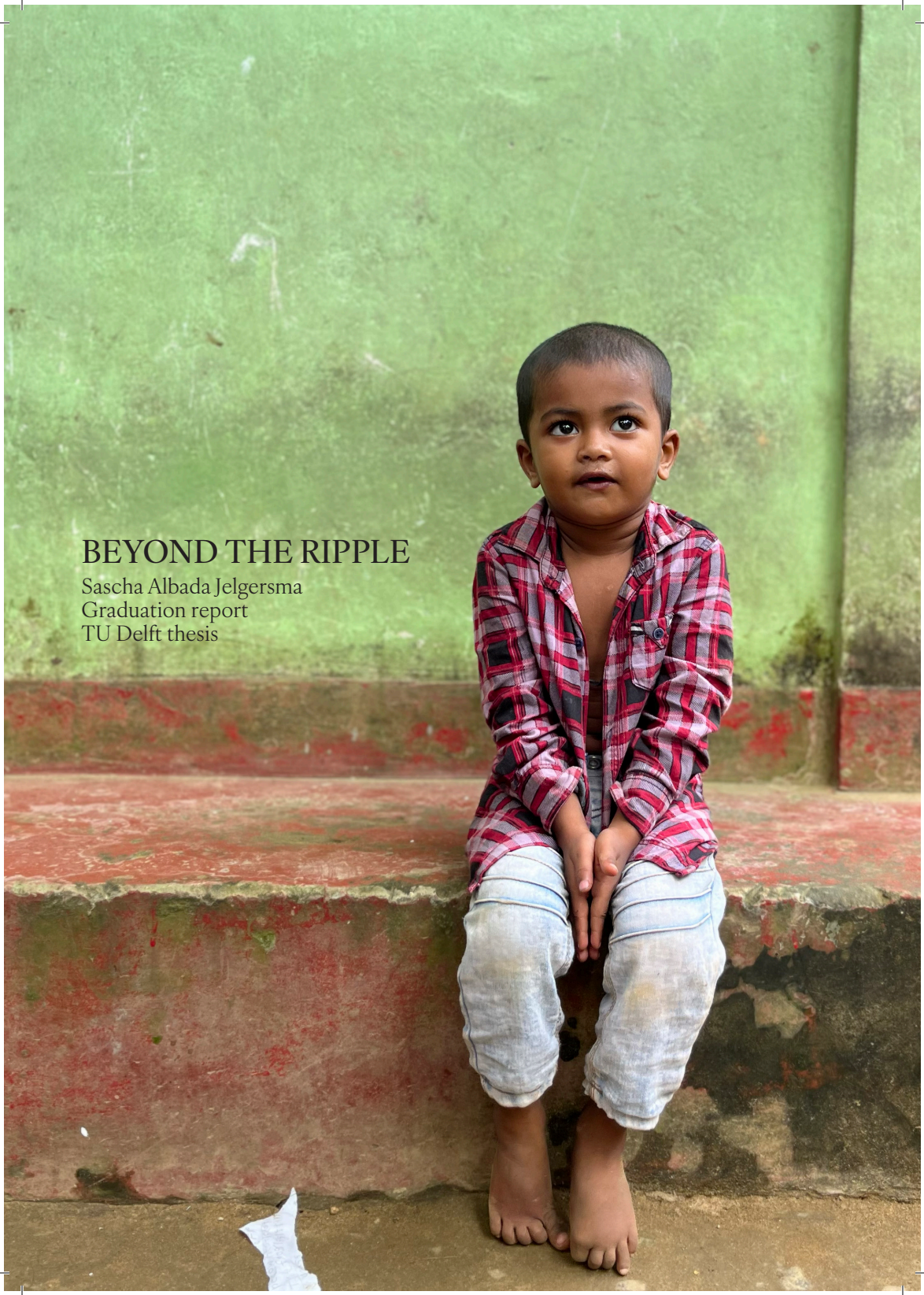


BEYOND THE RIPPLE

Sascha Albada Jelgersma
Graduation report
TU Delft thesis

CONTENT

RESEARCH

Research question:

How can design create a safer living environment and mitigate the impact of trauma due to floods among the children in the Tanguar Haor region?

Sub questions

What are the ways in which children can cope with trauma stemming from natural disasters like floods?

How are the daily lives of children in the Tanguar Haor region affected during floods?

How can housing design be employed to establish a safer living environment in relation to floods for children in the Tanguar Haor region?

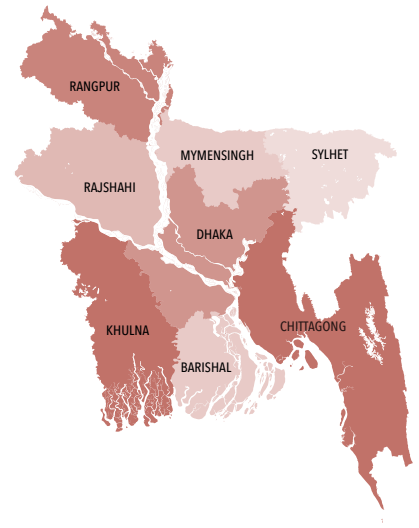


Fig. 01: Divisions of Bangladesh

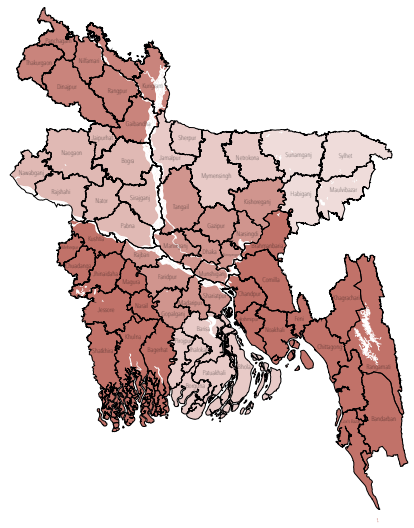


Fig. 02: Districts of Bangladesh

Bangladesh

Bangladesh, situated in the South Asian region, shares its geographical expanse with neighboring countries such as Sri Lanka, India, Afghanistan, Pakistan, Bhutan, Nepal, Iran, and the Maldives.

Covering an area of approximately 145,000 km2, Bangladesh serves as the homeland for an estimated population of around 140 million individuals. The nation is geographically bordered by India, with an extensive boundary spanning approximately 4,083 kilometers. To the southeast, the border is delineated by Myanmar, stretching across a distance of 193 kilometers, while to the south, Bangladesh's coastal boundary extends along the Bay of Bengal, encompassing a length of 580 kilometers (info@theworldofinfo.com, n.d.).

Bangladesh consists out of 8 divisions. Each division has a principal city, which serves as an administrative capital for the respective jurisdiction. Then, the divisions are divided in districts which in turn, are then divided into Upazilas (similar to municipalities.) (Divisions of Bangladesh, n.d.).

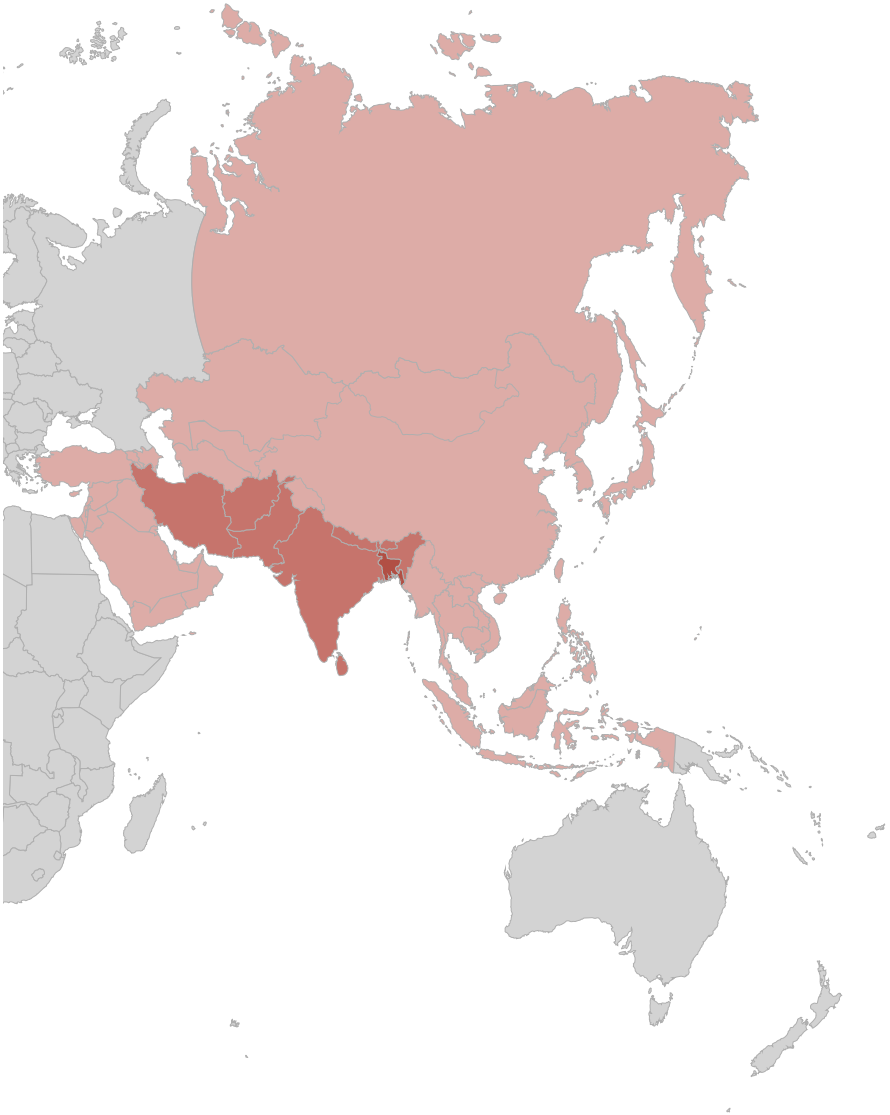


Fig. 03: Map showing Asia, South Asia & Bangladesh

Climate

Bangladesh witnesses a rich spectrum of seasons, transitioning approximately every two months. These seasonal shifts are delineated based on the predominant weather patterns in distinct regions, earning Bangladesh the moniker "The Land of Six Seasons": summer, rainy season, autumn, late autumn, winter, and spring (K. Uddin & Matin, 2021). Summer inaugurates the seasonal cycle in Bangladesh, with April marking the commencement of the new year according to the Bengali Calendar.

In Bangladesh, temperatures fluctuations range from 12.3 ˚C to 28.1 ˚C during winter and from 22.8 ˚C to 33.4 ˚C in summer, with January registering as the coldest month and May as the warmest (World Bank Climate Change Knowledge Portal, n.d.)

The period preceding the monsoon is characterized by high temperatures, peaking at a maximum of 33.4 ˚C. Subsequently, the monsoon season ensues, bringing elevated temperatures and heavy rainfall. Western regions of

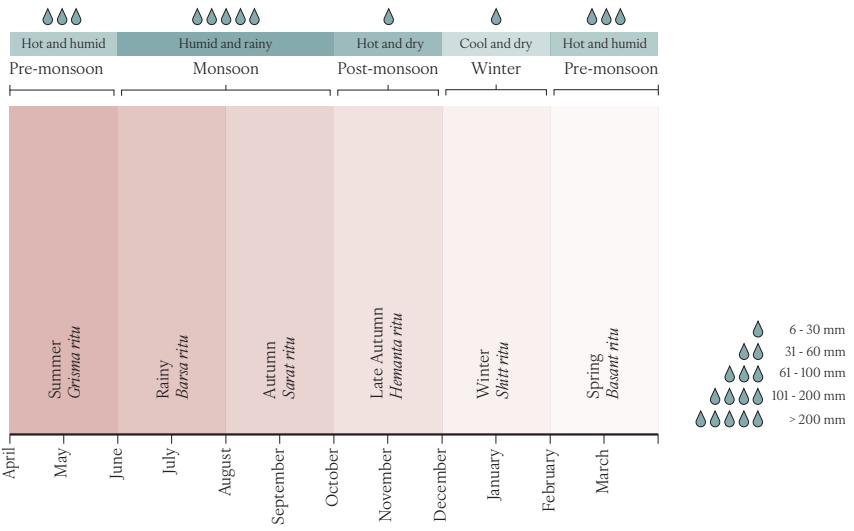


Fig. 04: Climate seasons in Bangladesh

Bangladesh typically experience higher temperatures during this time compared to the eastern districts. While the monsoon season is characterized by warm temperatures, occasional cooler days accompany intense rain showers (Agrawala et al., 2003)

The post-monsoon season marks a transition characterized by reduced rainfall and a gradual decline in nighttime minimum temperatures (Rashid, 2019).

Winter in Bangladesh is comparatively cooler and drier than other seasons.

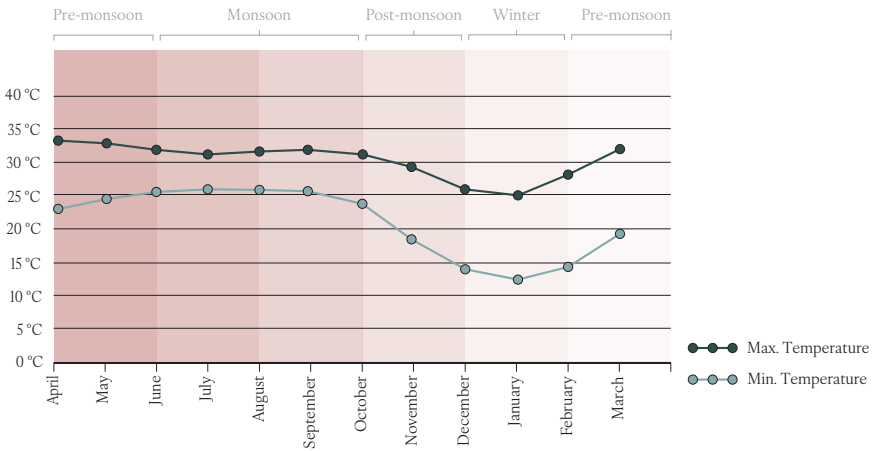


Fig. 05: Monthly temperature in Bangladesh

Fig. 06: Map Tanguar Haor

Tanguar Haor

The Tanguar Haor, nestled in the northeastern part of Bangladesh near the Indian border, stands as one of the region's most expansive wetlands. Spanning over 9727 hectares, it forms an integral part of the Surma-Kushiyara river basins, deriving its primary water influx from the southern river system, supplemented by water streaming down from the Indian hills to the north (Muhammad Mizanur Rahaman et al., 2016). As a region characterized by heavy rainfall, approximately 80% of the annual precipitation deluges the area during the monsoon season from May to October (IUCN, 2014).

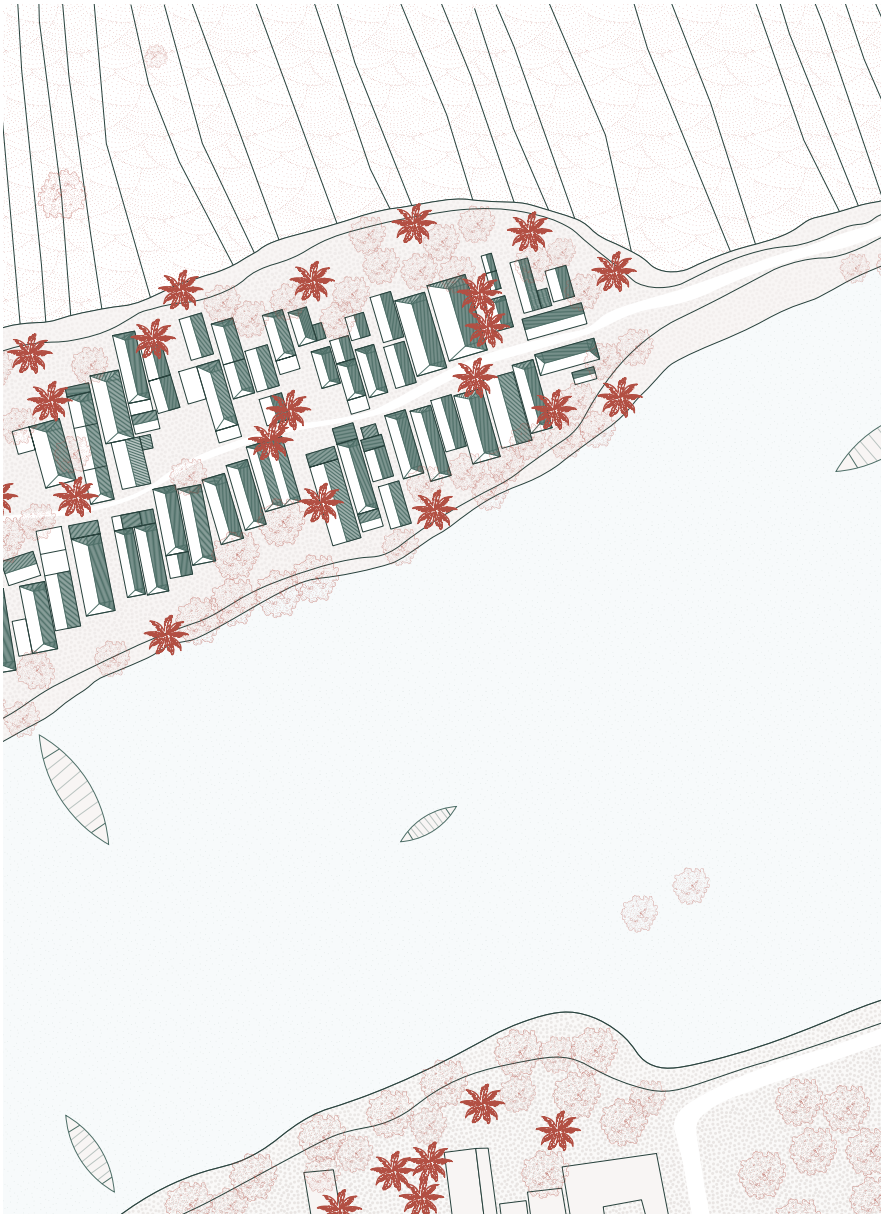
The Tanguar haor has a unique bowl-shaped wetland ecosystem (Mia, 2022). Located in the North-eastern region of Bangladesh. It is located in the sylhet division and Sunamganj district. About 50% of the area is made up of water bodies (5,682 ha) and 31% is made up of crop land (IUCN, n.d.).

The Tanguar Haor is generally recognized as freshwater wetlands. It provides social, economic, and environmental benefits and brings income and employment to the inhabitants of the region (Nishat et al., 1993). The Haor region is home to sweet water fishes and indigenous

birds. The fish production maintains the biodiversity and is also a good source of fish, meeting the local and regional demand (Uddin et al., 2015).

Fig. 07: Tangaur Haor at sunset

Existing site



Haor settlement patterns

Due to the unique geographical characteristics of the Hoar, the settlements adhere to a specific pattern. Linear structured islands emerge, enclosed by either the river's water or of the haor's basin. The linear structure creates a central primary road or courtyard. The houses surrounding the courtyard are closely packed resulting narrow pathways leading towards the embankment, only wide enough for one person to pass through. In some villages, ponds are situated behind the houses for washing and bathing purposes.

The islands vary in elevation. The highest level is constructed to match the monsoon level of the river and basin. However, during 5-7 days of the year, flood levels rise significantly, causing the village to flood..

Embankment erosion poses a significant challenge in these villages. Each monsoon season, the islands suffer damage and require repairs. Families spend approximately 20,000 taka annually to mend the embankments.

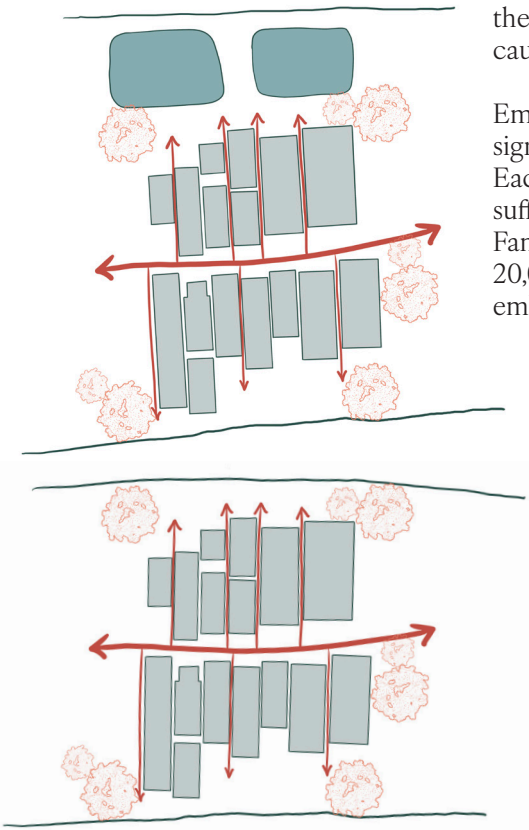


Fig. 08: Settlement pattern

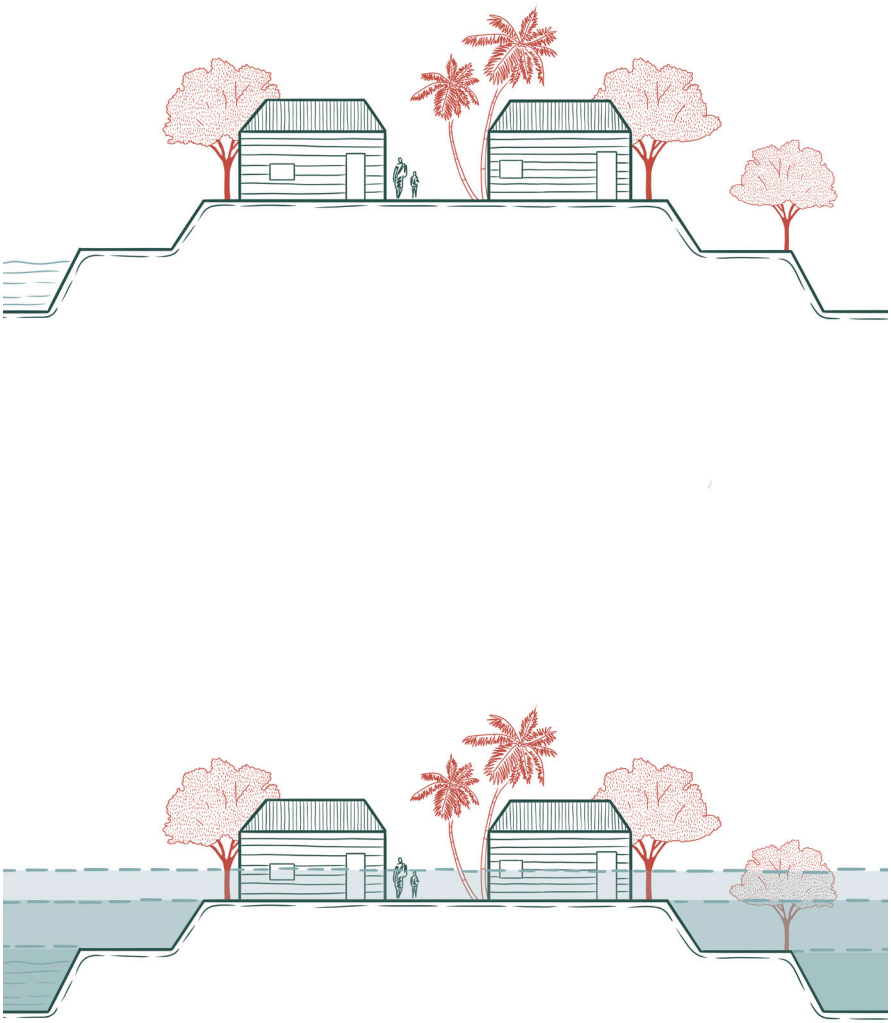


Fig. 09: Embankment pattern

Flooding in the Haor

The Tanguar Haor's unique topographical features contribute to a distinct cycle of inundation, with the land remaining submerged for nearly six months each year (Das, 2016). Adding to the complexity, the rivers traversing the Haor trigger flash floods during the pre-monsoon period in April and May (Muhammad Mizanur Rahaman et al., 2016).

Bangladesh and its Haor regions are seen as some of the most vulnerable with respect to climate change, owing to their distinctive geographical setting, high flood susceptibility, dense population, and prevalence of poverty among the inhabitants (Muhammad Mizanur Rahaman et al., 2016). The socioeconomically marginalized inhabitants of the Haor, predominantly reliant on agriculture, struggle with the seasonal floods, compelling many to shift occupations during the monsoon, either embracing fishing or seeking livelihood opportunities in urban areas (Alam et al., 2008; Pulla & Das, 2015).

Despite the recurrent challenges posed by annual floods, the resilient inhabitants of the Haor display an unwavering spirit, refusing to relinquish their homes and livelihoods, choosing instead to navigate the delicate balance between the water's adversity and its sustenance (Pulla and Das, 2015). The Haor represents a paradox, embodying both a curse and a blessing, testing the resilience and adaptability of the people who call this watery landscape home.

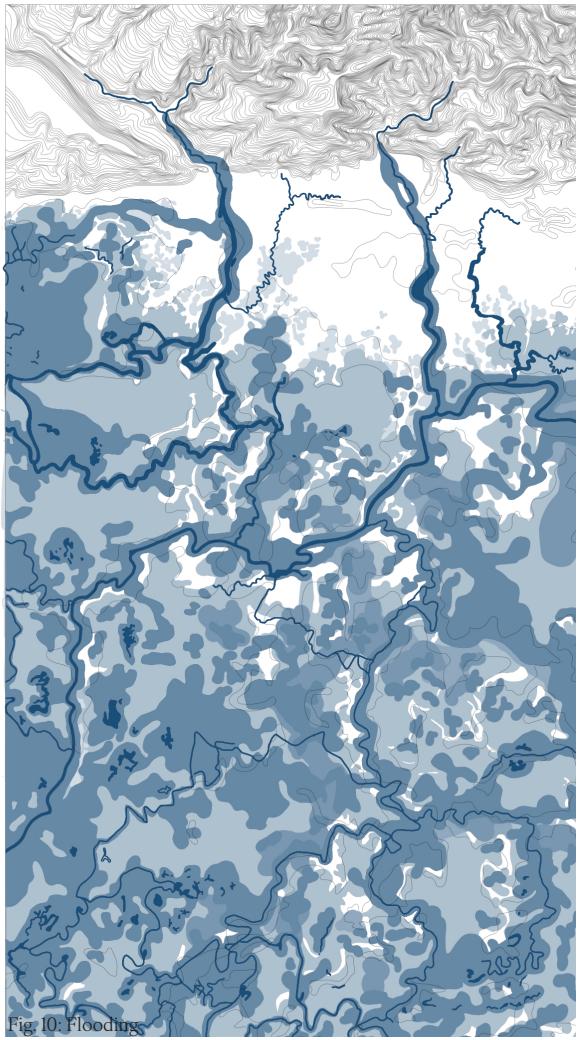
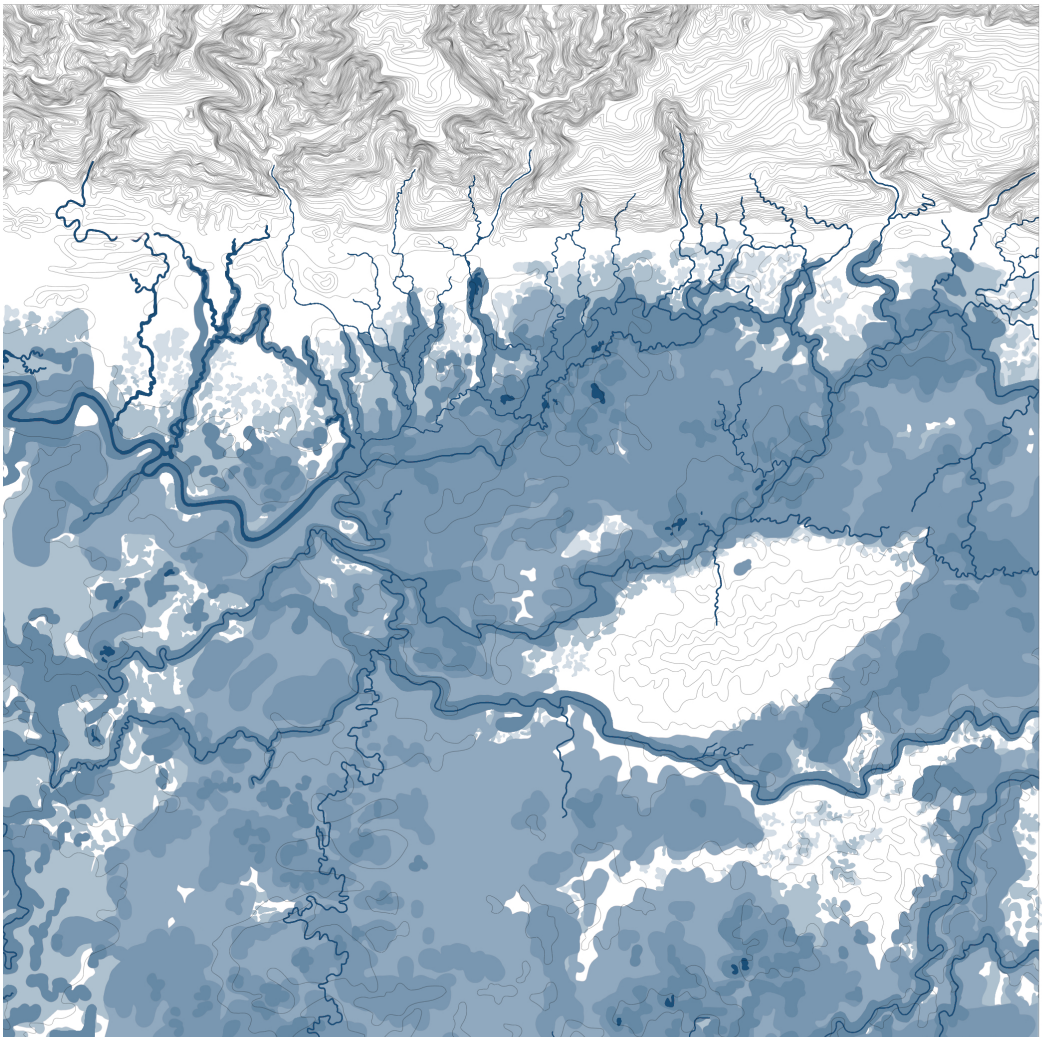


Fig. 10: Flooding



Children & floods

Children emerge as the most vulnerable demographic during natural disasters, facing countless challenges that demand urgent attention and comprehensive support. In research by Martin (2010) it is emphasized that children, alongside the elderly and disabled, are the foremost victims of such calamities, suffering physical, emotional, and mental distress.

Addressing the needs of children during natural disasters goes beyond mere provision of basic necessities such as water, food, and shelter. The International Strategy for Disaster Reduction (ISDR, 1973) highlights the importance of holistic support, encompassing emotional, mental, and social development. In Bangladesh, where approximately one-third of the population is under 18 years old (Bartlett, 2008; [PopulationPyramid.net](http://populationpyramid.net/), n.d.), this vulnerable group experiences profound losses during natural disasters, particularly floods.

Research by Peek (2008) categorizes the vulnerabilities faced by children during floods into psychological, physical, and educational dimensions. These traumatic situations induce emotional distress, fear of hunger, loss of educational opportunities, restricted freedom, increased workload, and heightened risk of physical and sexual abuse (Martin, 2010). During floods, communities often flee to overcrowded shelters lacking sufficient clean water and sanitation, exposing children to water-borne diseases (Martin, 2010).

Drowning emerges as a critical risk, with more than a quarter of deaths in children aged 1 to 4 attributed to drowning, a risk that escalates during the monsoon season (Rahman et al., 2017). Shockingly, over 90% of the 816 deaths reported during the 2007 floods were children under the age of 5 (Martin, 2010). Annual statistics reveal that close to 14,000 children drown in Bangladesh, while nearly 68,000 experience near-drowning incidents (Unicef, 2022).

Families often delay seeking refuge until the last moment, reluctant to leave their homes and livestock, resulting in chaotic and rapid evacuations (Martin, 2010). Furthermore, there is a limited understanding of psychosocial support for children dealing with trauma from conflict, loss of family members, or displacement (Khan et al., 2020). The negative impact of toxic stress on children's well-being during and after floods is an aspect often overlooked (National Scientific Council on the Developing Child, 2010 & 2014).

Despite the evident challenges, the emotional and mental states of children during and after floods are frequently neglected. This oversight jeopardizes their long-term development. Recognizing and addressing the comprehensive needs of children during natural disasters are crucial steps in fostering resilience and ensuring the well-being of the next generation in the face of adversity.

TRAUMA & PLAY

Trauma stemming from natural disasters

Children who experience natural disasters, such as floods, are at a heightened risk of developing posttraumatic stress disorder (PTSD), according to research conducted by Wolmer et al. in 2017. The impact of such traumatic events on young minds can be profound, and addressing the consequences becomes crucial for their well-being.

Halevi et al. (2016) emphasize that early exposure to prolonged and recurrent traumatic events does not naturally lead to healing and may even worsen over time. This insight underscores the need for effective interventions and support systems to mitigate the long-term effects on children who have faced such adversities.

Events related to natural disasters or political violence, are often collective and can significantly impact community infrastructure (Masten & Narayan, 2012). The repercussions extend beyond individual experiences, affecting the very foundations of the community. Understanding and addressing the broader community impact is essential for developing comprehensive strategies to support affected children.

Despite the evident challenges, research in this domain faces limitations, particularly regarding the coping mechanisms of preschool children and the effectiveness of preventive and therapeutic interventions. Halevi et al. (2016) highlight the difficulty in relying on young children's self-reports, which reduces the reliability of data and complicates efforts to understand and address their needs effectively.

Creating opportunities for emotional expression, fostering cognitive understanding, and promoting behavioral or fantasized changes are crucial for the process of healing traumatic experiences in children (Terr, 2013). These (playful) elements are identified as key components in aiding the recovery of children who have undergone traumatic events.

The world of play

The significance of play in fostering the healthy development of children is widely acknowledged in academic literature. Play has a vital role in the overall well-being and growth of young individuals (Nijhof et al., 2018). This sentiment is echoed by Huizinga (1938), who regards play as a fundamental aspect of life across diverse cultures, positioning it as a primary activity in flourishing societies.

Despite its importance, play lacks a formal definition; however, Huizinga (1938) provides a comprehensive understanding, defining play as "a volitional act within certain limits of space and time, according to voluntarily accepted but compelling rules, being a goal in itself, accompanied by feelings of excitement and joy, different from everyday life." This definition encapsulates the essence of play as a self-driven, rule-bound, and inherently enjoyable activity.

To further emphasize the fluid nature of play, its forms and meanings do not conform to sharp boundaries, but rather blend into one another (Wittgenstein, 1989). Some research (Graham & Burghardt, 2010) state that play can be characterized through five criteria, describing it as spontaneous, repeated but not stereotypic, pleasurable, different from serious behaviors, and initiated in the absence of severe stress. Thus play, according to this characterization, is an activity pursued for enjoyment and recreation rather than serious or practical purposes.

