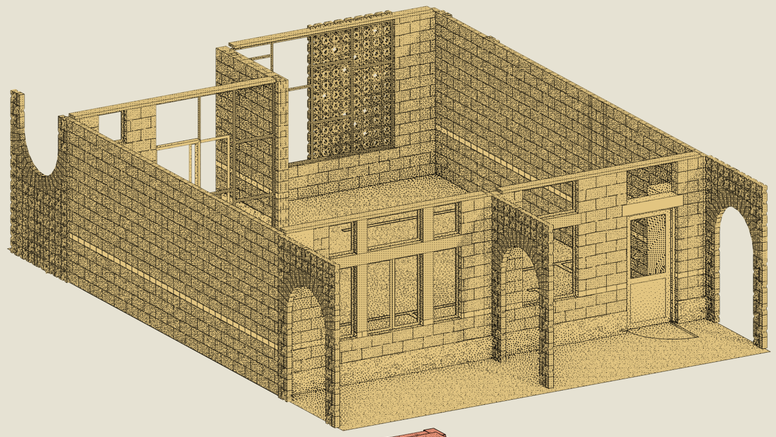


Material Strategy

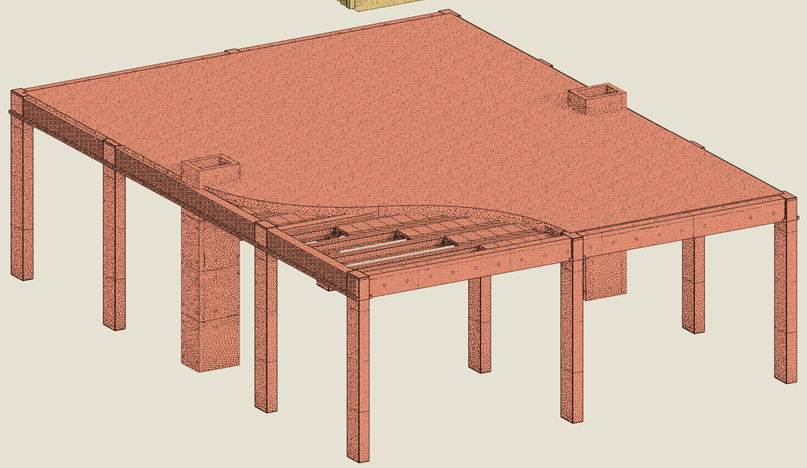
Half-Timbered

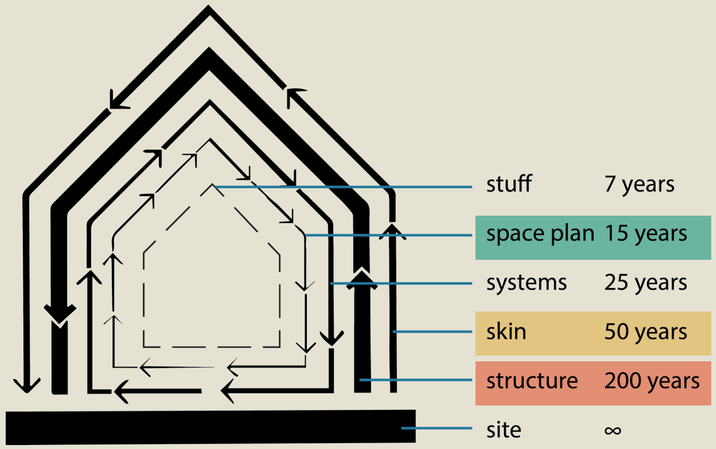


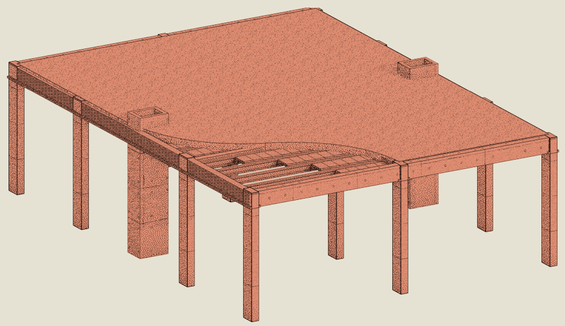
Hollow Blocks



Concrete & Brick

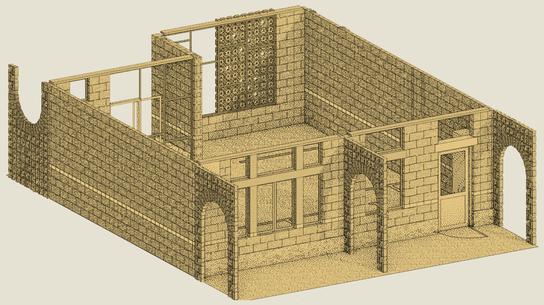






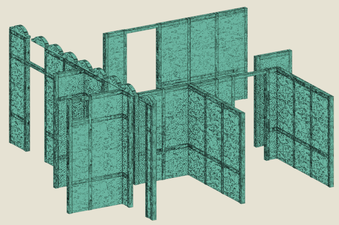
Concrete & Brick

Density: High
Durability: High
Embodied Carbon: High
Whole-life carbon (WLC): Low only across a long lifespan



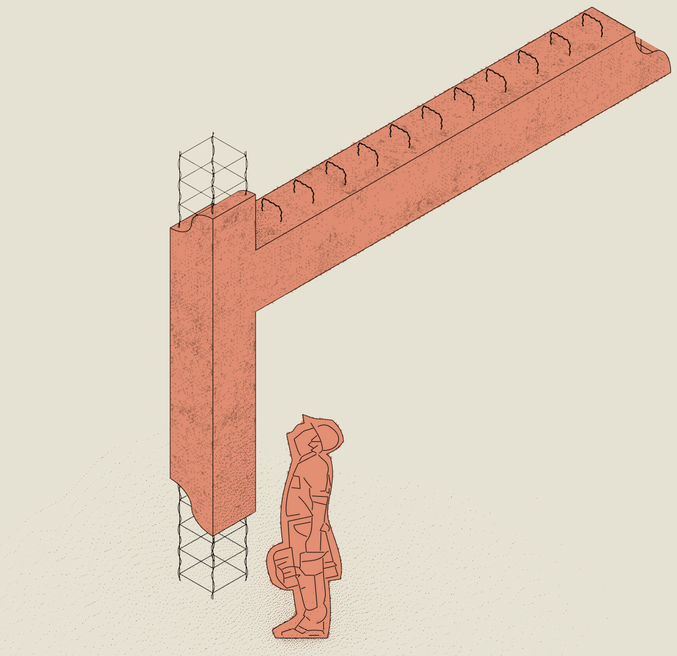
Hollow Blocks

Density: Medium
Durability: Medium
Embodied Carbon: Medium
Whole-life carbon (WLC): Low across a medium lifespan



Half-Timbered

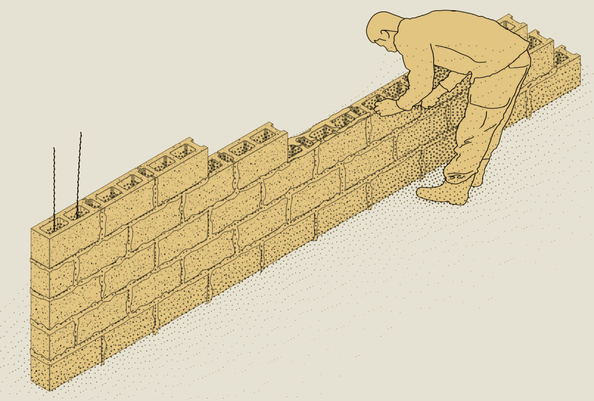
Density: Medium
Durability: Medium
Embodied Carbon: Medium
Whole-life carbon (WLC): Low even across a short lifespan



Concrete & Brick

While concrete is a heavy material with high embodied carbon, a well desinged concrete stucture can last almost indefinitely. As such, a building with a concrete structure can still achive a low whole-life carbon value. Concrete is the most commonly used structural material for large buildings in Bangladesh and therefore benefits from widespread availability and construction expertise. This means it is cost effective, reliable and comparativley easy to work with. Similarly brick is extremely prevalent in Bangladesh and commonly used in both loadbearing and non-loadbearing capacities. It also benefits from widespread availability, expertise and high durability.

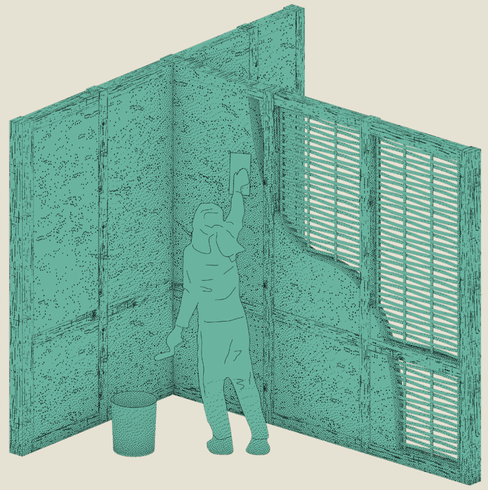
These factors influenced the choice of these materials for the most permanent elements of the construction.



Hollow Blocks

Hollow blocks come in various forms with concrete hollow blocks being the most commonly used in construction. Hollow blocks benefit from being easy to work with without requiring specialist skills, due to the hollow chambers reducing density they are easy to handle on site and can be readily cut or reconfigured to suit different layouts. The material composition of the blocks can also be easily varied from high-strength high-cement content mixes all the way through to unfired stabilised earth blocks with a very low cement content. Additionally, for standard wall constructions, rebar is used in the hollow chambers to add tensile strength and the proportion can be easily adjusted to meet desired parameters. For high rise construction in an earthquake prone region like Sylhet, standardised concrete blocks with modular dimensions (e.g. 190x190x390mm) are the most cost effective and suitable in strength. While customised blocks and material mixes are easy to make, standardised blocks benefit vastly from economies of scale and as such are better suited for standard wall constructions.

However, for non-loadbearing walls with aesthetic functions, such as for Jali walls, non-standard blocks are suitable. Furthermore they can be made of clay or other natural materials, with low embodied carbon.



Half-Timbered

Half-timbered construction is traditionally used in rural dwellings in Bangladesh, particularly in Bangla Baton houses. Walls are framed in timber of relatively slender sizes (such as 75x75mm and 100x100mm) with wattle and daub infill. The wattle is usually made of a bamboo lattice or a combination of bamboo and Ikra reed. Ikra reed is less susceptible to insect attack than bamboo. The bamboo should be treated to improve resistance to water and pests. This can be done in various ways but a traditional method common in Bangladesh is to use Gaab fruit. In the past, the daub was frequently made of a mix of mud, cow dung and straw (or other fibrous material). Today cement plaster is also often used, out of convenience and due to the preception of concrete as a superior material. However due to lack of breathability and ductility, use of cement plaster can result in poor humidity regulation, movement cracking and poor acoustic absorption. Use of a clay plaster, with clay already being used for hollow blocks in the project, was considered optimal. A thickness of clay plaster between 25-75mm is considered optimal for humidity regulation. A rough finish will also produce good sound absorption charateristics. Where necessary, a lime plaster finish can be used to improve water resistance.

The lumberyard adjacent to the site can be a good source of timber for the wall panels, they can even be pre-assembled at the yard and then craned into place, as they are lightweight. The lumberyard sources predominantly Lohakath Ironwood, which is very common in the hilly forest areas of greater Sylhet.

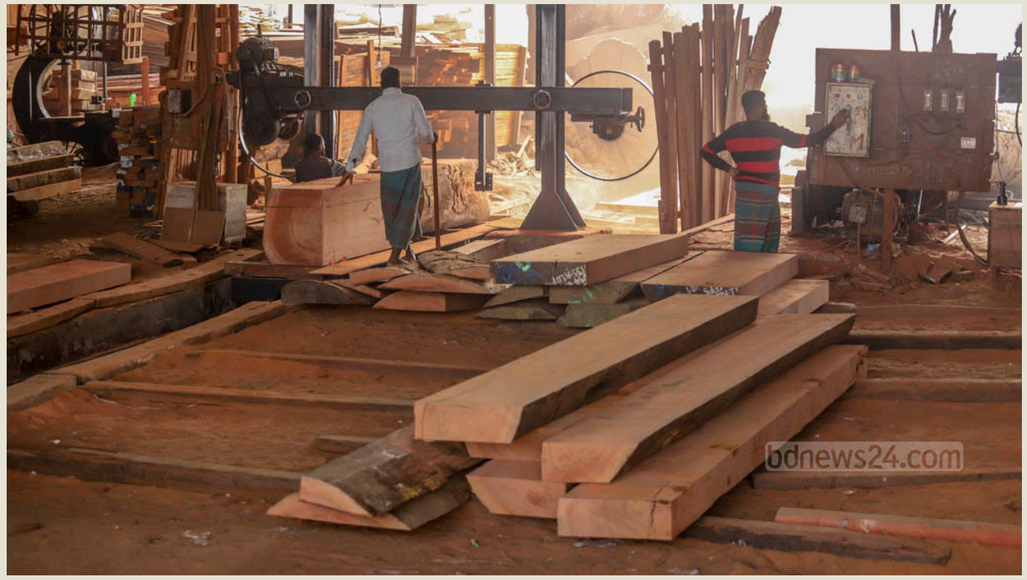
Lohakath Ironwood

The lumberyard adjacent to the site can be a good source of timber for the wall panels, the lightweight frames can even be pre-assembled at the yard and craned into the building. The lumberyard sources predominantly Lohakath Ironwood, which is very common in the hilly forest areas of greater Sylhet.

The heartwood is a reddish colour and naturally resistant to insects due to the resisns in the wood. It is a dense hardwood that is very suitable for construction, though less so for carving or intricate joinery. Besides use for building construction, it is also used to make bridges, railway sleepers and boats.

While this wood is still readily availble in Sylhet at affordable prices, the quality and desirablity of this hardwood, as well the sustainablity of current forestry pracitces may lead to to sharp price increases in the future. If this is the case, the primary framing material for the internal partition walls in the project could also easily switch to bamboo. However the continued sustainable use of this wood, along with the associated knoweldge and carpentry skills, are deemed as broadly valuable to the heritage of Sylhet and more specifically to local craftsmen or even as a source of practial skills and employment for low-income families moving to the project site.

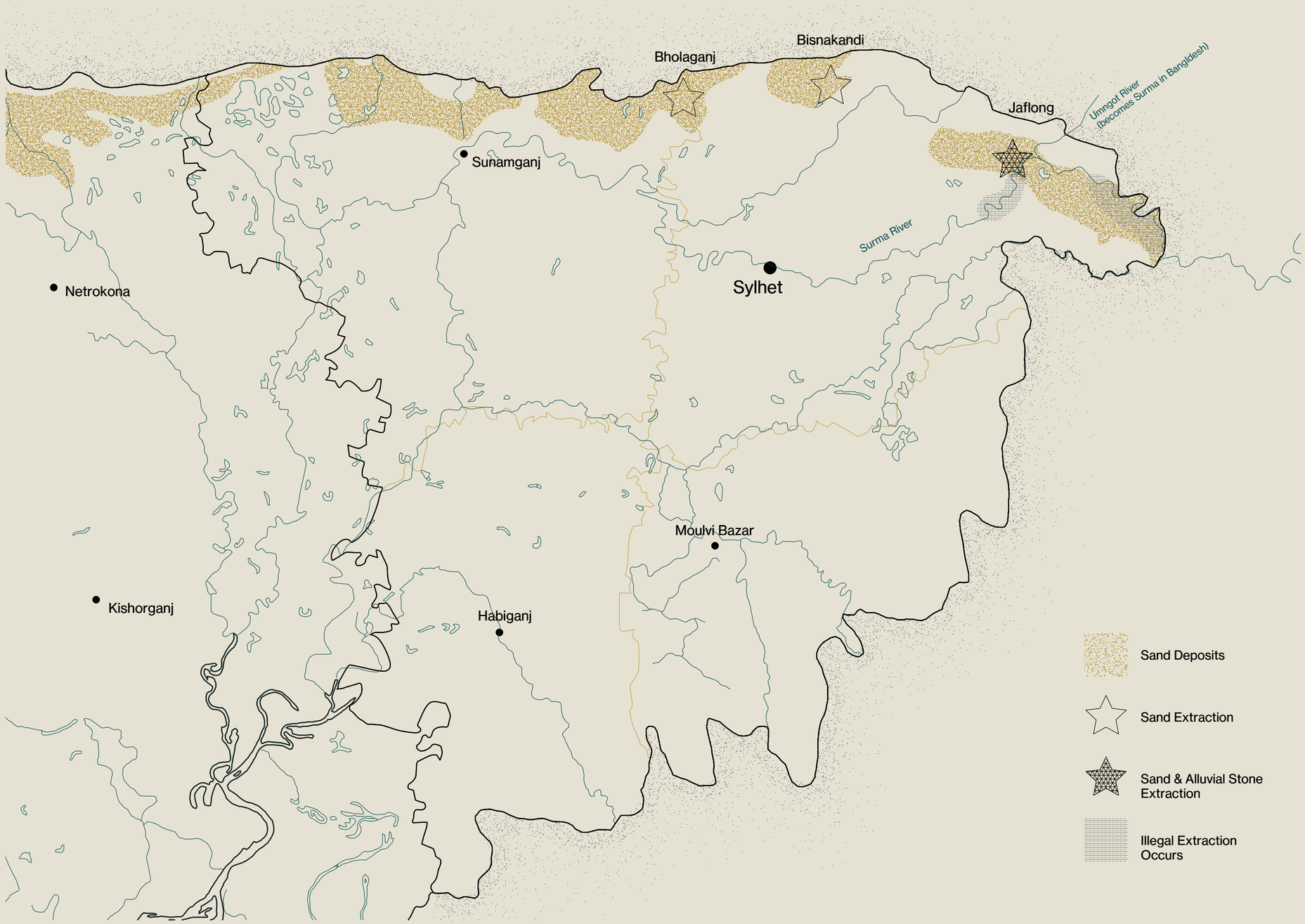


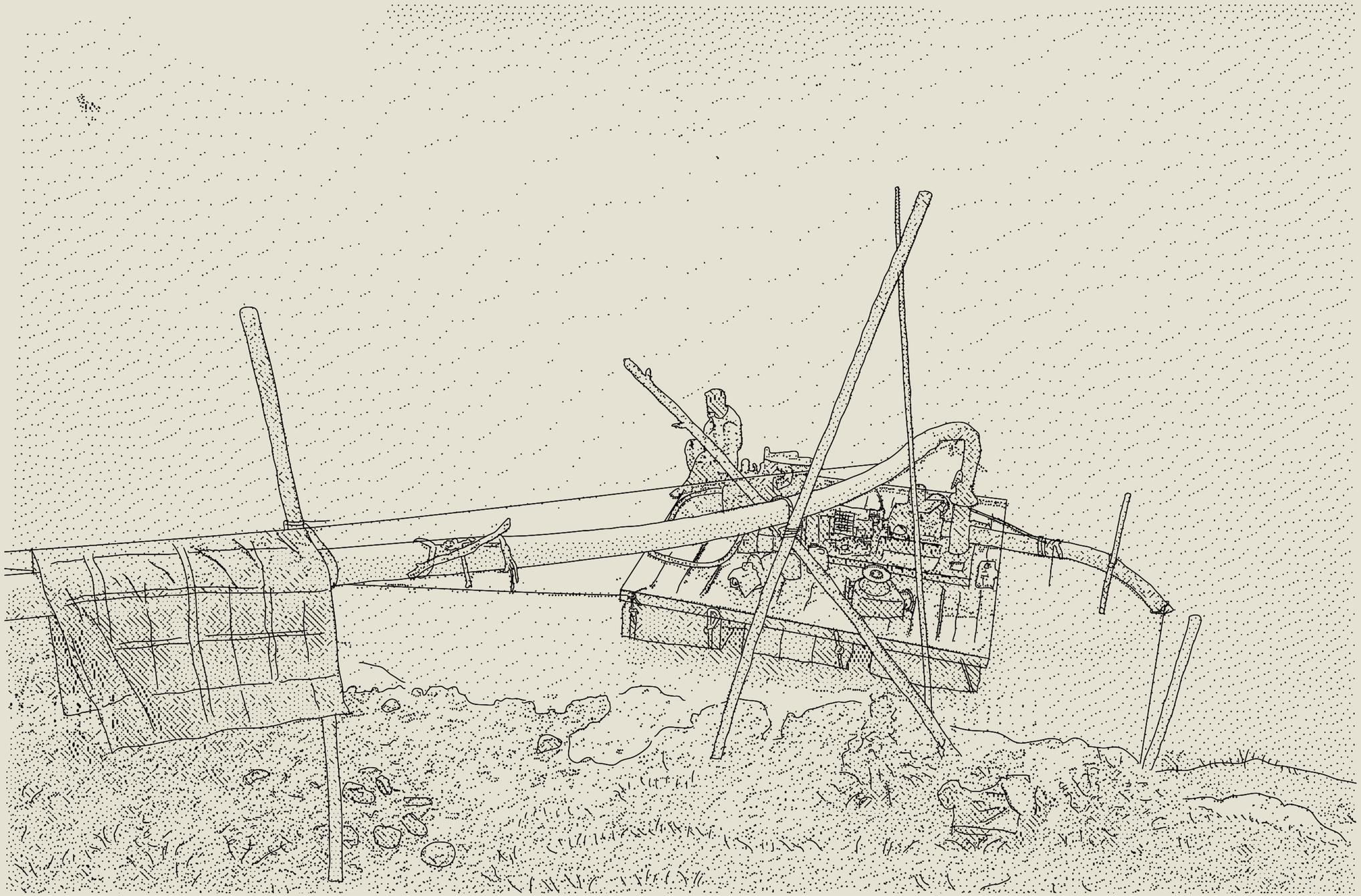




Clay and Sand

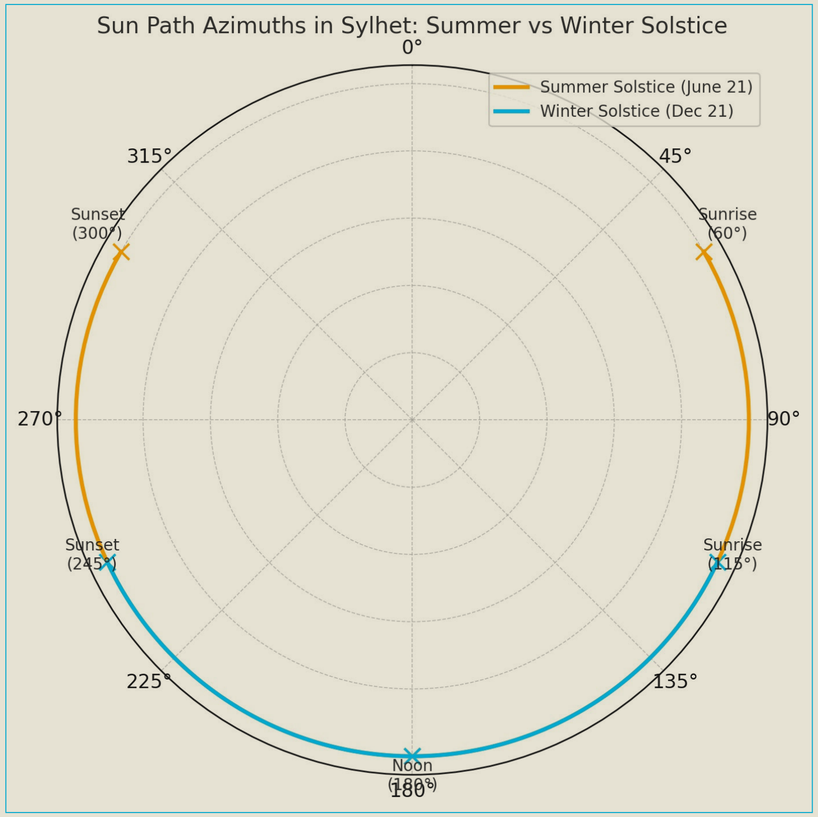
A half of Bangladesh's landmass is actively deltaic and many major rivers flow through the country. As such, alluvial soil deposits are abundant including many sources of high quality clay and sand. Sylhet in particular has sand deposits of a fine quality at its northern border with key extraction sites at Bholaganj, Bisnakandi and Jaflong. The Umgat river flows from India into Bangladesh at Jaflong, in Bangladesh it is known as the Surma river and flows directly through Sylhet, therefore providing a good transportation route by river.

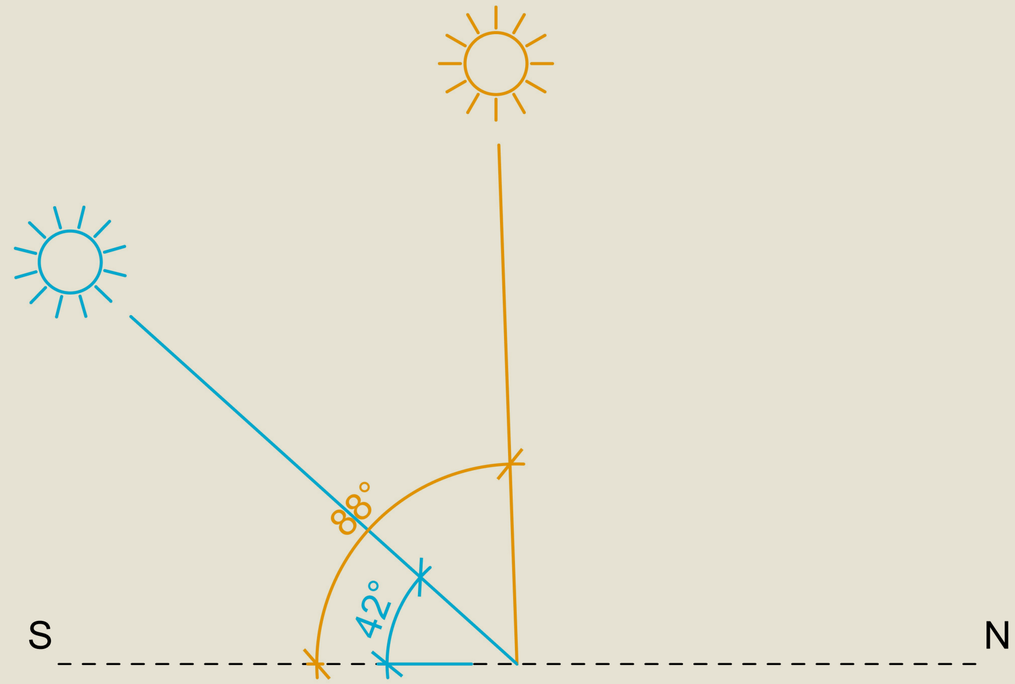




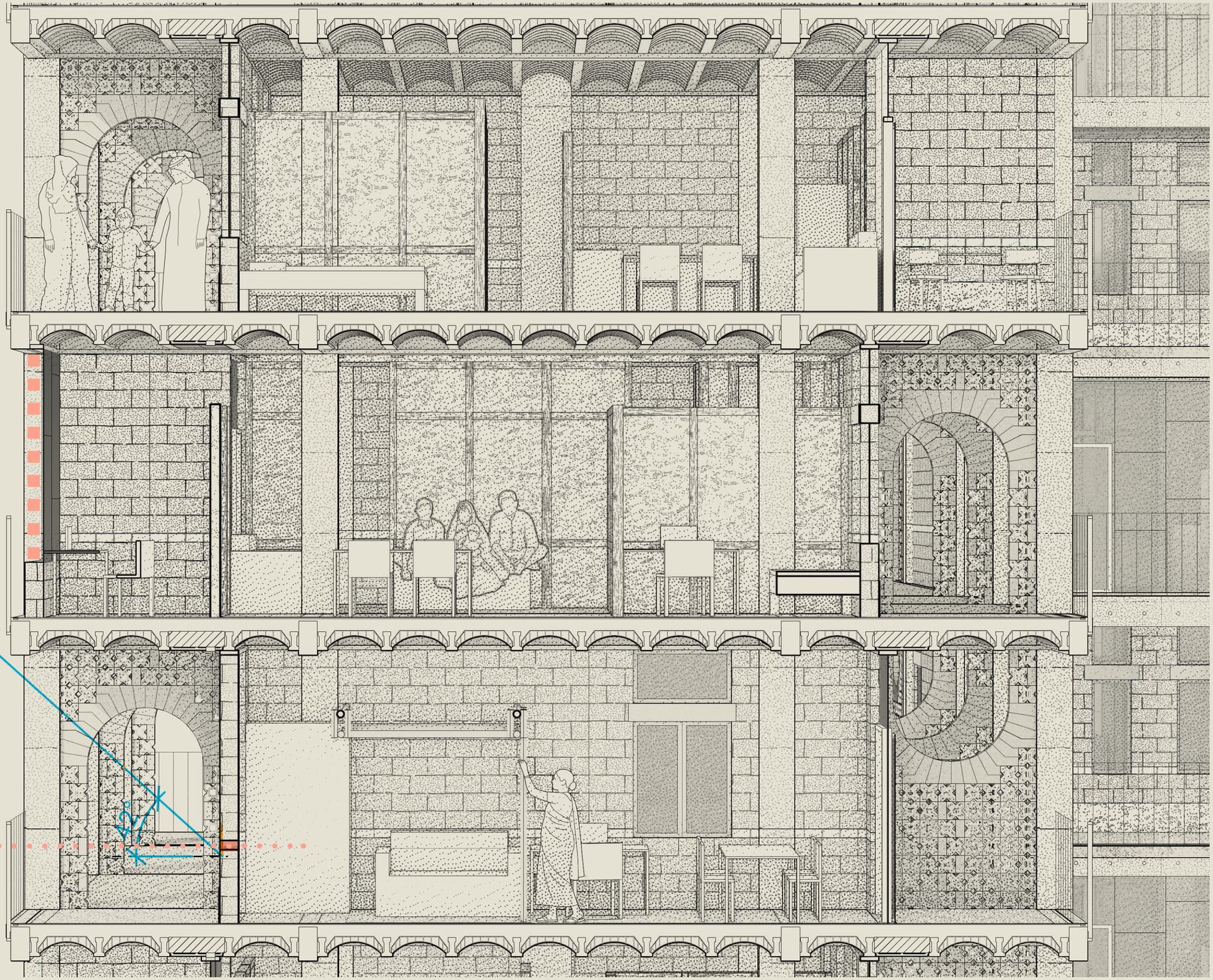
Climate Strategy

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Sun Path Azimuths in Sylhet: Summer vs Winter Solstice
Summer Solstice (June 21)
Winter Solstice (Dec 21)
0°
45°
90°
135°
180°
225°
270°
315°
Sunrise
(60°)
Sunset
(300°)
Sunrise
(115°)
Sunset
(245°)
Noon
(180°)