Other dimensions of play are explored by Lester and Russell (2008) and include highly active games such as social play, language play, pretend and sociodramatic play, chasing and rough-and-tumble play, games with rules, and construction play. The National Institute for Play identifies seven forms of play, encompassing creative play, storytelling-narrative play, imaginative and pretend play, social play, object play, body play and movement, and attunement and mimic play.

Besides that playing is important for the development of children it also offers opportunities to replicate real-life conflicts, alleviate negative feelings, and work out ideal resolutions for their pleasure (Piaget, 1962). In particular narrative and storytelling can contribute to children's integration of positive and negative life experiences (Habermas & Buck, 2000).

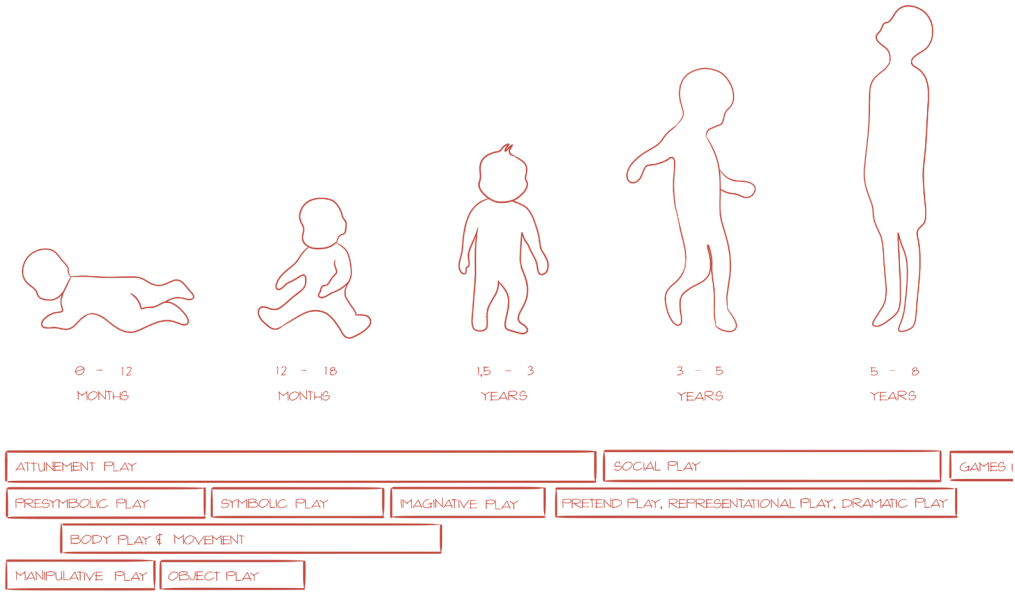


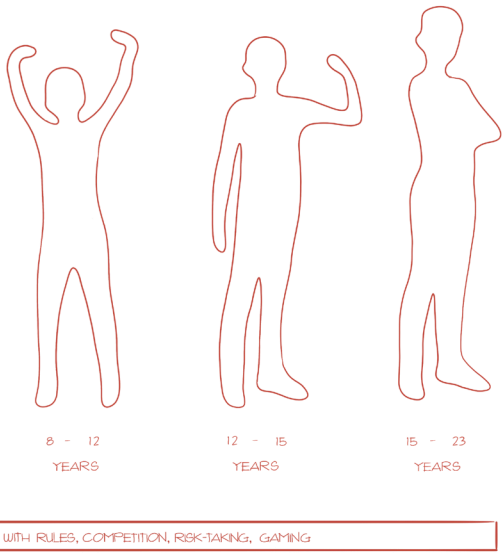
Fig. 11: Types of play per age

A natural coping mechanism

Free play emerges as a creative and natural coping mechanism, offering children a means to progressively revisit and process traumatic memories (Bonanno et al., 2011; Fredrickson, 2000). This fundamental function of play extends beyond the realms of external reality, providing a space for engagements that support the emergence of positive affect—a crucial element in adaptive coping with both acute and chronic stress.

Through play, Children who have experienced trauma are able to organize their memories, integrate fragmented sensory experiences, and reconstruct them to enhance comprehension (Cohén & Gadassi, 2018). This process allows for a holistic approach to dealing with traumatic events, contributing to the child's cognitive and emotional development.

The experience of self-efficacy is a major healing function of play. It



empowers children by transforming the passive victim role into an active one, allowing them to showcase their power and capabilities in fantasy (Chazan & Cohén, 2010; Gil, 2017). From a neuroscientific perspective, play and relationships are crucial means of regulating excitement and managing with fear. This dual impact of play, operating at both metaphorical and neurobiological levels, facilitates the reworking of trauma memories.

The involvement of parents in play with their young children is identified as a significant factor in fostering resilience in spite of continuous exposure to traumatic events (Cohen, 2014; Cohén & Shulman, 2017). Creating spaces for parental engagement in play contributes to a supportive environment, reinforcing the child's ability to navigate and cope with challenging experiences.

The multifaceted role of play in the face of trauma is evident. From providing a creative mechanism for revisiting memories to fostering self-efficacy and resilience, play serves as a dynamic and essential tool in a child's coping arsenal. Parental involvement and the potential risks associated with different forms of Post post-traumatic play add complexity to the understanding, emphasizing the need for careful consideration and support in utilizing play as a therapeutic and developmental tool for children exposed to trauma.

Community trauma

There is a growing awareness of the importance of community-based interventions, particularly in the initial stages following a Collective Traumatic Event (CTE). This recognition stems from the understanding that CTEs impact multiple systems (Saltzman et al., 2017). These events, whether natural disasters or political violence, have far-reaching consequences that extend beyond individual

experiences, necessitating a holistic approach to recovery and support.

A study conducted by Masten and her colleagues (2012) on children in war and disaster shows the significance of normalizing everyday life for children and their families affected by such traumatic events. This includes the resumption of school activities and the provision of opportunities for children to play and socialize. This recognition of the importance of recreating the infrastructure that enables children to play safely becomes a pivotal community-level intervention.

The environment of play

Children possess a natural inclination for creativity and imagination, however, these innate abilities often face constraints under formal instruction. Children are perfectly capable of autonomously developing their imaginative capabilities if adults provide nurturing care, and allow their offspring to play freely in a stimulating physical environment (Altman et al., 1978). This development involves organizing games, inventing stories, imitating adult behavior, and, through various means, expanding their worlds.

Nature emerges as a powerful facilitator in the imaginative world of children. Contrary to the notion that expensive toys are necessary, children can utilize nature and their imagination for play(Altman et al., 1978). Regardless of geographical variations, children almost everywhere have access to certain natural play materials, including water, sand, clay, and mud.

The design of environments for play needs to align with the contemporary culture of childhood (Dudek & Laris 2005). These environments can both transform the user and be transformed by the user, underlining the dynamic and reciprocal relationship between the child and the play environment.

In an ideal dwelling for a family with children, the transition between the outdoors and indoors becomes seamless. (Bengtsson, 1939). This encourages children to move freely between these spaces, expanding the radius of their activities as their feelings of safety and self-reliance grow. Creating spaces that are safe for children to play is of great importance, as children will naturally play wherever they find themselves, regardless of whether the spaces are designed for playing or considered ‘suitable’ or not.

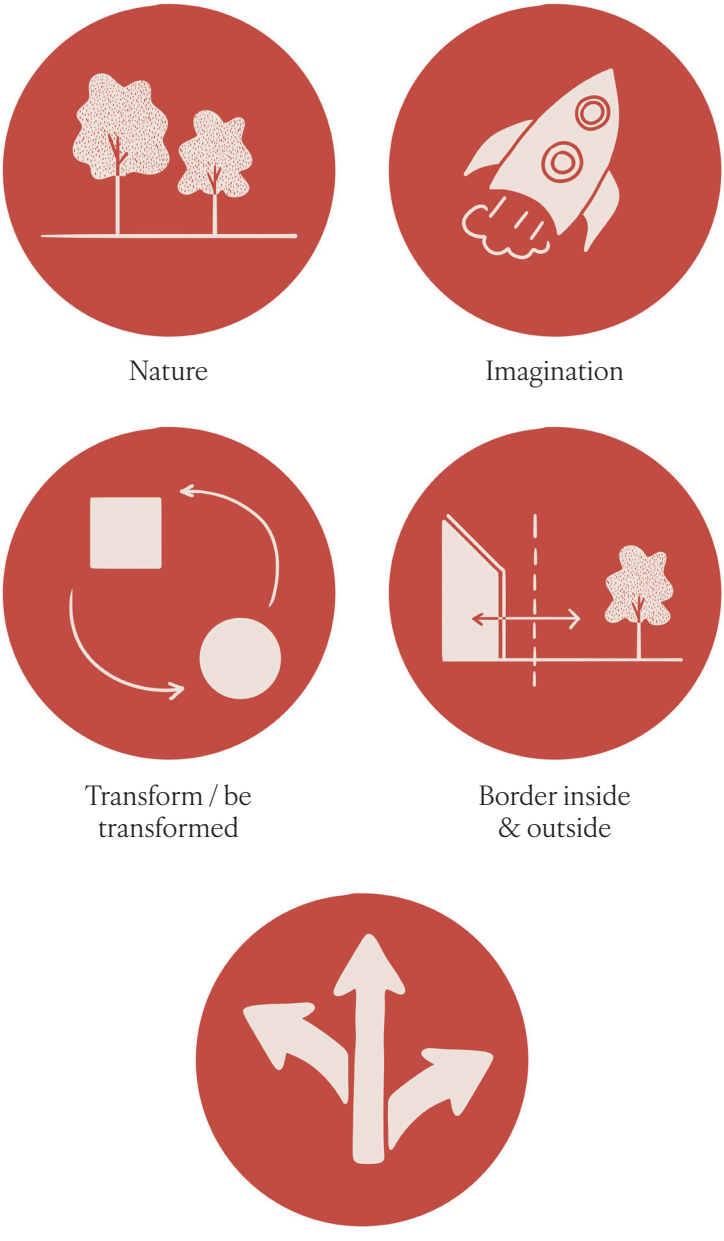


Fig. 12: Environment of play

CASE STUDIES

Aranya low-cost housing

Location: Indore, India
Architect: Balkrishna Doshi
Completion: 1989
Function: Low cost housing

"They are not houses but homes where a happy community lives. That is what finally matters," - B.V Doshi

The Aranya low-cost housing project, located in the city of Indore, India, was initiated by the Vastu-Shilpa Foundation under the leadership of Balkrishna Doshi, commencing in 1989.

The project's primary merit lies in its innovative operational approach to housing development, addressing

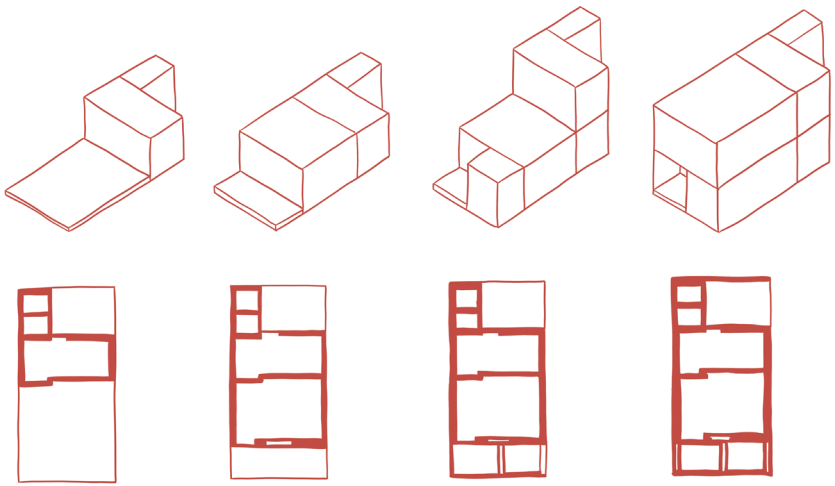


Fig. 13: Incremental growth

the challenges of limited financial and material resources within socially vulnerable contexts. Rather than adopting a rigid, pre-defined planning model, the architectural team proposed an open-ended framework capable of evolving over time, anchored by the construction of essential infrastructural elements and amenities (Hidden Architecture, 2023).

Doshi opted to provide families with a foundational structure, encompassing provisions for services, a toilet block, and a brick plinth for construction.

Instead of presenting a completed dwelling, this framework empowered residents to configure the space according to their core needs and lifestyle preferences. This concept facilitated subjective growth of the dwelling, influencing factors such as connectivity, adaptability, private and public domains, indoor-outdoor interactions, and spatial flow (Awasarkar, 2021).

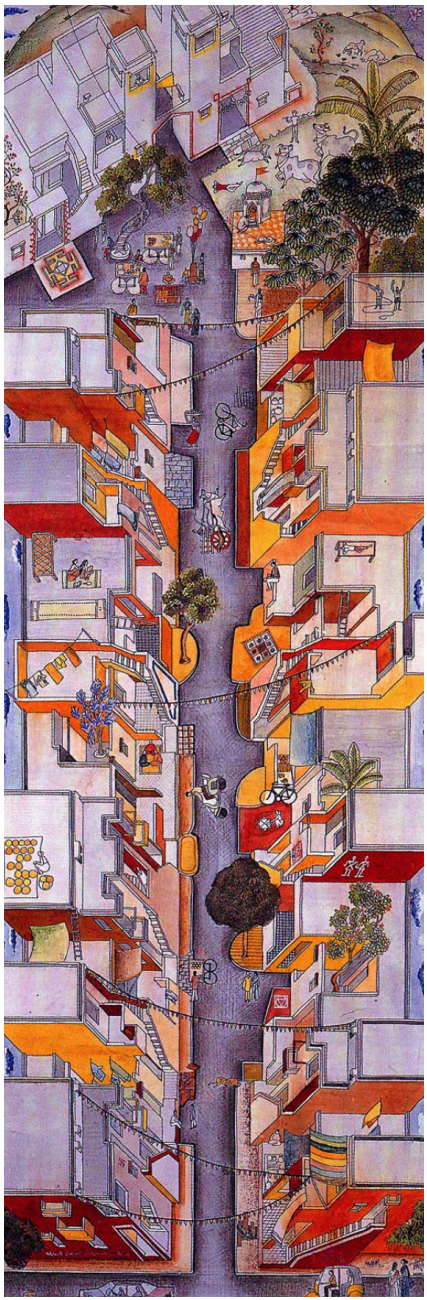


Fig. 14: Impression Aranya

Belapur housing

Location: Navi Mumbai, India
Architect: Charles Correa
Completion: 1983
Function: Collective housing

Traditional Indian urban spatial syntax is used and re-interpreted in the housing project of Charles Correa. Through observing traditional Indian settlements, Correa finds that cities should be designed by using a spatial hierarchy. Consisting of the private life of the individual, 'behind the doorstep' the communal courtyard (with a well or common tap). And the Maindan, the public space or promenade of the community.
The main objective of the project was to develop individual plots for each

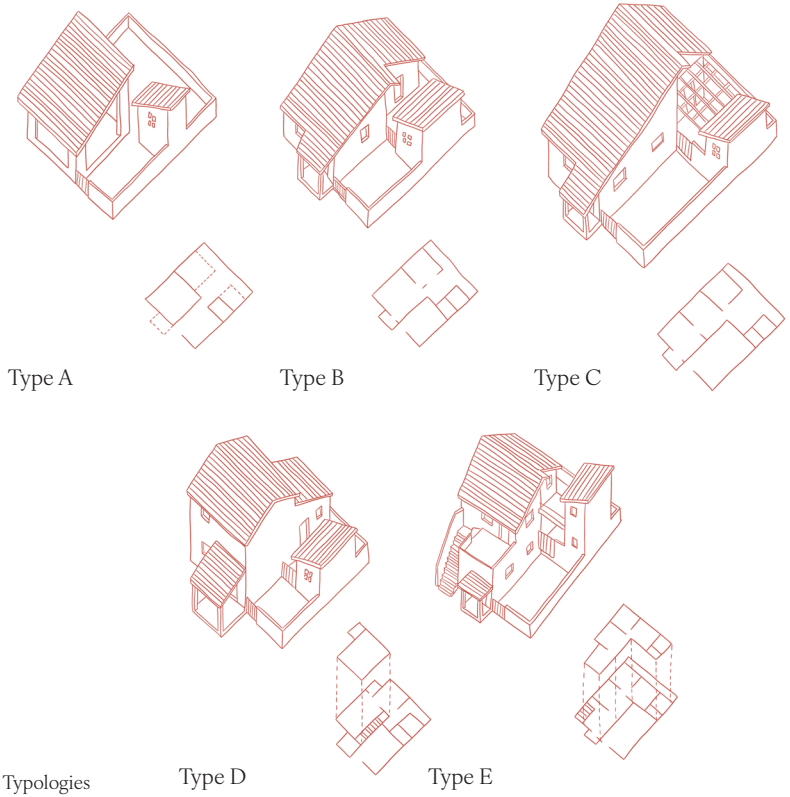


Fig. 15: Typologies

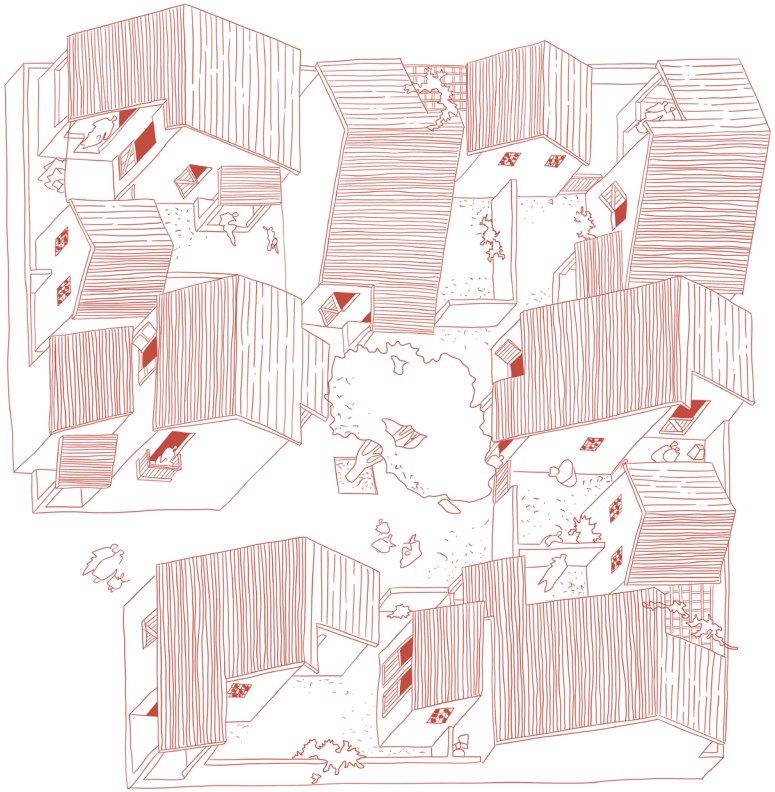


Fig. 16: Axo Belapur

dwelling which in turn allows for future expansion (Chapekar, 2022). The house therefore, functions as the main element, surrounded with a private yard. Ensuring the privacy of families within their living space is paramount, and he contends that in the Indian climate, the presence of "open-to-the-sky space" is vital for fostering family well-being (Hidden Architecture, 2023).

Within the project there are 5 types of dwellings. Ranging from a single room with a toilet to a two-story apartment. The structure of the housing units was made simple to ensure that local (unskilled) laborers could have the opportunity to employment (Khan et al., 1987).

Villa Verde

Location: Constitución, Chile
Architect: Alejandro Aravena
Completion: 2013
Function: Housing
Area: 57 m^2 to 85 m^2

Fig. 17: Typology

Fig. 18: Incremental growth

Blooming Bamboo

Location: Cau Dien Town, Hanoi, Vietnam
Architect: H&P Architects
Completion: 2013
Function: Residence, classroom / library, community center, healthcare
Area: 44 m^2
Cost: $2500

Designed to address the threat of flooding in Vietnam, this prototype offers a practical solution for vulnerable communities. Elevated on stilts, it can withstand floods up to 1.5 meters. Integrated recycled oil tanks enable the building to rise with the level of floodwaters, while steel piles anchor it securely, preventing the building from drifting

Fig. 19: Unit design

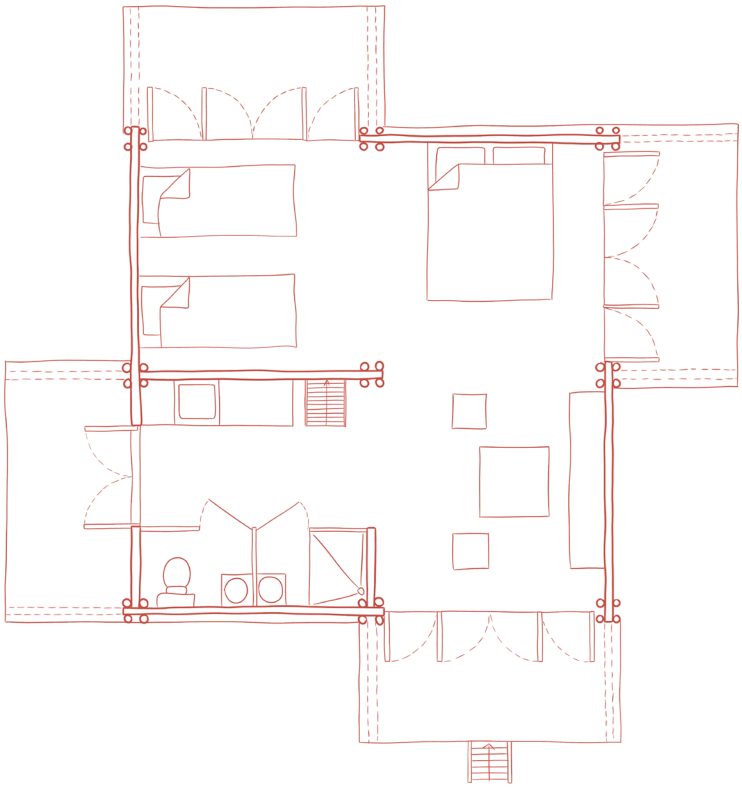


Fig. 20: Floor plan - ground floor

away. The modular design allows for easy expansion. Versatile in function, it can serve as a residence, medical center, classroom, library, or community center.

The modular system is structured within a 3m x 3m grid. The main structure utilizes bamboo canes with diameters ranging from 80mm to 100mm, while smaller diameter bamboo canes (40mm to 50mm) are employed for other components. Facade cladding can be tailored to suit local climate conditions and materials. Users can construct the building themselves using techniques like bolting, binding, and hanging. On average, assembly takes approximately 25 days (H&P Architects, 2021). (Minke, 2016)

Son La Restaurant

Location: Son La, Vietnam
Architect: VTN Architects
Completion: 2014
Function: Restaurant
Area: 1984 m^2
Cost: 600USD/m2

Son La province, situated in the northern region of Vietnam, with its untouched forests and picturesque mountain landscapes, the province offers a unique setting for architectural innovation that integrates local resources and traditional building techniques. The project embraces a philosophy of utilizing locally available resources to minimize environmental impact and foster cultural authenticity. Bamboo and stone, abundant in the area, serve as primary building materials, while local expertise

Fig. 21: Interior

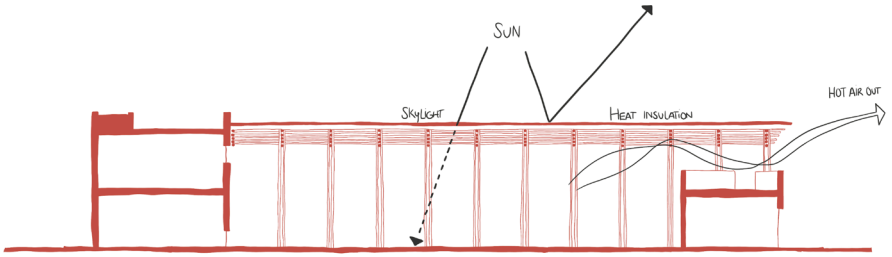


Fig. 22: Cross section

is enlisted due to the challenging terrain and limited accessibility of the region. At the heart of the architectural design are the bamboo column units, comprising 96 units crafted from four bamboo poles each. Ranging from 80 to 100 mm in diameter, these bamboo poles are meticulously assembled using traditional Vietnamese techniques, including bamboo dowel nails and rope. Prior to construction, the bamboo undergoes a treatment process involving soaking in mud and smoking, enhancing its durability and weather resistance. Ten-layered crossed bamboo beams act as braces, connecting the stone buildings and ensuring structural stability. This fusion of traditional craftsmanship with modern engineering principles ensures the longevity and resilience of the architectural ensemble. The roofing and ceiling elements of the structures reflect a blend of local materials and cultural aesthetics. Locally sourced thatch, known as "vot," forms the ceiling, providing natural insulation and ventilation. Transparent composite roof sheeting covers the roof above, allowing ample natural light while shielding against environmental elements (Sánchez, 2021).

Fig. 23: interior

Meti School

Location: Rudrapur, Bangladesh
Architect: Anna Heringer & Eike Roswag
Completion: 2005
Function: School
Area: 325 m^2
Cost:

In Rudrapur, a village of 1500 residents in the north-west of Bangladesh, a new school was built. Featuring six classrooms, the school primarily utilized traditional materials like earth and bamboo. However, it stood out from neighboring structures, particularly in its foundation and the bamboo load-bearing framework.

The primary objective was to address the issue of earth buildings being washed away during the monsoon season, a common occurrence in Rudrapur, where roughly 70 percent

Fig. 24: Ground floor facade

Fig. 25: Building method

of the land is submerged. To combat rising damp and ensure durability, the school's foundations were constructed with kiln bricks, layered with a horizontal damp-proof course.

Constructed in horizontal layers using a blend of earth and straw, the walls were finished with loam rendering internally and left untreated externally. The first-floor structure featured a load-bearing framework made of bamboo, with inclined bearers supported by column-like elements.

The METI school's design prioritized simplicity and practicality, avoiding unnecessary complexity. Apart from foreign donations, the only imported resources were construction expertise, highlighting the community's resourcefulness in creating a resilient and functional educational facility (Pawlitschko, 2007).

Vocational school

Location: Rudrapur, Bangladesh
Architect: Anna Heringer
Completion: 2008
Function: School
Area: 300 m²

In Rudrapur, a northern Bangladeshi town with a population of 3,000, a model project is underway to revive traditional, eco-friendly construction techniques. Starting in 2006 with the METI village school, the initiative has expanded to include housing and the DESI vocational school for electricians. Local craftsmen, teachers, and students, supported by a foreign planning team, aim to improve living conditions and promote modernized construction methods for wider use.

Key features of the project emphasize energy independence, utilizing photovoltaic panels for electricity and a solar plant for hot water. The typical single-storey brick or metal huts are replaced with compact, two-storey structures made of mud and bamboo. A polythene foil damp-proof course prevents moisture rise, while mud or clay walls reinforced with straw help avoid cracking. The

Fig. 26: Facade

upper-level veranda and classroom structures are built with hand-bound bamboo reinforced with iron dowels. To reduce heat, the roof is insulated with coconut fibers and clay. Colorful, hand-woven cloths and palm leaves provide sun shading, creating a vibrant interplay of light and shadow on the earthy walls and floors (Detail, 2012).

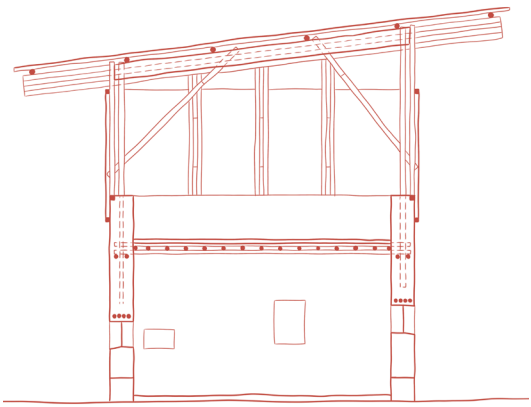


Fig. 27: Cross section

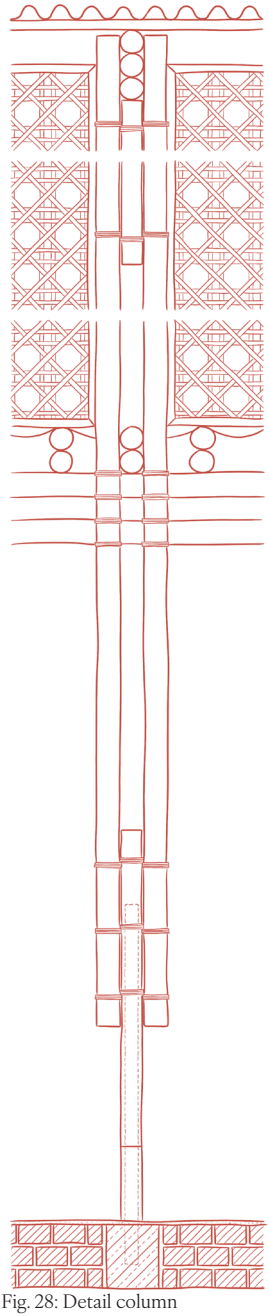


Fig. 28: Detail column

Community Center

Location: Rajarhat, Bangladesh
Architect: SchilderScholte architects
Completion: 2014
Function: Community Center
Area: 910 m²

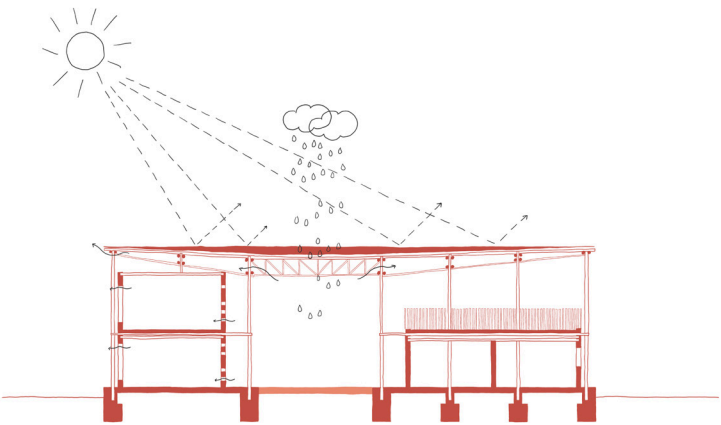


Fig. 29: Section

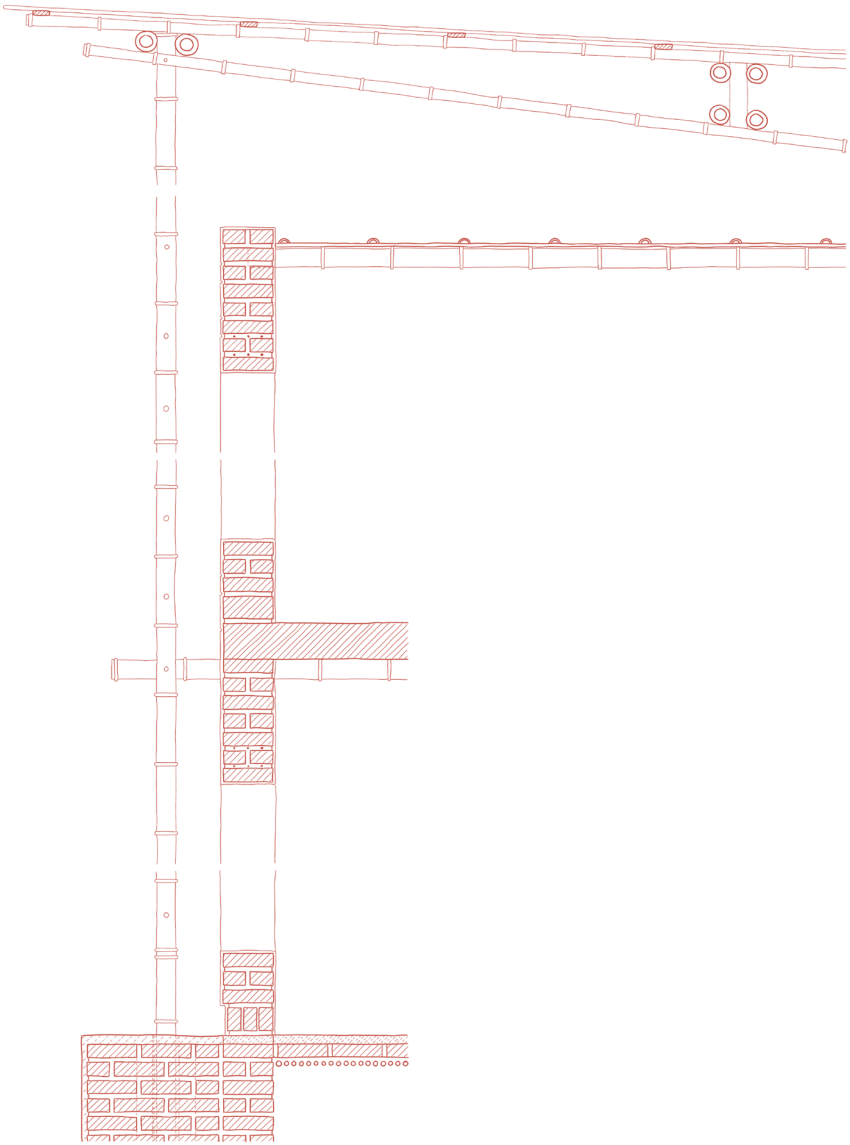


Fig. 30: Detail

MATERIALS

Bamboo

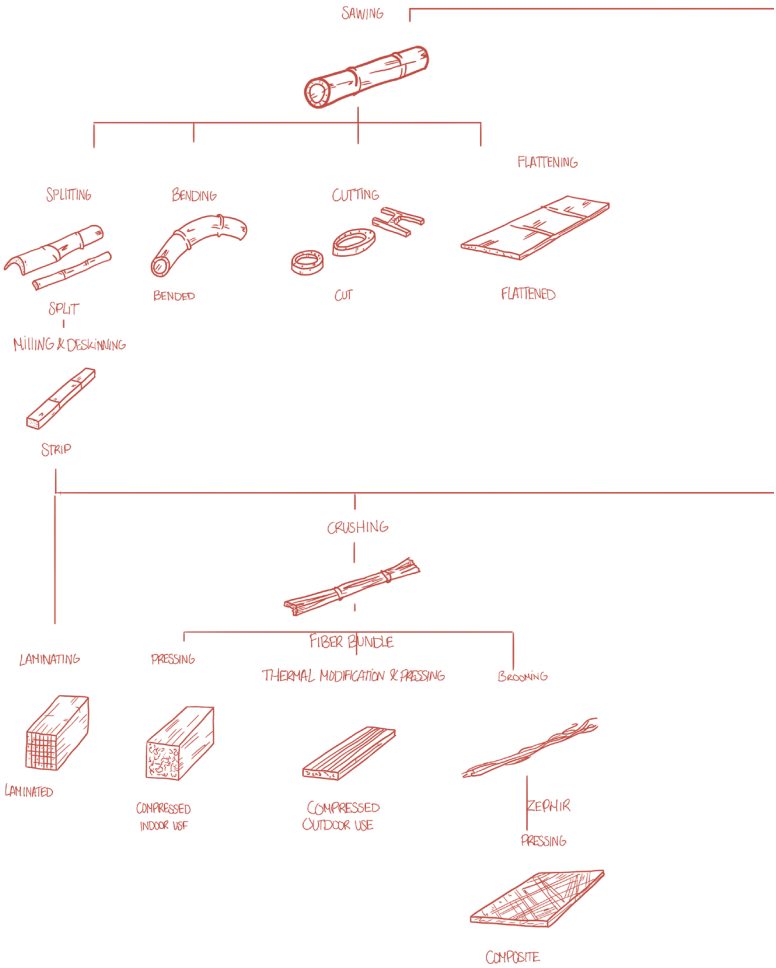
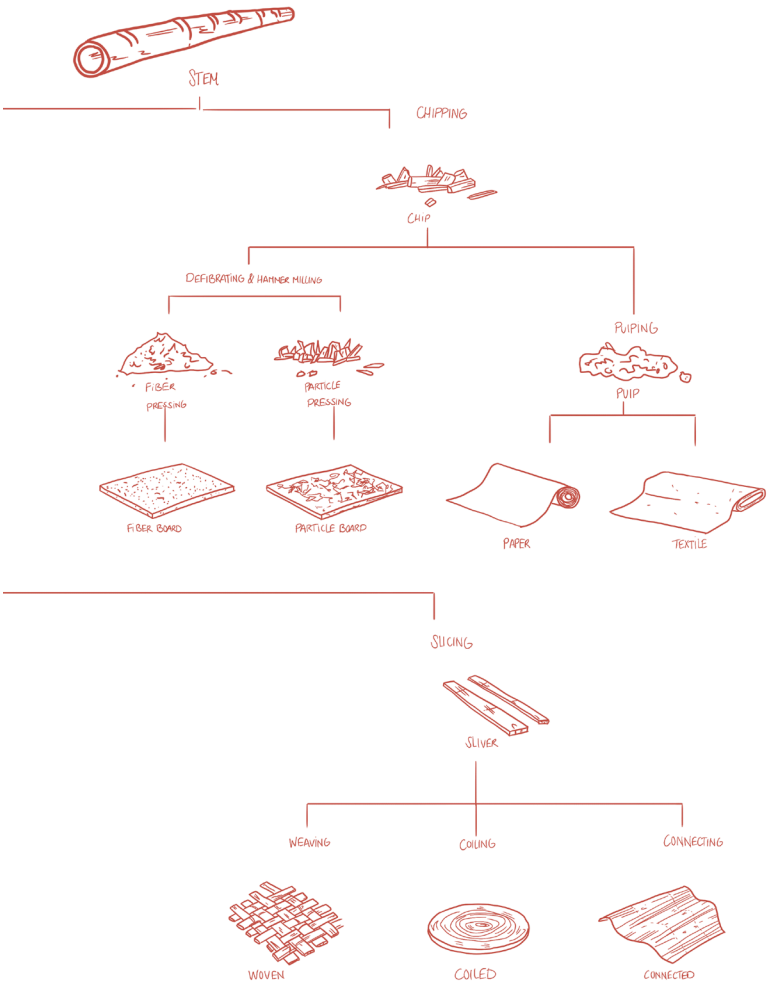