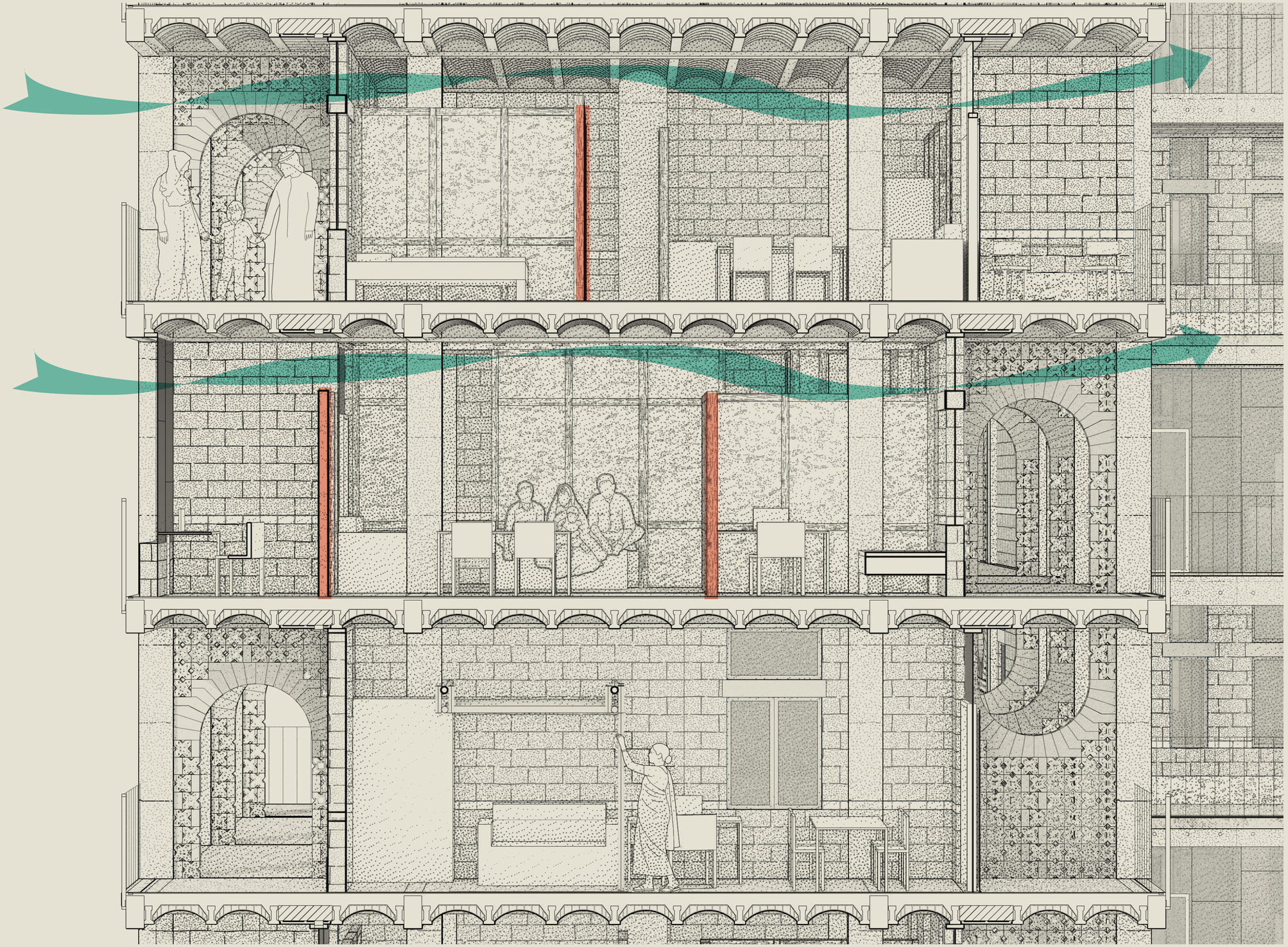

88°
42°
S
N

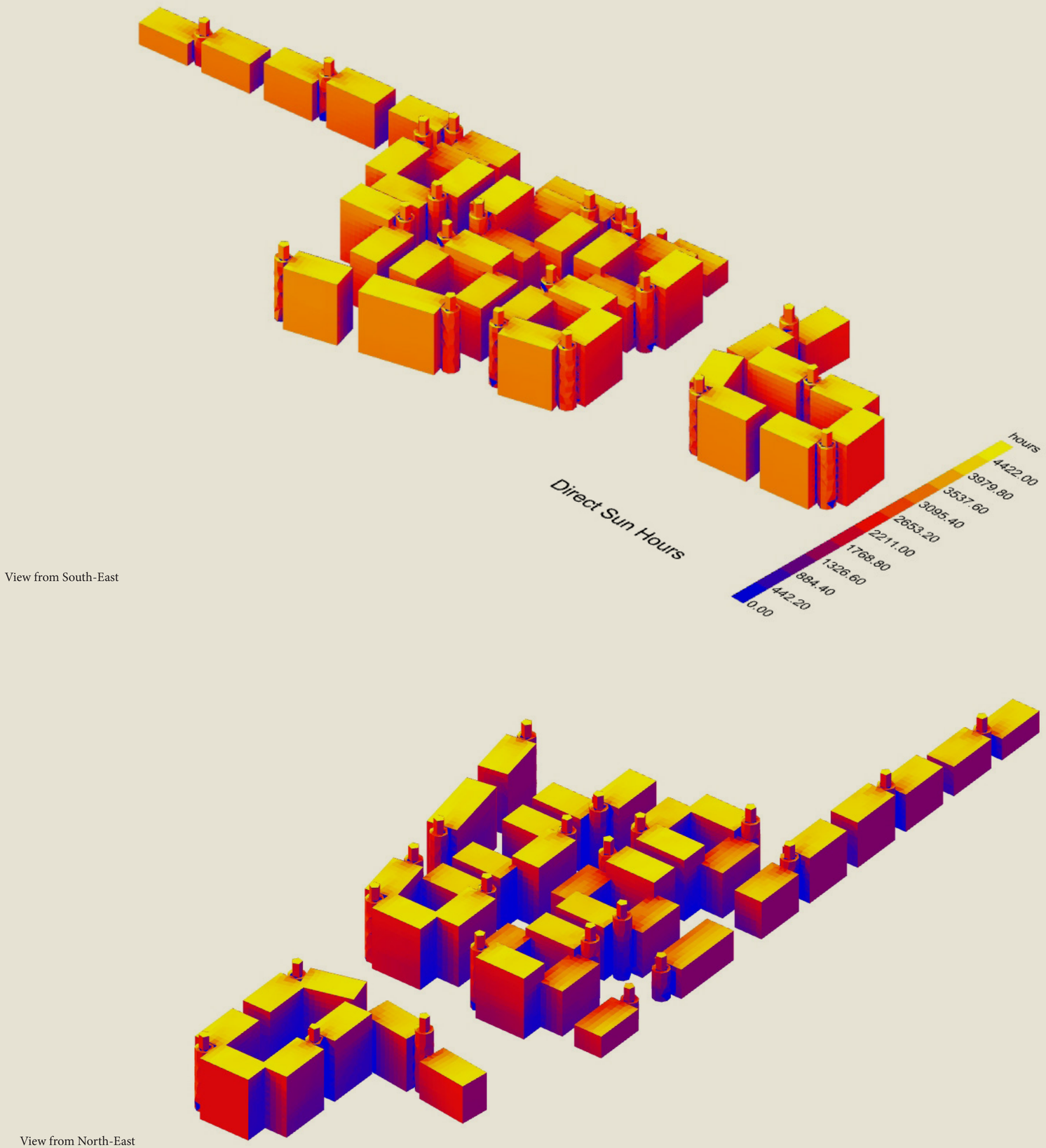
Shading through hollow block Jali wall



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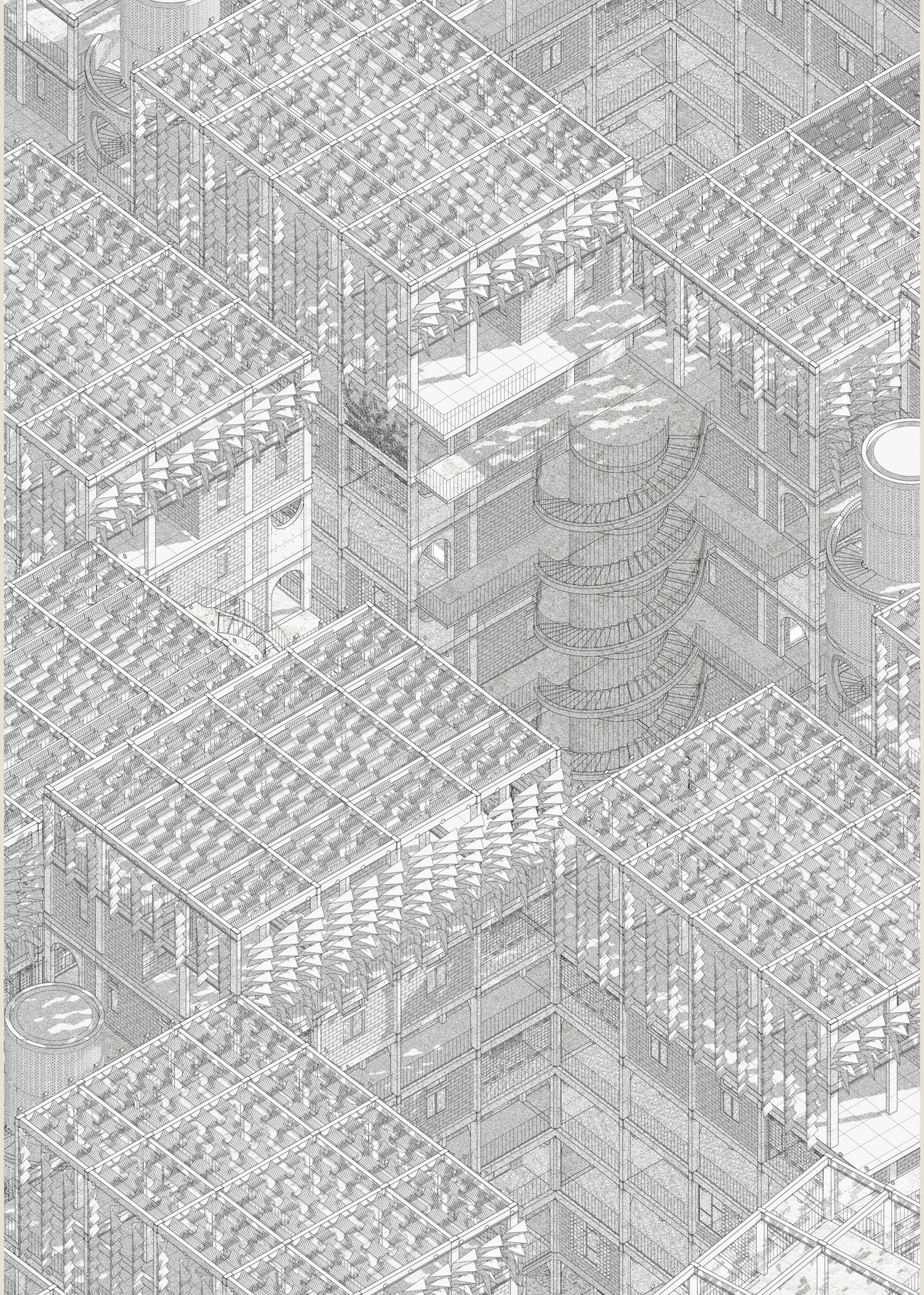
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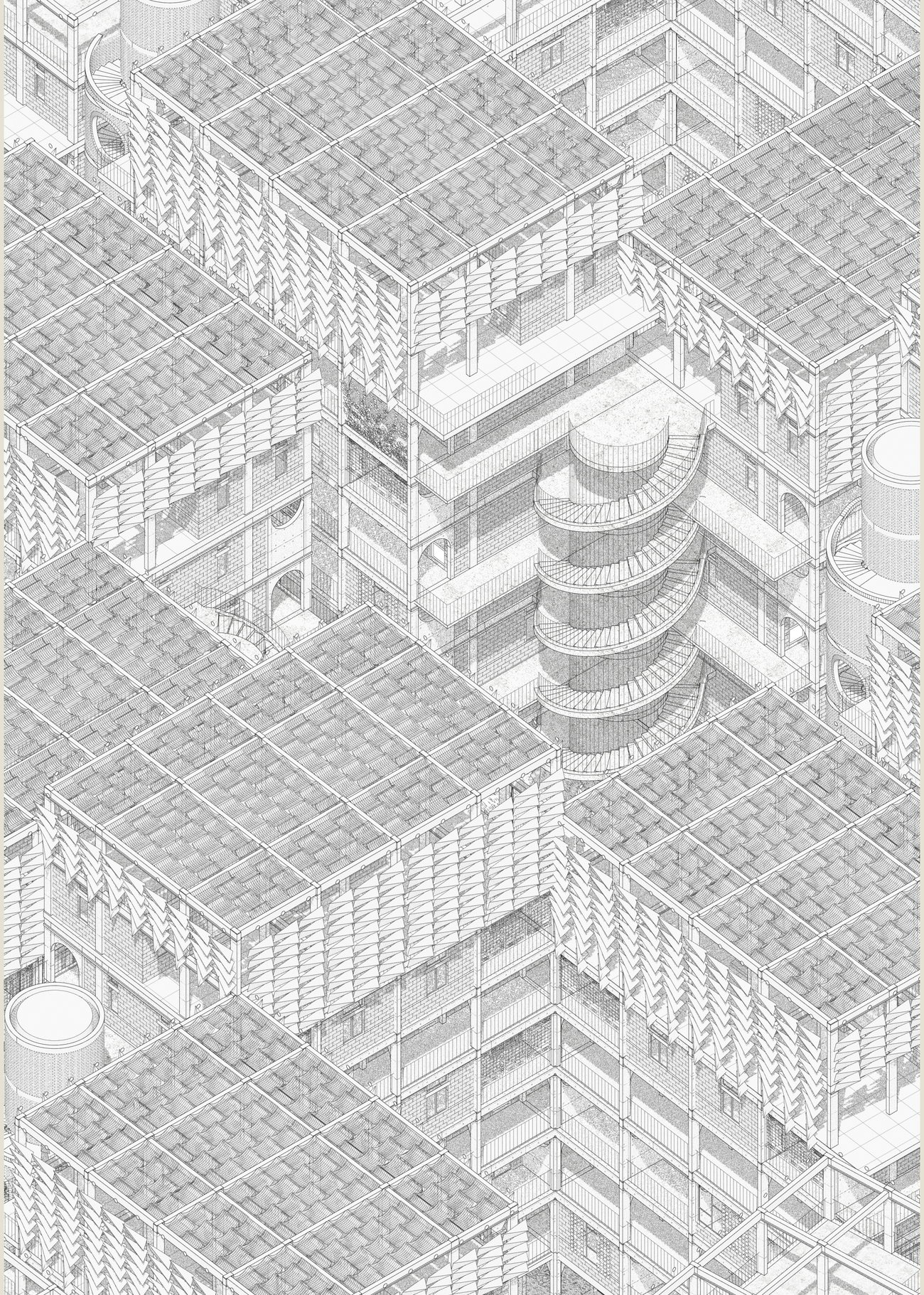
View from South-East

View from North-East



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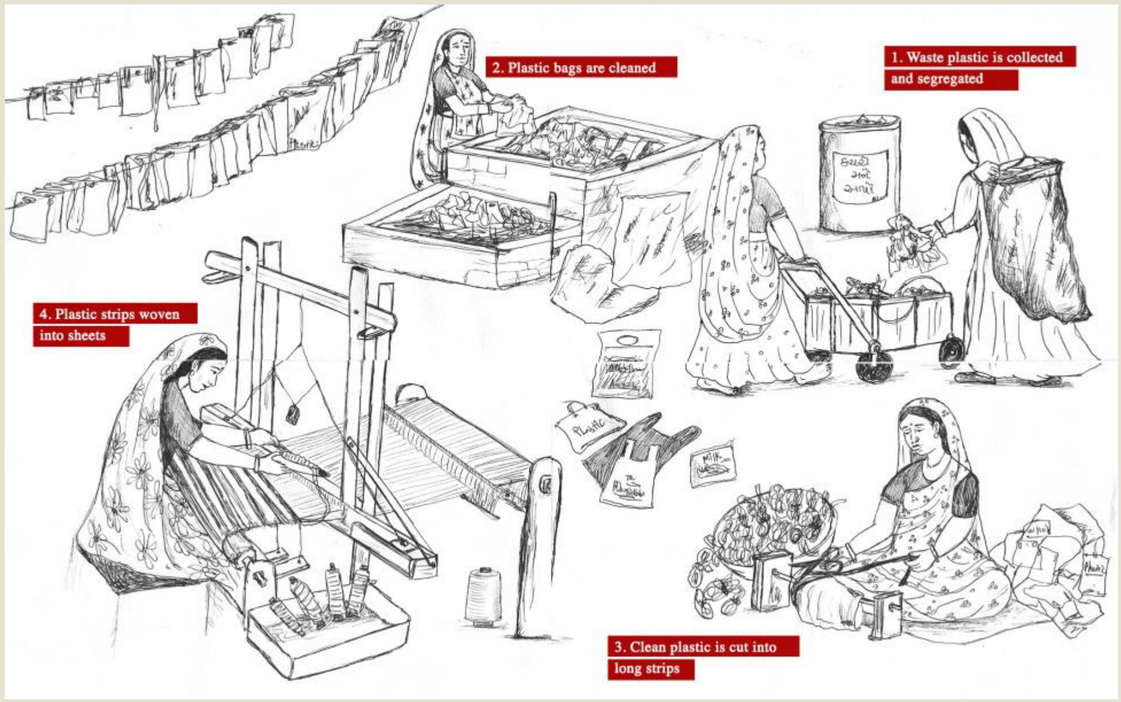
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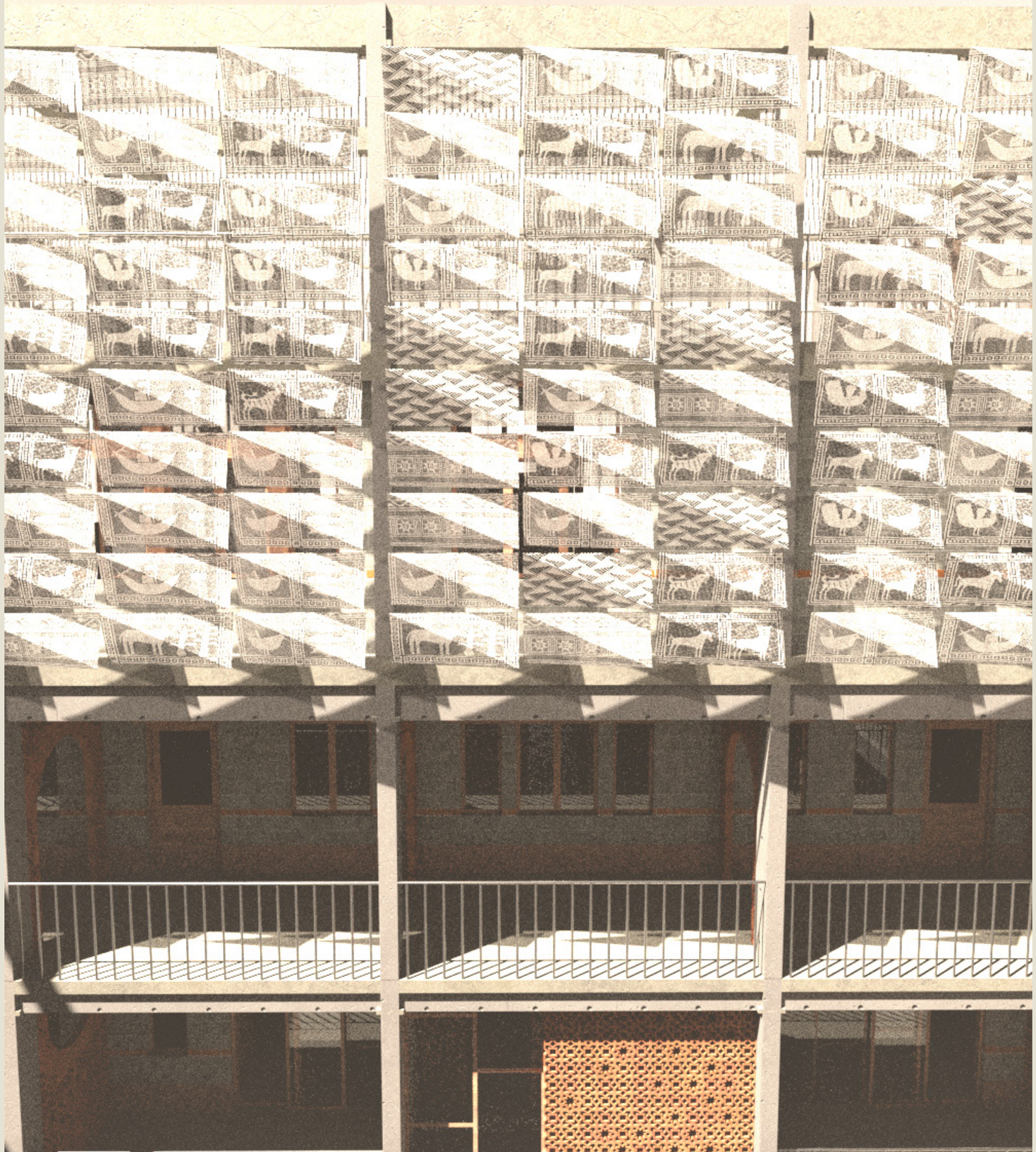




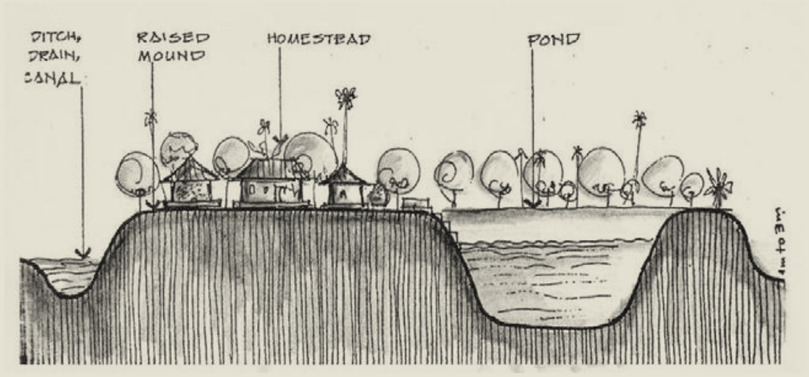

2. Plastic bags are cleaned
1. Waste plastic is collected and segregated
4. Plastic strips woven into sheets
3. Clean plastic is cut into long strips