Fig. 31: Bamboo production


STEM
CHIPPING
CHIP
DEFIBRATING & HAMMER MILLING
PULPING
FIBER PRESSING
PARTICLE PRESSING
PULP
FIBER BOARD
PARTICLE BOARD
PAPER
TEXTILE
SLICING
SLIVER
WEAVING
COILING
CONNECTING
WOVEN
COILED
CONNECTED

Brick

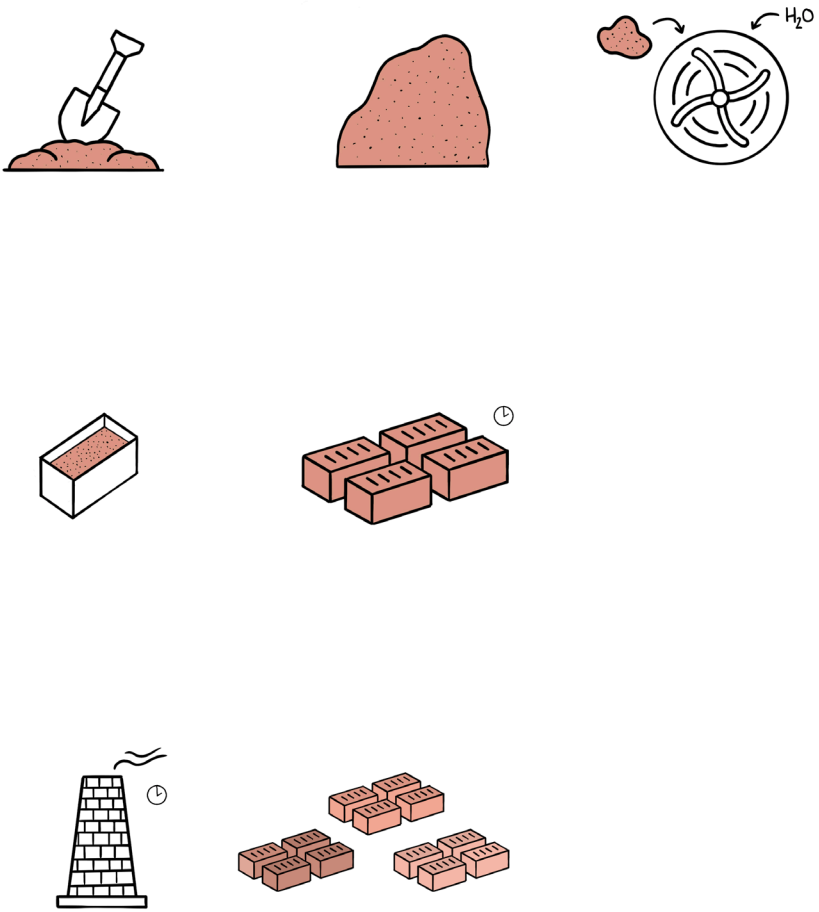


Fig. 32: Brick production

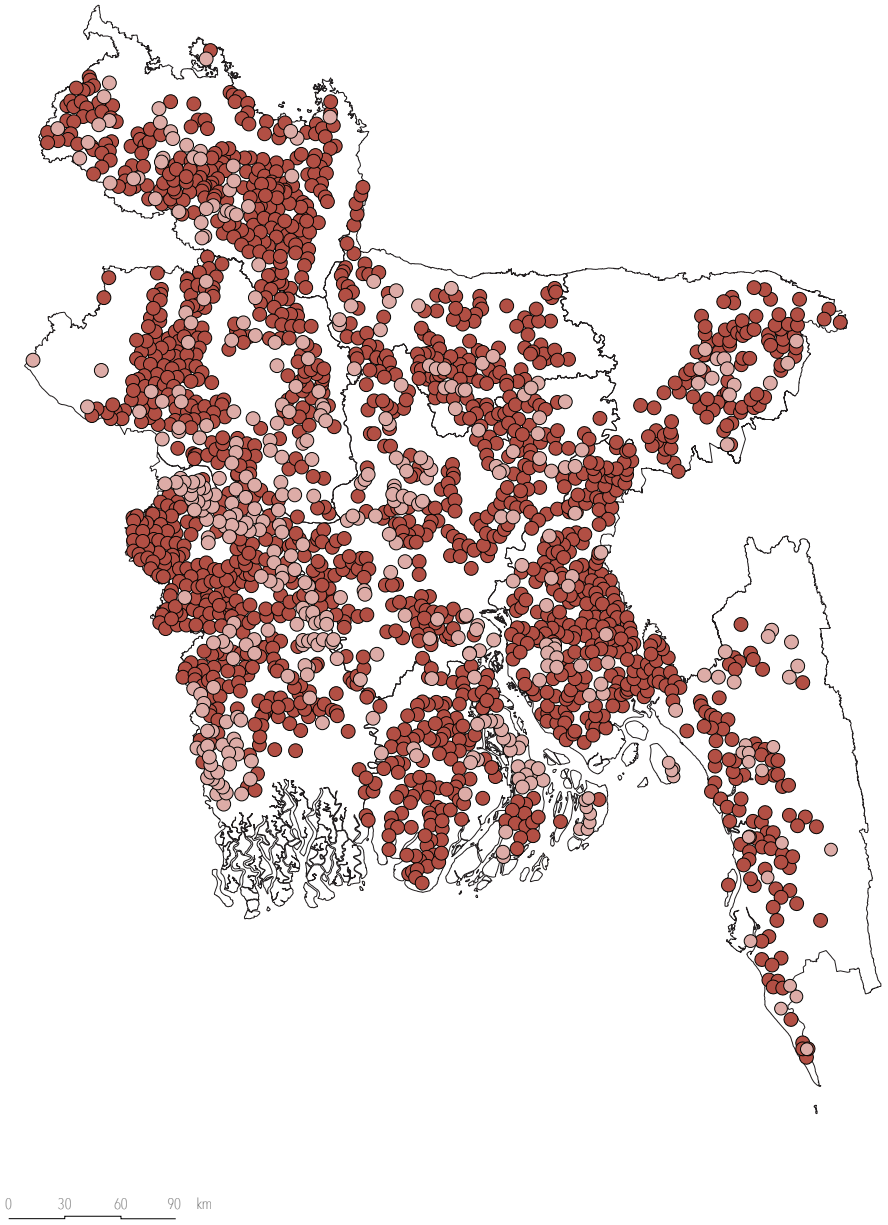
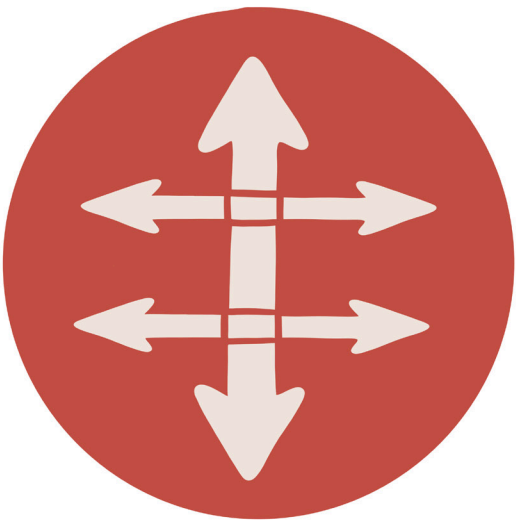


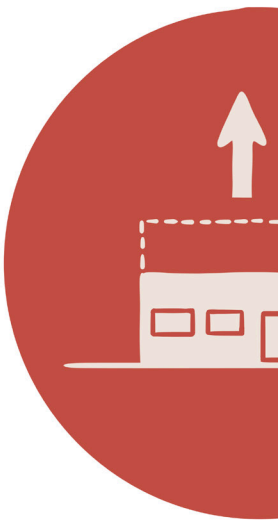
Fig. 33: Brick kiln location

DESIGN VISION

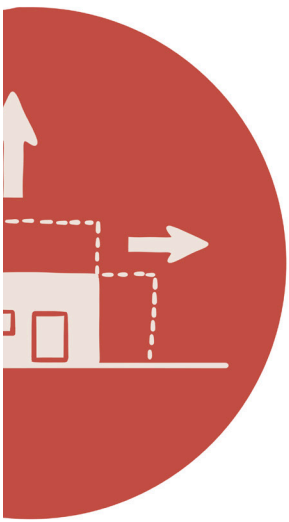
Design vision



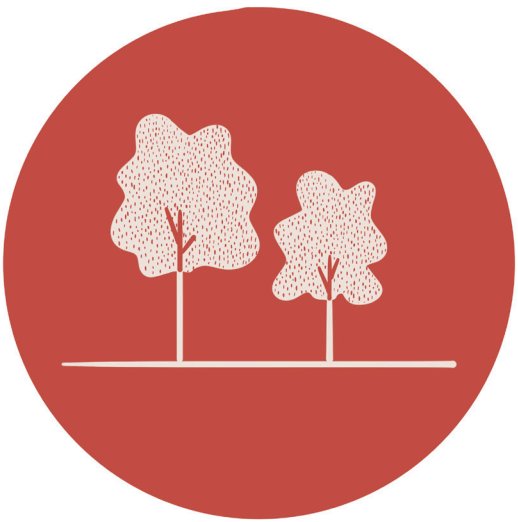
Re-imagine
circulation



Increm
grov



:remental
growth



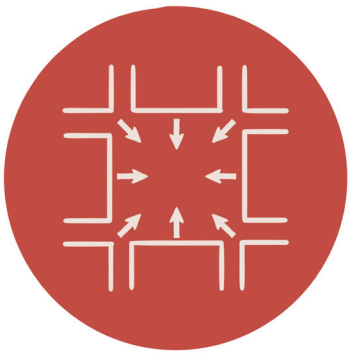
Re-imagine
open spaces

Design approach

Connectivity
open spaces

Flood
protection

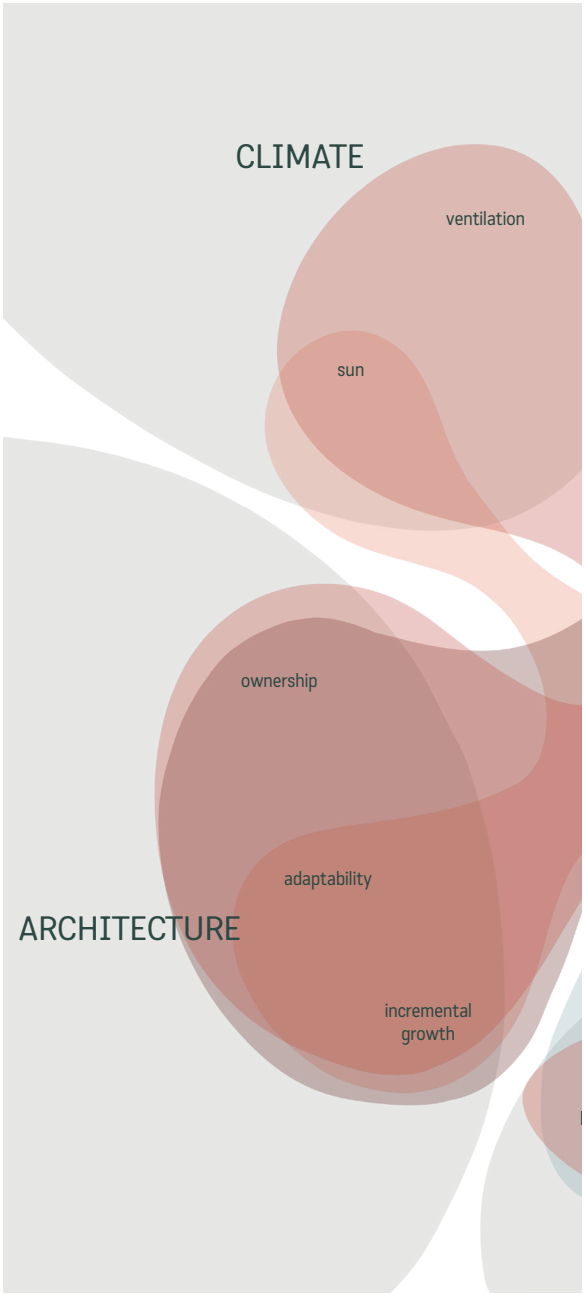
Basic elements



Courtyard

SYSTEM APPROACH

System approach



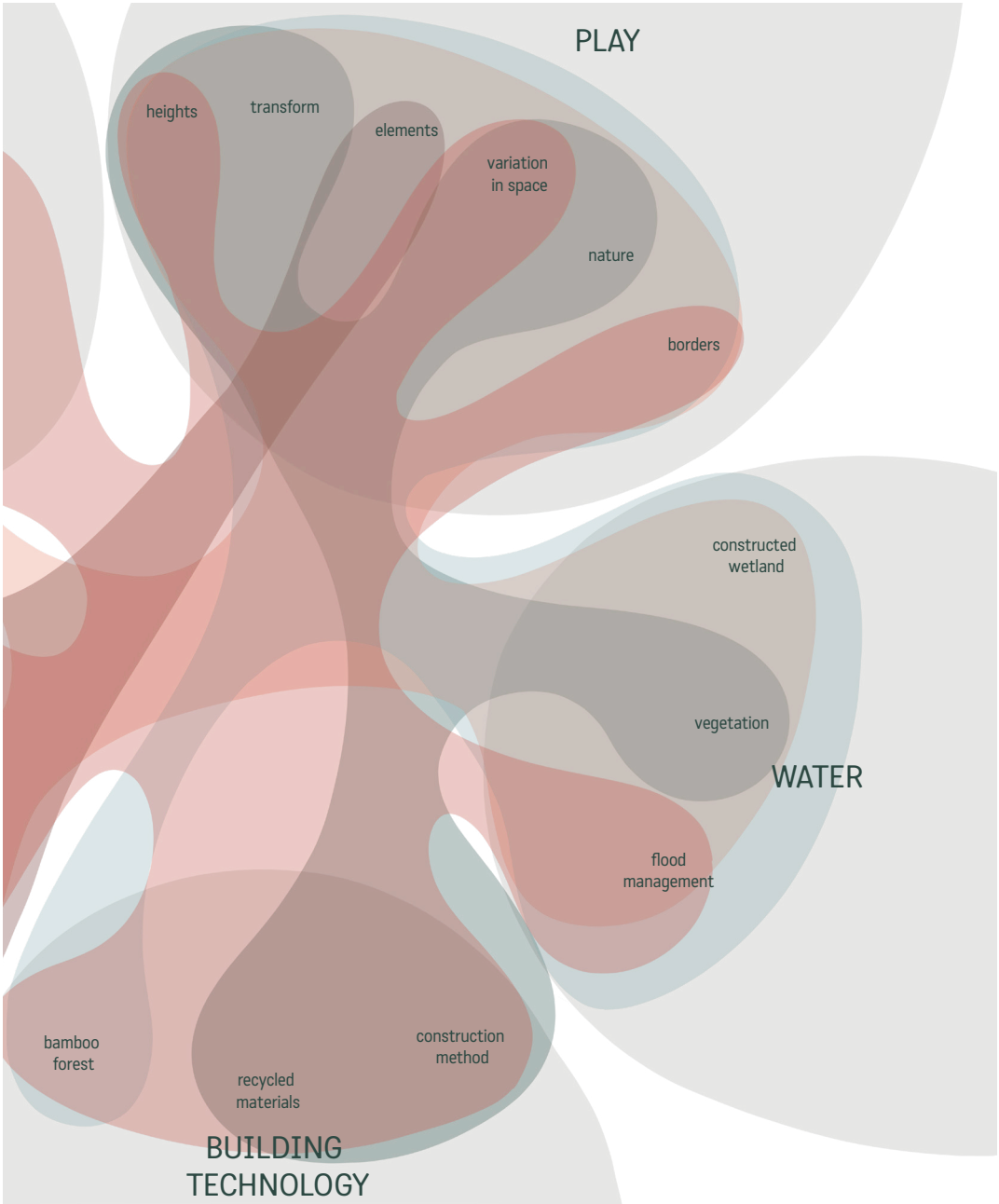
participation

unit

cluster

village

landscape


PLAY
heights
transform
elements
variation
in space
nature
borders
constructed
wetland
vegetation
WATER
flood
management
bamboo
forest
construction
method
recycled
materials
BUILDING
TECHNOLOGY

PARTICIPATION STRATEGY

Child participation

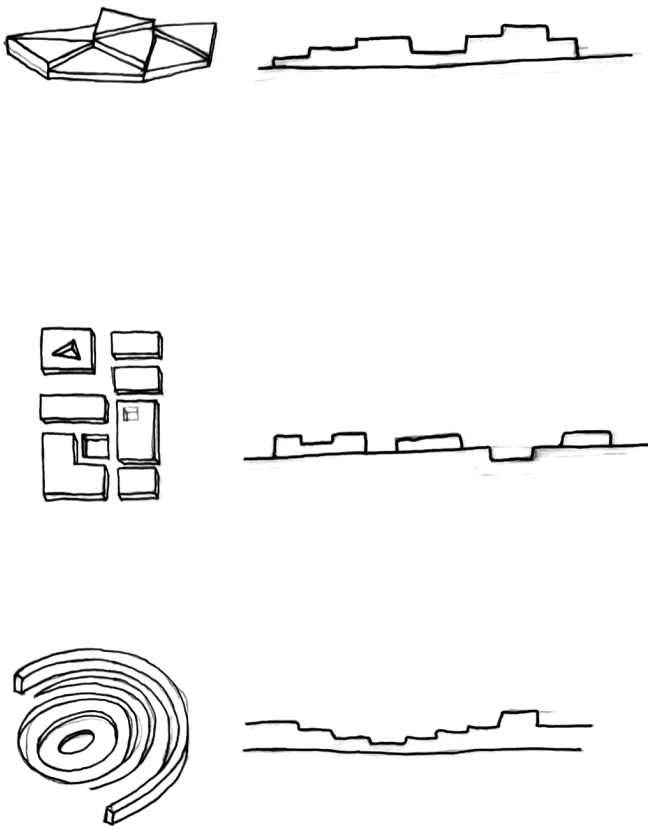
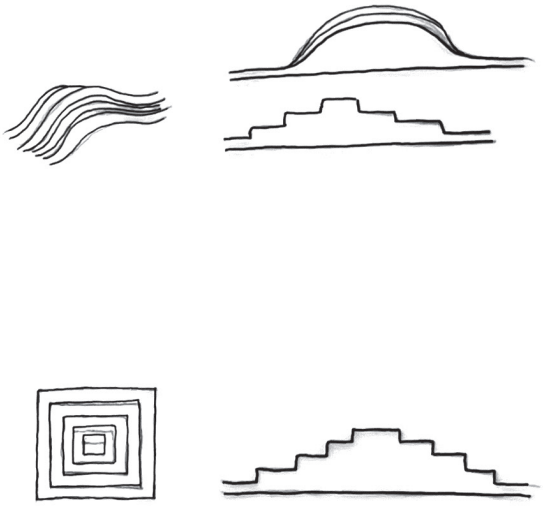


Fig. 34: Play elements



Choose your home

Before construction begins, residents follow a step-by-step process to ensure their homes meet their specific needs.

Step 1: Choose Your Type of Home
Residents select the type of home, considering family size or occupation, ensuring it suits its intended purpose, whether single-family or multi-generational.

Step 2: Choose Your Plot
Next, they choose their plot from various sizes and price ranges, fitting their budget and spatial needs, whether for a compact urban lot or a larger suburban area.

Step 3: Choose Your Plinth
Residents then select their plinth, determining the transition from private to public space, impacting the home's layout and functionality with options like gardens or courtyards.

Step 4: Choose Your Elements
Finally, they choose elements like doors, openings, inner walls, and facades, personalizing the design to reflect their preferences and lifestyle.

This structured process allows residents to actively participate in designing and constructing their homes, creating a diverse and personalized community.

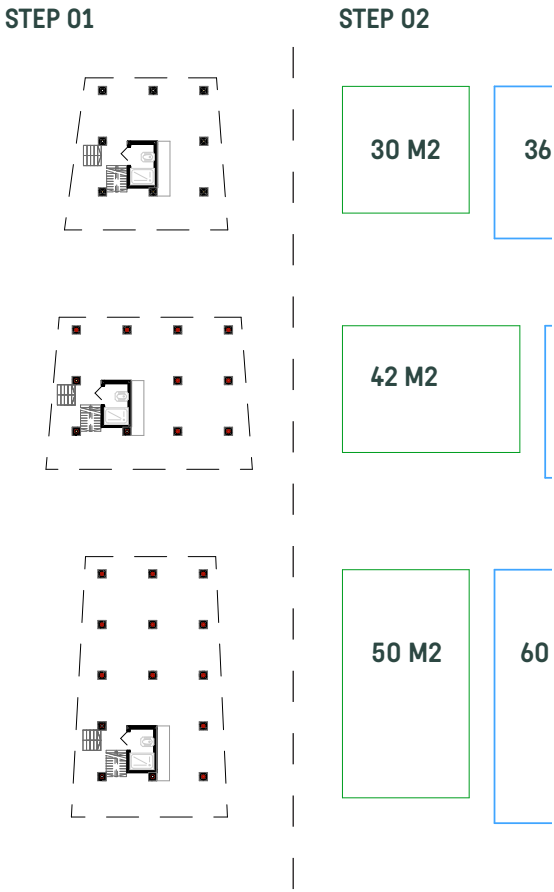


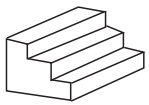
Fig. 35: Step process

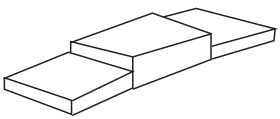
STEP 03

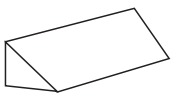
36 M2 | 42 M2 | 56 M2

48 M2 | 56 M2 | 64 M2

60 M2 | 70 M2 | 80 M2







Element list

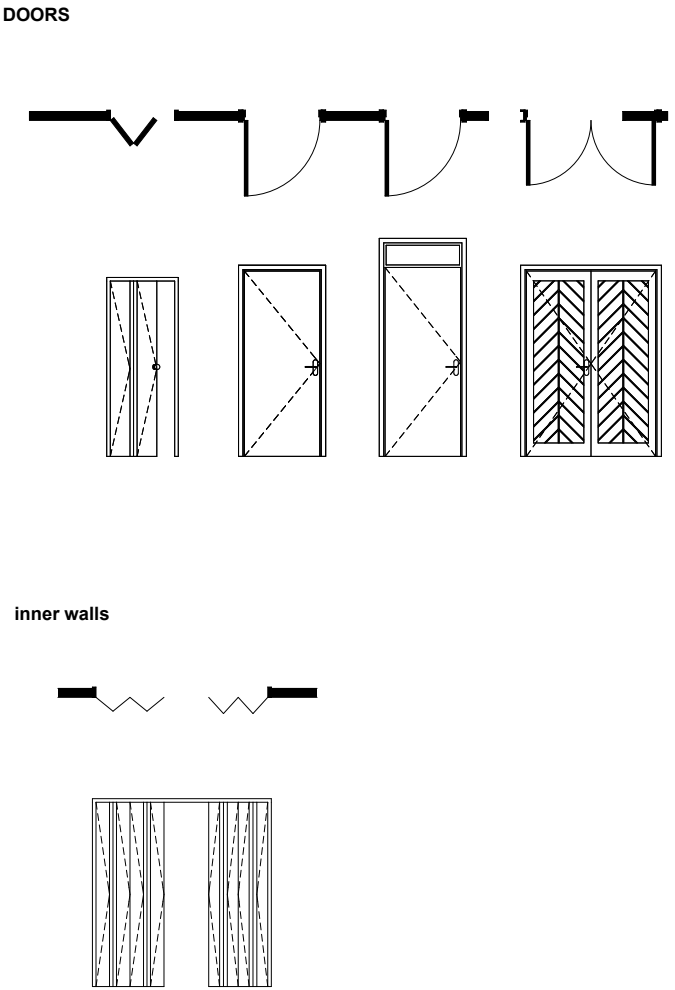
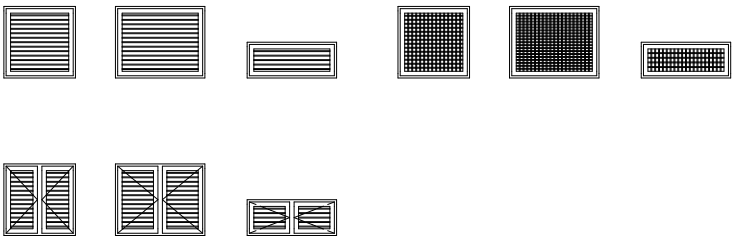
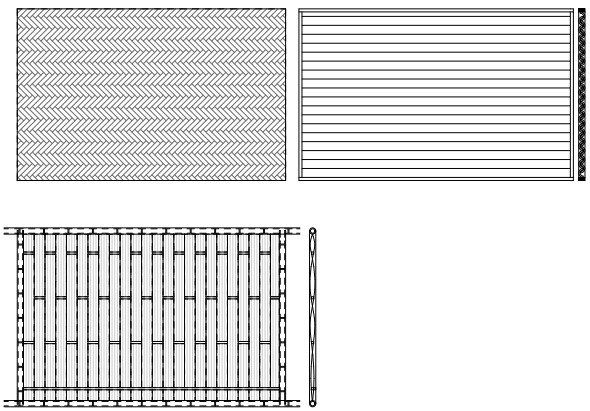


Fig. 36: Element list

openings



facade



Managerial strategy

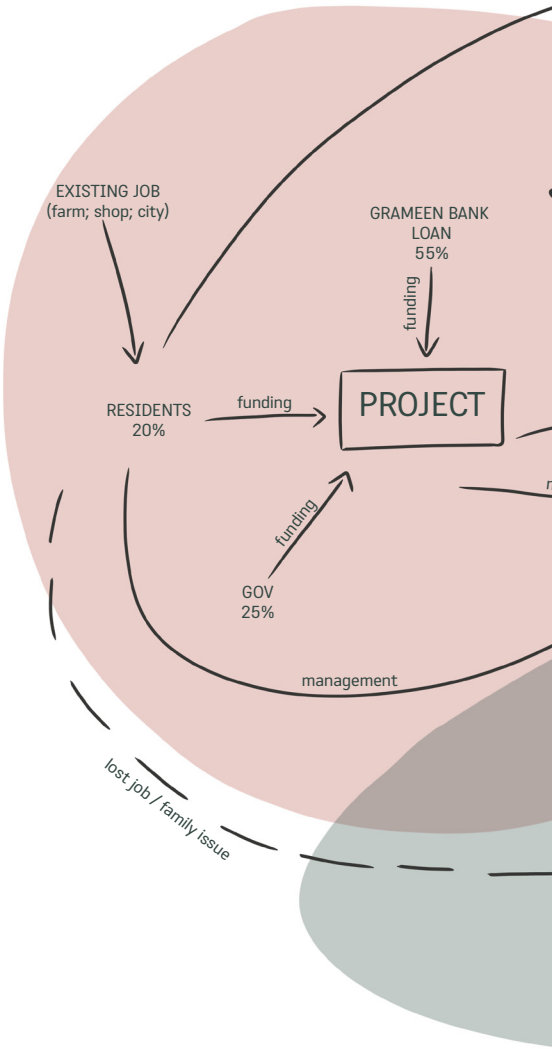
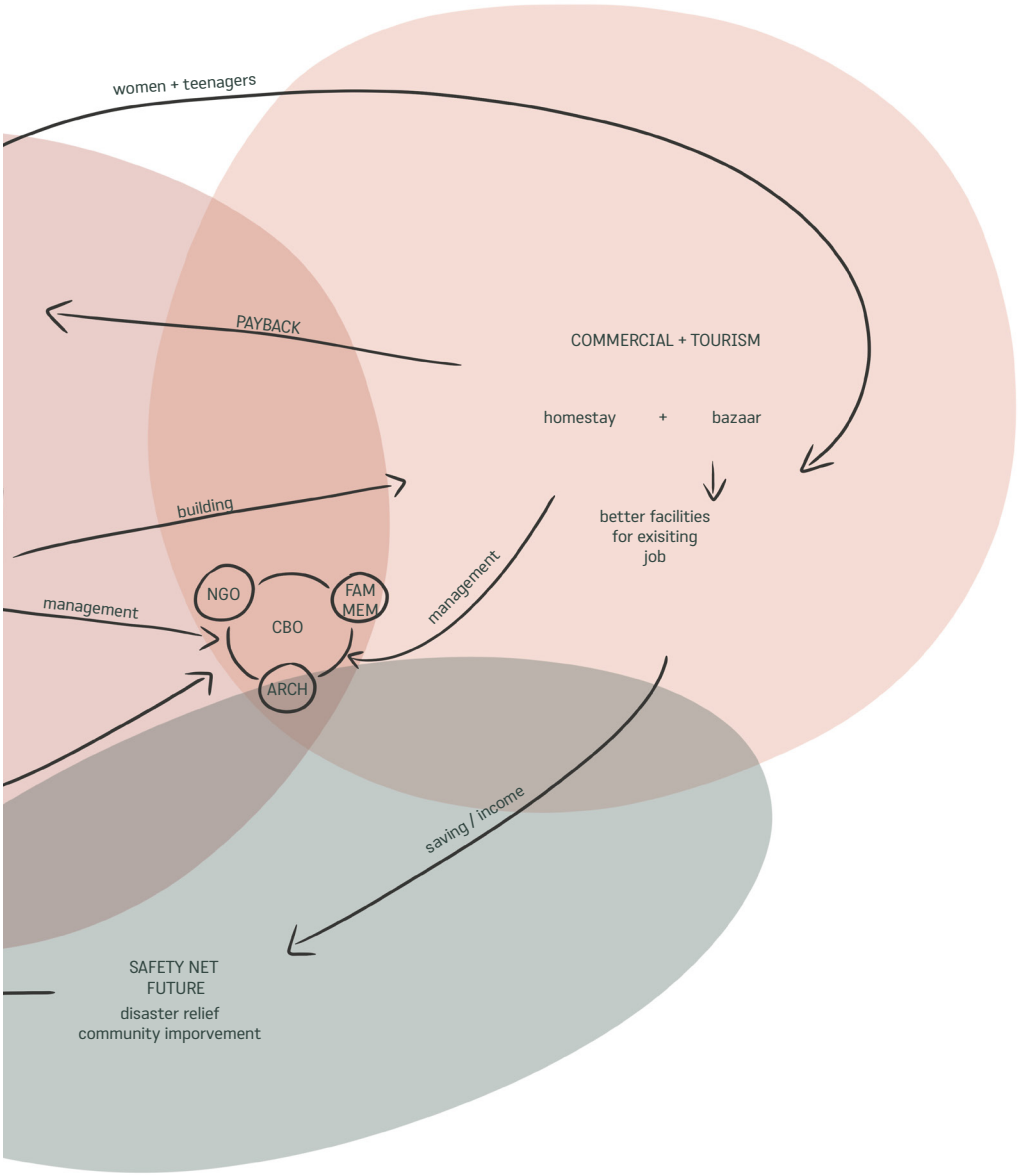


Fig. 37: Managerial strategy


women + teenagers
PAYBACK
COMMERCIAL + TOURISM
homestay + bazaar
better facilities
for exisiting
job
building
management
management
NGO
FAM
MEM
CBO
ARCH
saving / income
SAFETY NET
FUTURE
disaster relief
community imporvement

UNIT STRATEGY

Roof design

The roof design adapts to the climate, creating more shade on the south and west sides of the facade. This design lowers the view lines, connecting residents more with the ground rather than the vast sky. Additionally, the “tropen dak” roof enhances ventilation, improving comfort inside the home.