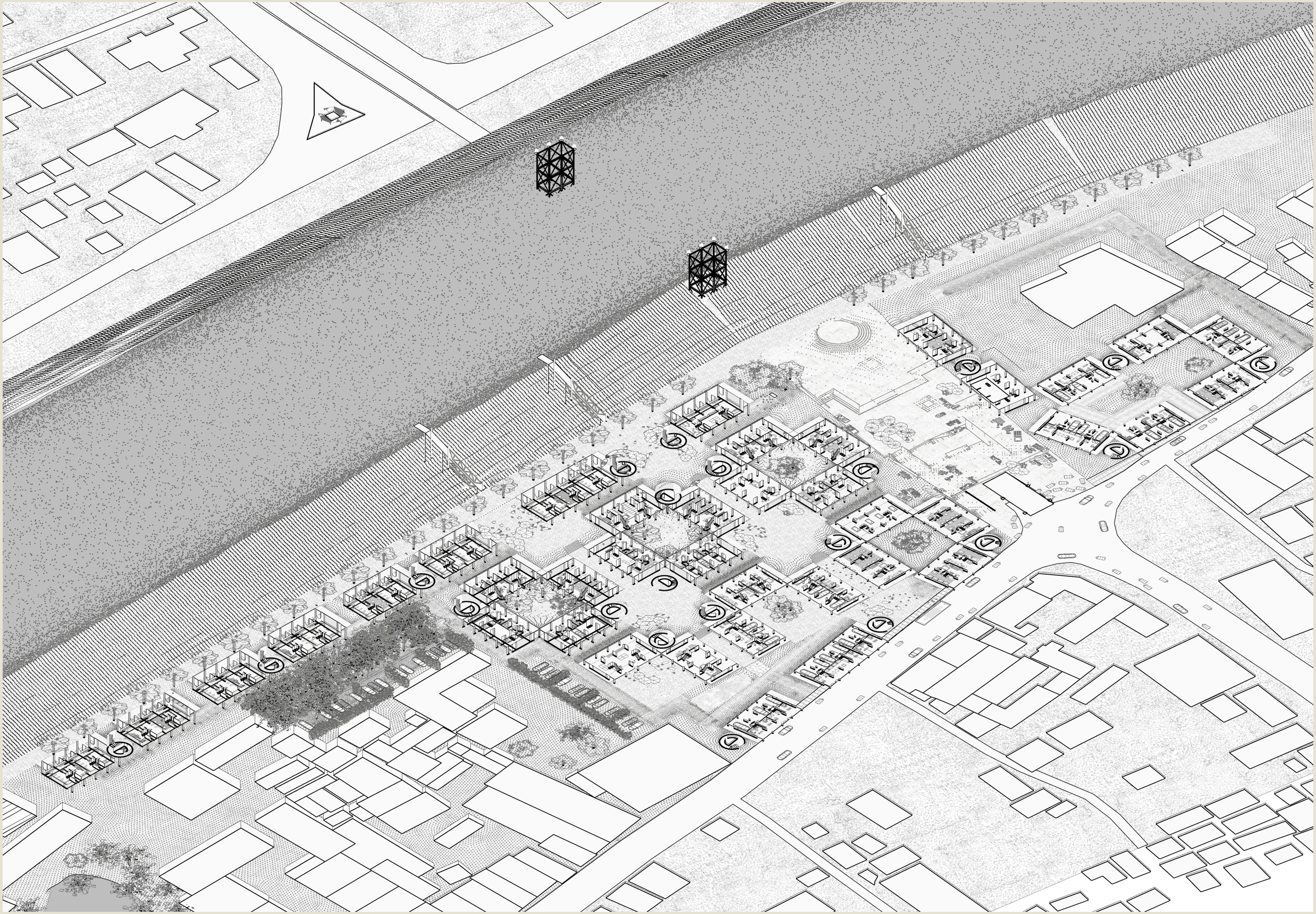
Water Mangagement


DITCH,
DRAIN,
CANAL
RAISED
MOUND
HOMESTEAD
POND



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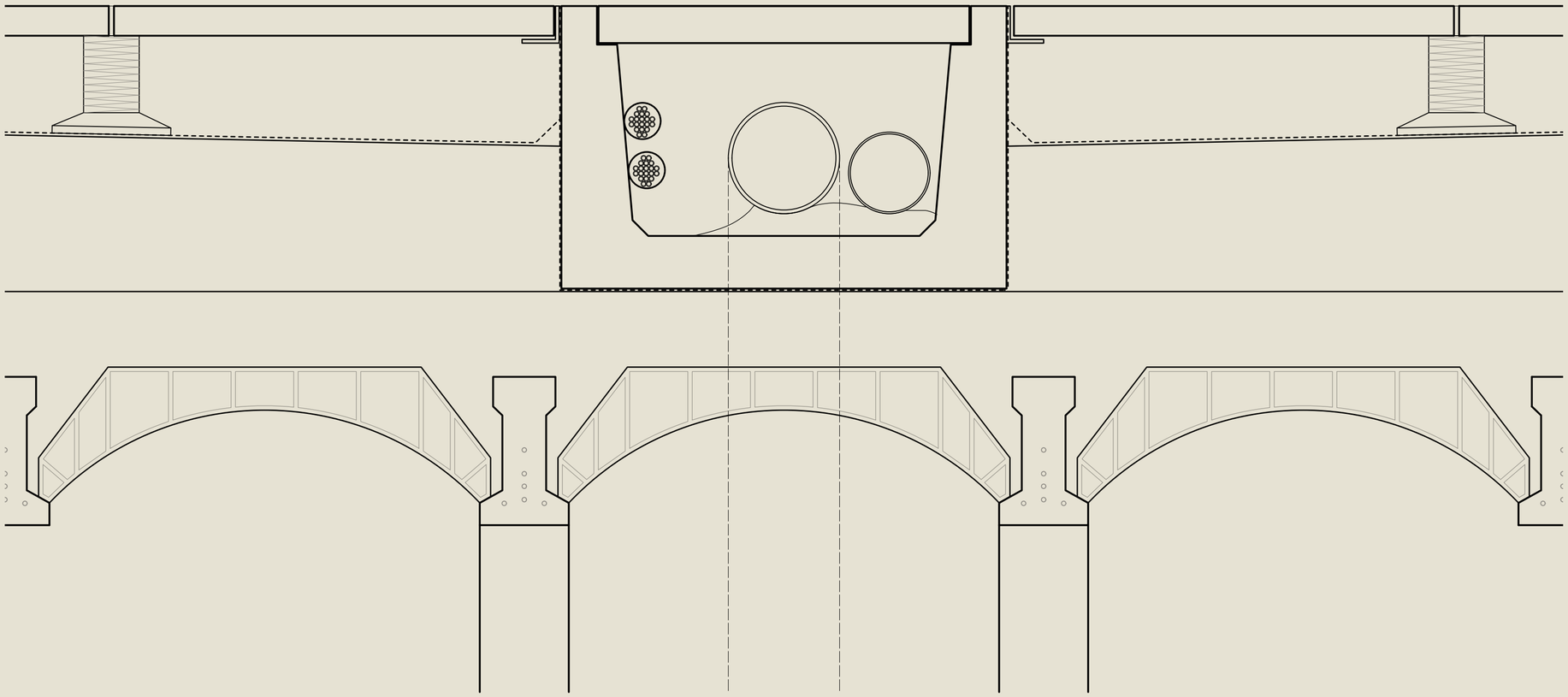
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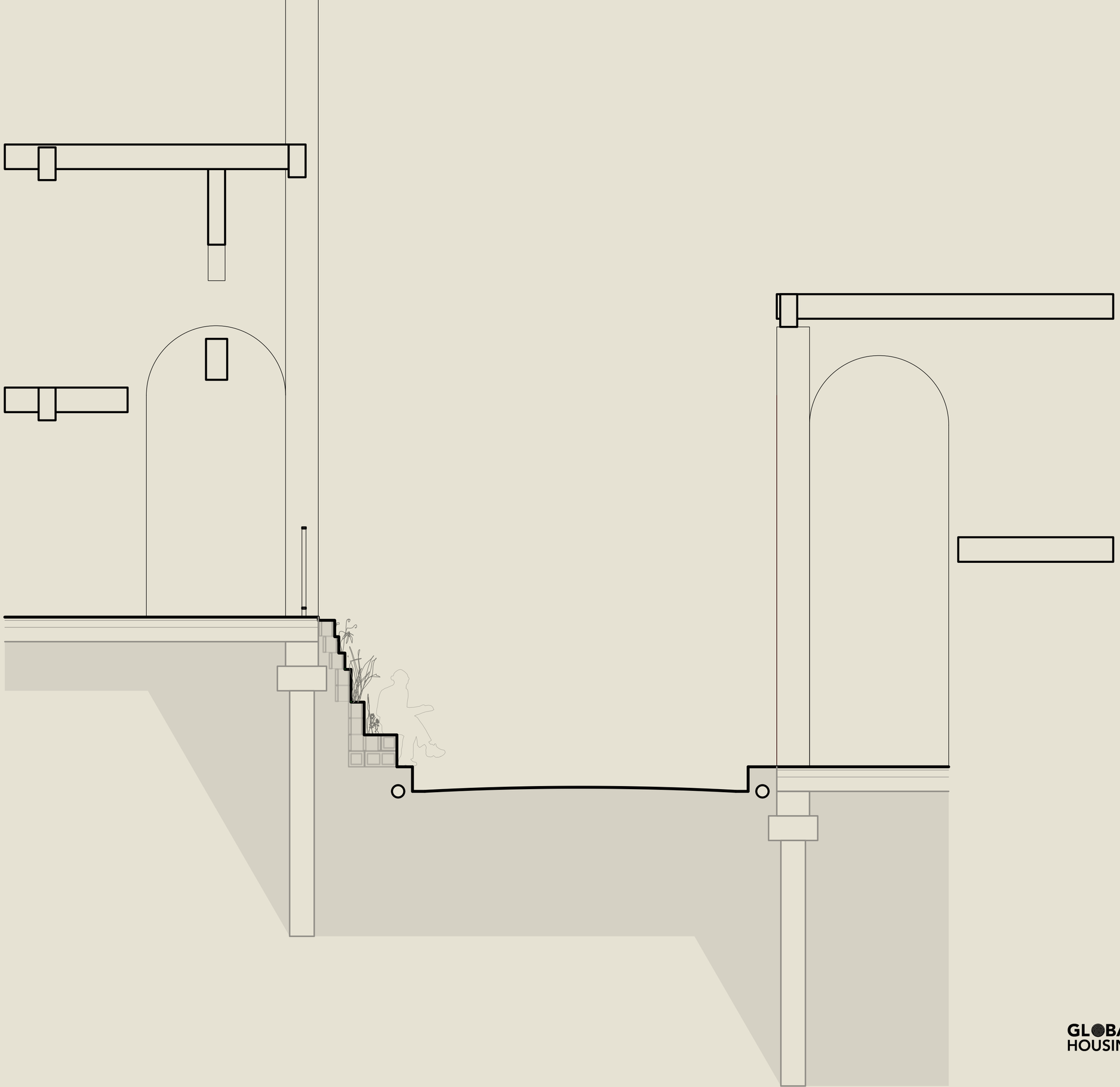
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Street Profiles

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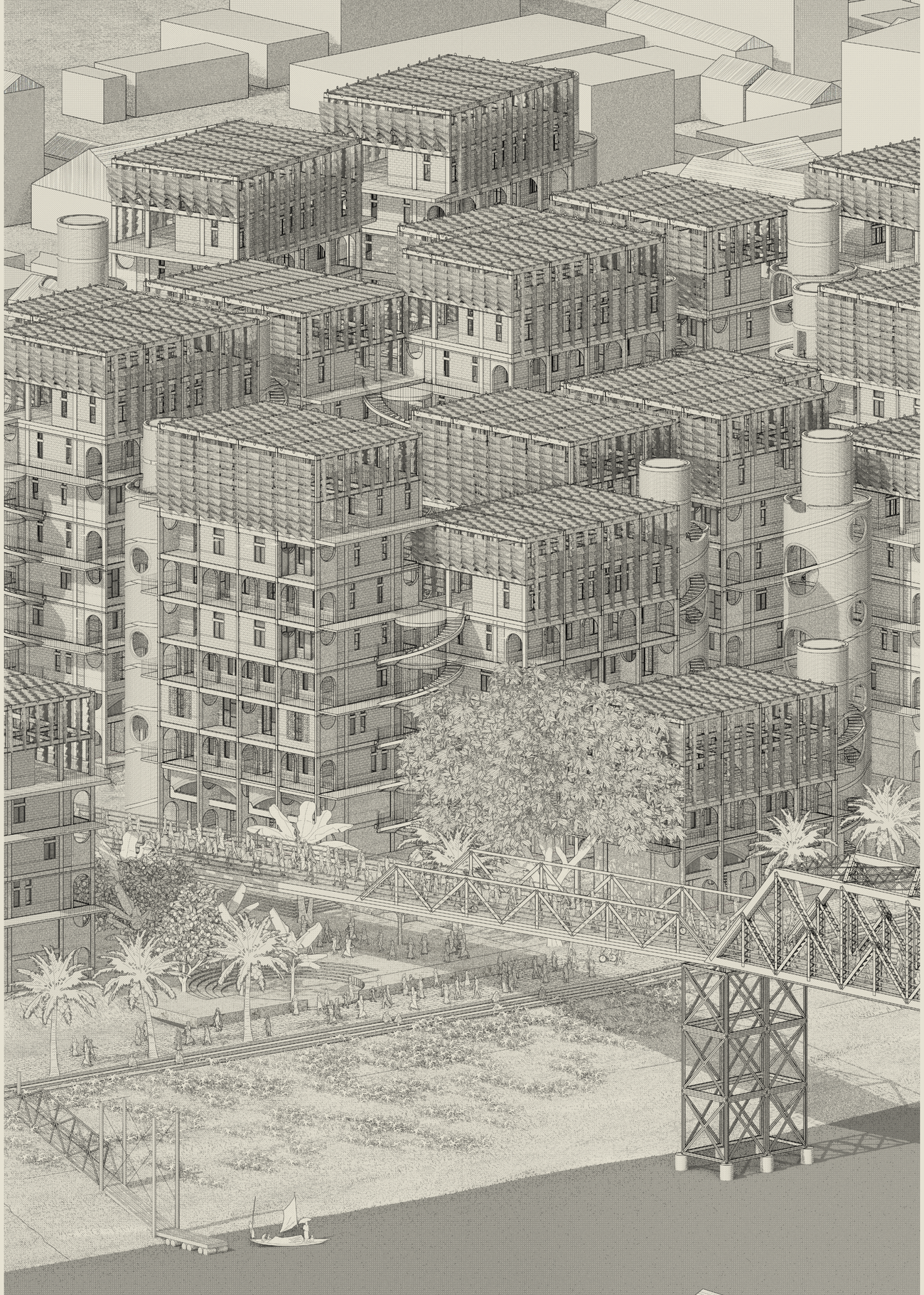
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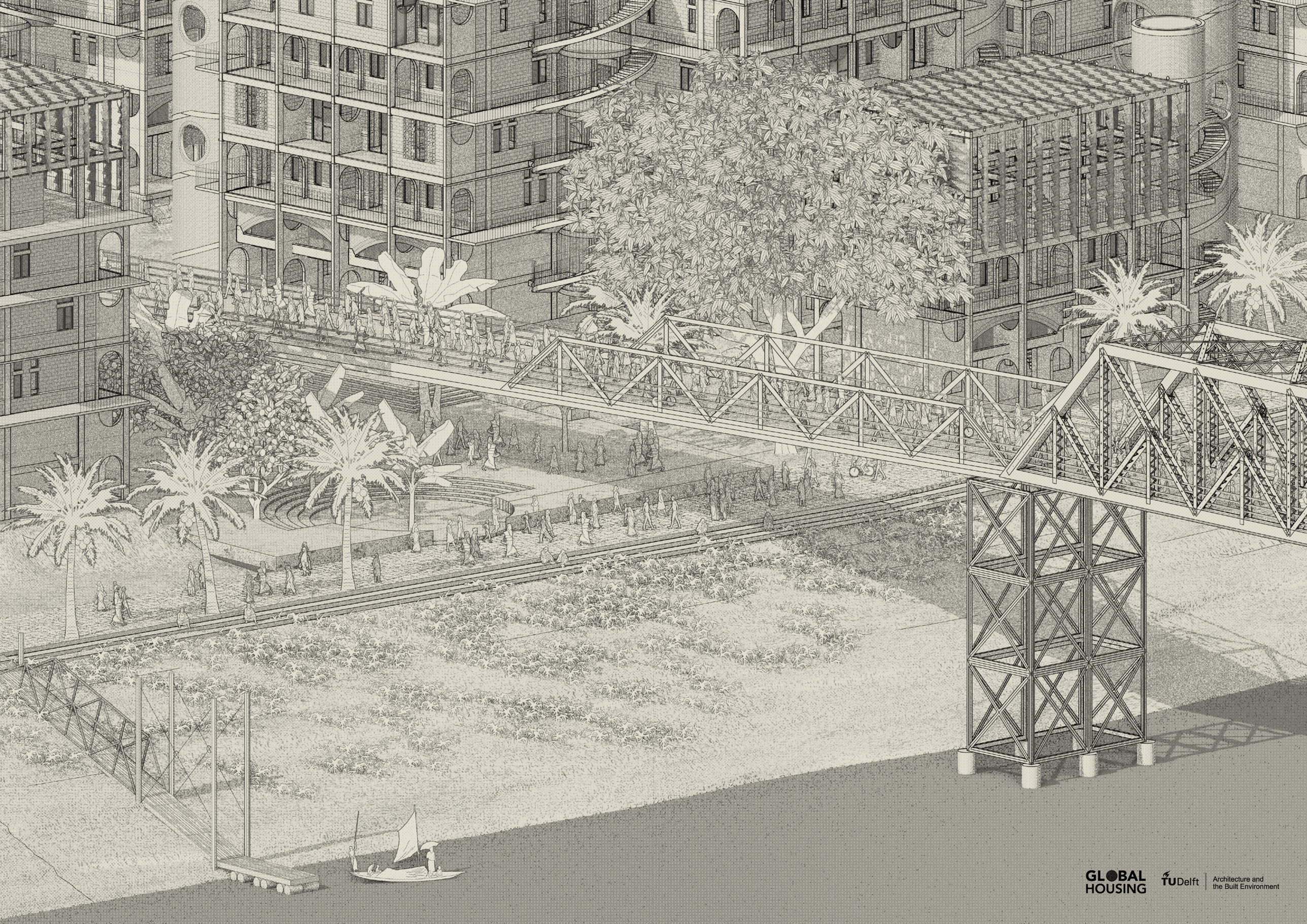

KEBAB GARDEN
Restaurant
বাড়ি ফ্যাশ
TRUST BELTS











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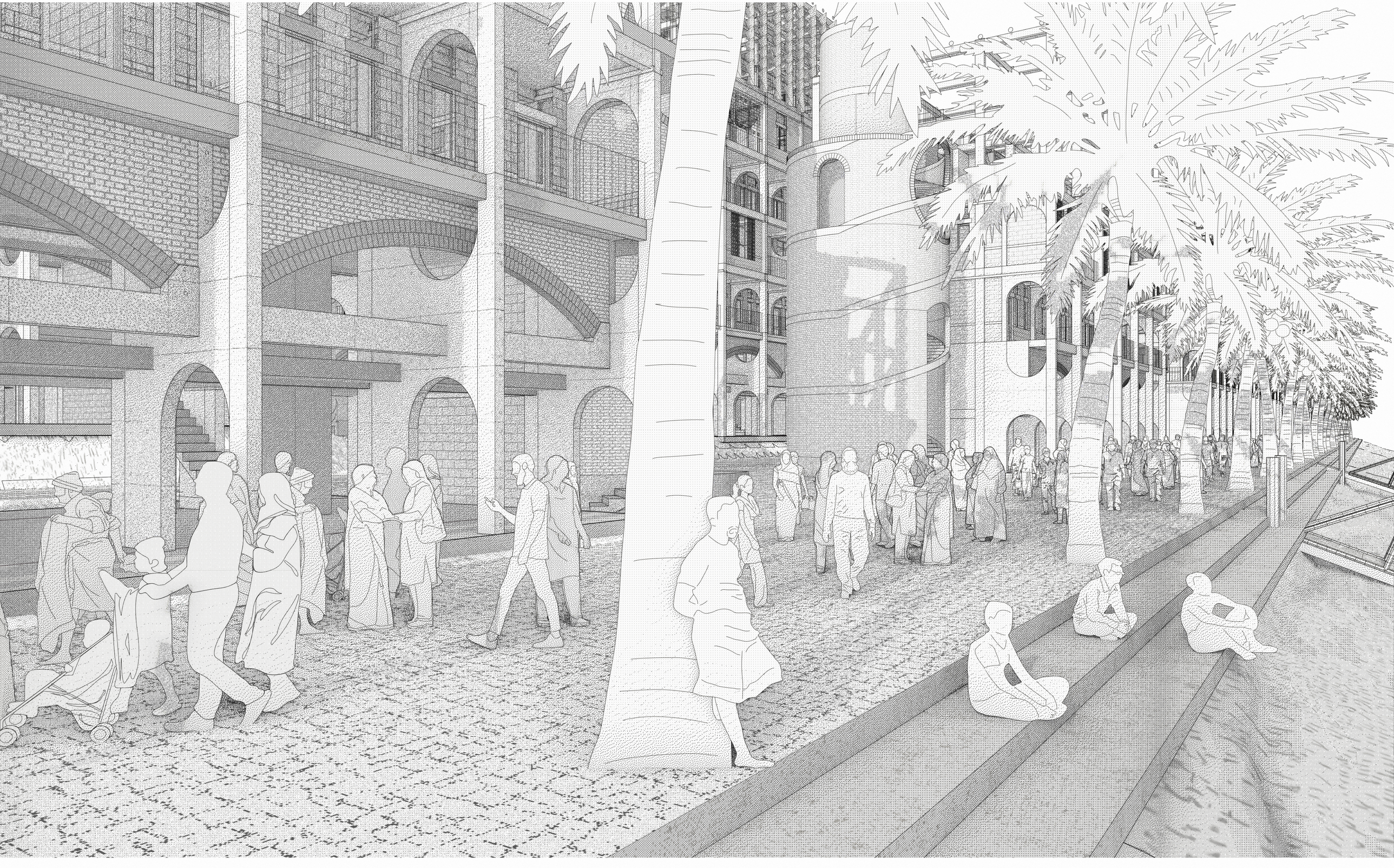
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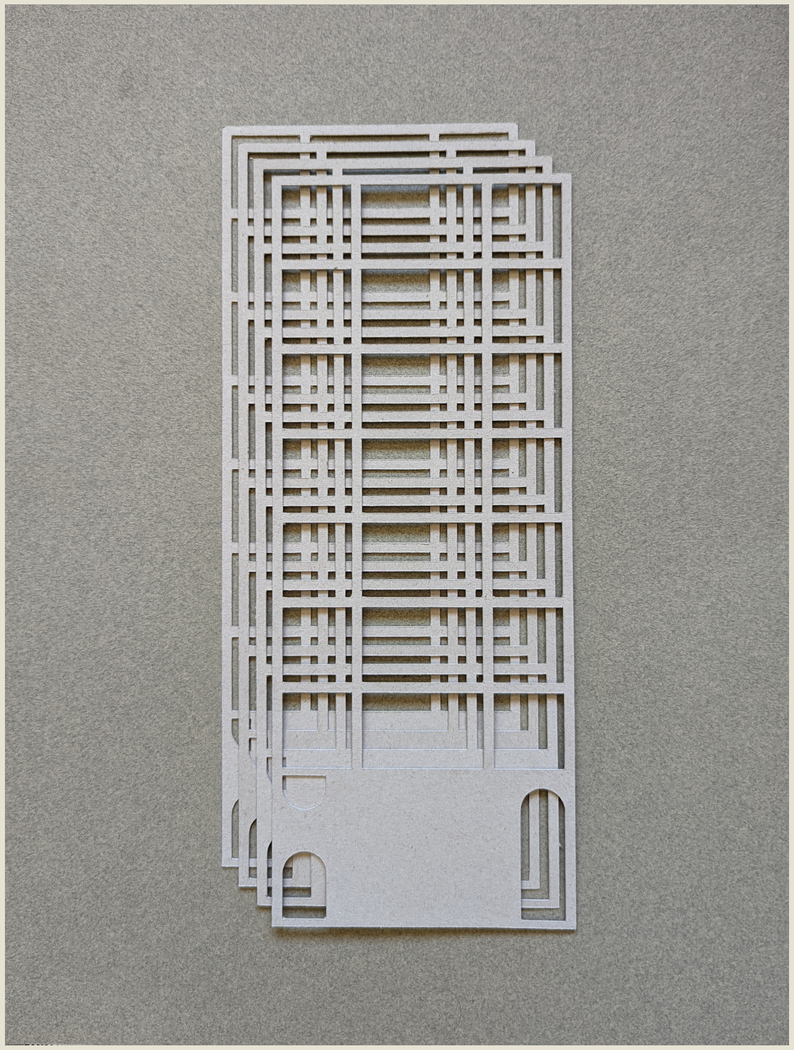
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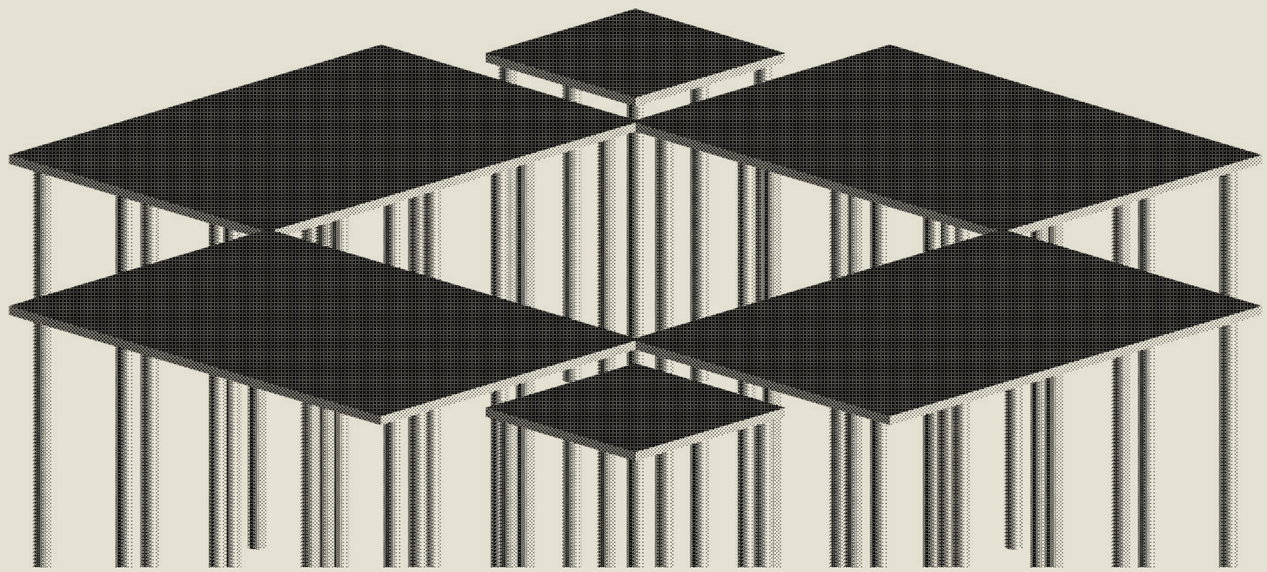
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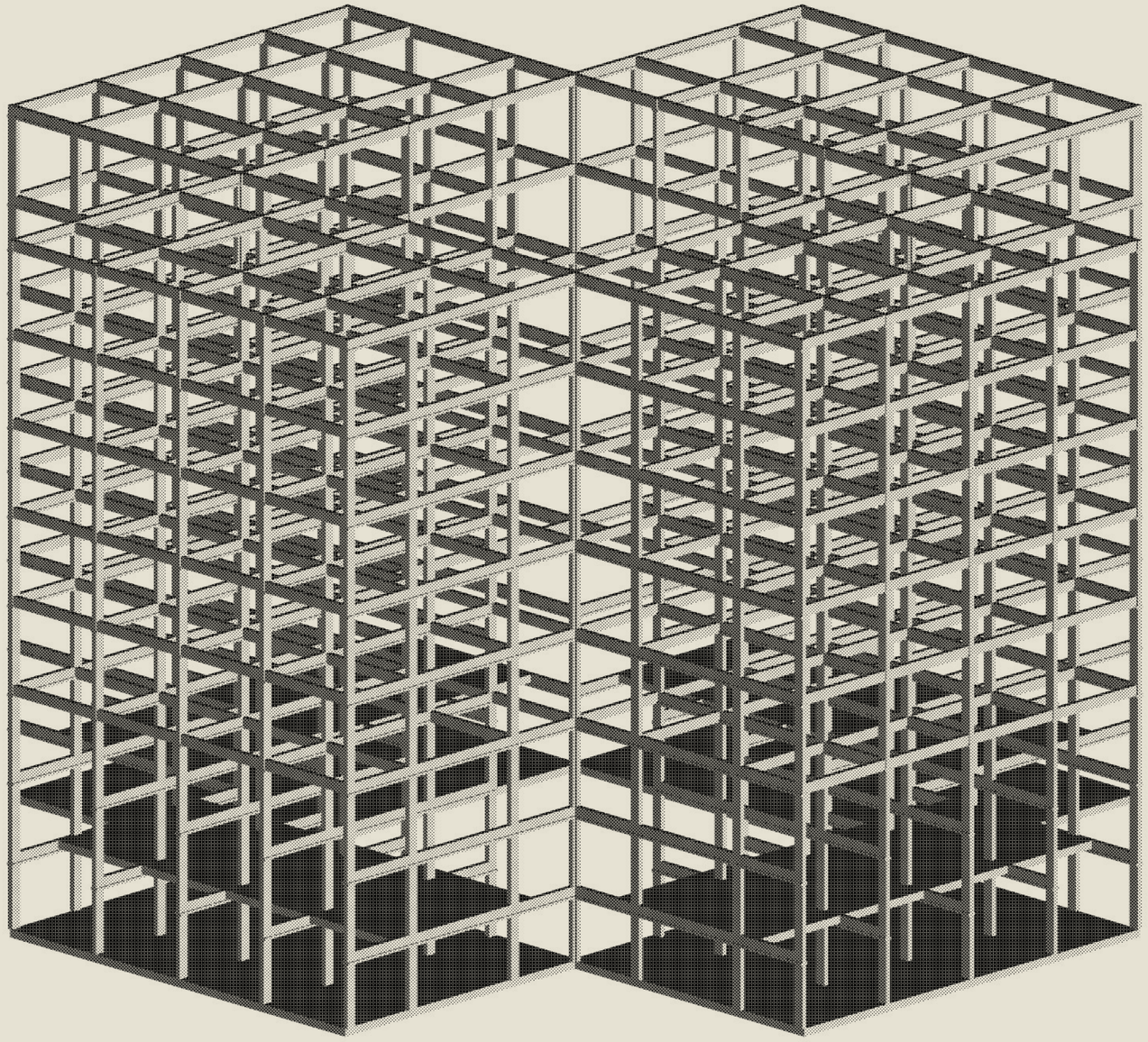