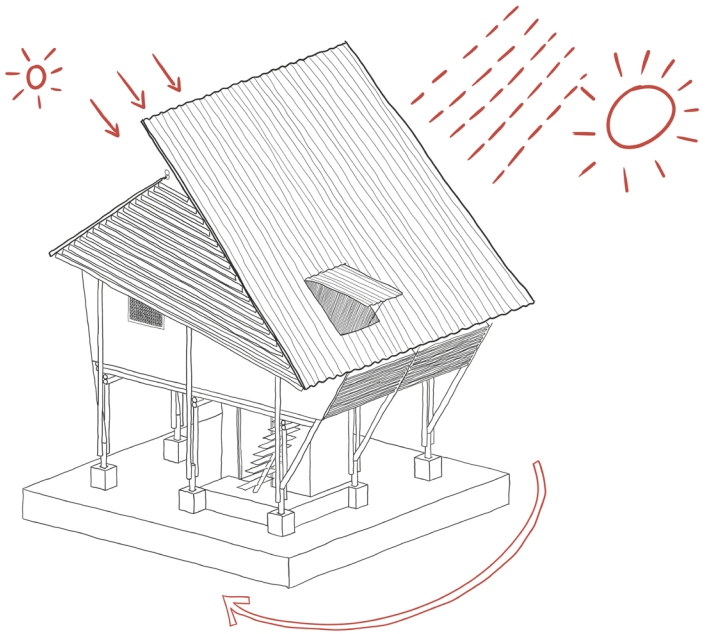


Fig. 38: Roof design

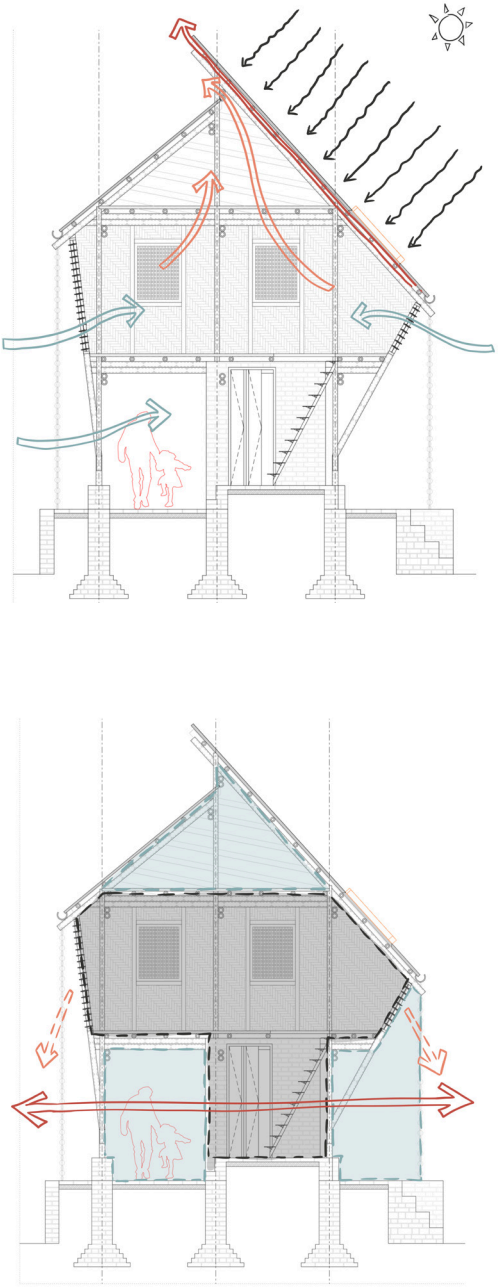
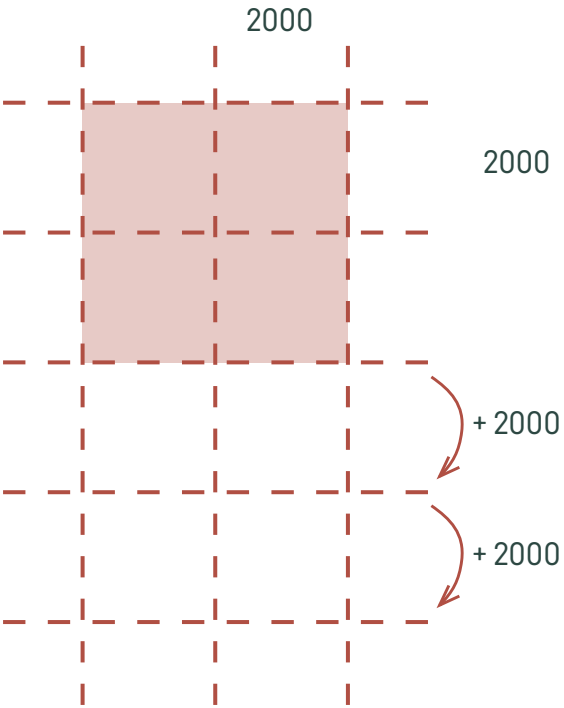


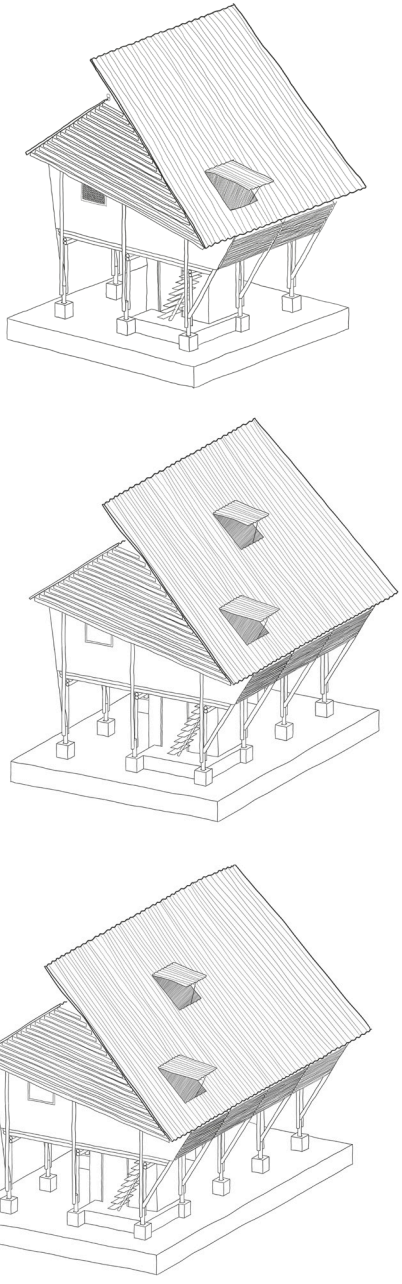
Fig. 39: Roof design

Unit variation

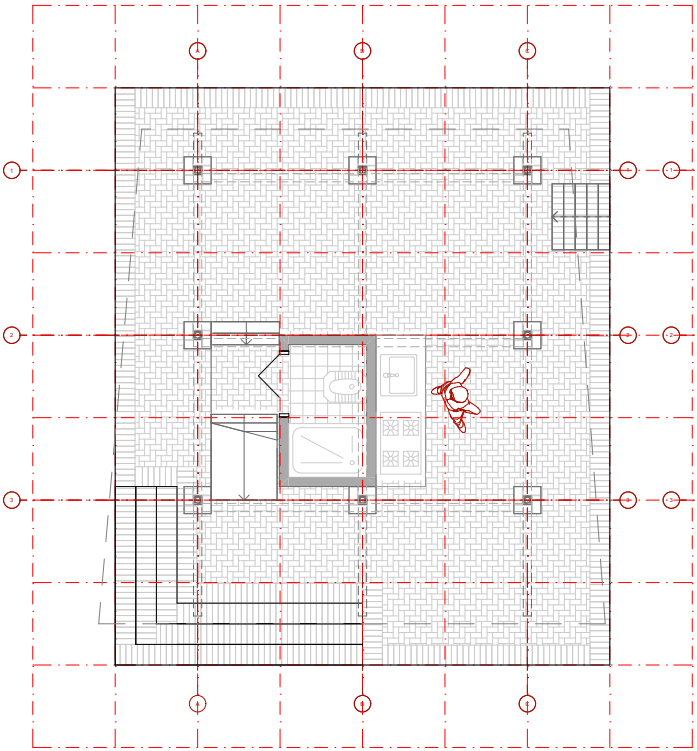
Various building types are designed to accommodate different family sizes and types. Each building follows a 2x2m grid section, allowing for flexible expansion. This grid system can be multiplied to extend the unit's length, ensuring tailored solutions for diverse family needs.

type A - 6 people
type B - 8 people
type C - 10 people

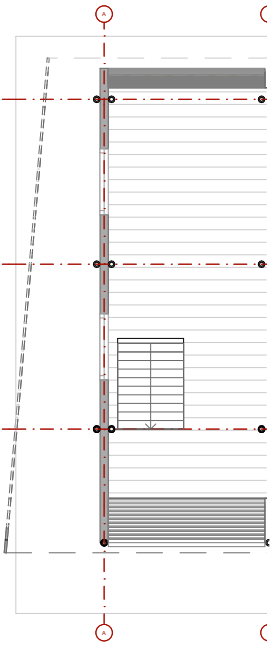




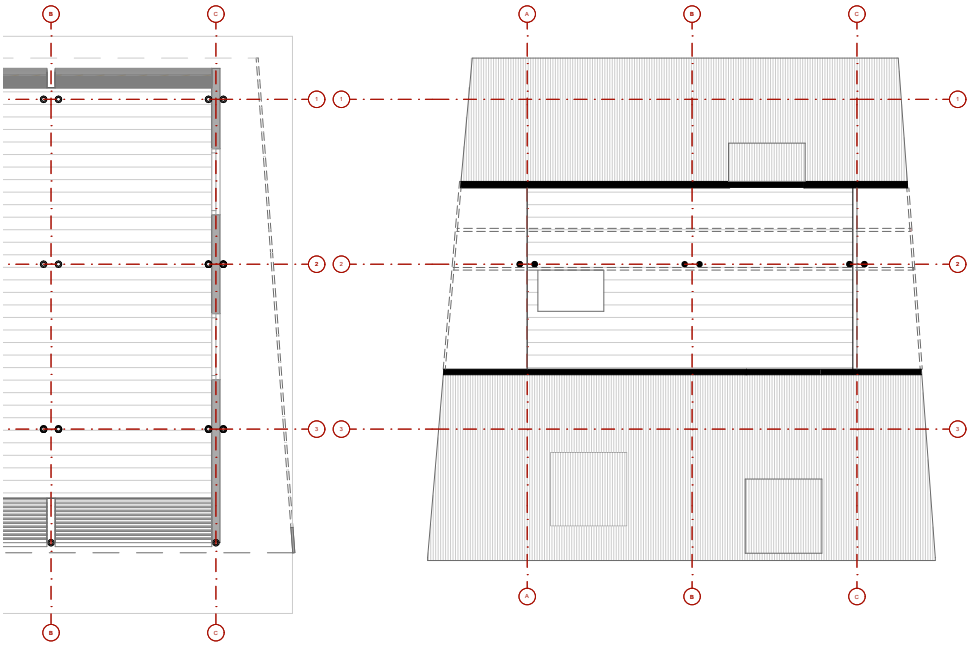
Type A - basic plans



Ground floor

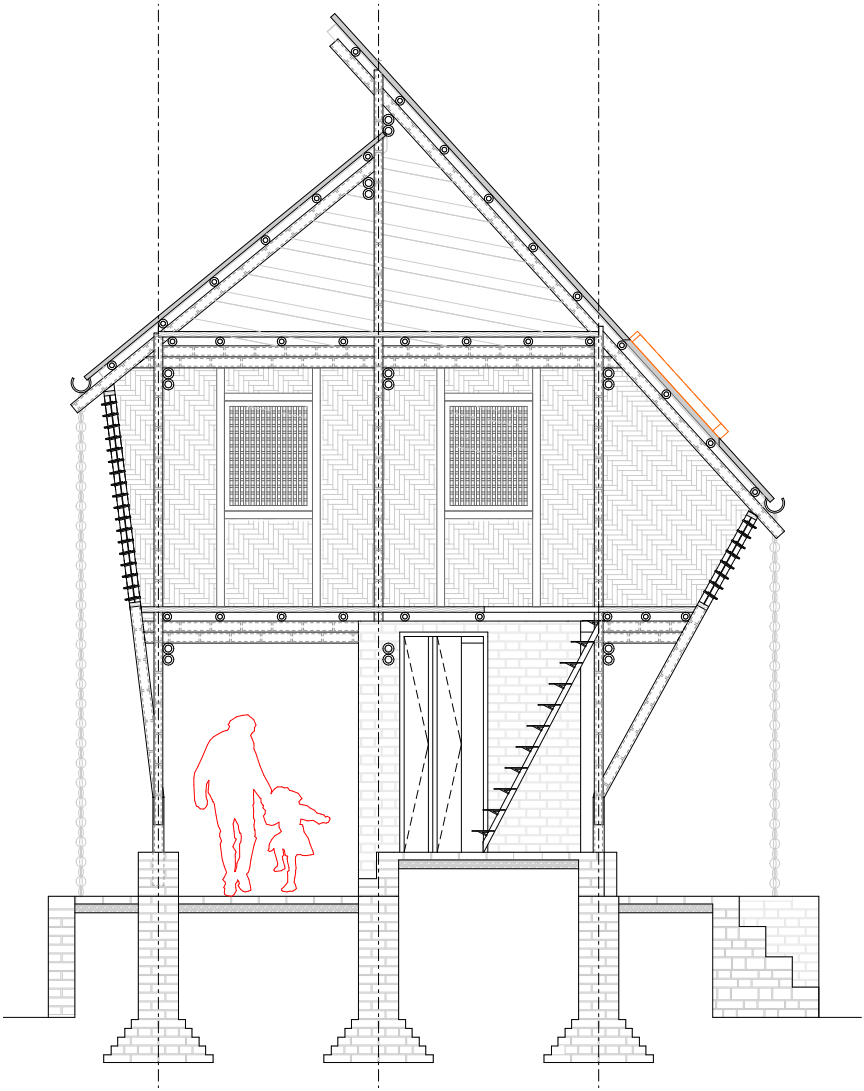


First floor

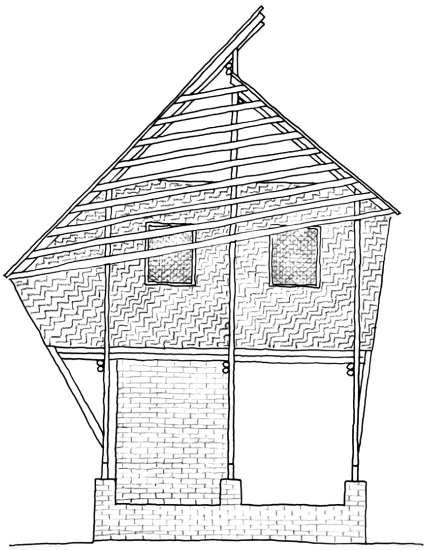


Second floor

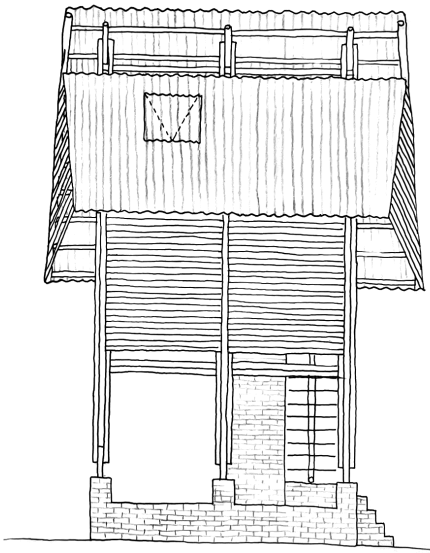
Type A - section



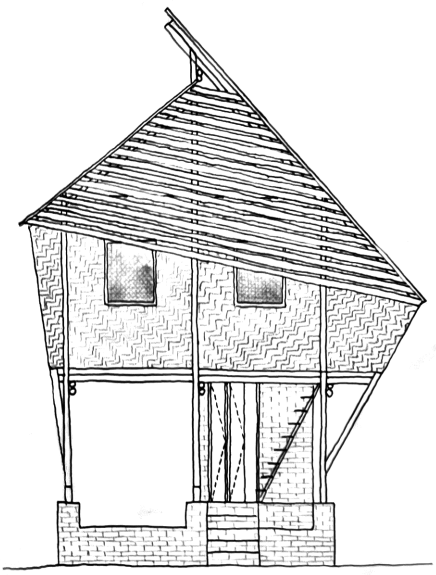
Type A - basic elevations



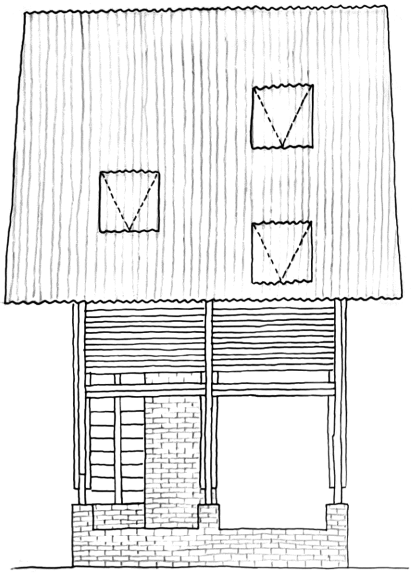
EAST



NORTH.