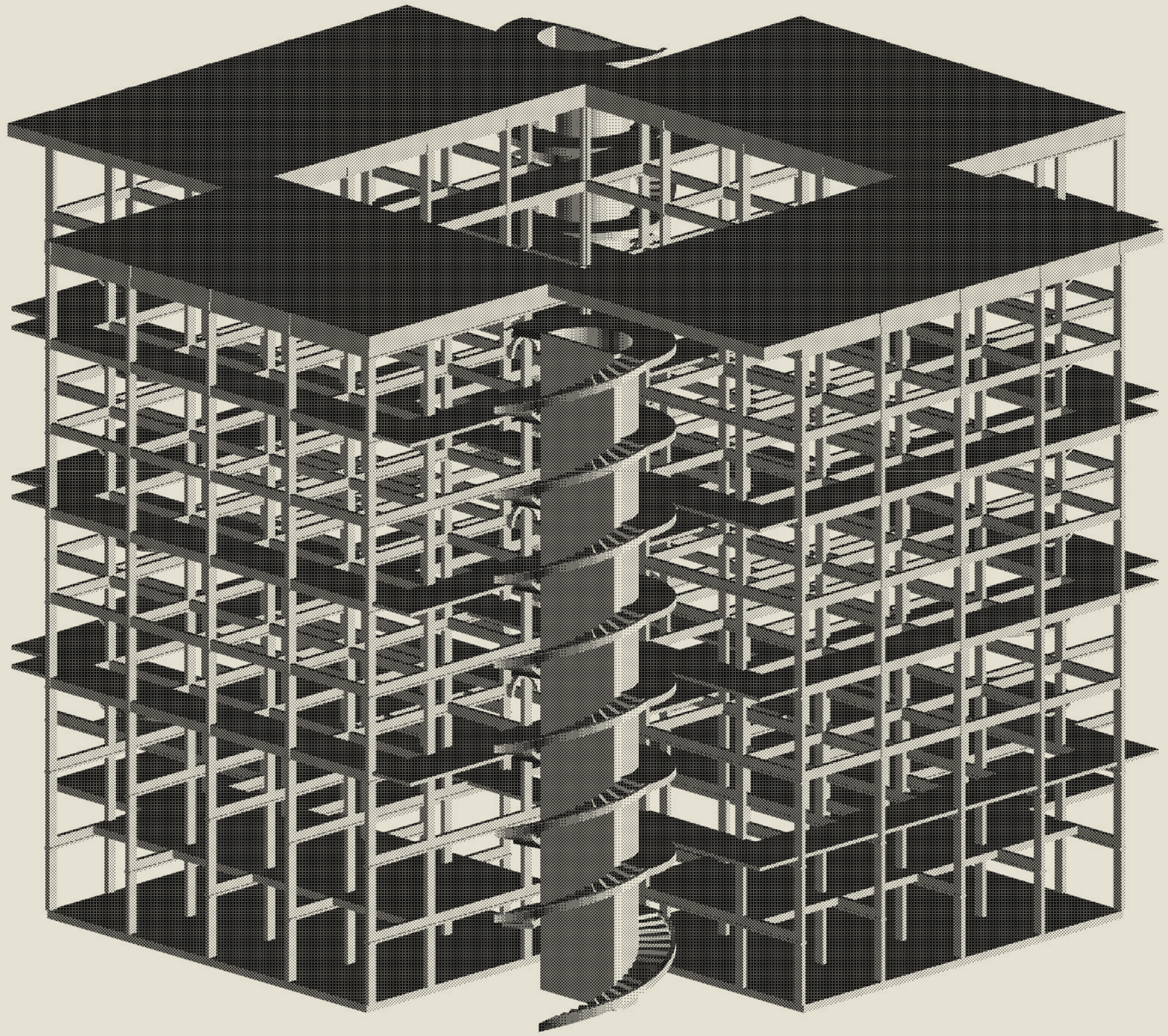
Construction Sequence

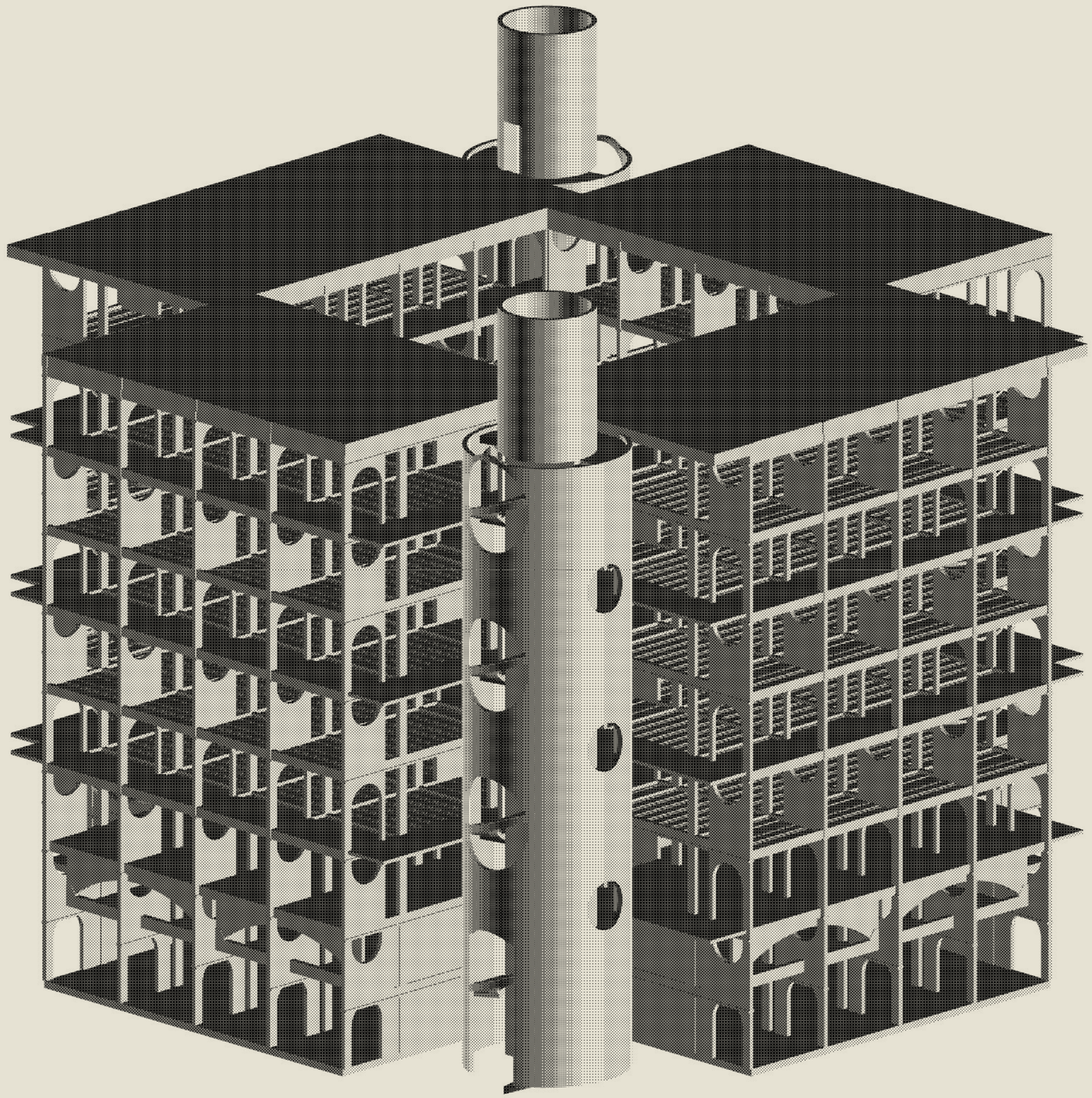


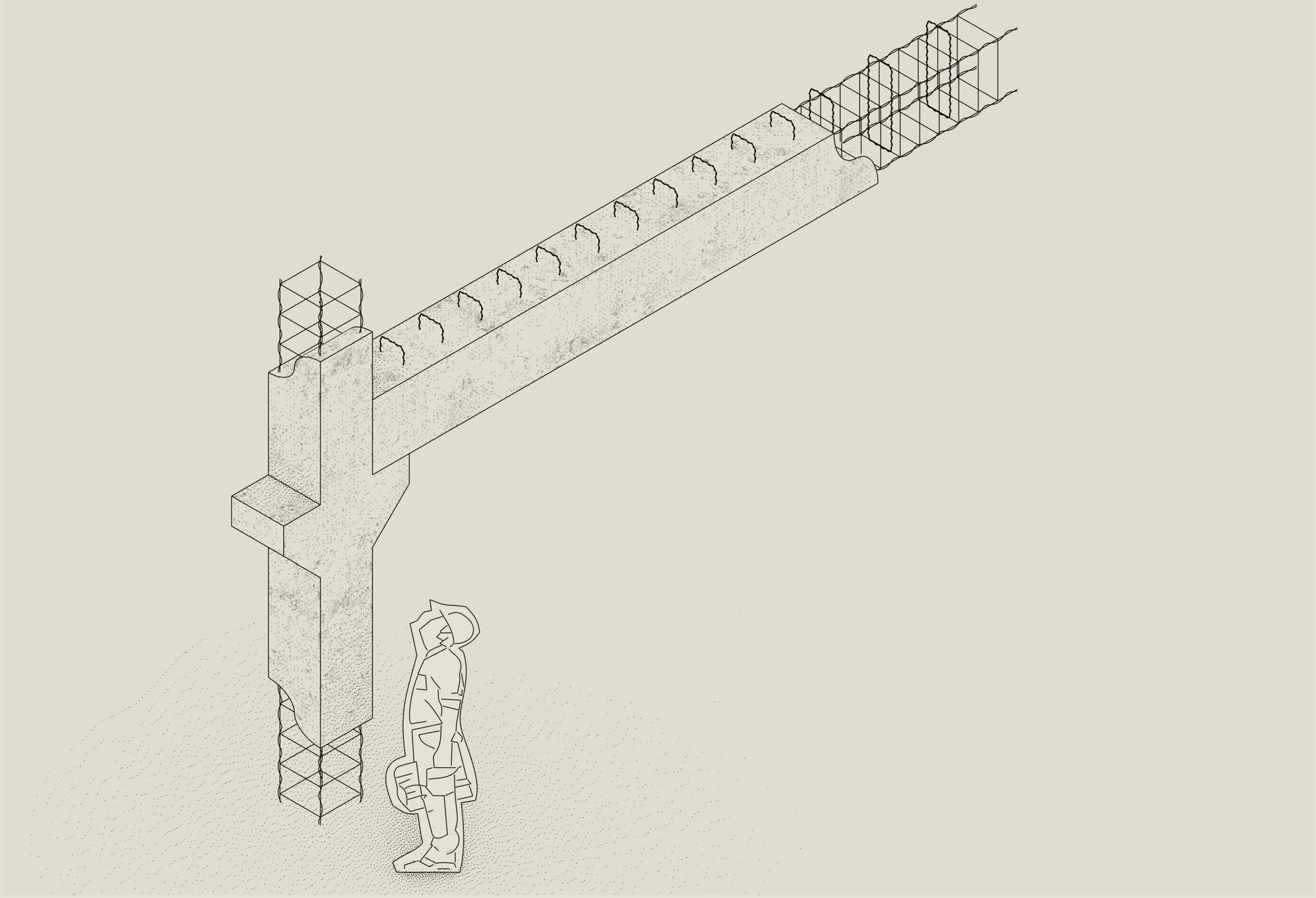
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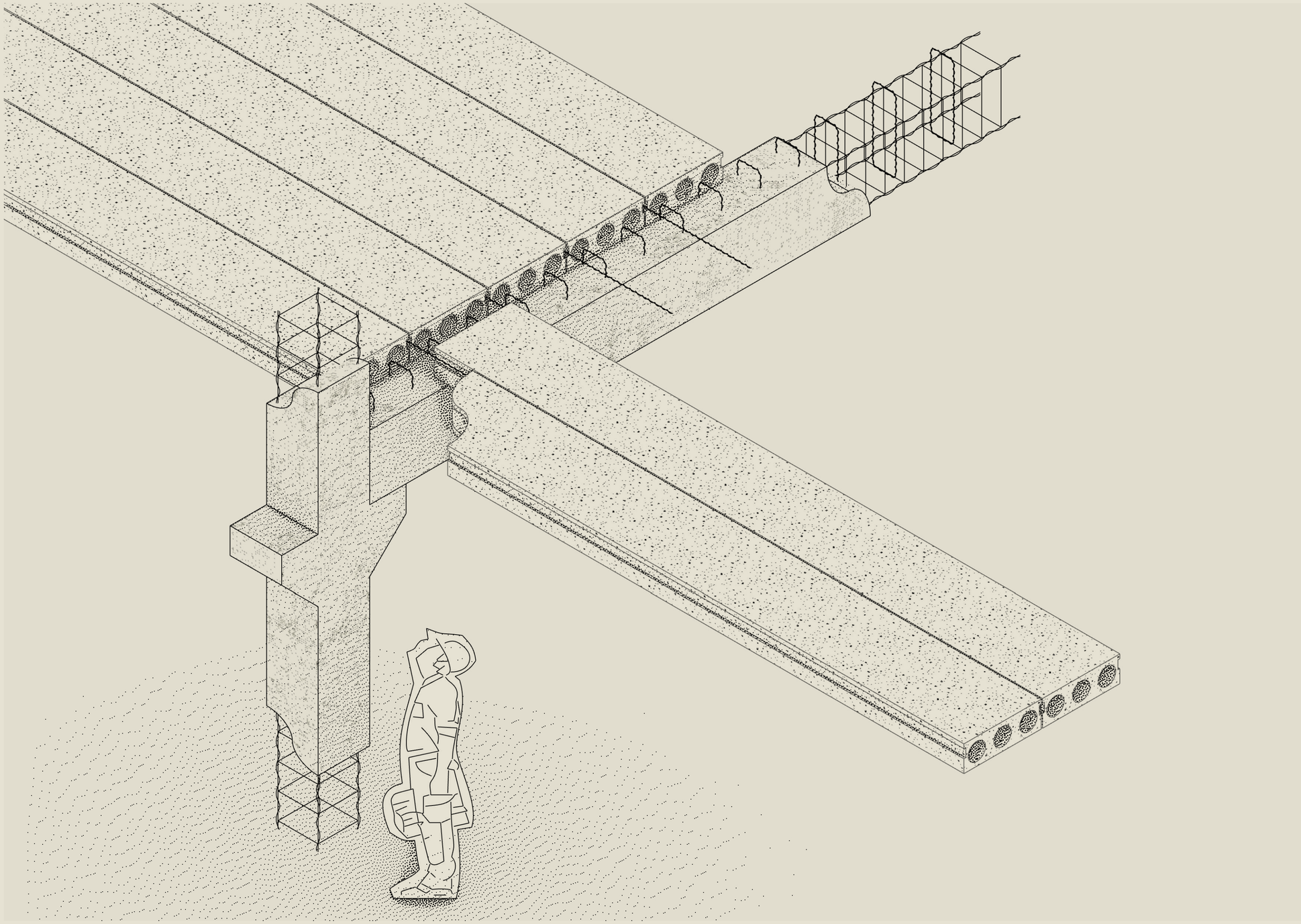
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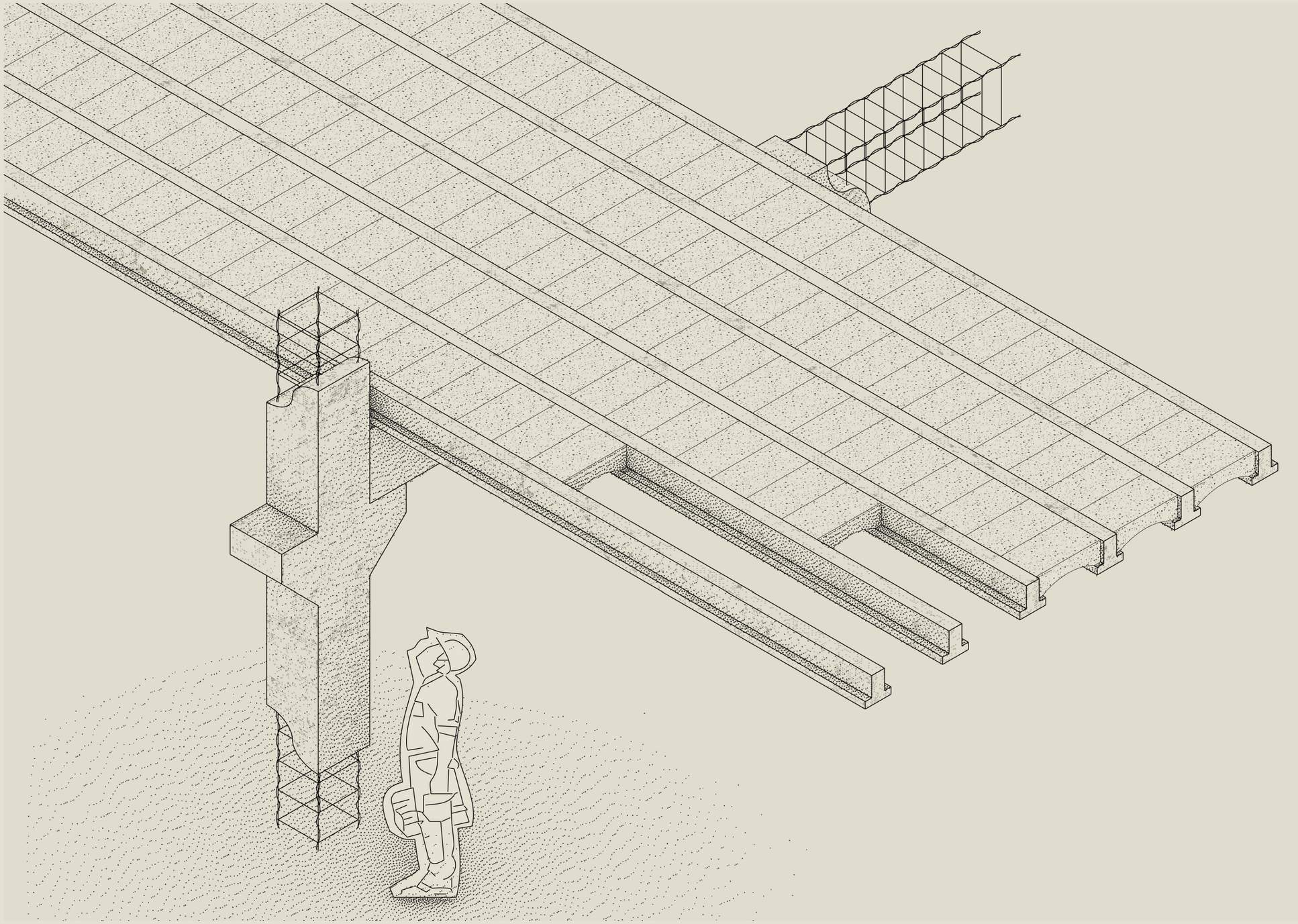