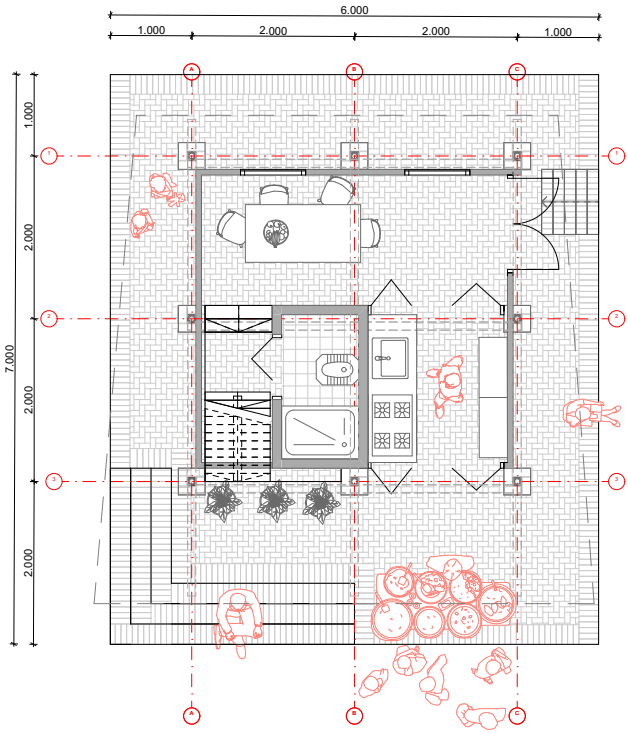


WEST

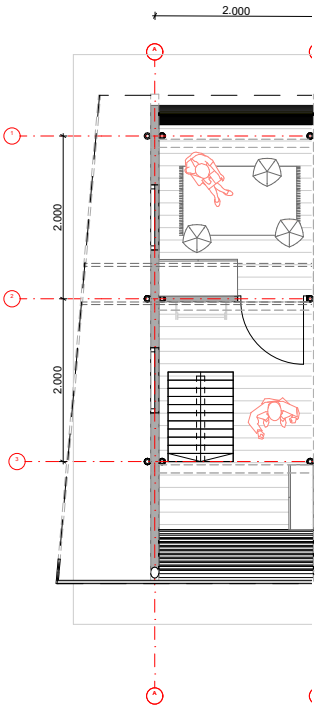


SOUTH

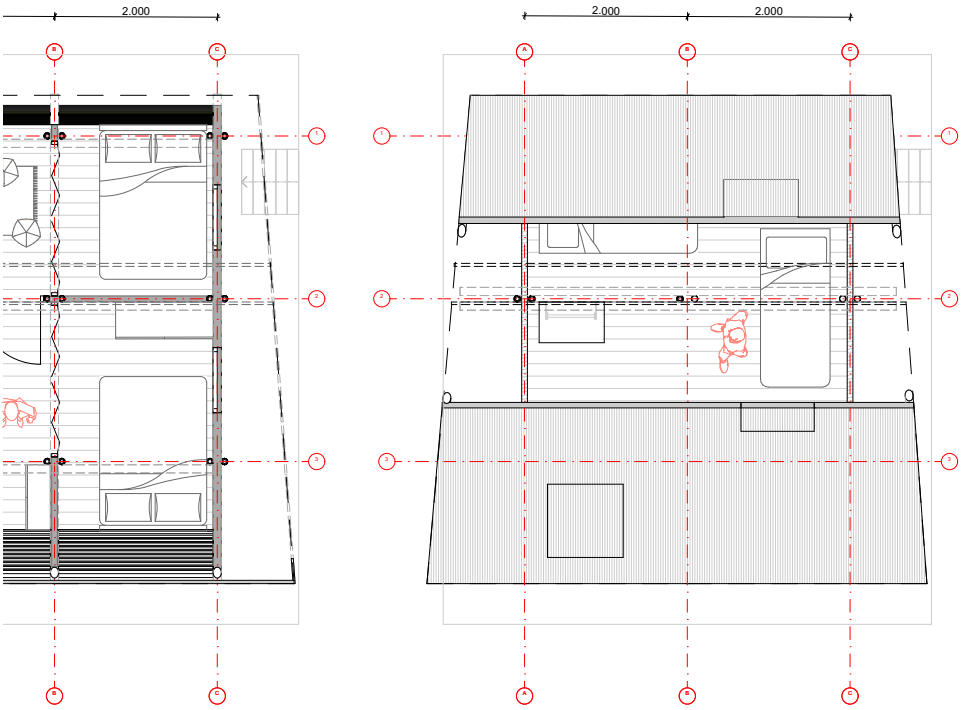
Type A - Future plans
Food shop



Ground floor

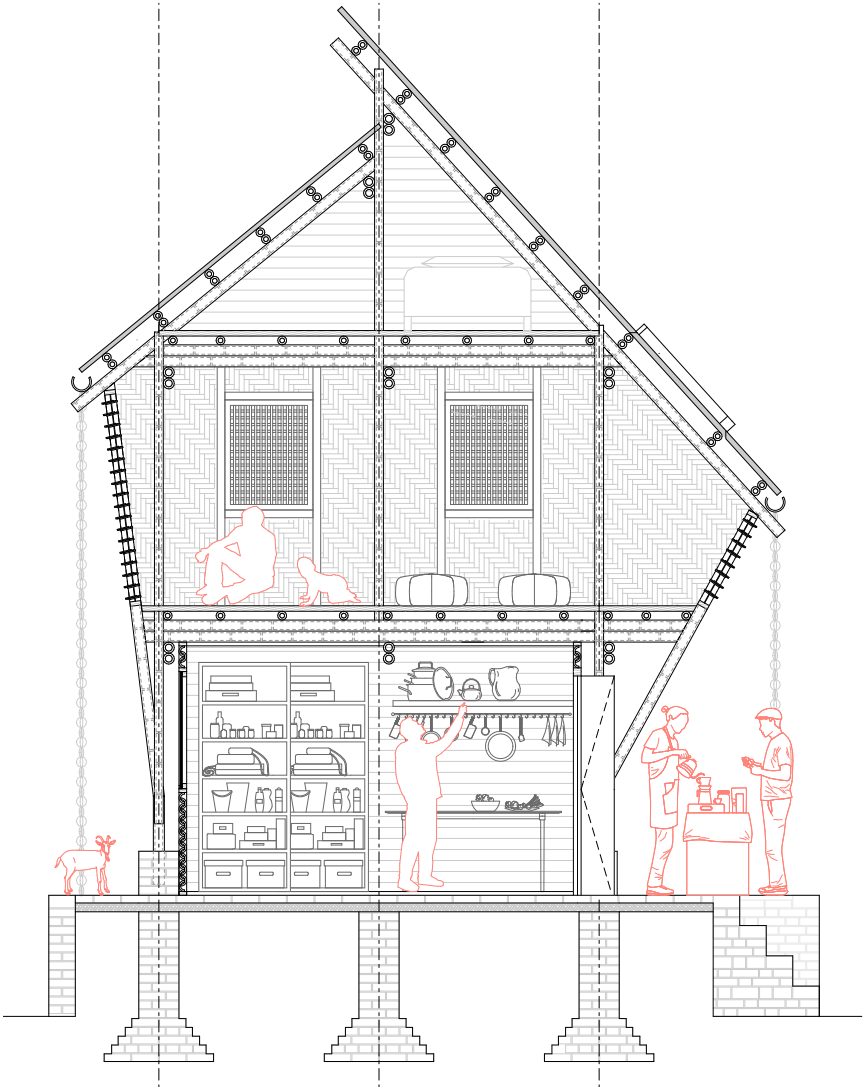


First floor

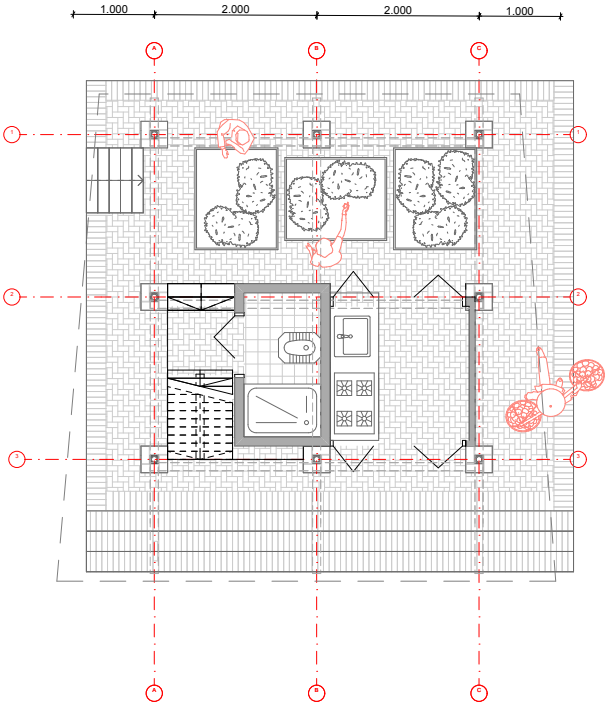


Second floor

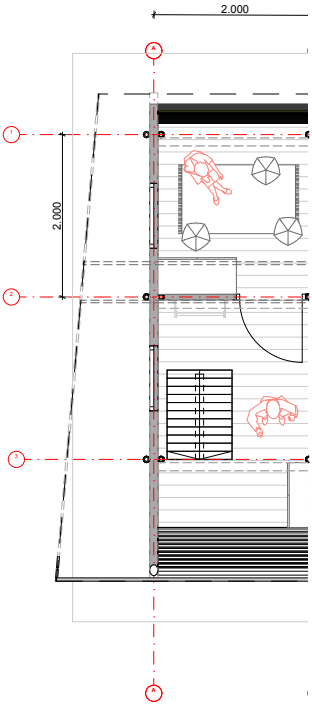
Type A - Future section Food shop



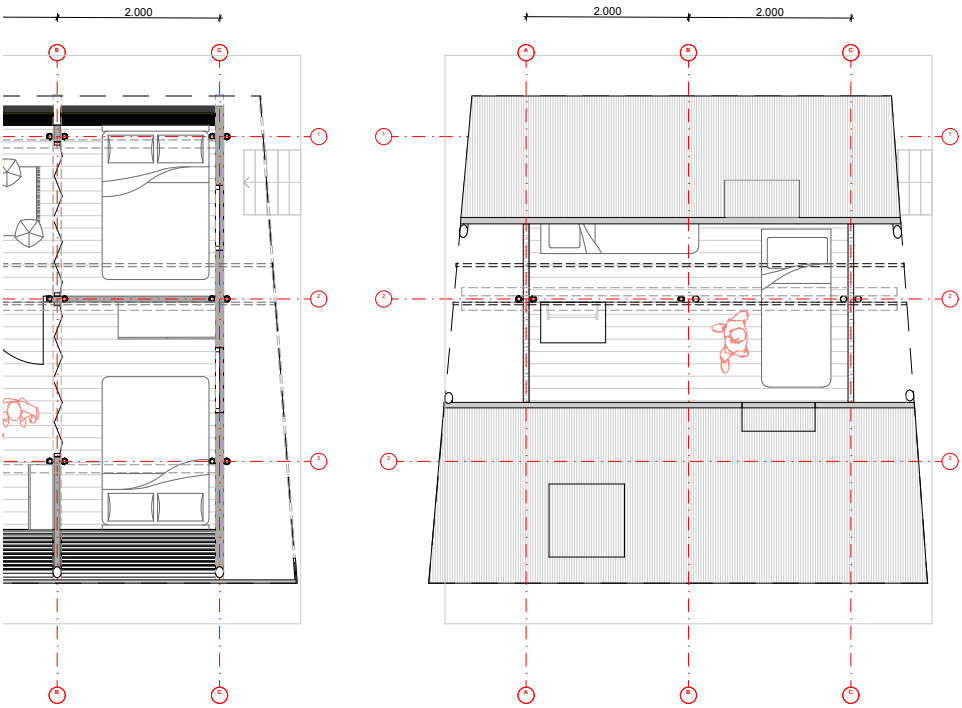
Type A - Future plans
Farmer



Ground floor

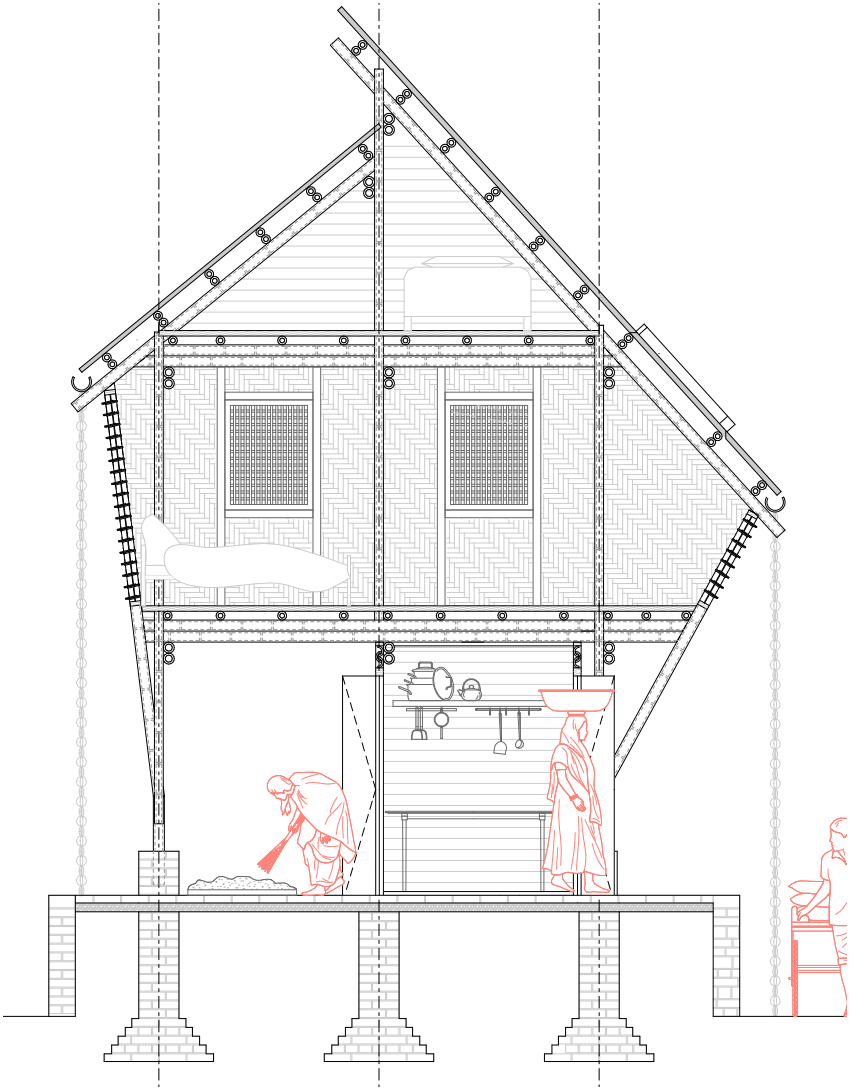


First floor

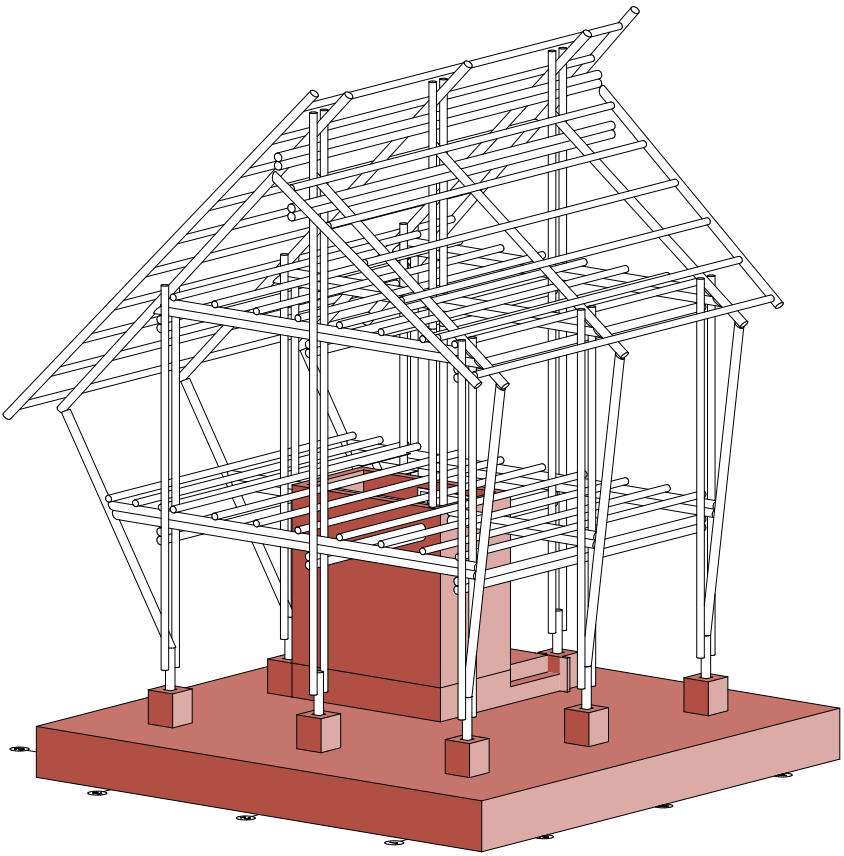


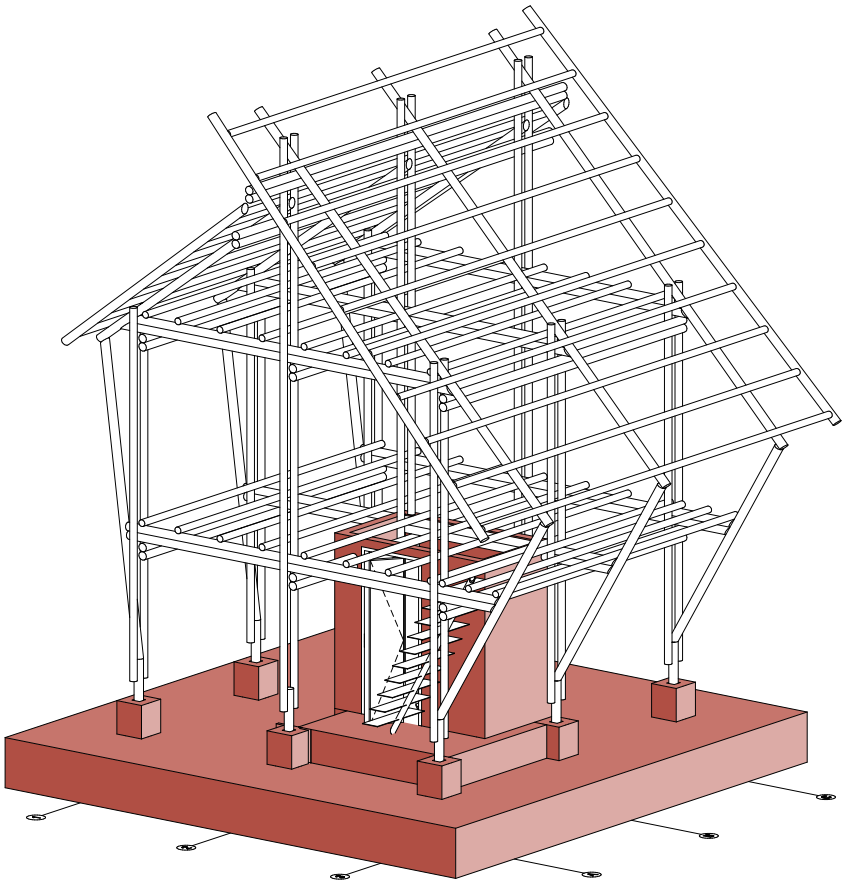
Second floor

Type A - Future section Farmer

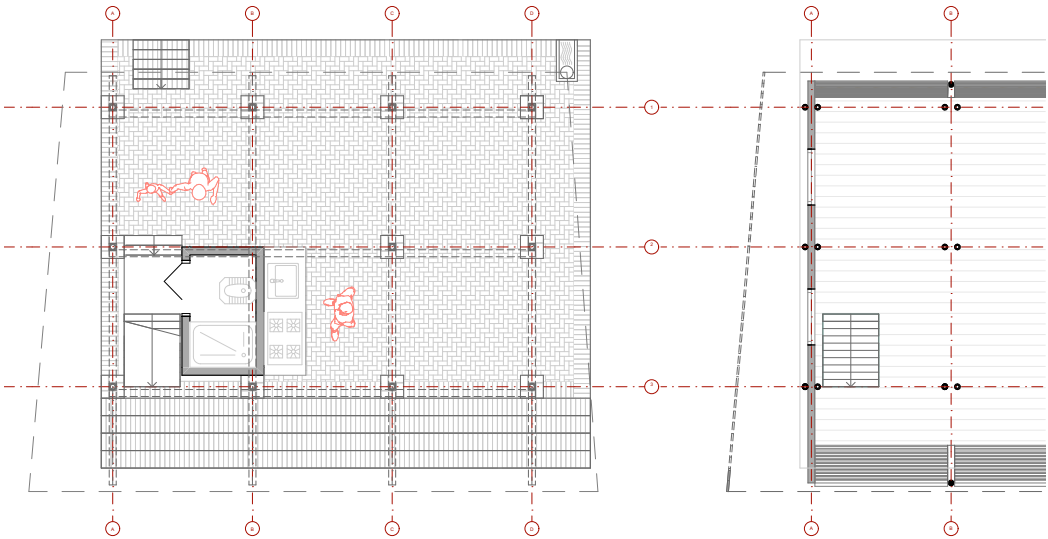


Type A - construction



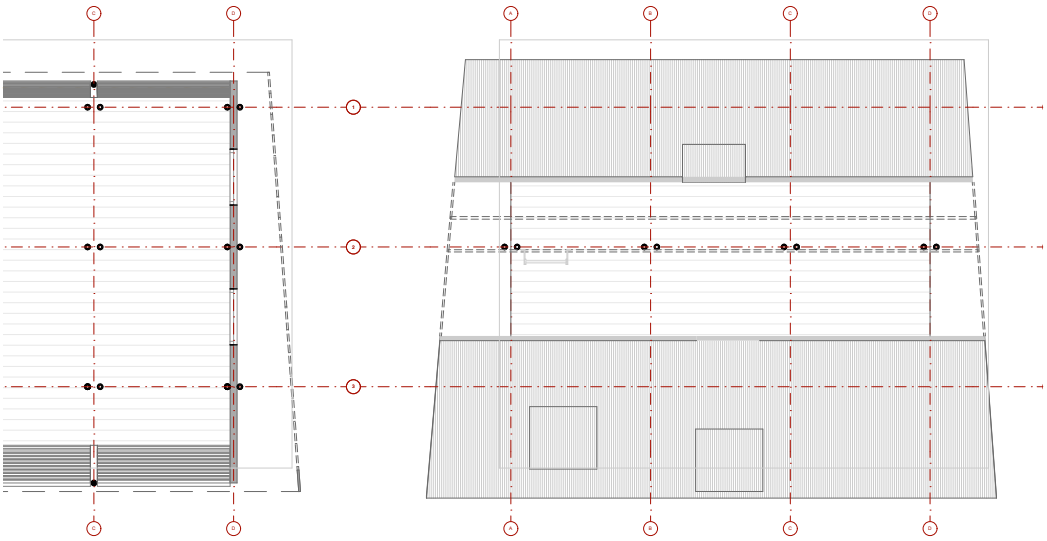


Type B - Basic plans



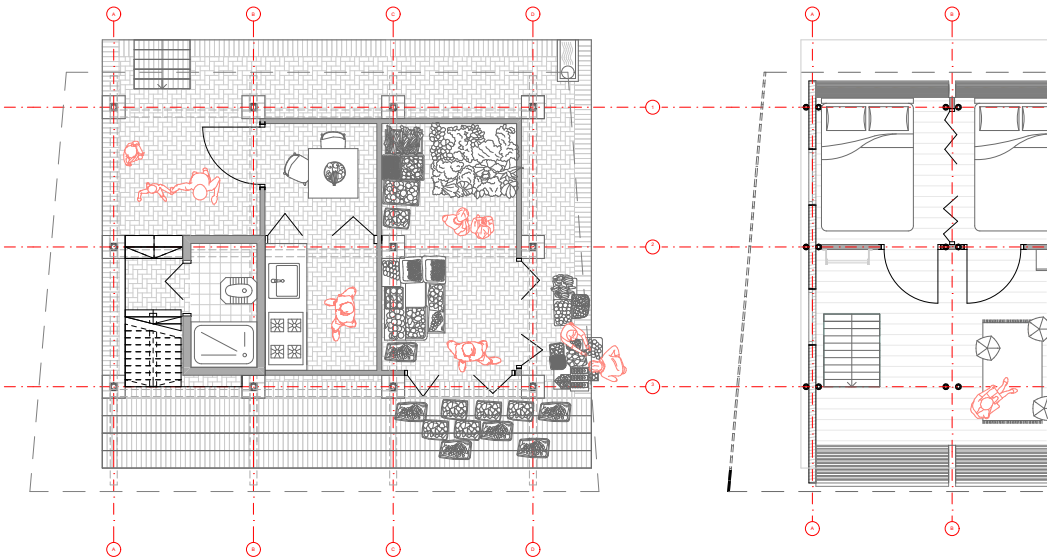
Ground floor

First floor



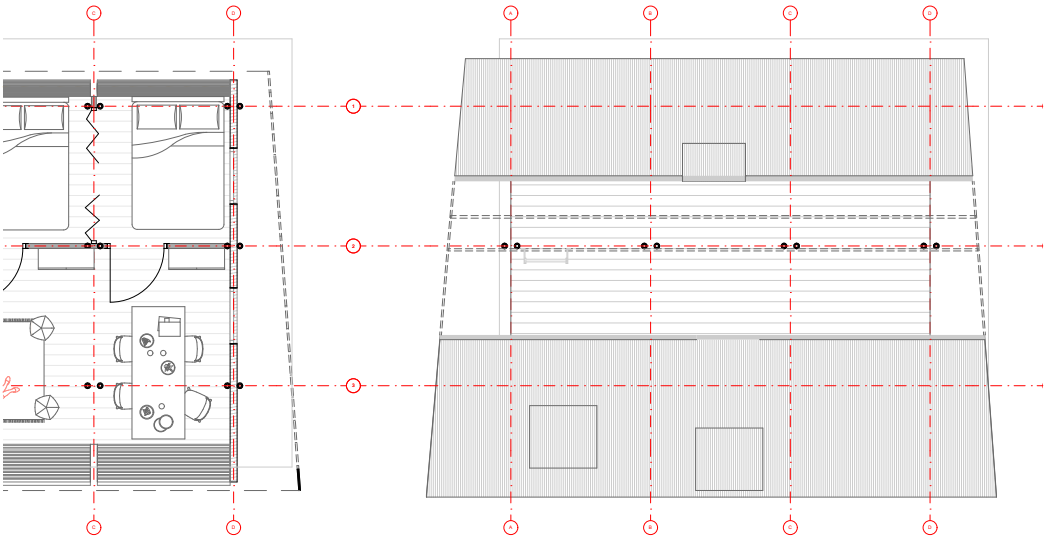
Second floor

Type B - Future plans
Fruit shop



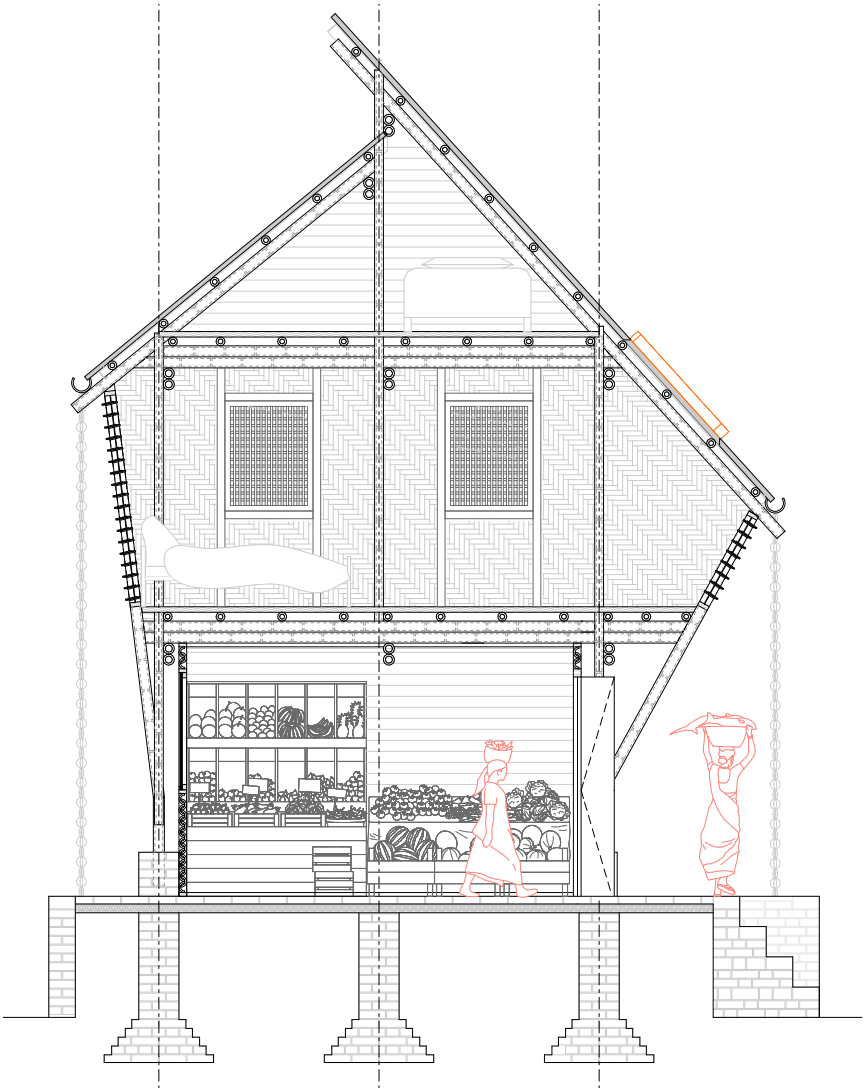
Ground floor

First floor

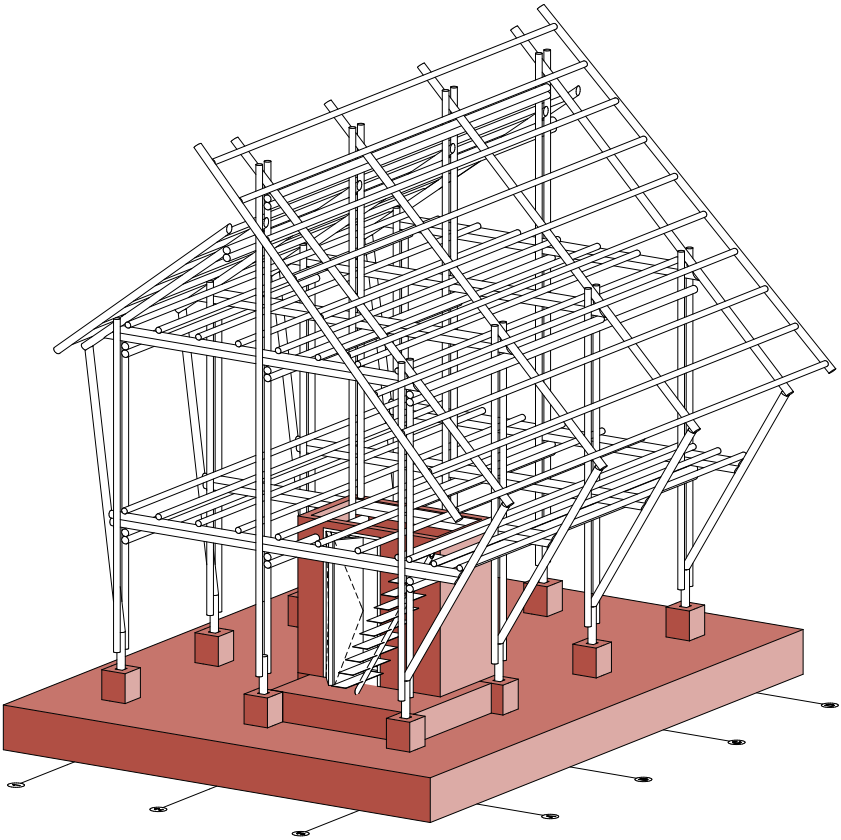


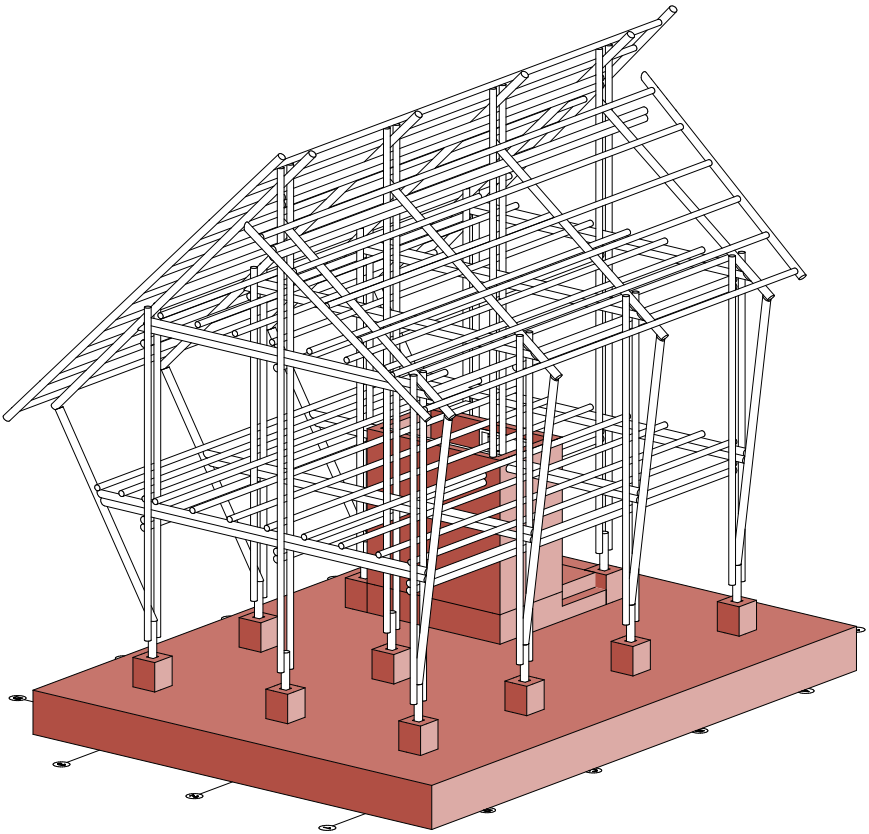
Second floor

Type B - Future section Fruit shop

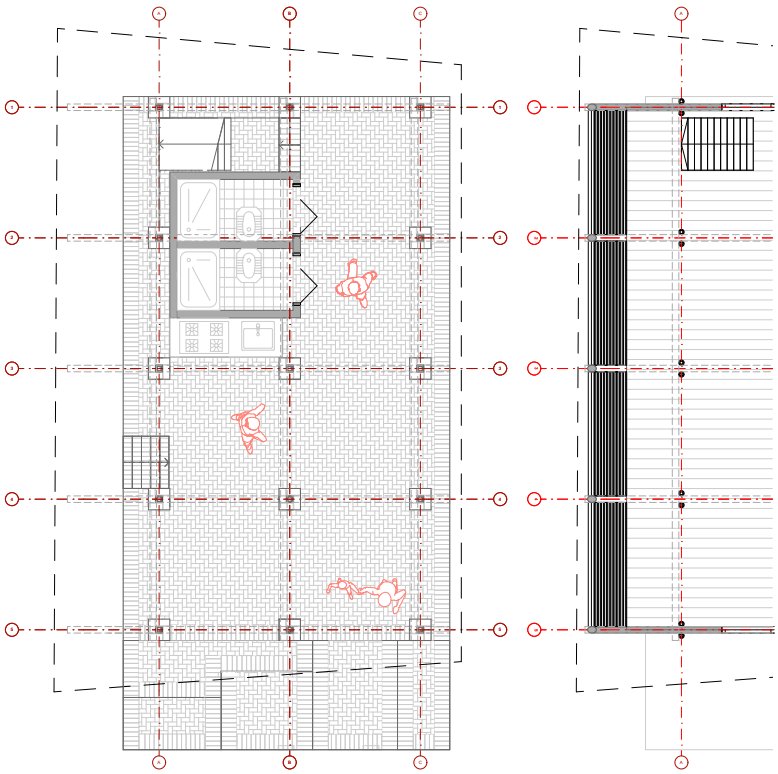


Type B - construction



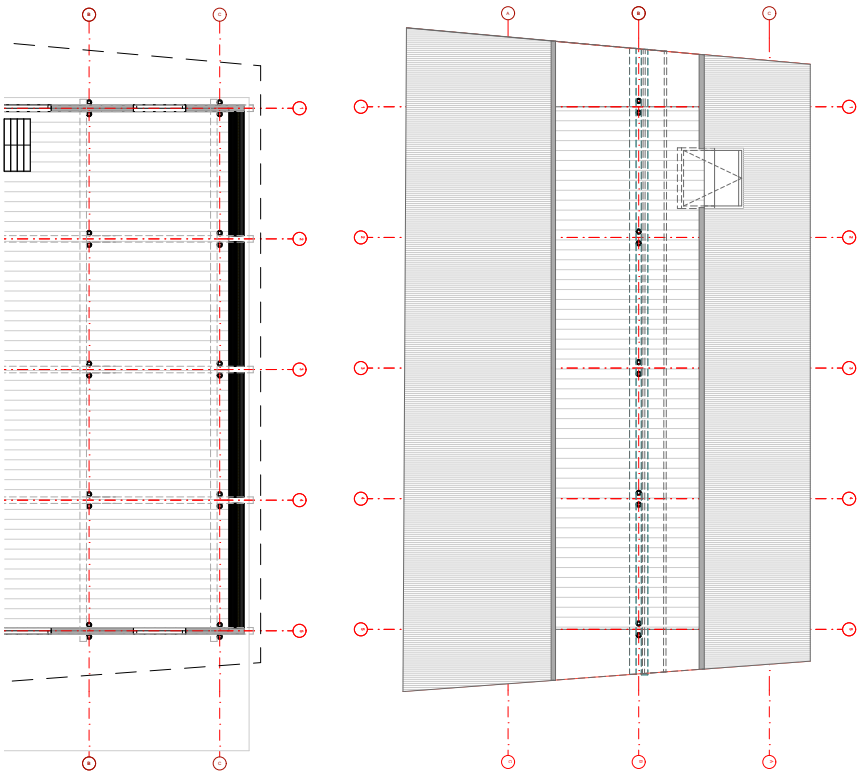


Type C - Basic plans



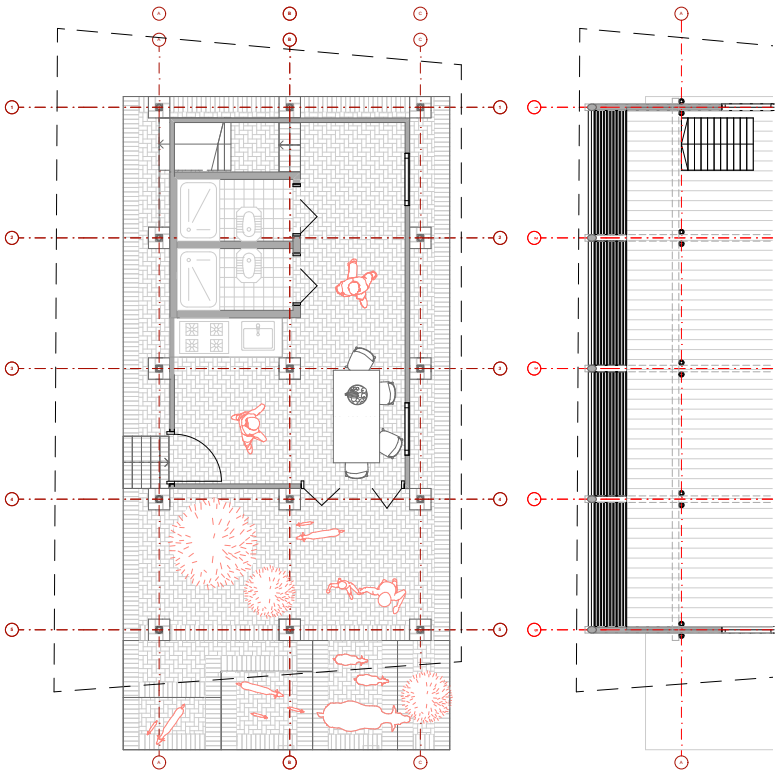
Ground floor

First floor

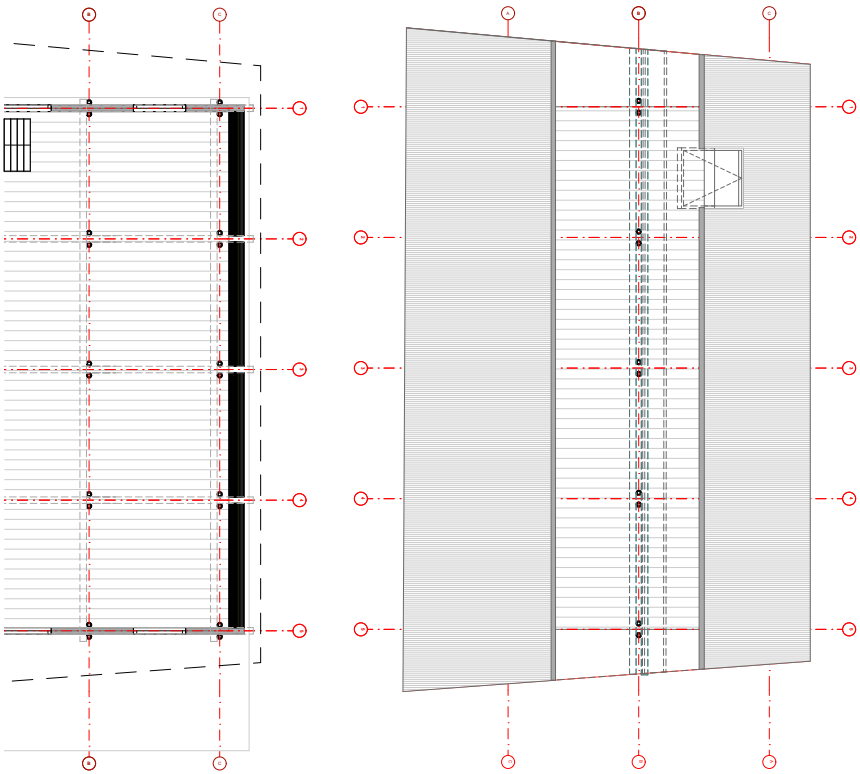


Second floor

Type C - Future plans Cattle farmer

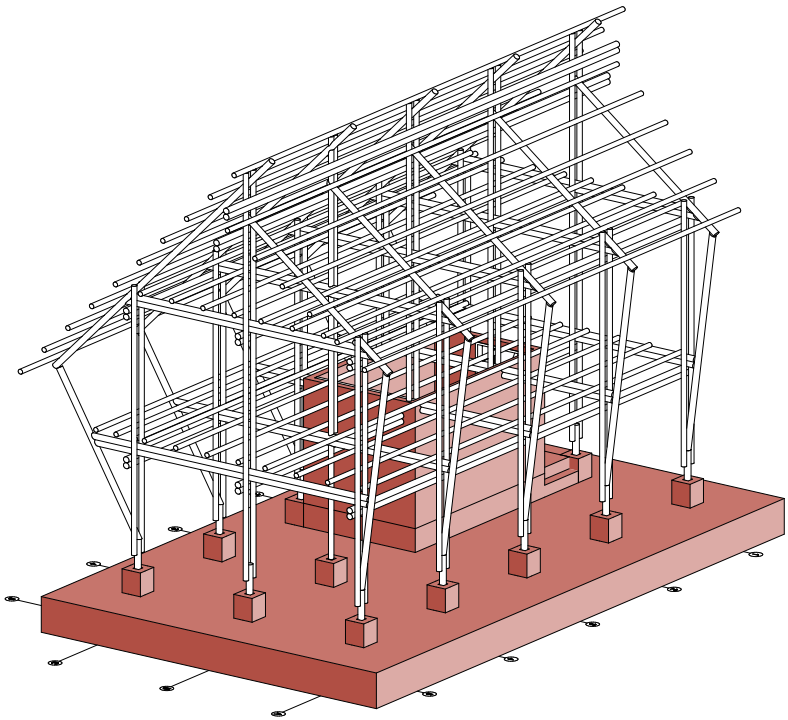


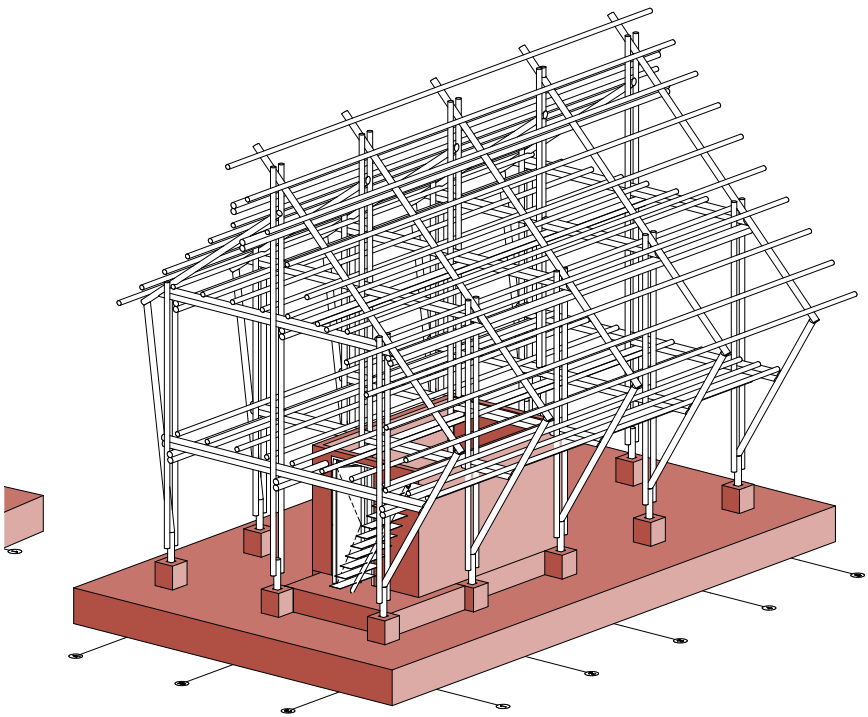
Ground floor First floor



Second floor

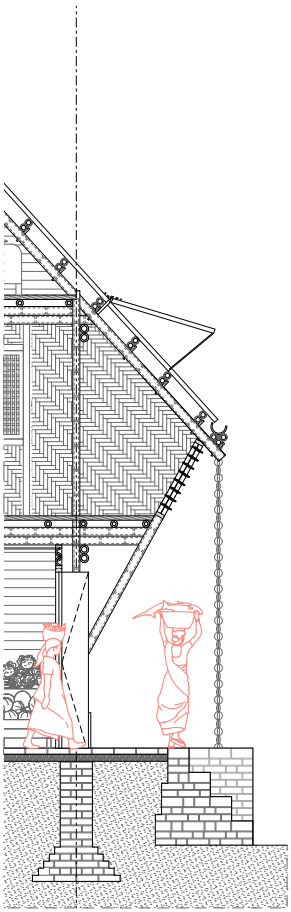
Type C - construction

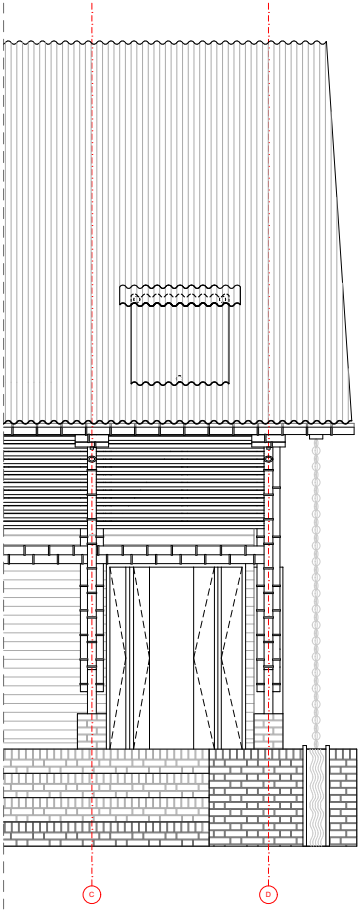


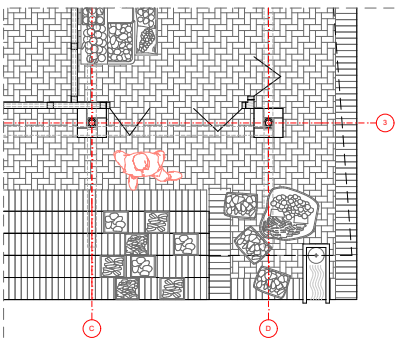


BUILDING TECHNOLOGY

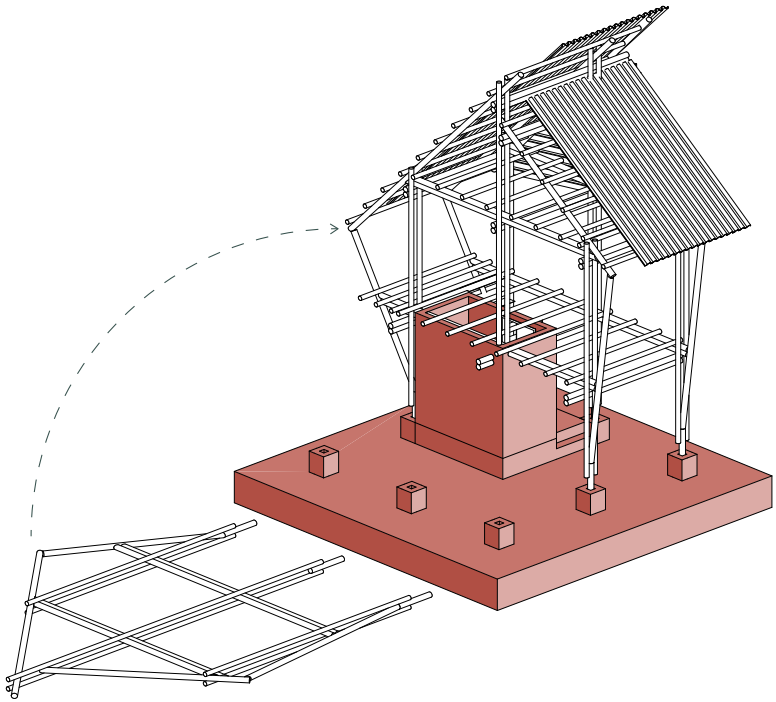
Fragment

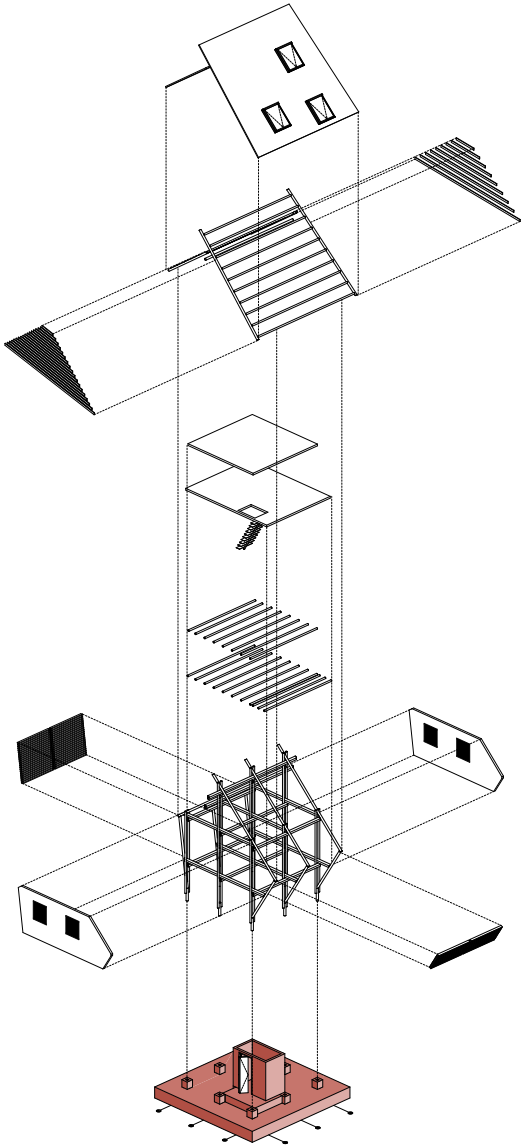




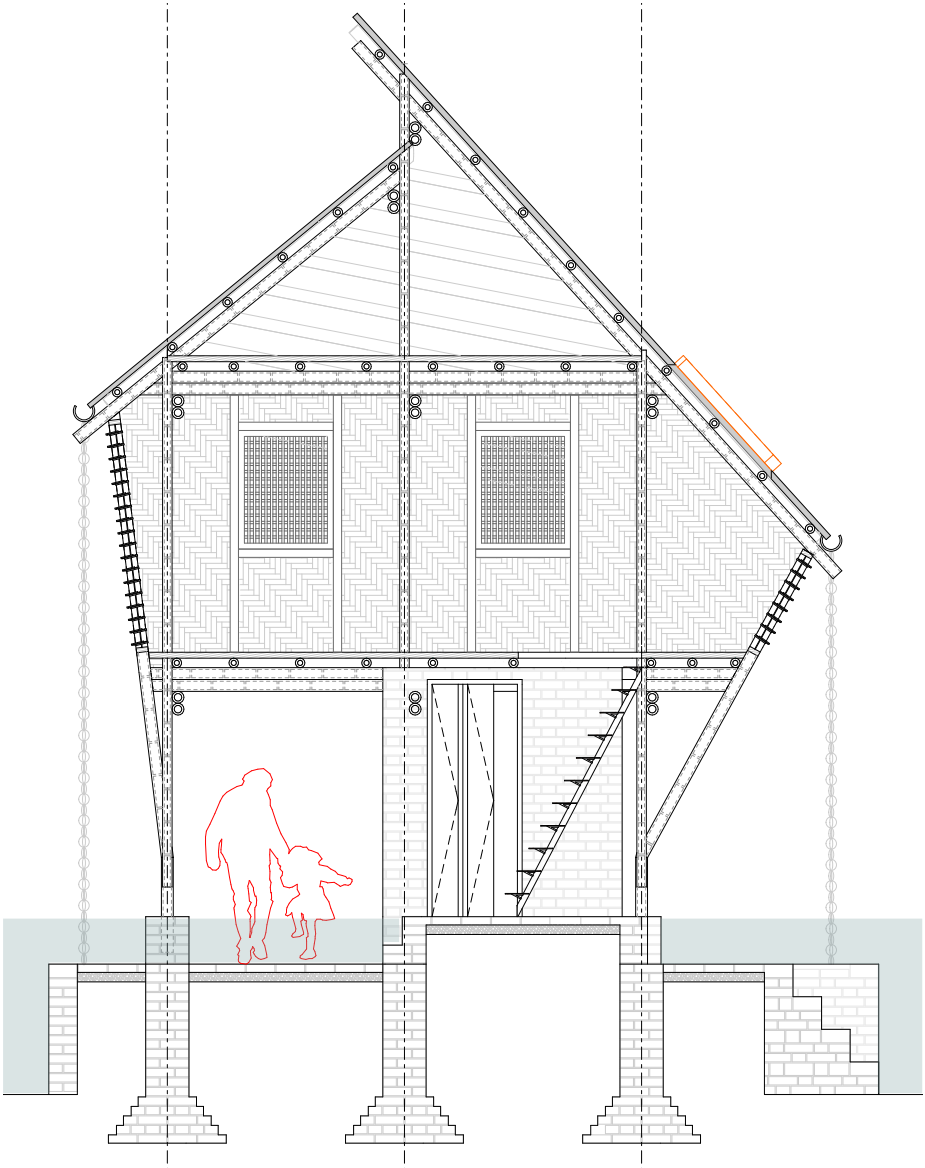


Construction

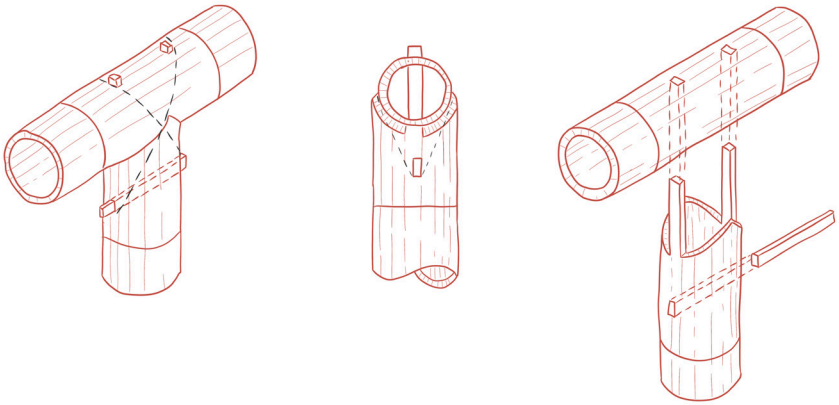




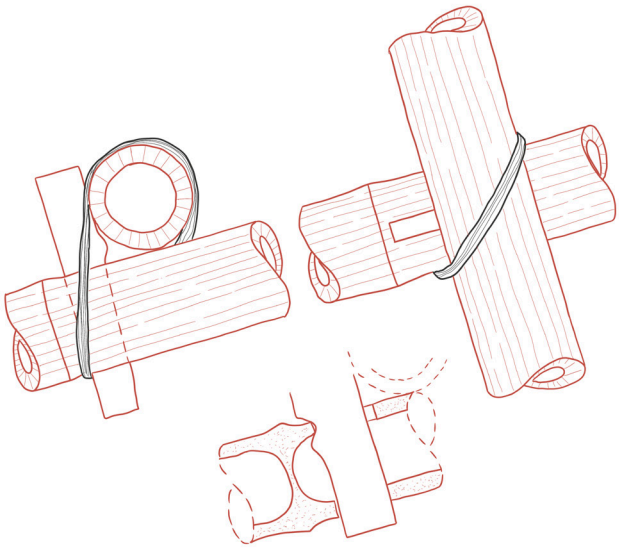
Use through the seasons



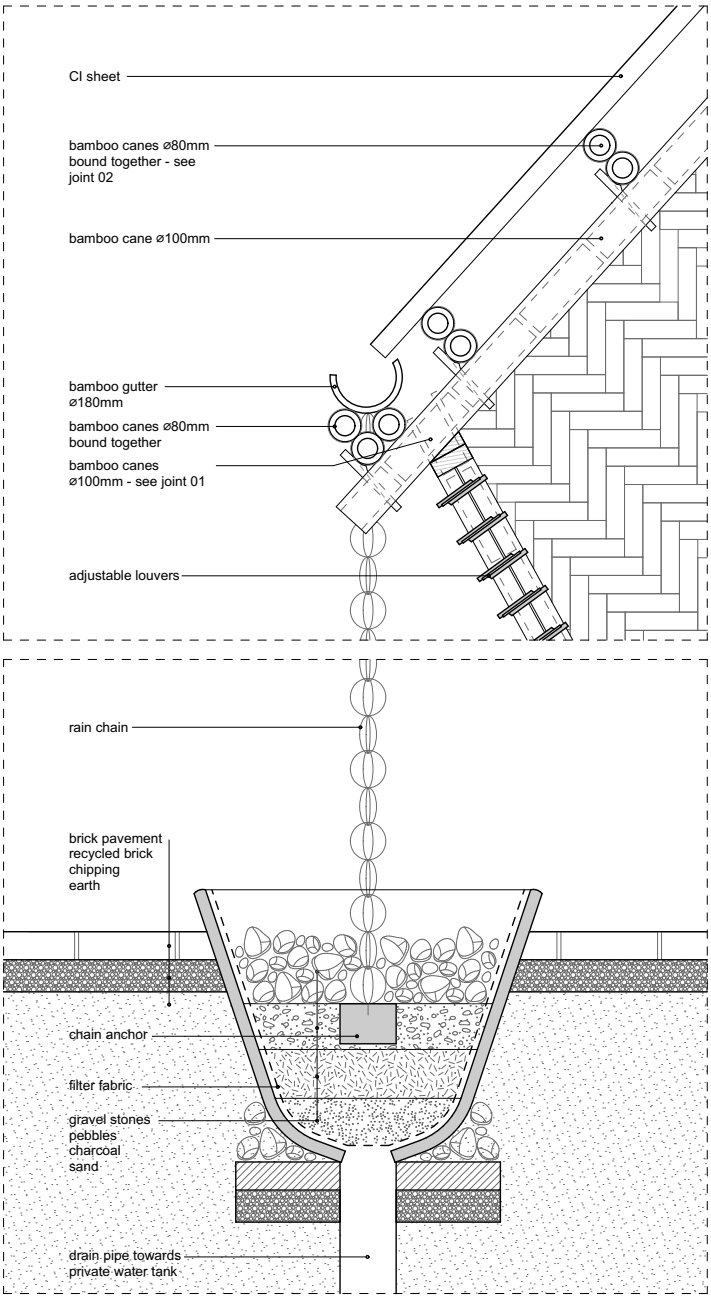
Detailing - roof



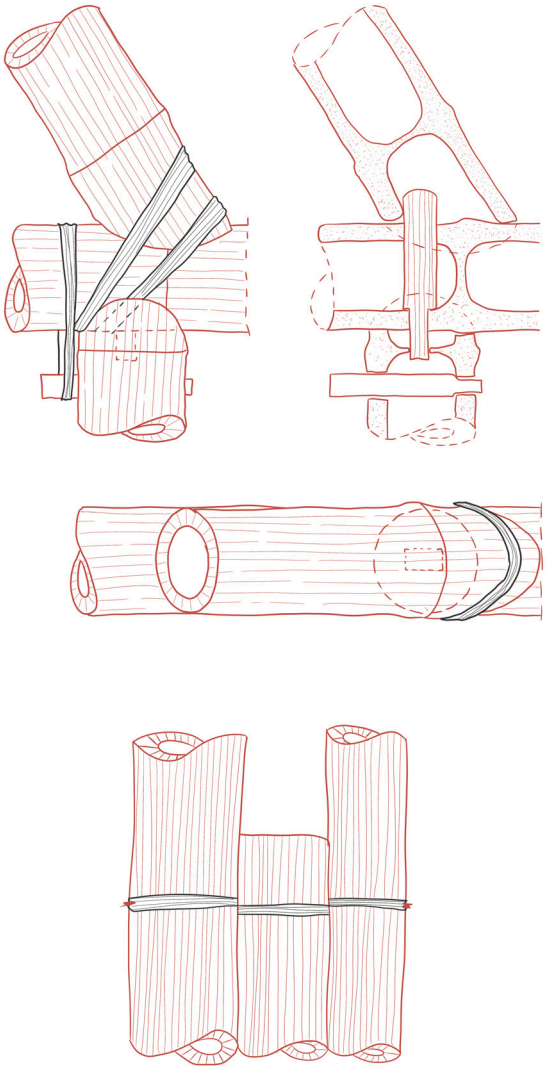
Joint 01



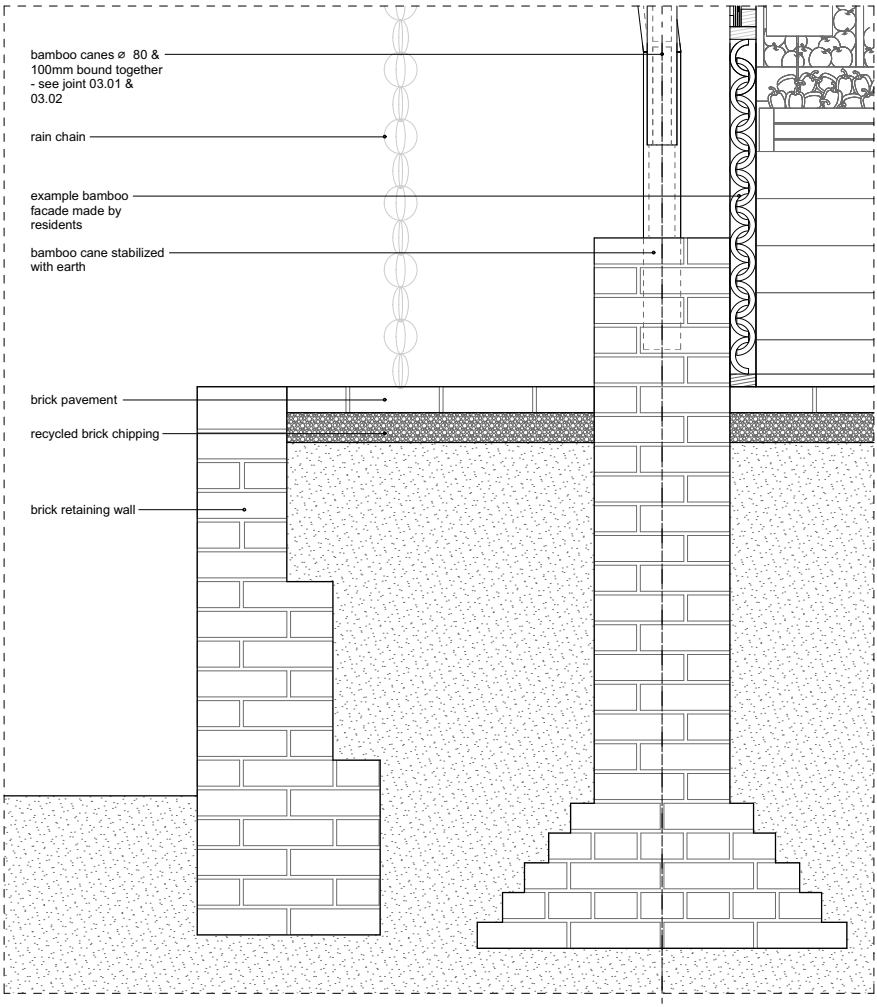
Joint 02


CI sheet
bamboo canes ø80mm bound together - see joint 02
bamboo cane ø100mm
bamboo gutter ø180mm
bamboo canes ø80mm bound together
bamboo canes ø100mm - see joint 01
adjustable louvers
rain chain
brick pavement
recycled brick chipping
earth
chain anchor
filter fabric