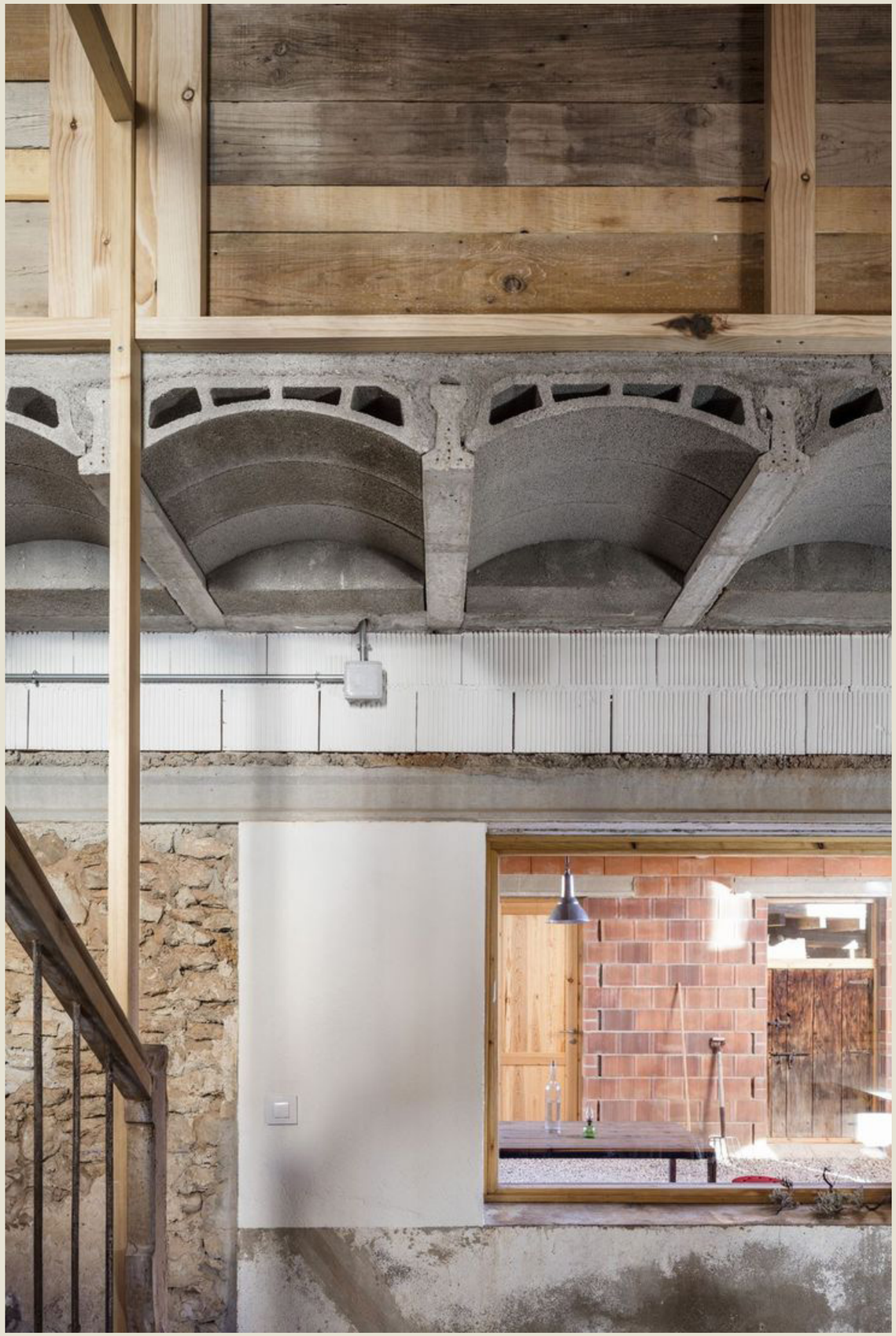






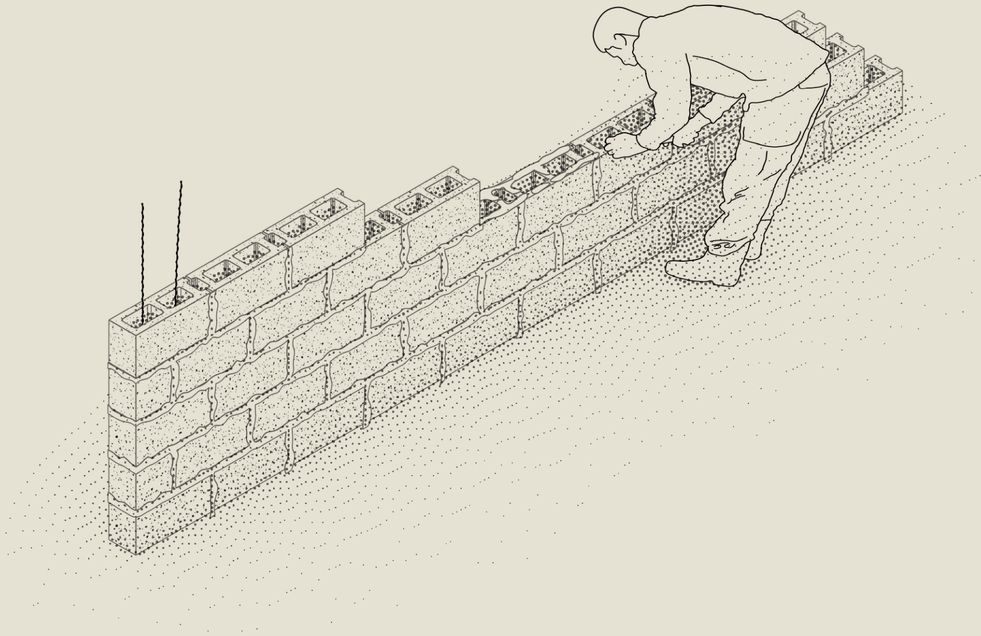


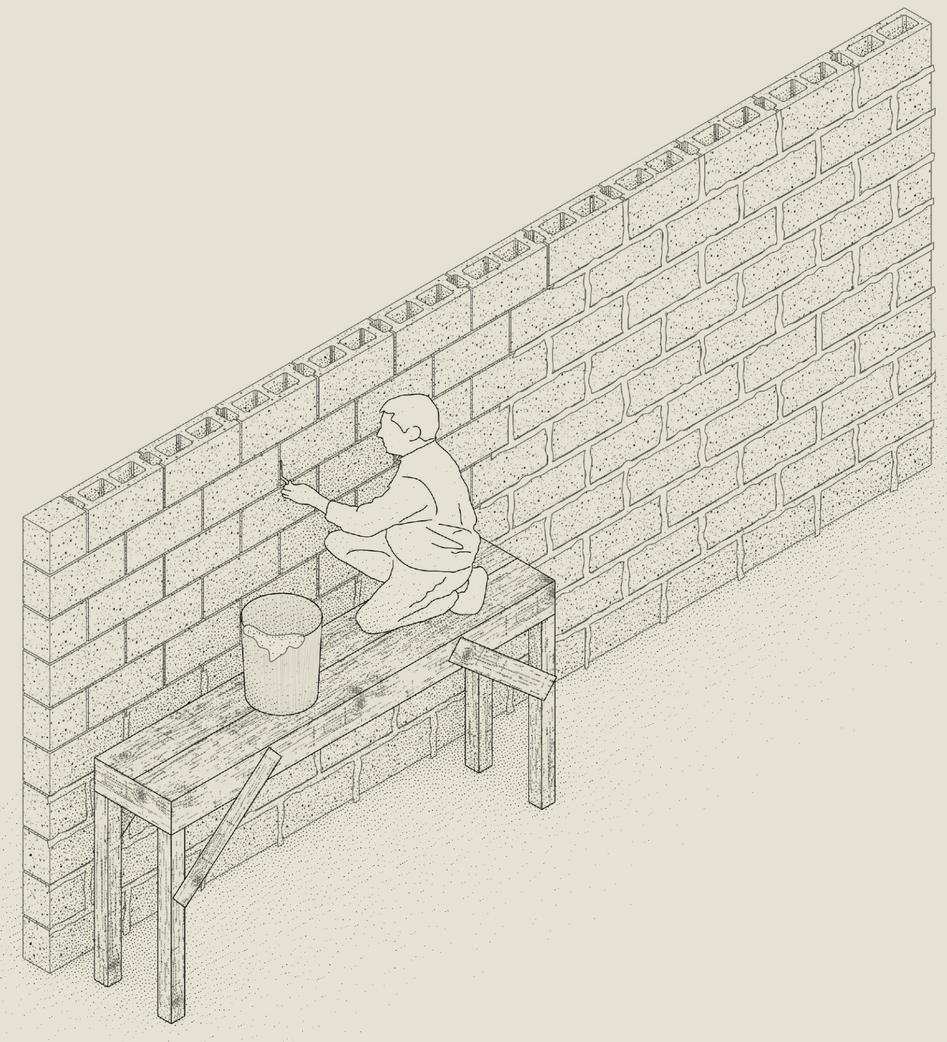


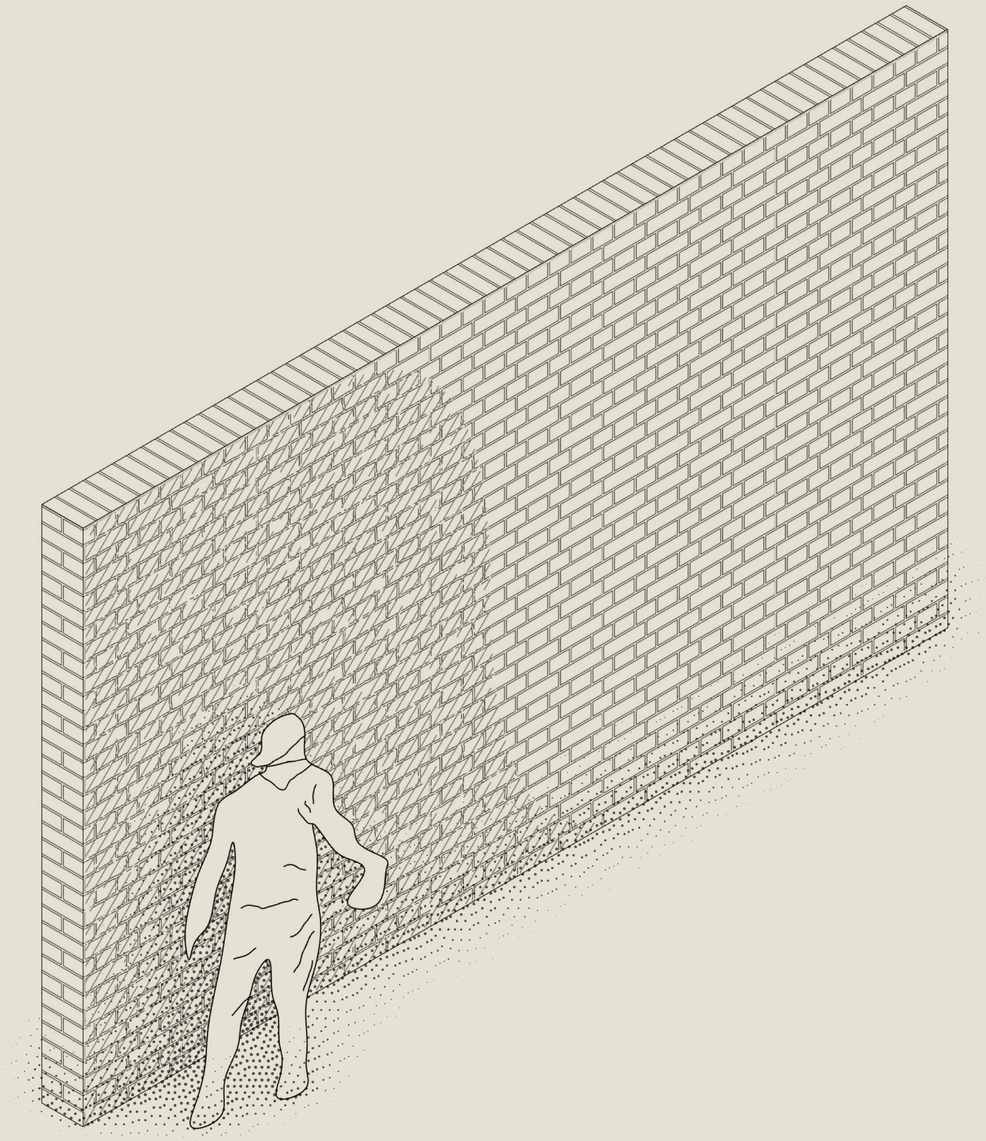


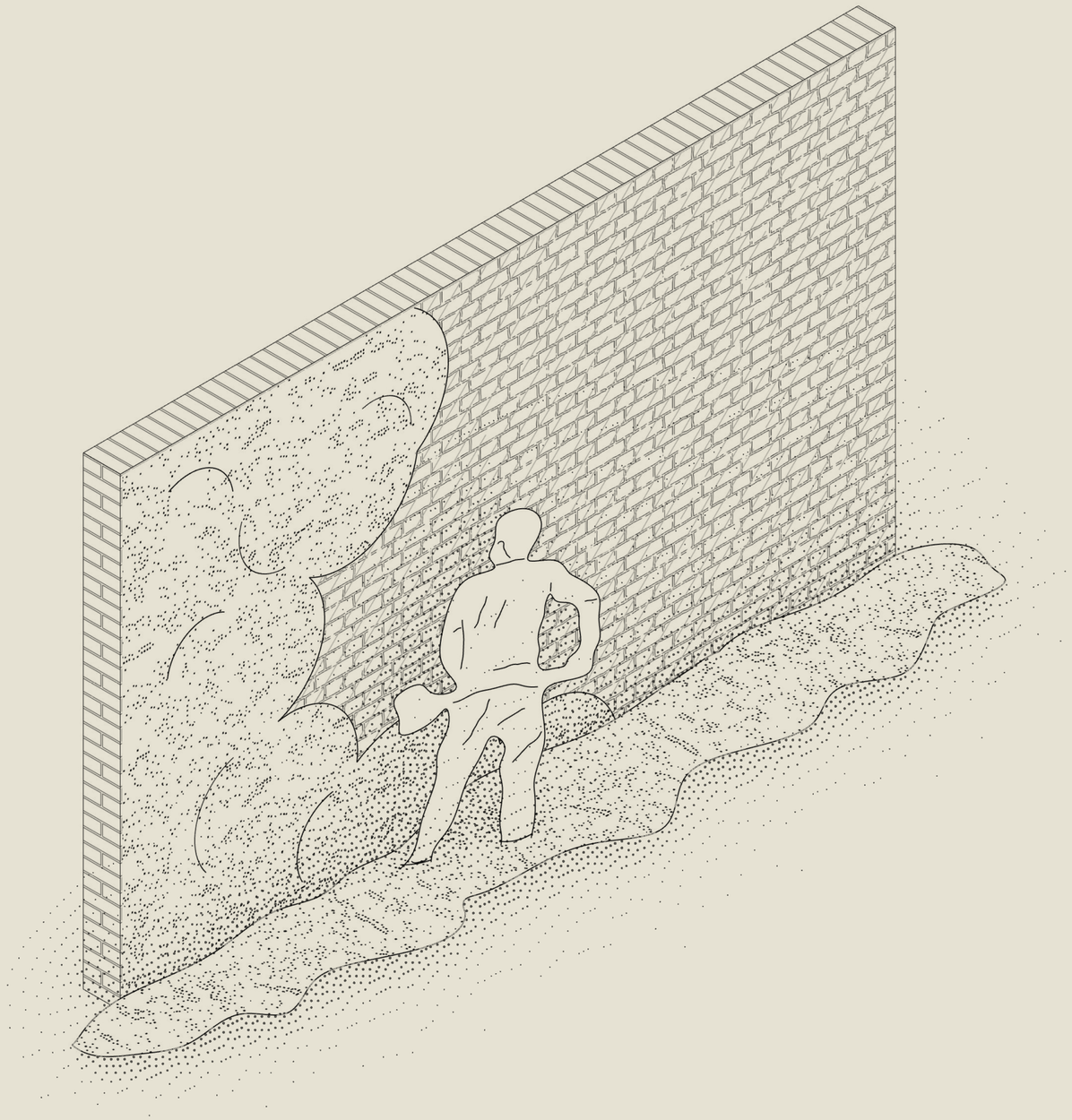


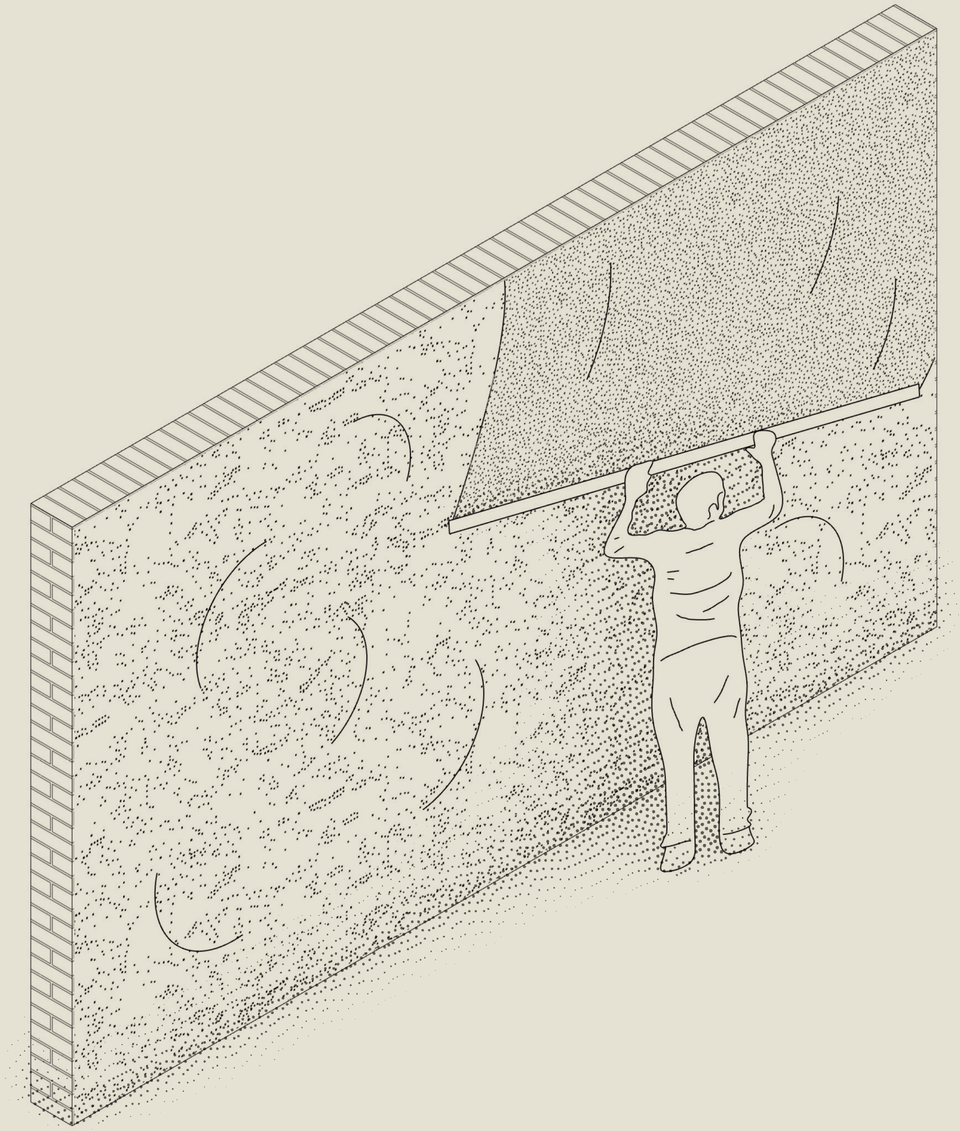


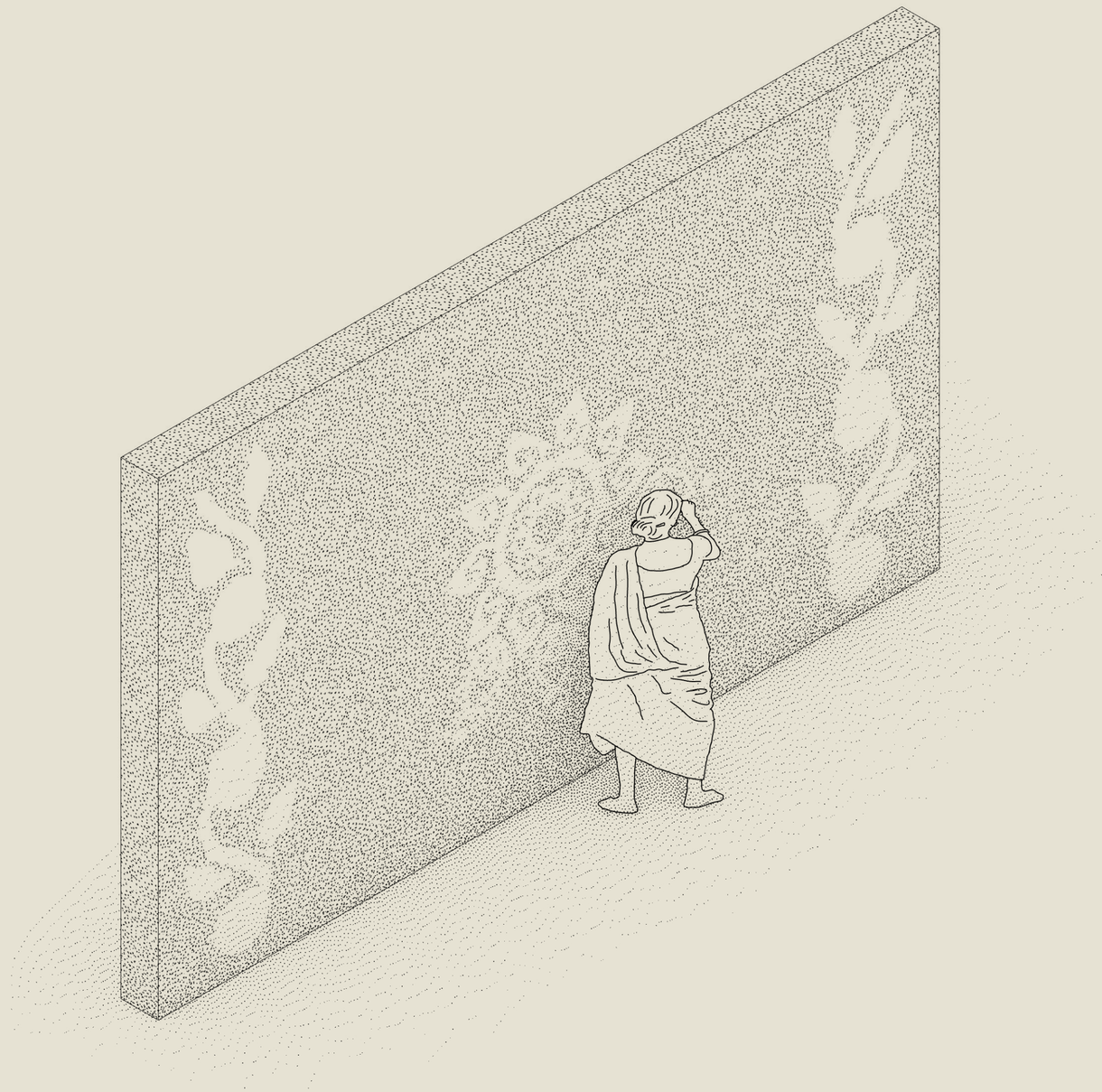








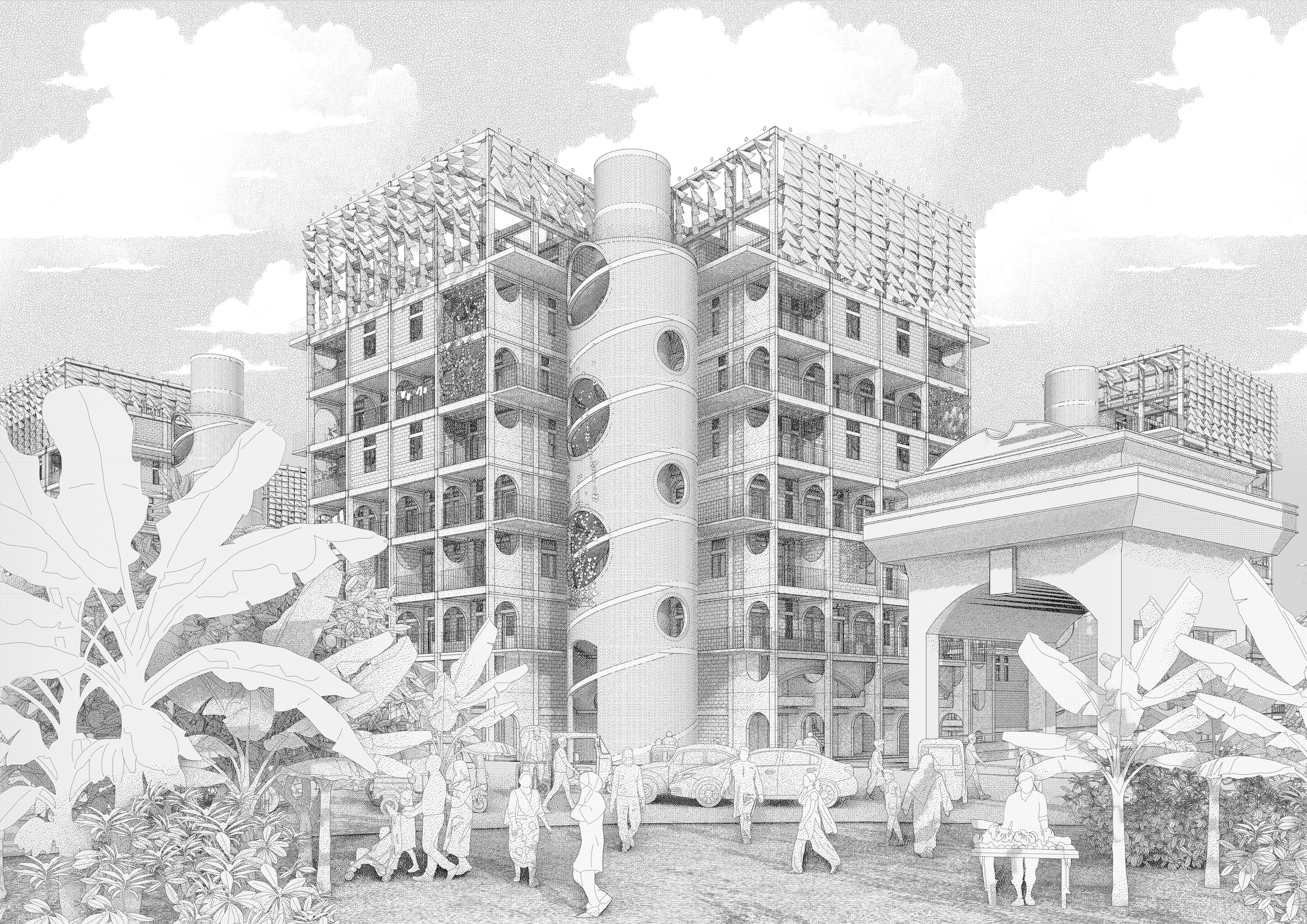




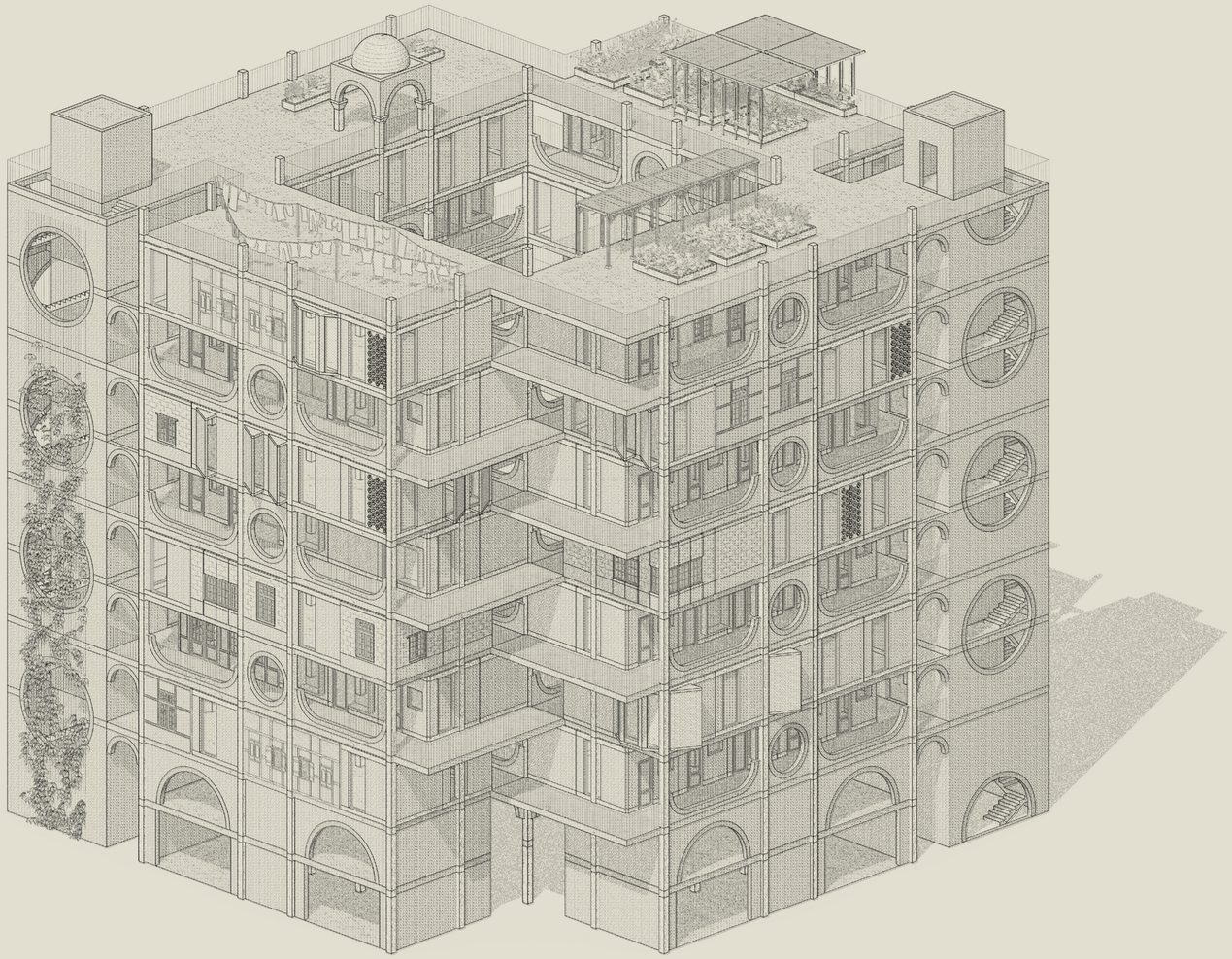


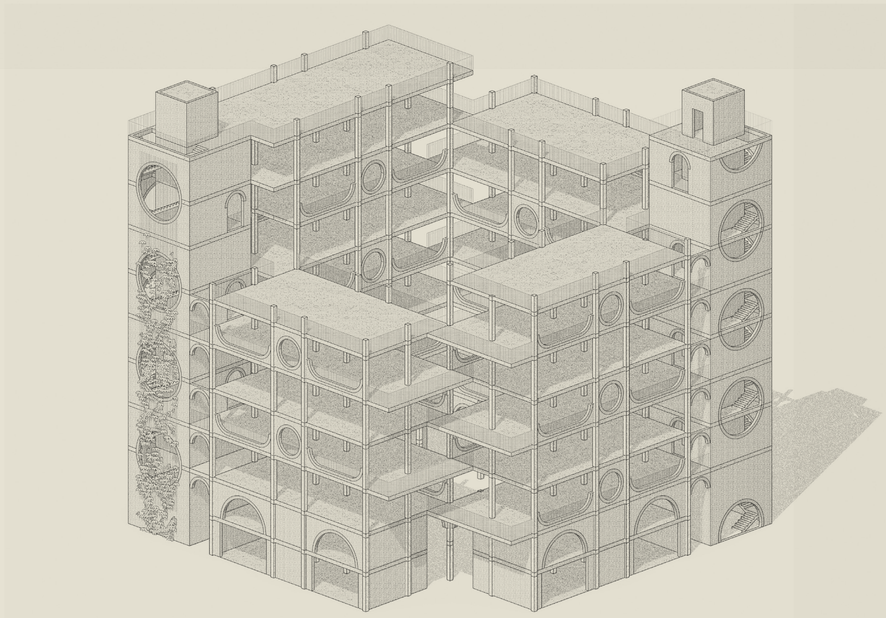