gravel stones
pebbles
charcoal
sand
drain pipe towards private water tank

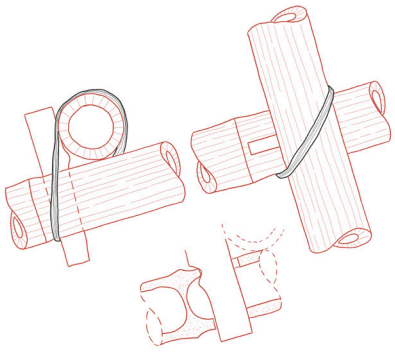
Detailing - foundation



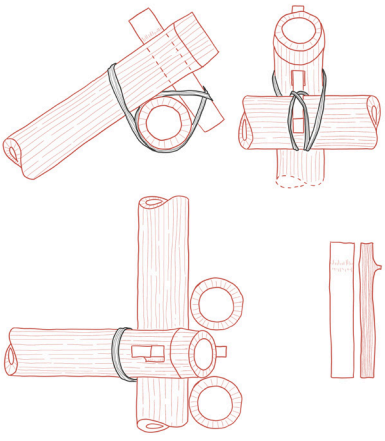
Joint 03.01 & 03.02


bamboo canes ⌀ 80 & 100mm bound together - see joint 03.01 & 03.02
rain chain
example bamboo facade made by residents
bamboo cane stabilized with earth
brick pavement
recycled brick chipping
brick retaining wall

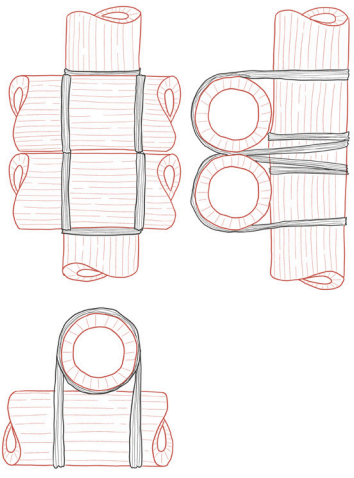
Detailing - roof top



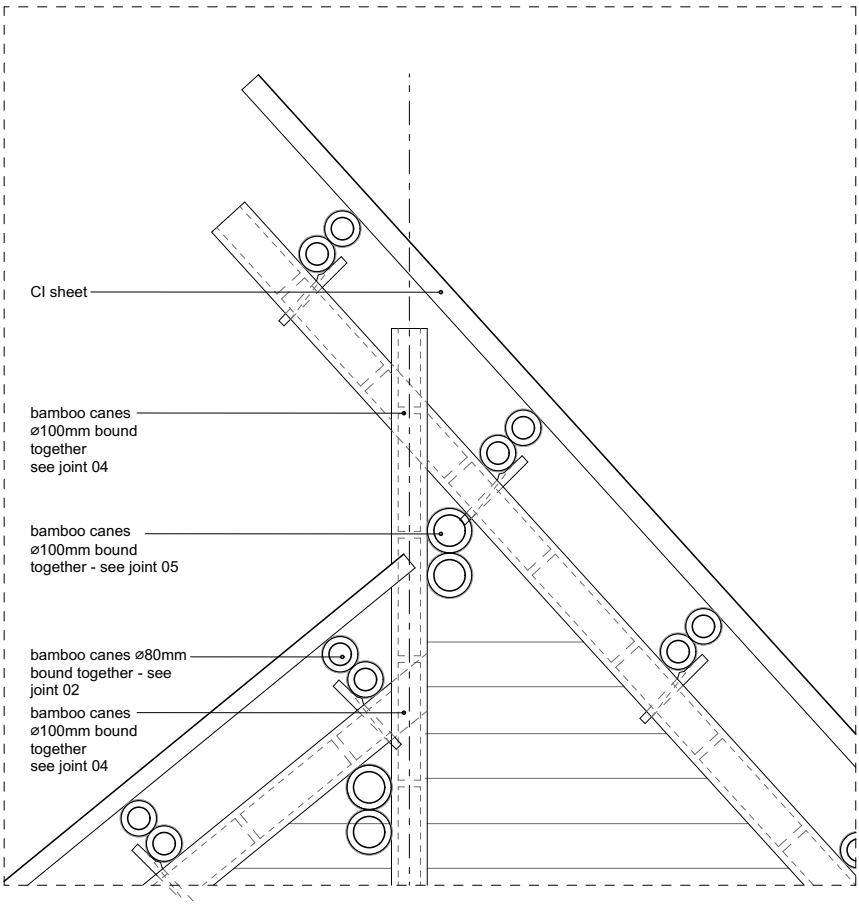
Joint 02



Joint 04



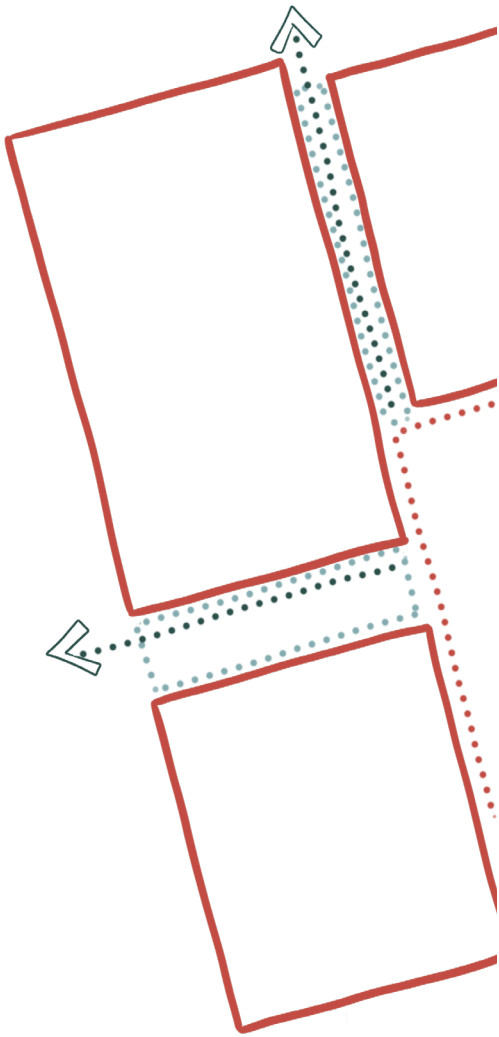
Joint 05

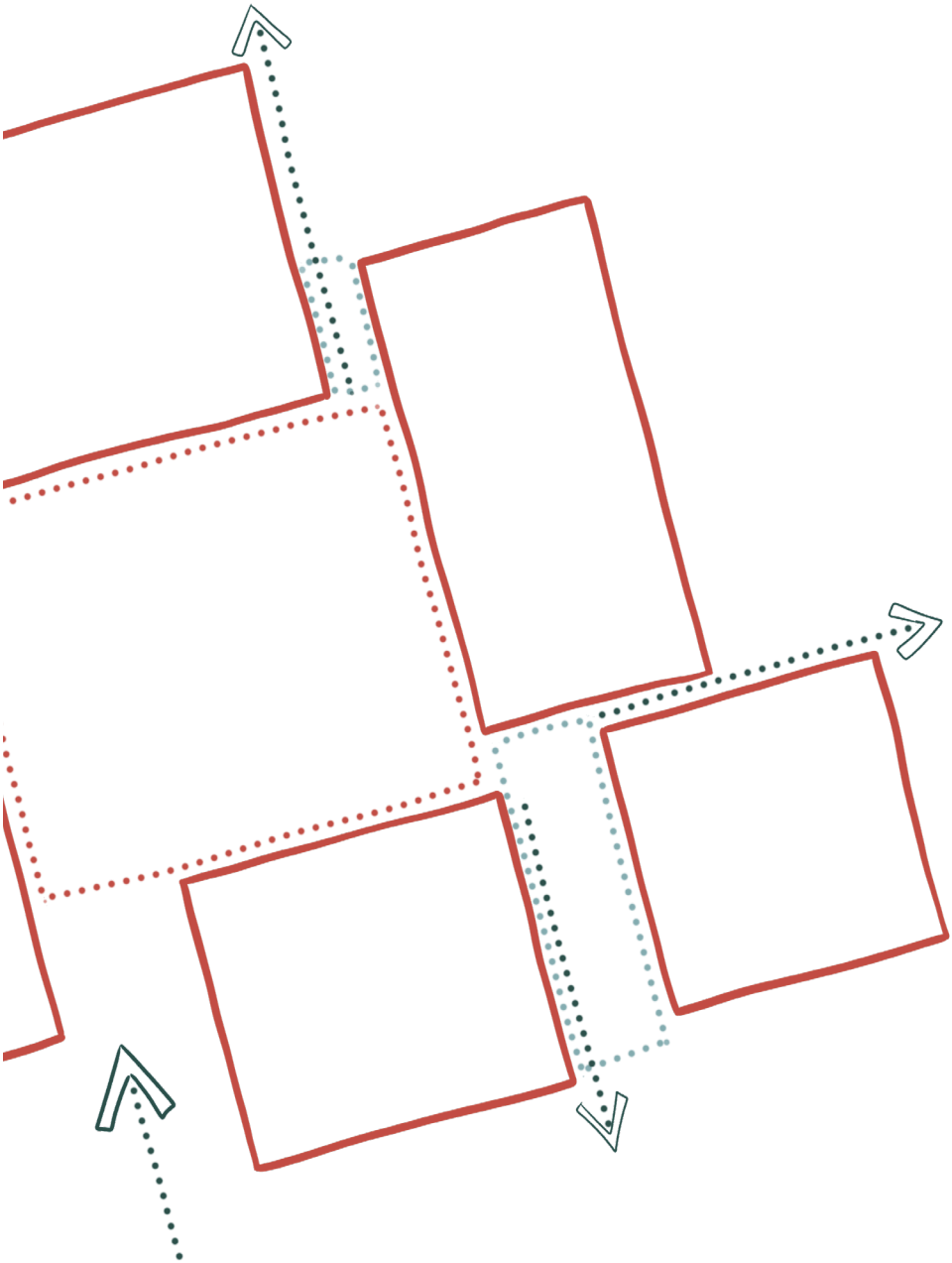

CI sheet
bamboo canes
ø100mm bound
together
see joint 04
bamboo canes
ø100mm bound
together - see joint 05
bamboo canes ø80mm
bound together - see
joint 02
bamboo canes
ø100mm bound
together
see joint 04

CLUSTER STRATEGY

Cluster principle

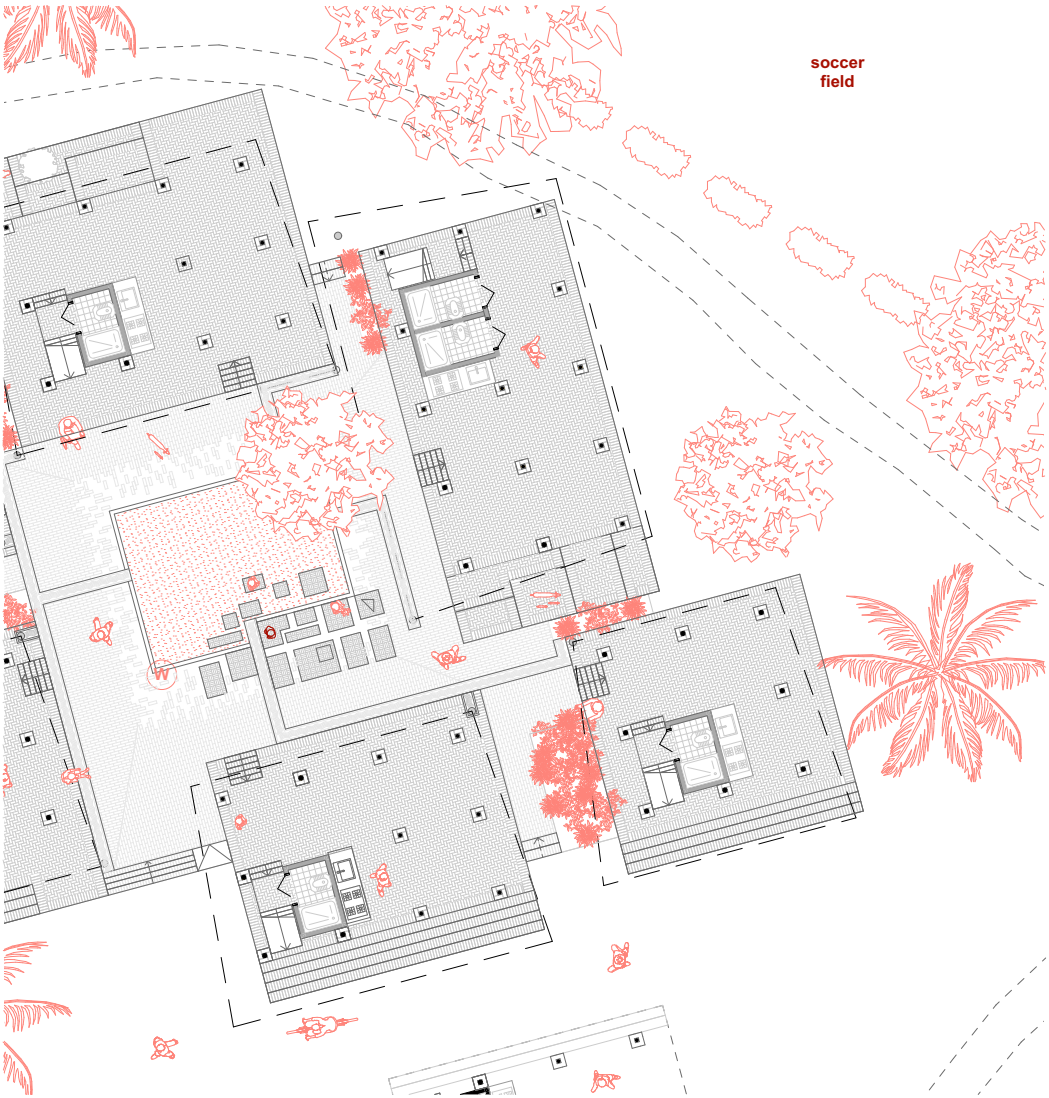
The units encircle a central courtyard, which serves as the community's heart. This courtyard has one main entrance, but the variation in plot sizes creates small, open alleyways that informally connect the surrounding spaces. These alleyways enhance accessibility and encourage interaction among residents. At the courtyard's center lies a constructed wetland that collects and filters rainwater, promoting sustainability and providing a serene focal point.



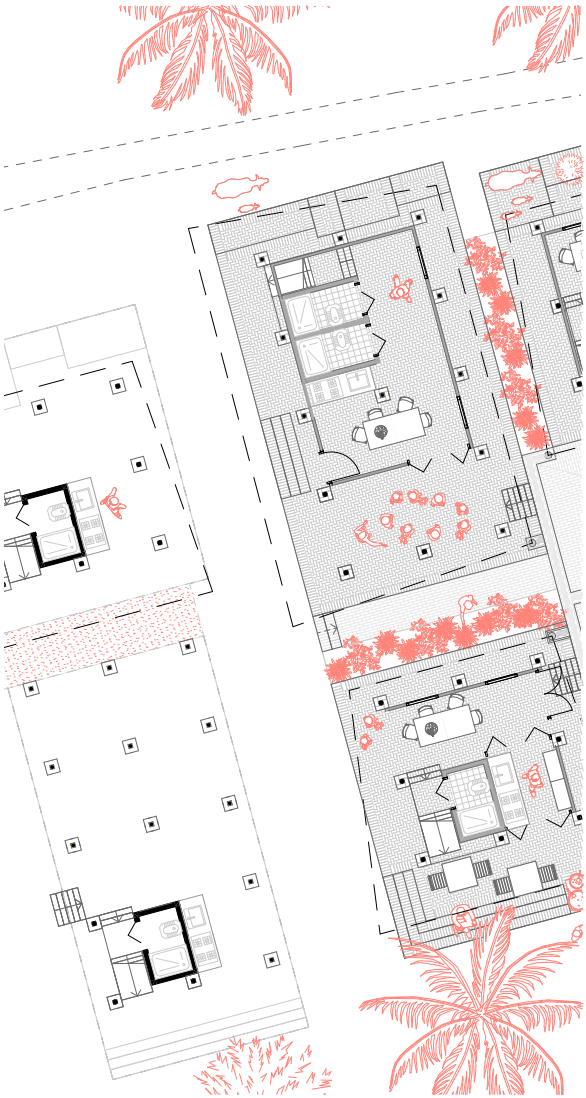


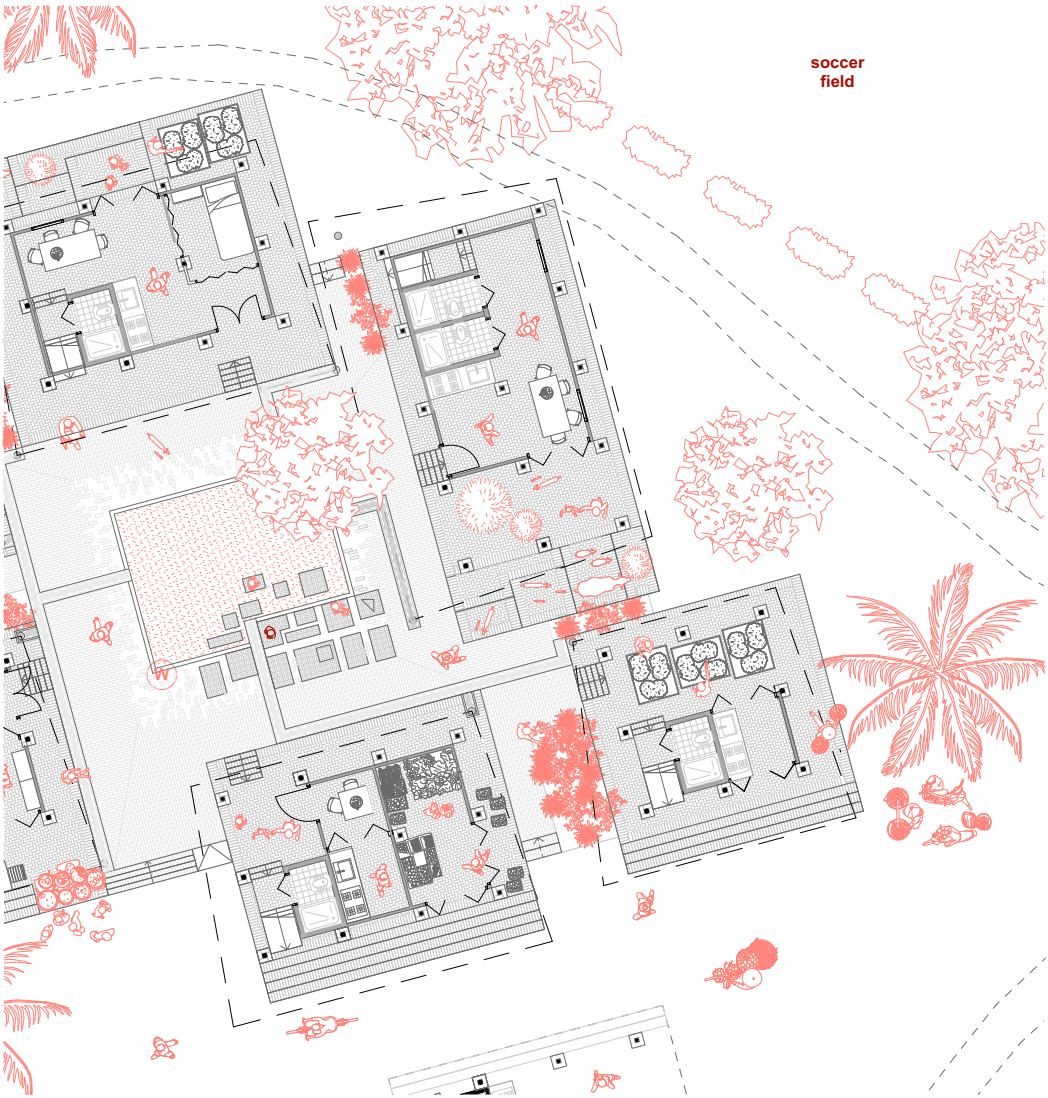
Cluster GF - basic

The cluster consists of various building types mixed together around a central courtyard. The open ground floor seamlessly integrates with the landscape, creating the perfect playground for children. Residents can adapt this space to their preferences and needs. Each cluster features a unique play element that serves multiple purposes. The plinth of the cluster is designed to enhance the transition to public space, offering versatile uses to enrich community interaction.


soccer
field

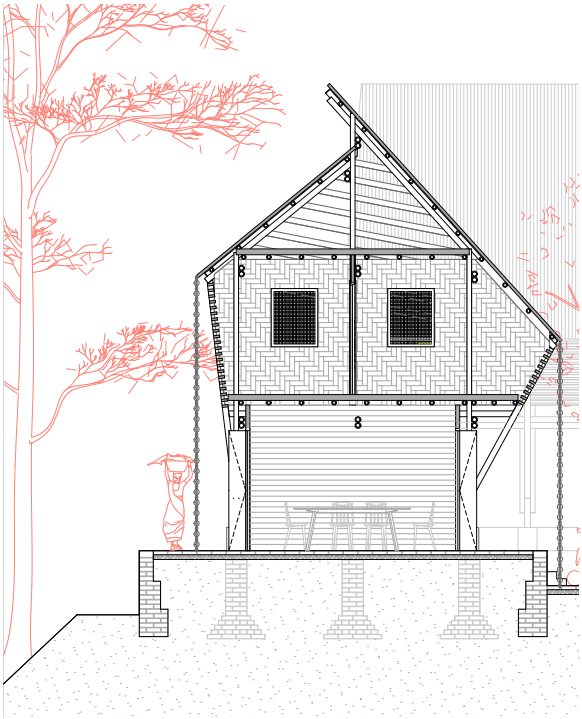
Cluster GF - future

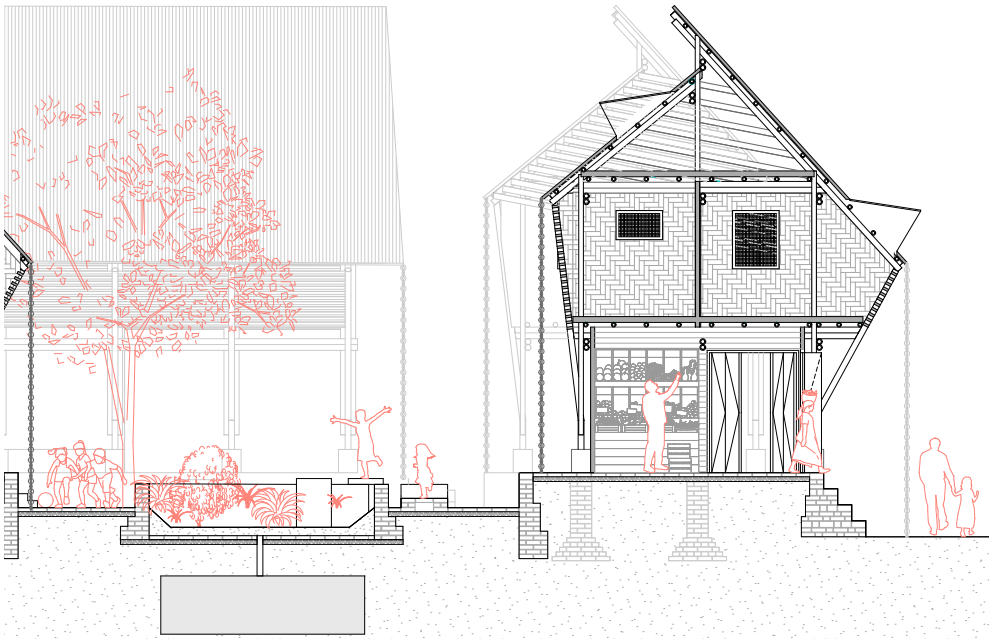



soccer
field

Cluster section

Various elements are elevated to integrate play into the landscape while serving practical functions like stalling cattle and drying rice. This dual-purpose design ensures that recreational spaces harmoniously blend with everyday agricultural activities, enhancing both leisure and productivity in the environment.