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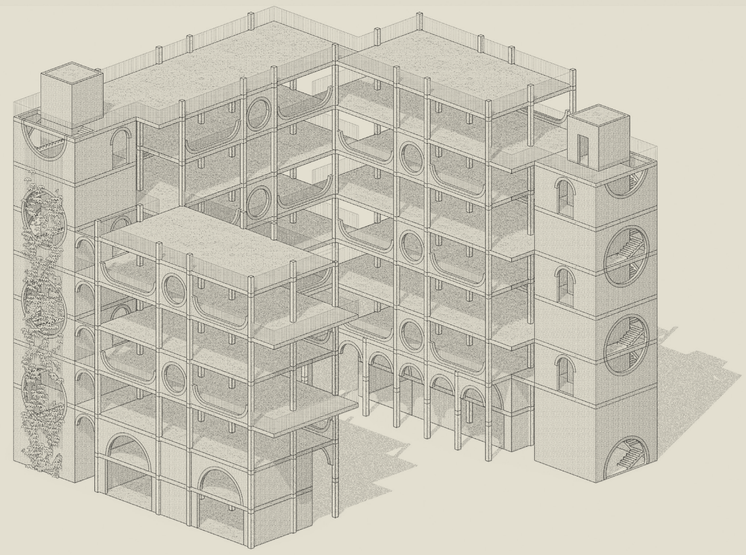
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VAN BBQ VAN BBQ

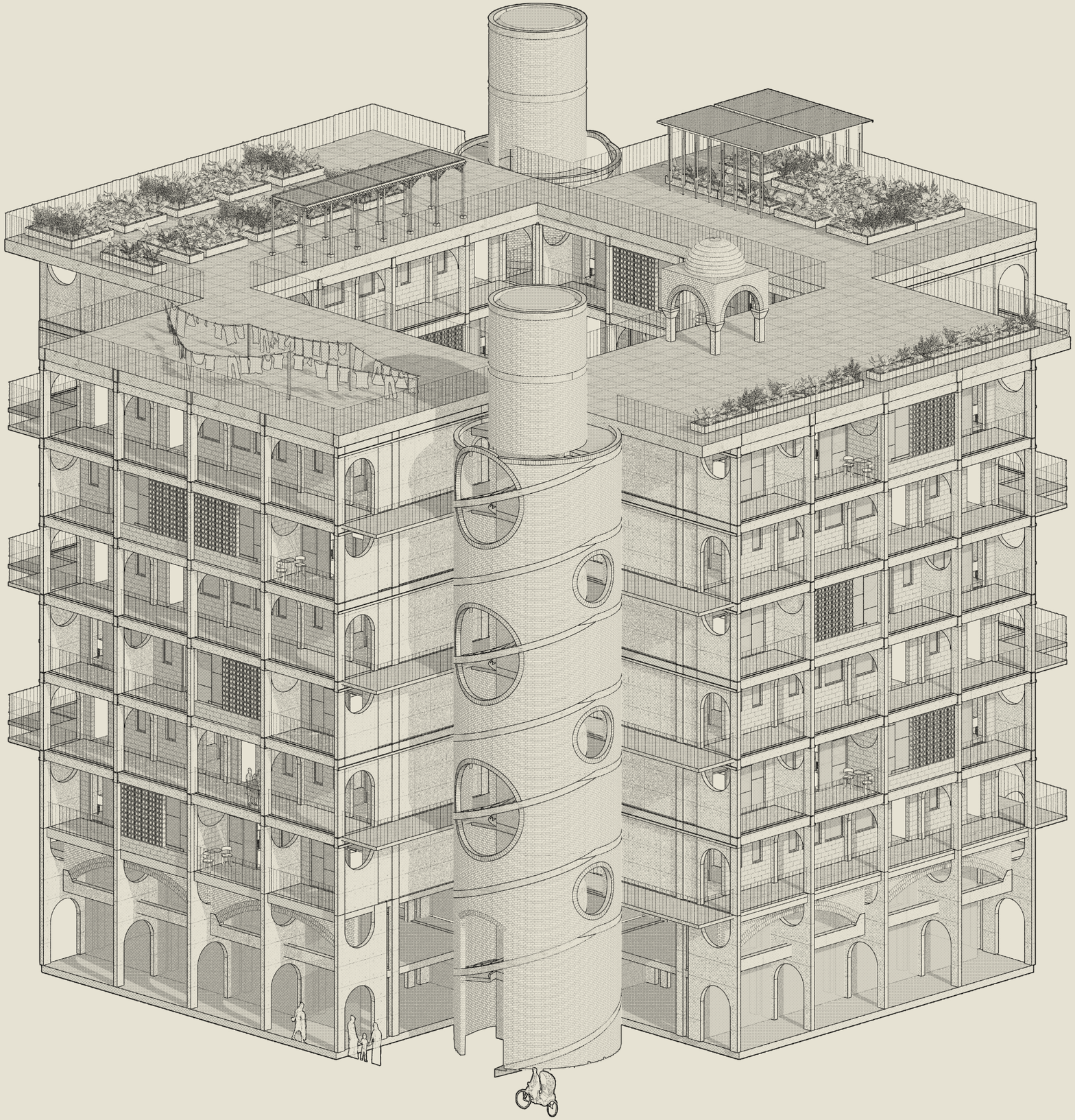




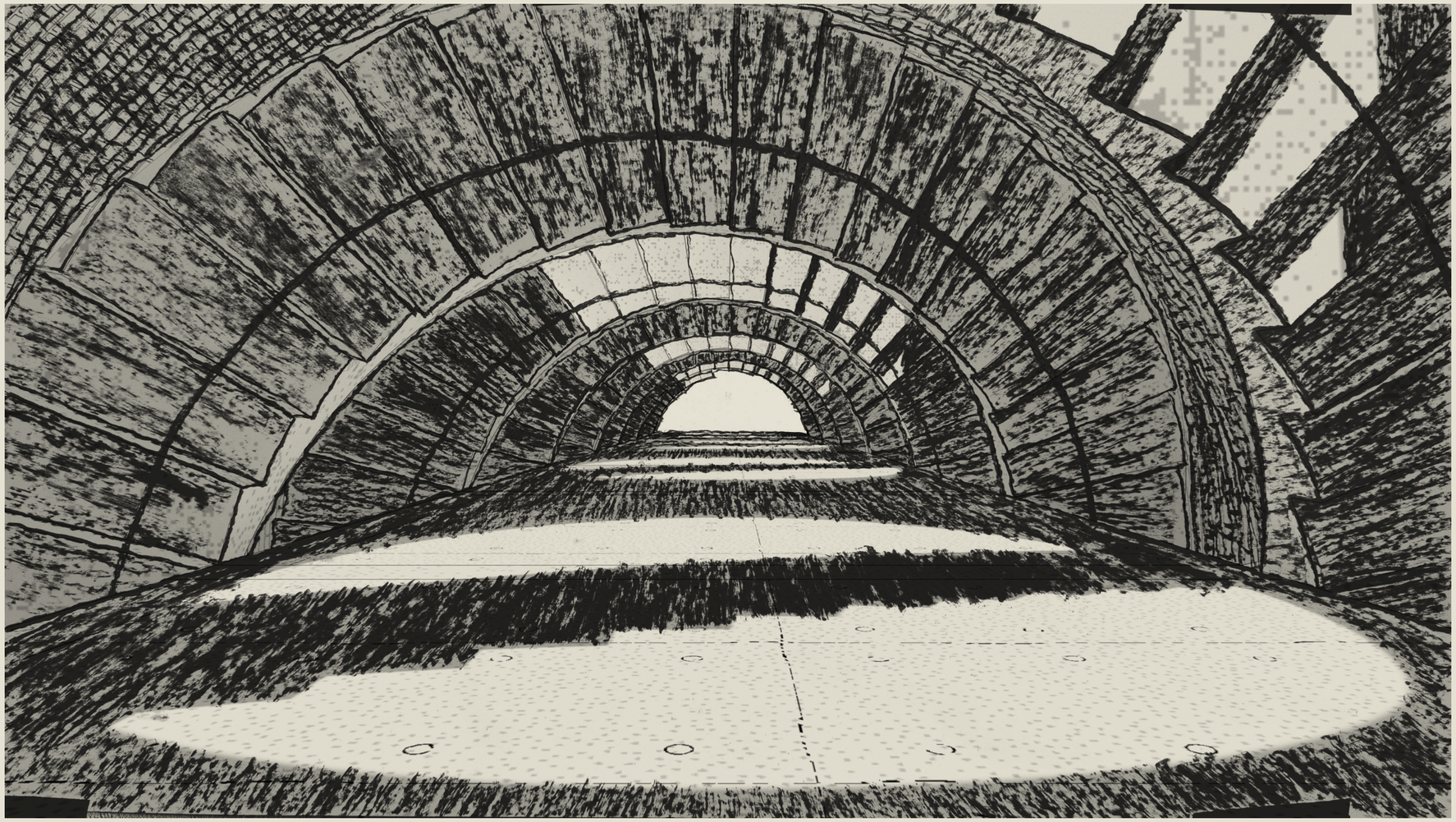


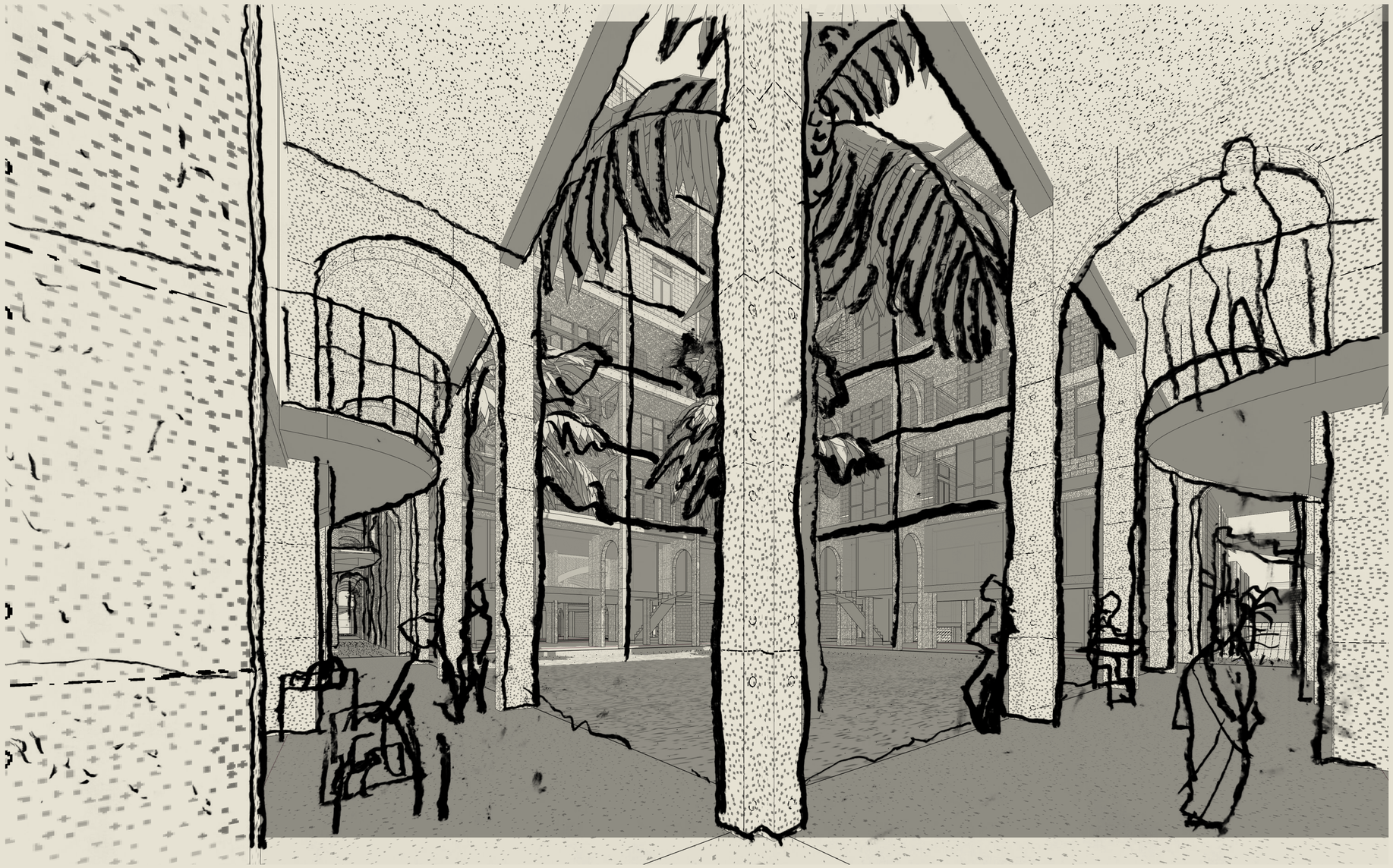
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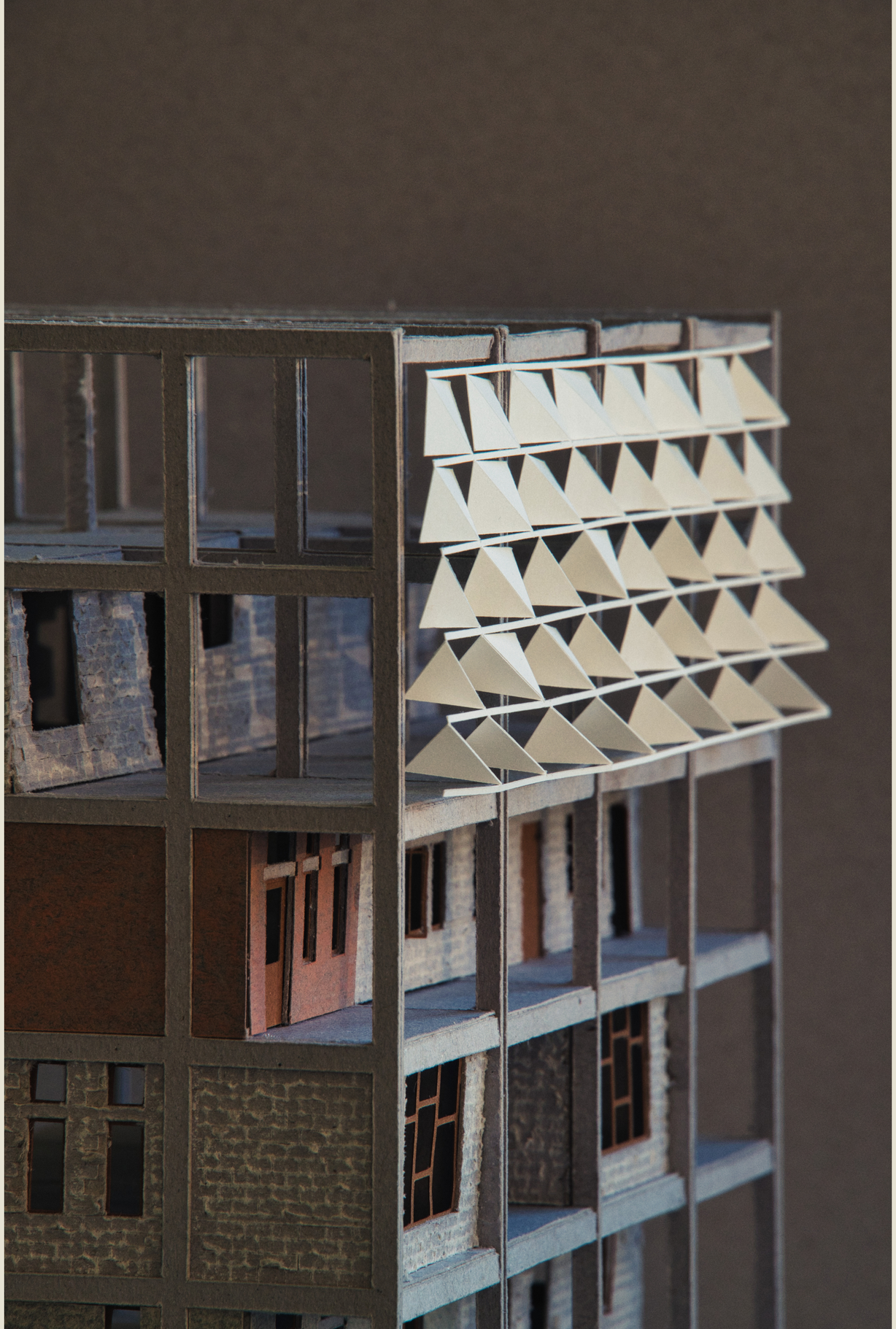
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Thank You

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