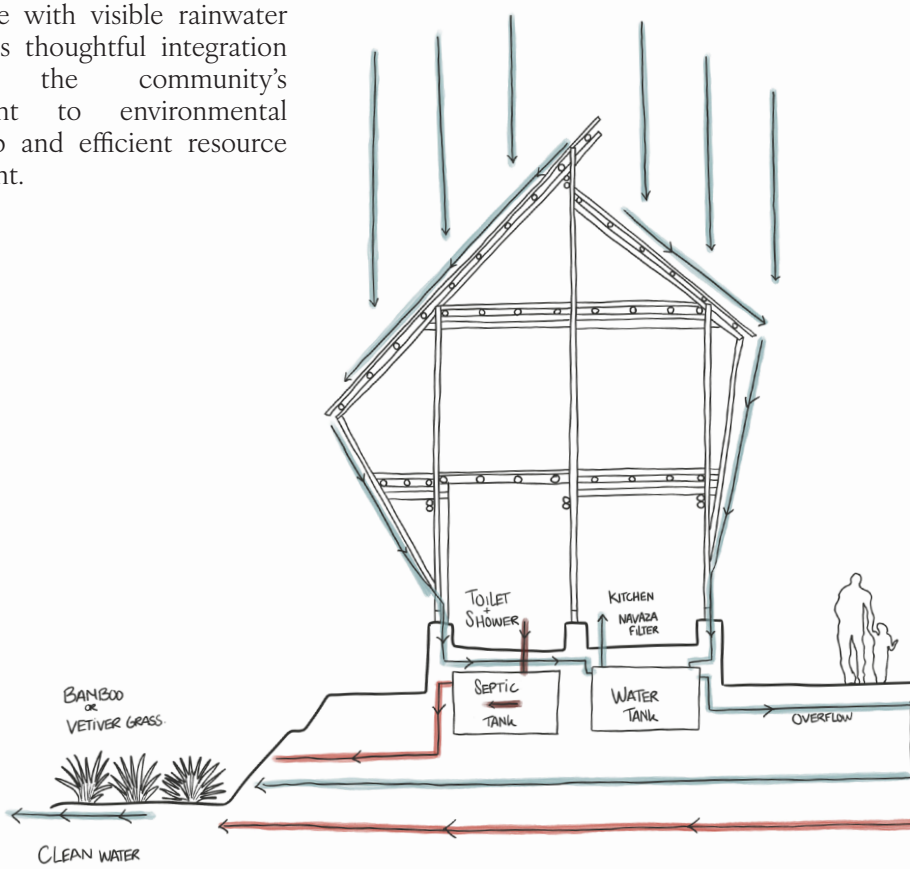


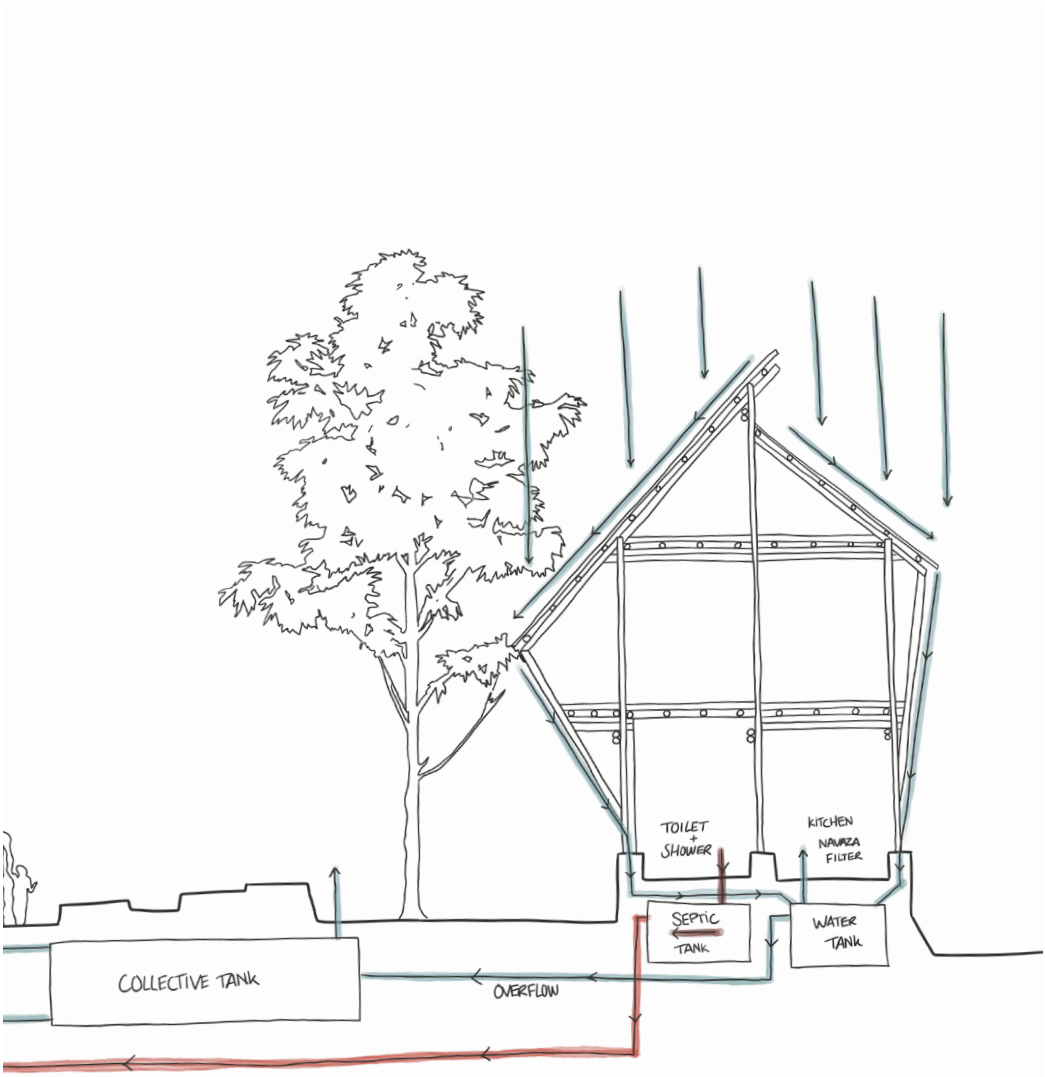


Cluster elevation

Water management

Water conservation is key in this community where rainwater is celebrated, not feared. Rainwater is collected and stored in tanks large enough to supply all residents for seven days. This sustainable approach not only ensures drinking water security but also emphasizes water reuse with visible rainwater chains. This thoughtful integration highlights the community's commitment to environmental stewardship and efficient resource management.




TOILET + SHOWER
KITCHEN NAVAZA FILTER
SEPTIC TANK
WATER TANK
COLLECTIVE TANK
OVERFLOW

Water management

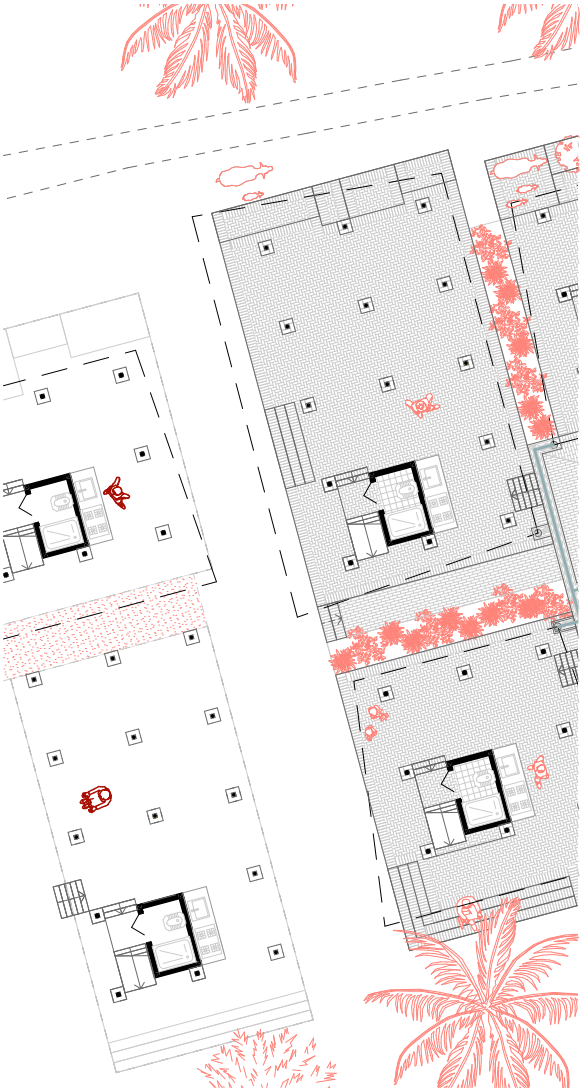
Calculations

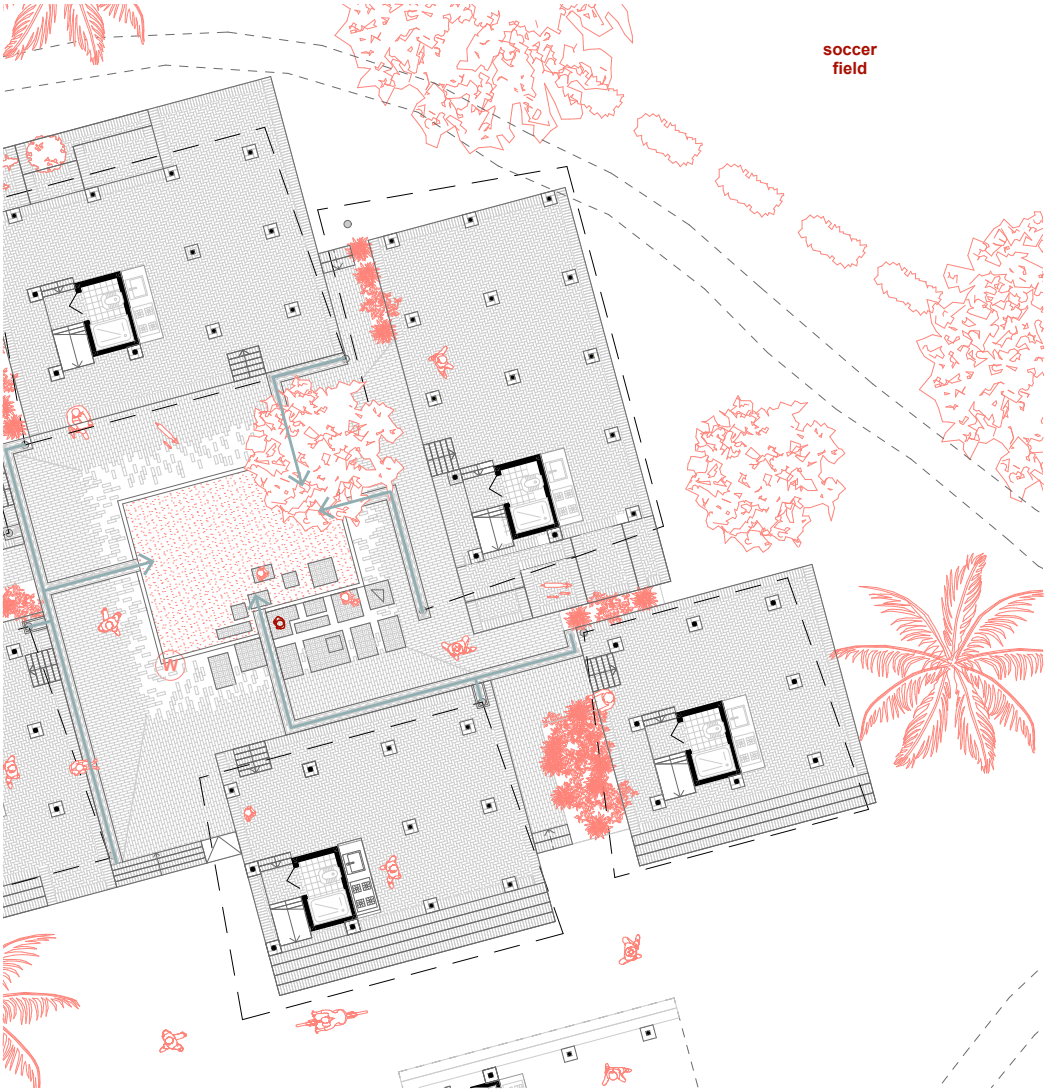
Rainfall
Monsoon season - > 200 mm in 24 hours
Dry season - average 18 mm in 24 hours

water usage
Per person - 62,47 l / d
Per household (6 residents) - 374,82 l / d

Water capacity
Roof m2 - 24 m2
Capacity roofmonsoon season - 200 * 34 = 6800 l in 24 hours
Capacity roofdry season - 18 * 34 = 612 l in 24 hours

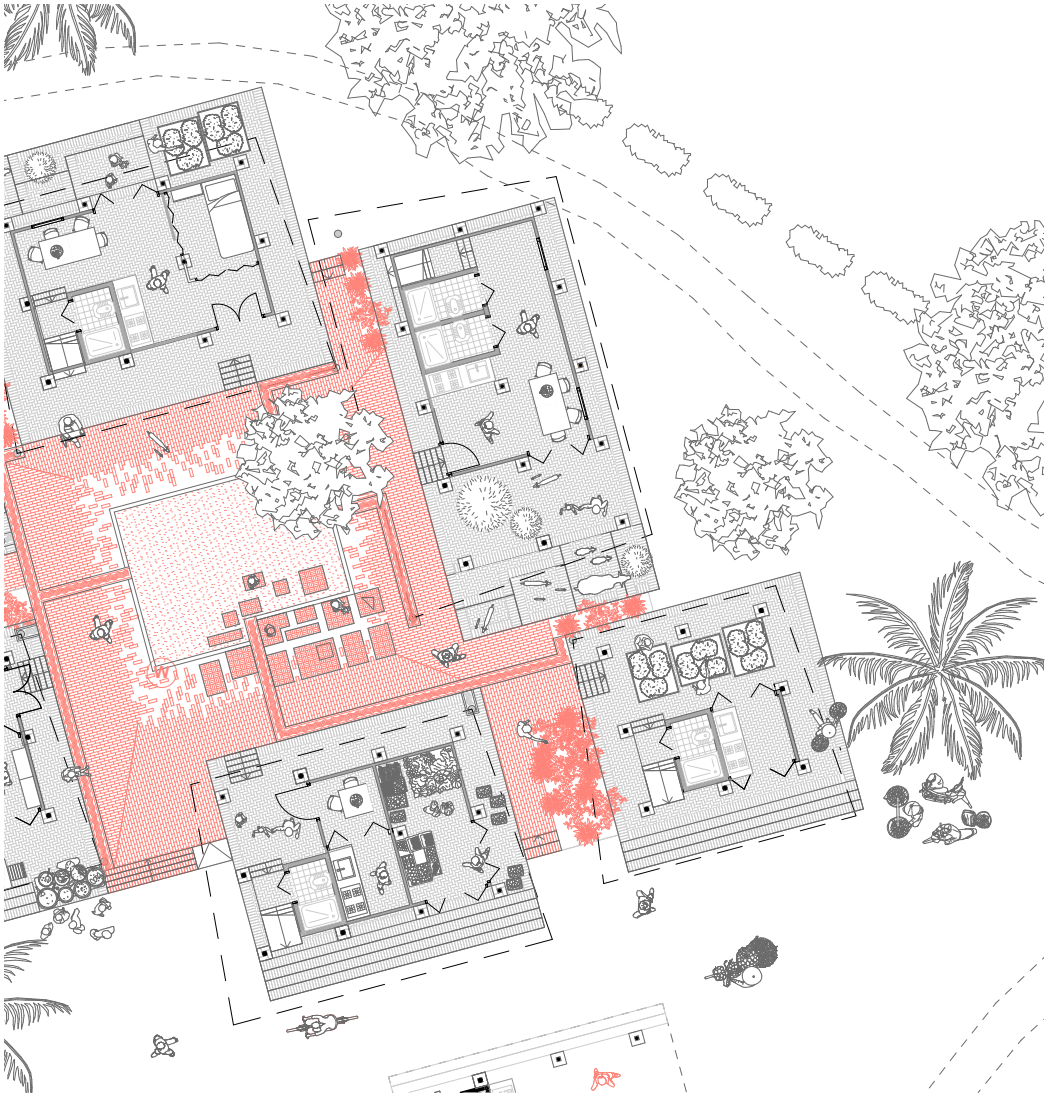
Collective tank measurements
Units per cluster - average 7
7 days of water - 374,82 * 7 * 7 =18.366 l water
Size tank - 18 m3 (2,65 * 2,65 * 2,65 m)



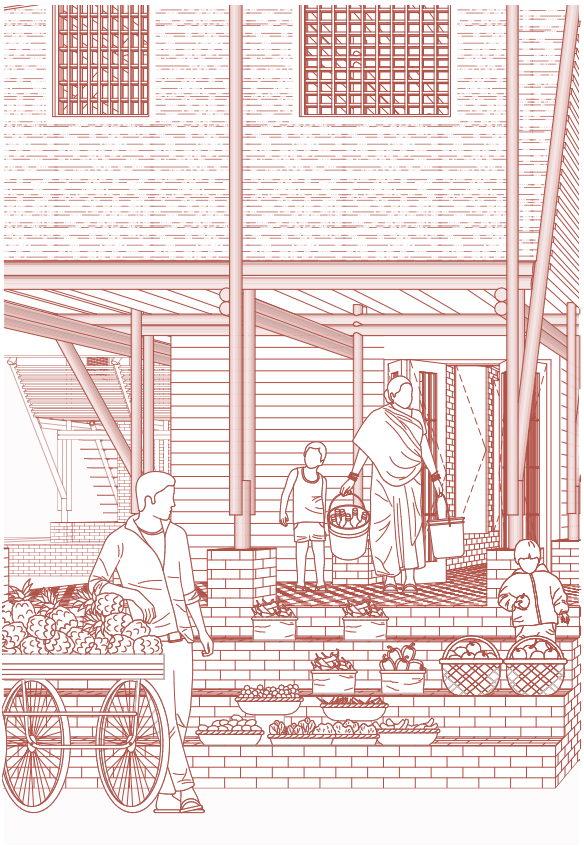

soccer
field

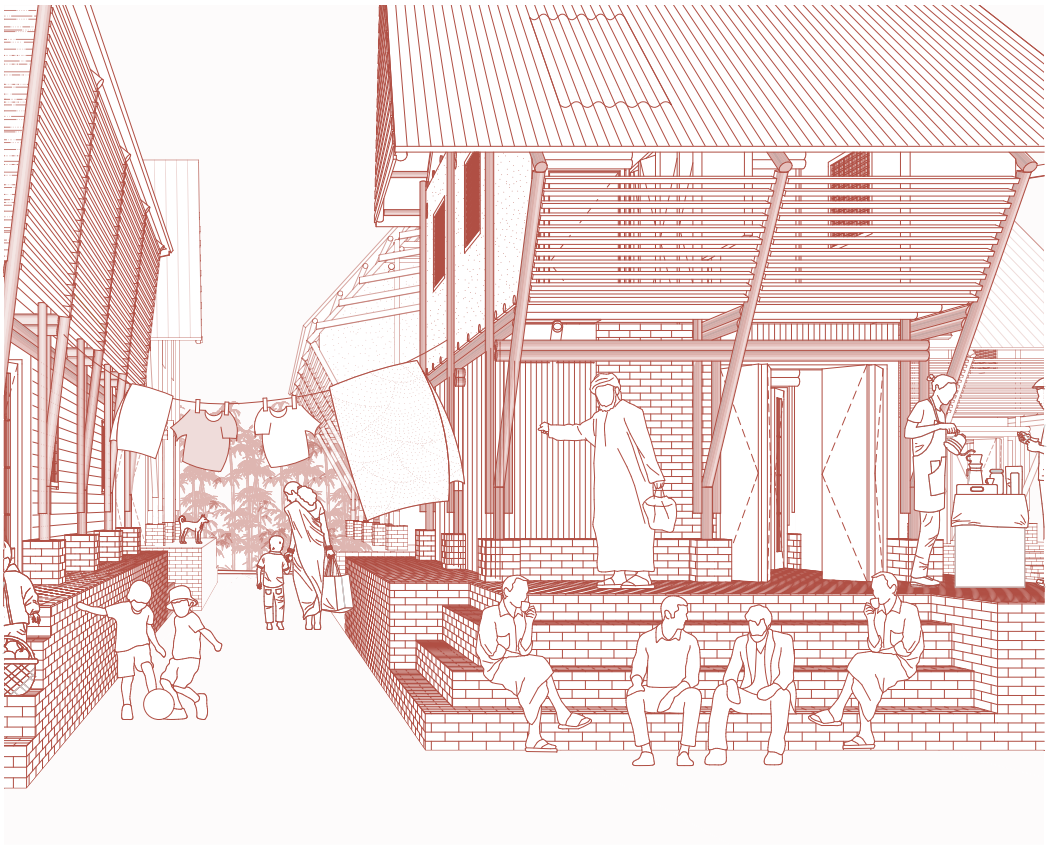
Cluster materials

Water permeates the cluster through its materials and design. Solid brick gives way gradually to open green spaces, culminating in the constructed wetland—a focal point of environmental harmony. Alleyways provide additional opportunities, nurturing green fruit gardens where residents cultivate crops, fostering a sustainable and verdant community ethos. This integration of green spaces and water elements enhances both the aesthetic appeal and ecological sustainability of the cluster.



Small informal streets



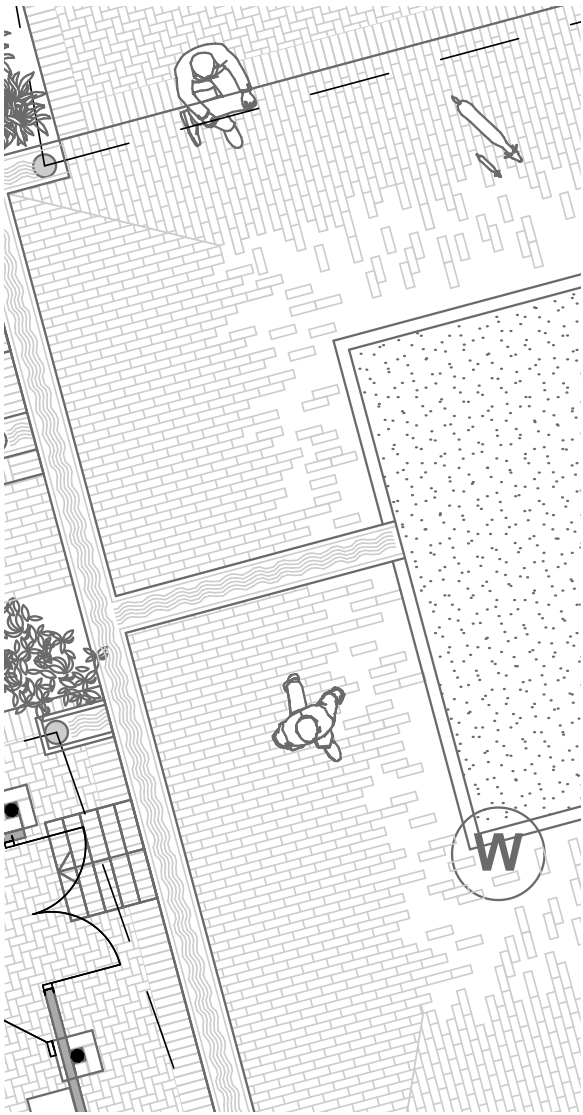


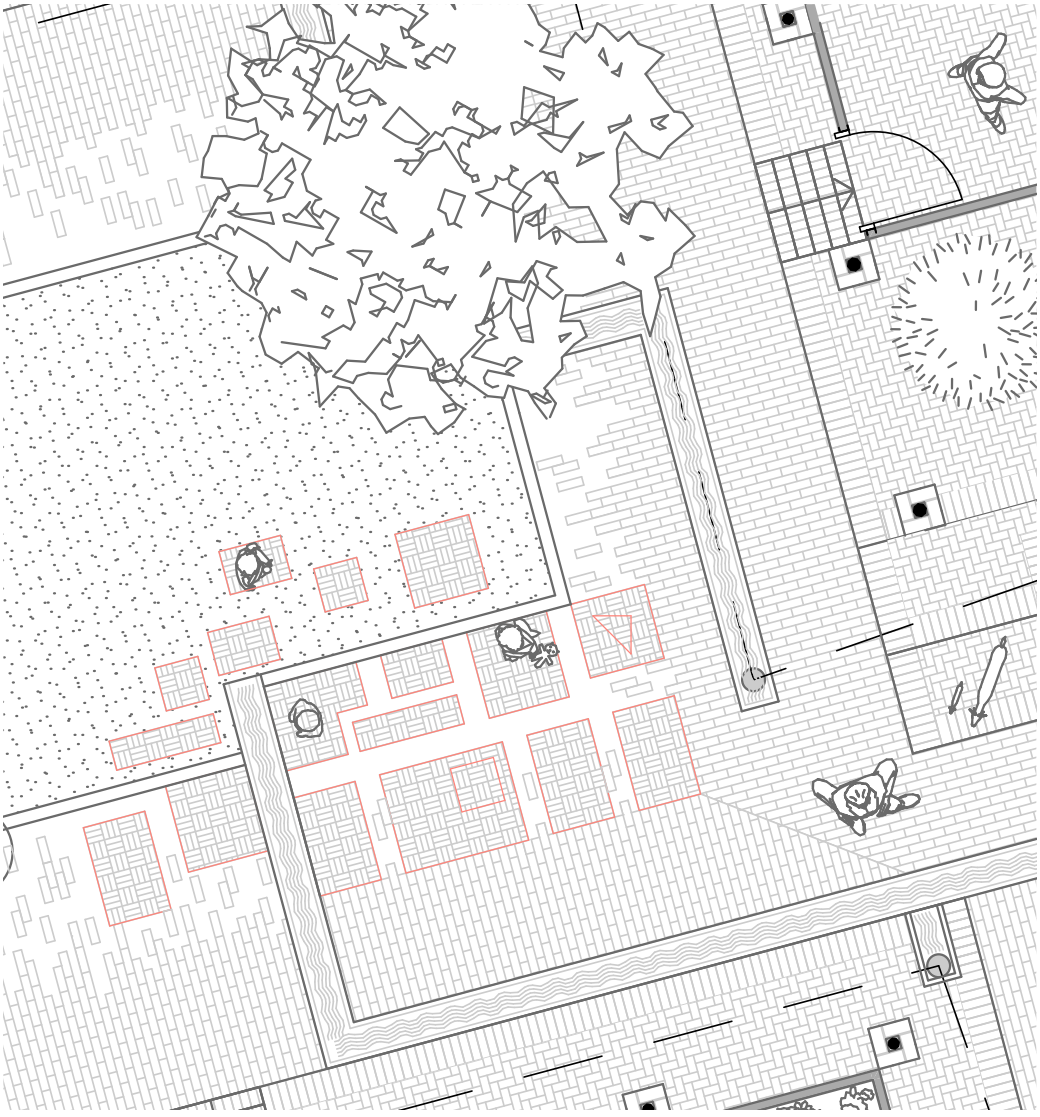
Cluster as the playground

In every corner and nook, ample space is curated for children's play, fostering a dynamic environment. The distinction between indoor and outdoor spaces blurs, enhancing accessibility to nature's diverse play areas. This design approach encourages exploration and interaction with the natural surroundings, promoting creativity and physical activity among the younger residents.

Cluster as the playground

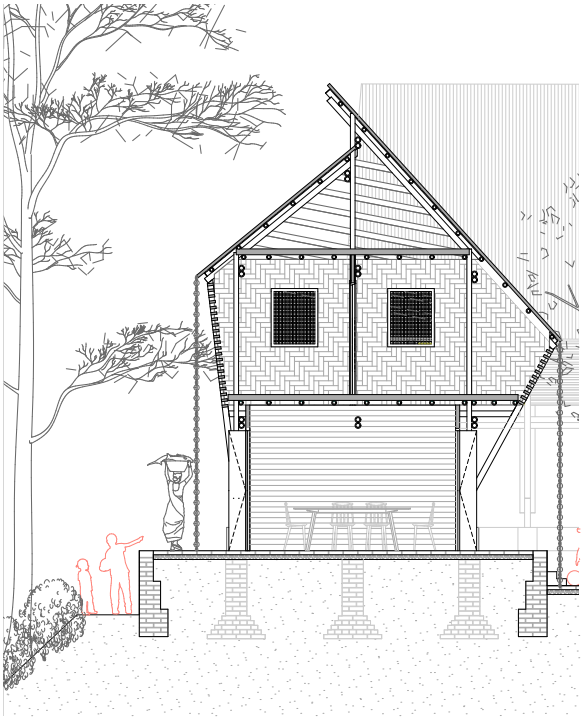
The play elements selected for this community are strategically connected to the constructed wetland, fostering a deeper connection with nature and promoting a positive view of water. This intentional design not only integrates playful interactions with the environment but also encourages residents, especially children, to appreciate and value water as a friendly and essential resource in their daily lives.

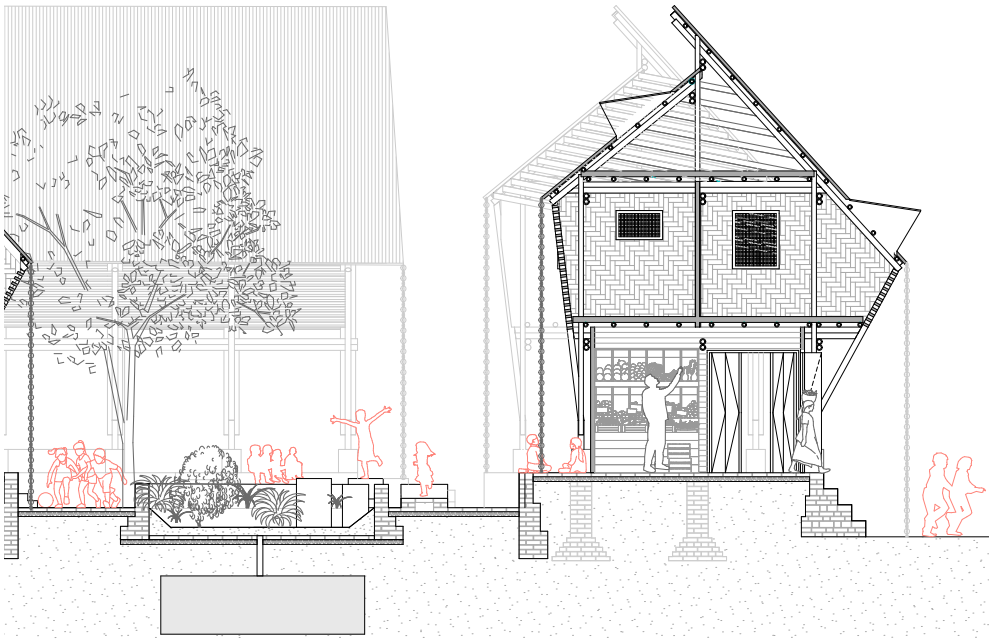




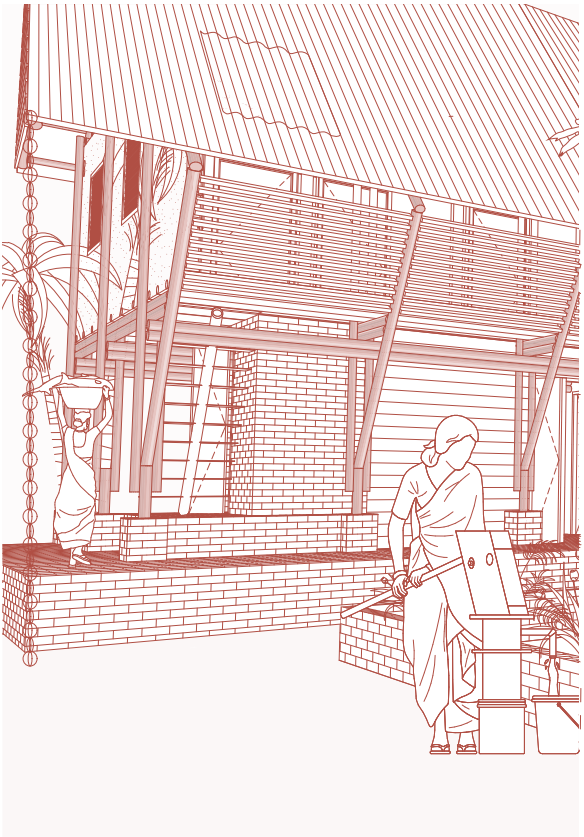
Cluster as the playground

The varying heights within the courtyard provide abundant opportunities for children to unleash their creativity and play in diverse ways. These differences in elevation create a dynamic landscape where kids can explore, climb, and invent imaginative games, fostering a vibrant and engaging environment for active play and social interaction.





Cluster as a playground



VILLAGE STRATEGY

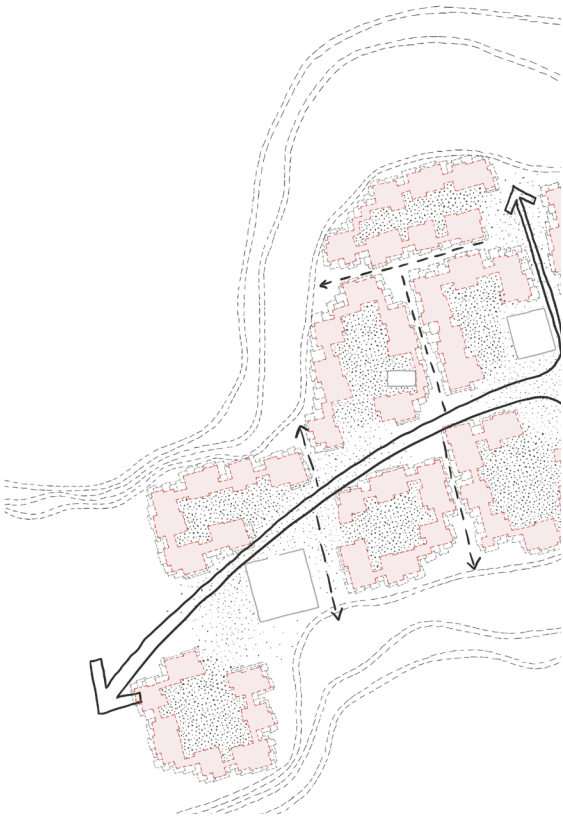
Hierarchy of spaces

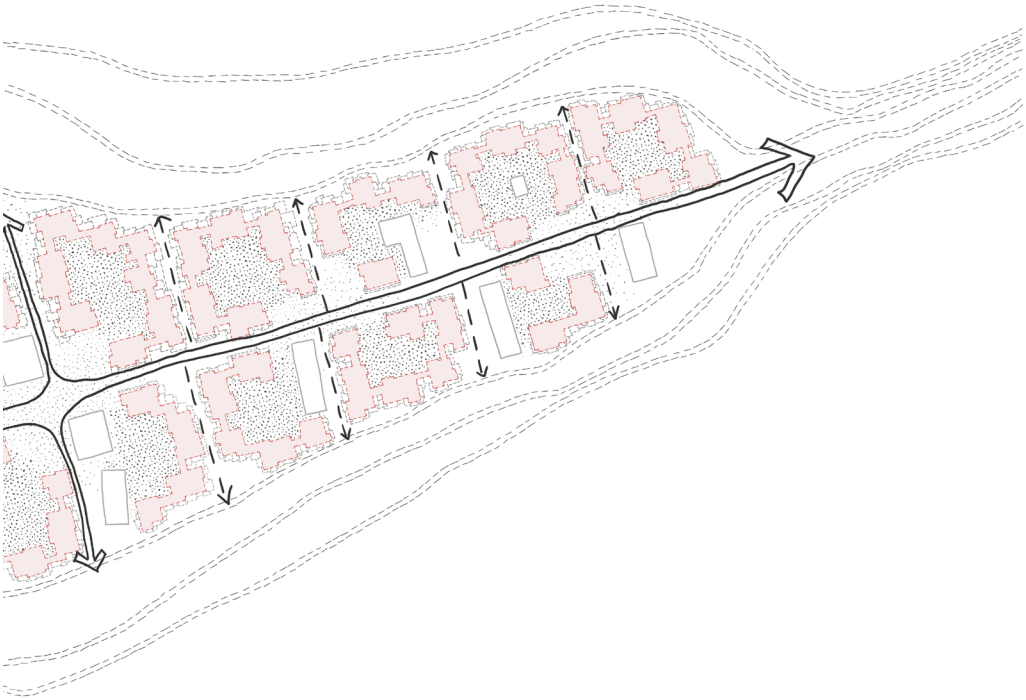
Each block in this community is composed of four clusters, with their openings facing each other to form a central, public open space. Each block features a distinctive element: a mosque, commercial spaces for local business activities, a water feature for sustainability, and a community center for gatherings and events. This thoughtful arrangement encourages community interaction and cohesion while providing essential amenities and services at the heart of the neighborhood.


BARN
COM. CENTER
HAY SHED
?

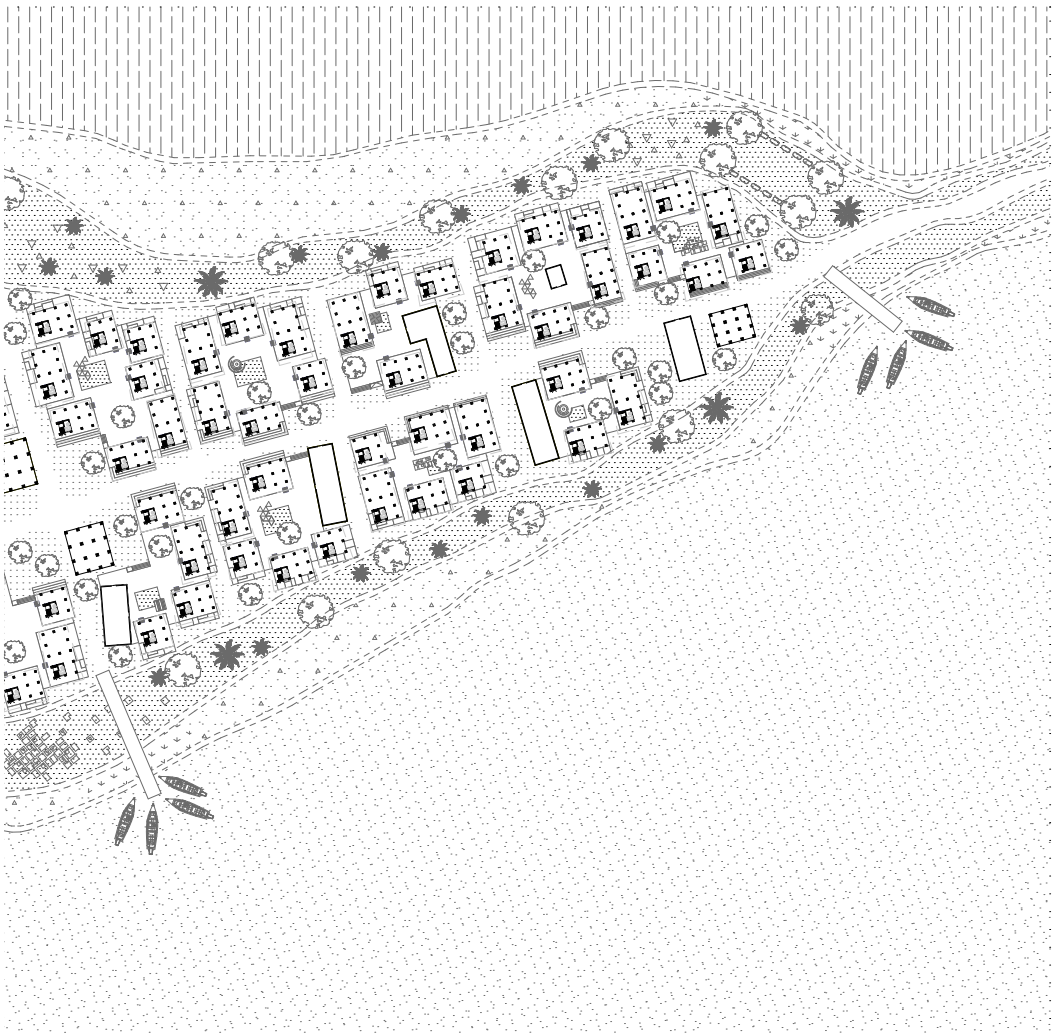
Hierarchy of spaces

The site is organized around a central main road that divides it, creating a structured layout. At the heart of the community lies a bustling main square, complete with a vibrant bazaar and essential commercial facilities. This central hub not only serves as a lively marketplace but also connects seamlessly to the nearby river and playful embankment, offering recreational opportunities and scenic views. Secondary roads extend from this core, linking the site to surrounding areas and soft embankments, enhancing accessibility and ensuring a well-connected neighborhood design.

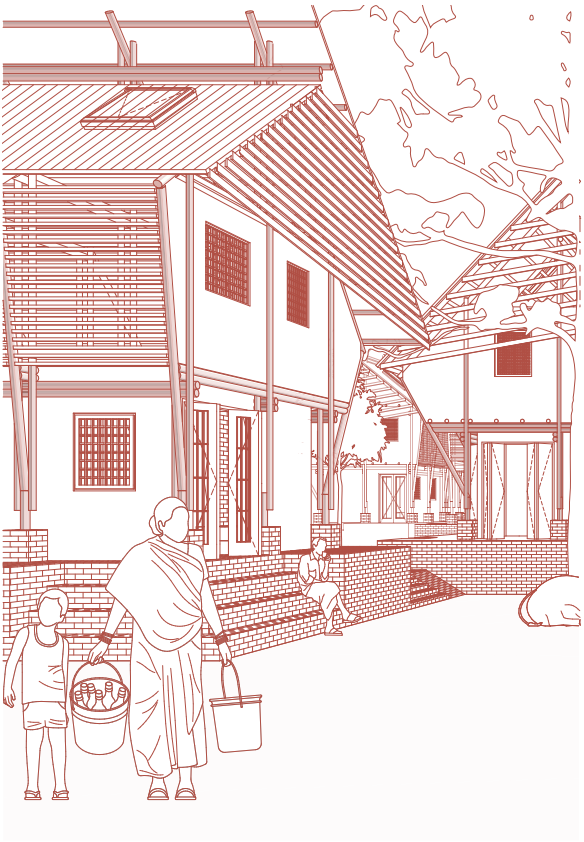




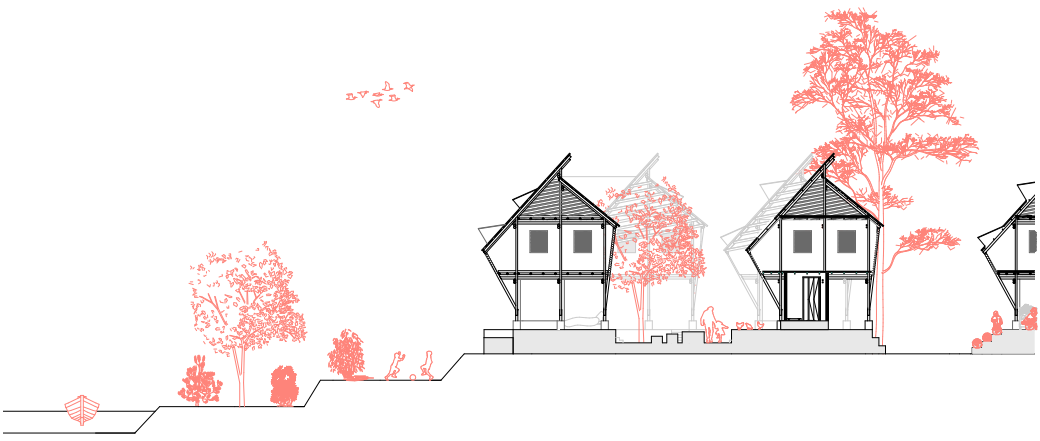
Masterplan

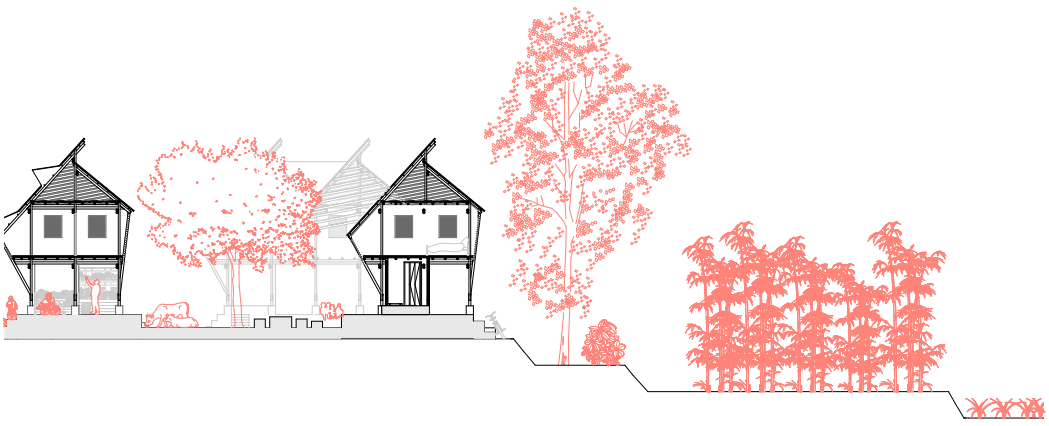


Main road

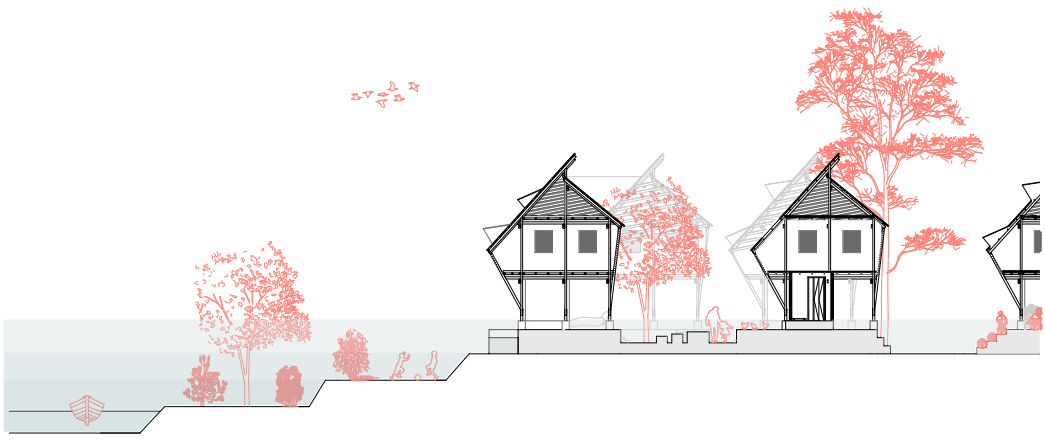


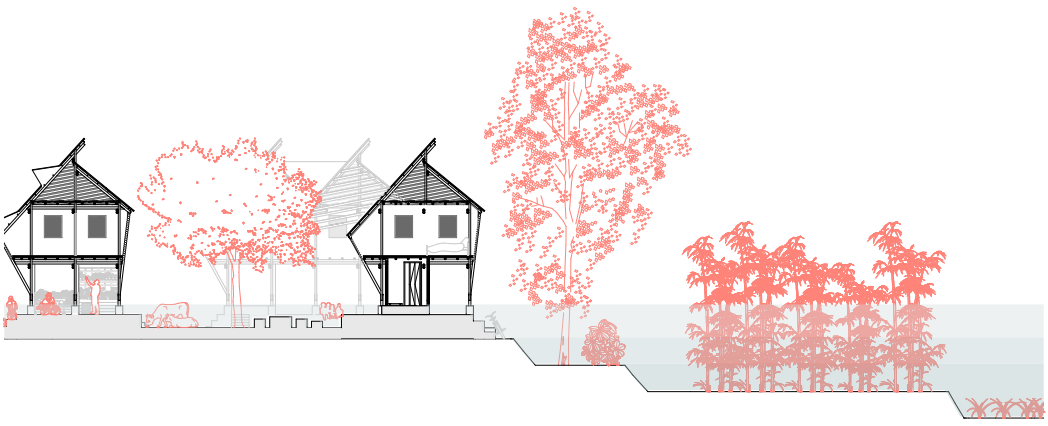
Village section





Village section





3D view entire site

Numbers

Existing situation

100 homes - average 6 people per household

Total residents - 600

Existing plot size - 11.329 m2

Total gross floor area - 4.218 m2

GSIexisting - 4.218 / 11.329 = 0,372

FSIexisting - 4.244,86 / 11.329 = 0,374

5,2m2 per person

New situation

16 clusters

total gross floor area per type
type Astart - 24,83 m2
type Abuilt - 54,14 m2
type Bstart - 35,02 m2
type Bbuilt - 80,99 m2
type Cstart - 49,42 m2
type Cbuilt - 107,38 m2

Total gross floor area site (including courtyard) - 7.421,73 m2

GSInew - 7.421,73 / 11.329 = 0,655

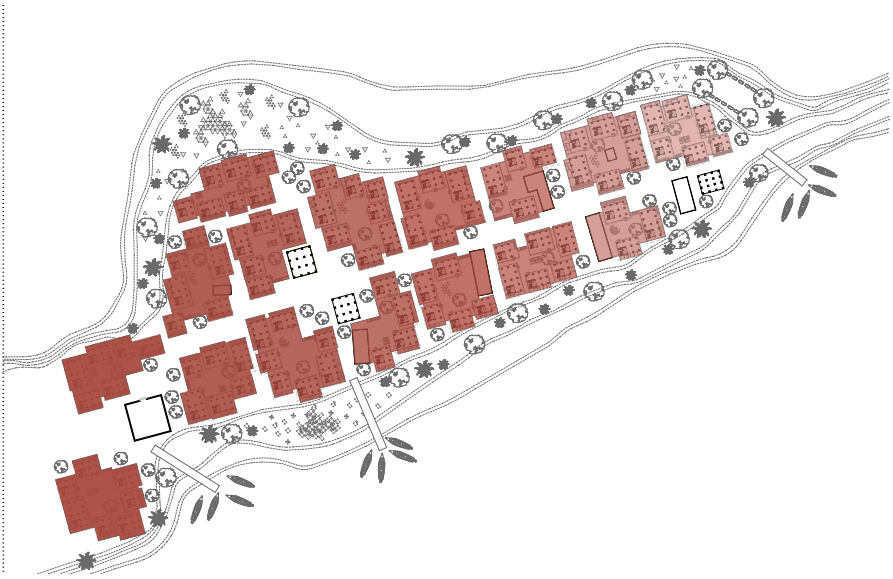
Total area site (all floors) start - 10.103,58 m2

FSIstart - 10.103,58 / 11.329 = 0,89

Total area site (all floors) built - 12.198,22 m2

FSIbuilt - 12.198,22 / 11.329 = 1,08

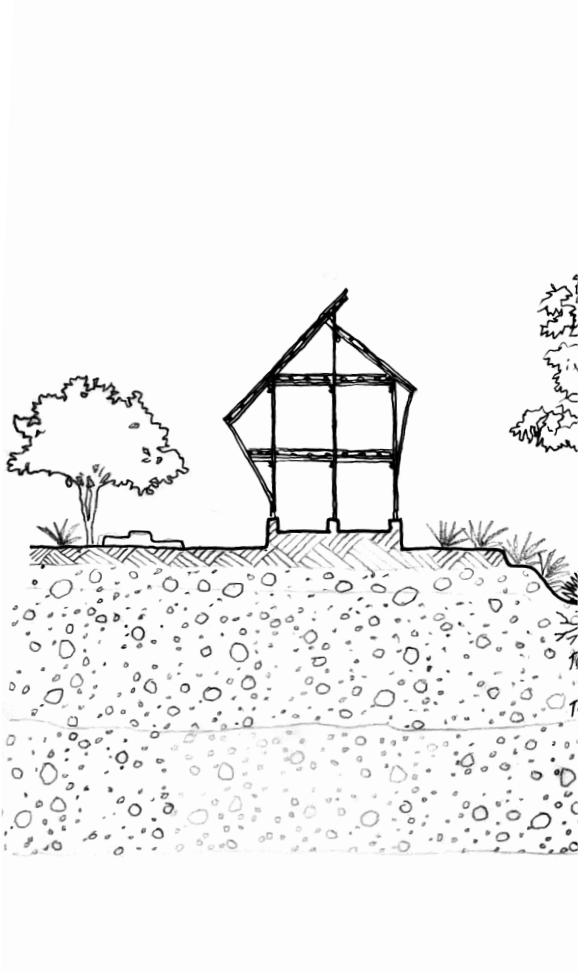
Phasing



LANDSCAPE STRATEGY

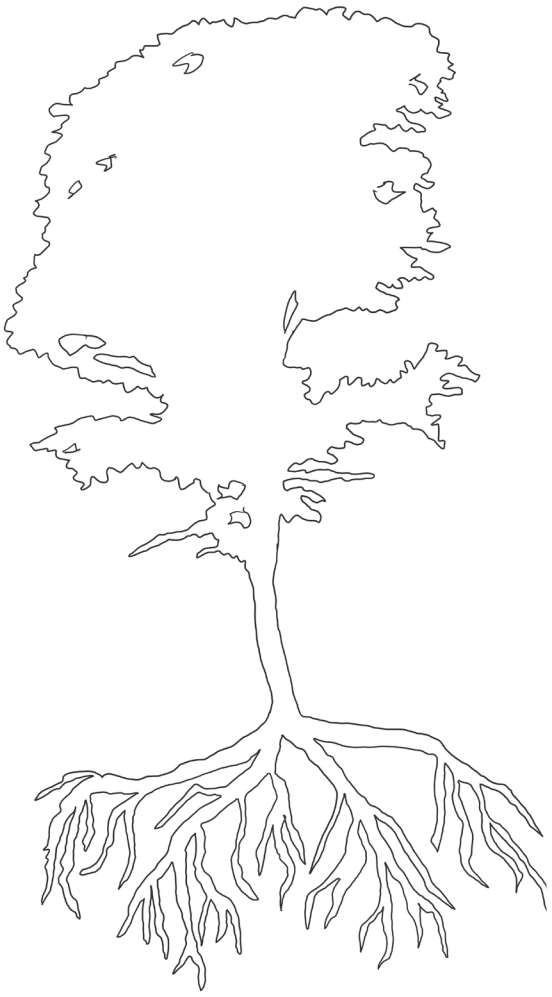
Soft embankment

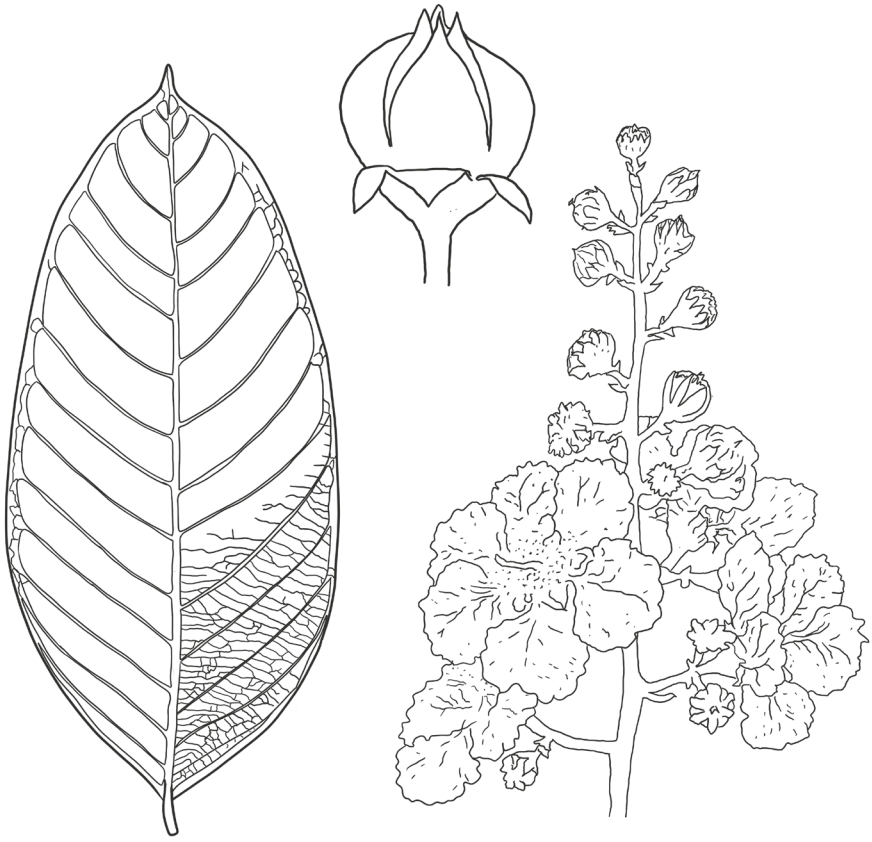
The site is structured into four distinct levels, each serving a specific function. The first level encompasses the river and rice paddy fields, essential for agricultural activities. Above, the soft embankment, fortified with vegetation and sturdy roots, ensures safety from erosion and floods. This level not only protects but also facilitates various activities. Play elements are strategically placed on the third level, enhancing opportunities for recreation and community engagement. A bamboo forest is cultivated nearby, providing a sustainable source for house repairs when necessary, showcasing the community's resourcefulness and resilience in maintaining their environment and homes.



Vegetation - Indian Oak

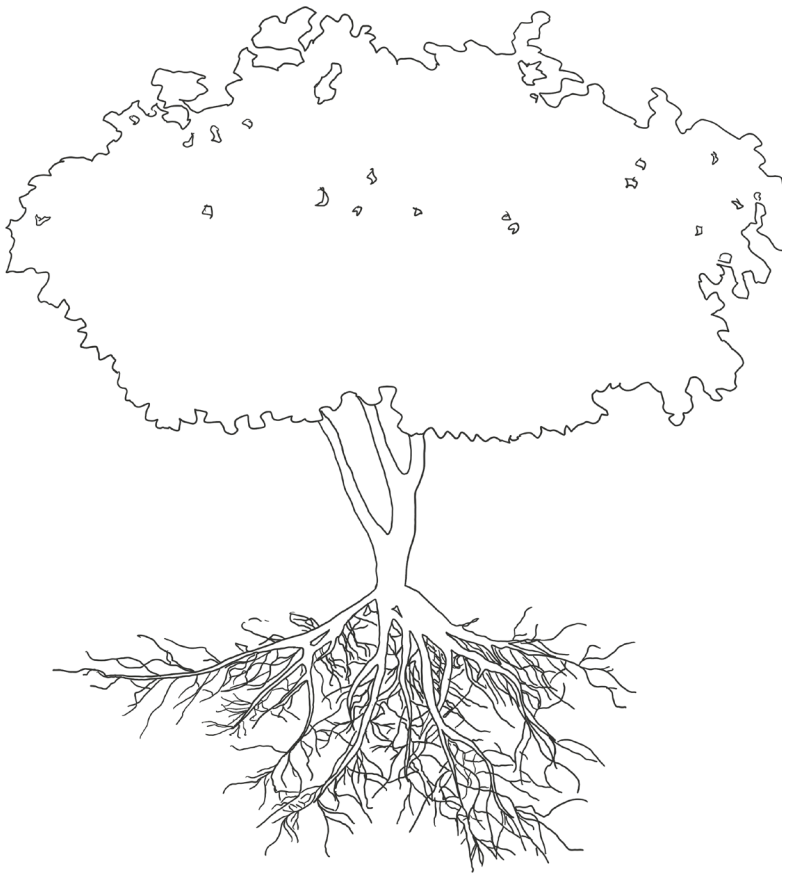
Scientific name: Barringtonia Acutangula
Size: 8 - 15 m.
Location: wetland
2nd use: Food & medicine





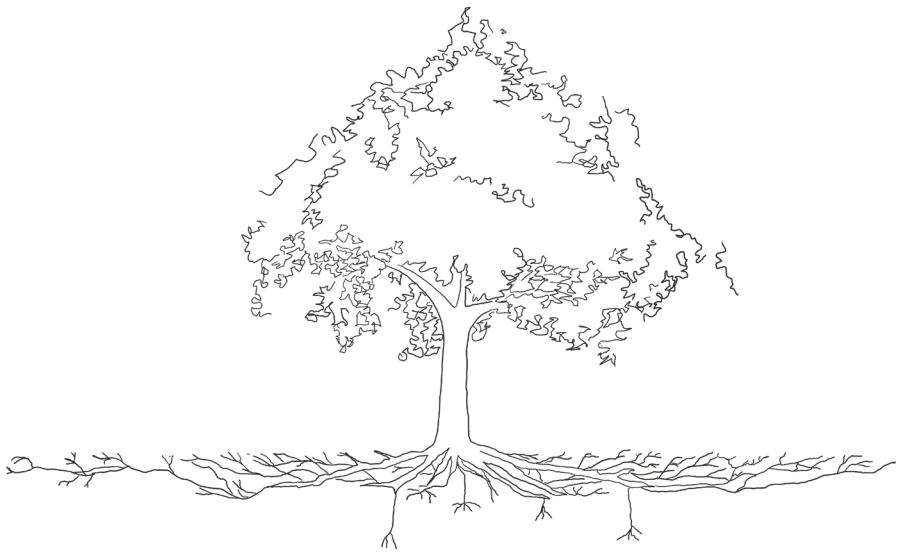
Vegetation - Pongamia Pinnata

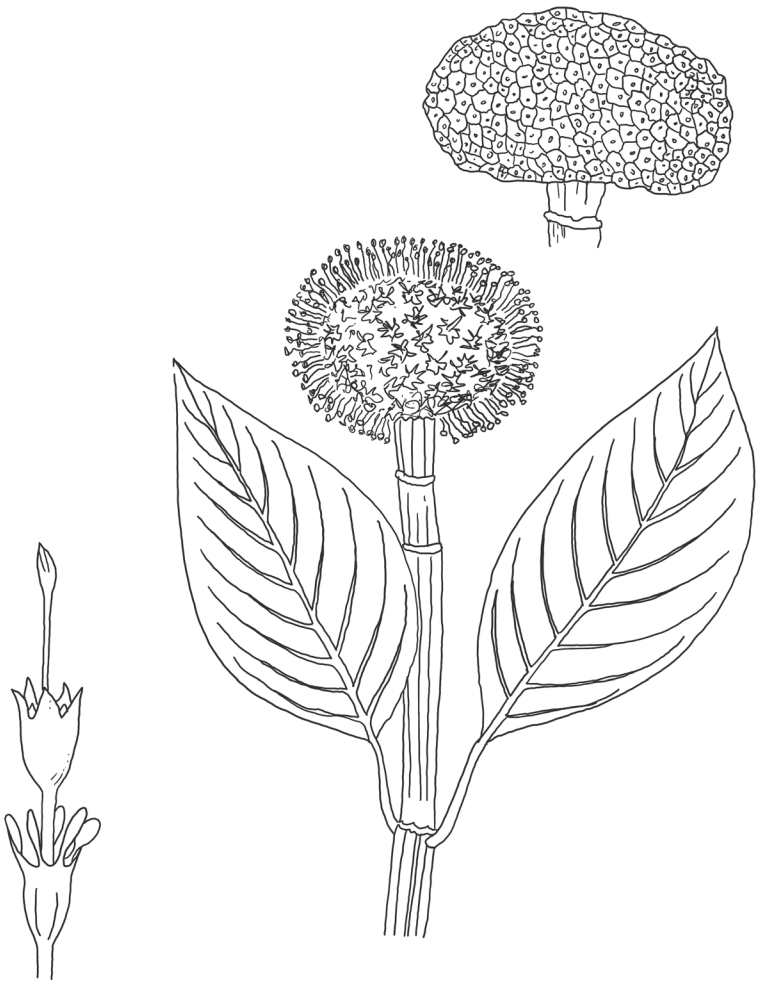
Scientific name: Pongamia Pinnata
Size: 15 - 25 m
2nd use: oils



Vegetation - Burflower tree

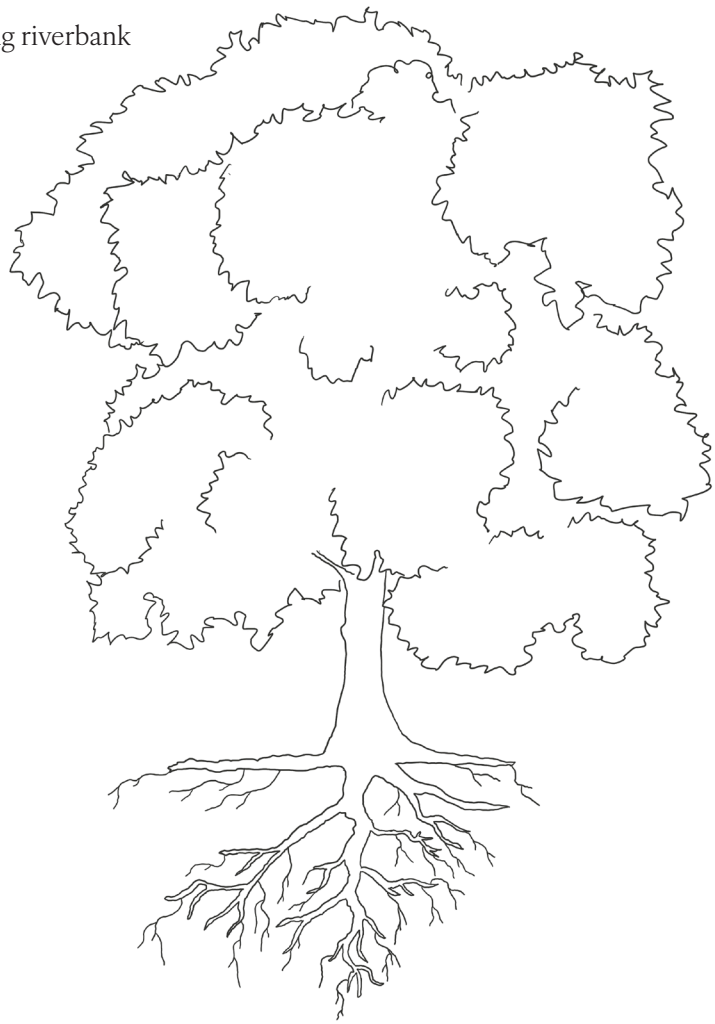
Scientific name: Neolamarckia Cadamba
Size: 45 m
Location: Along river bank





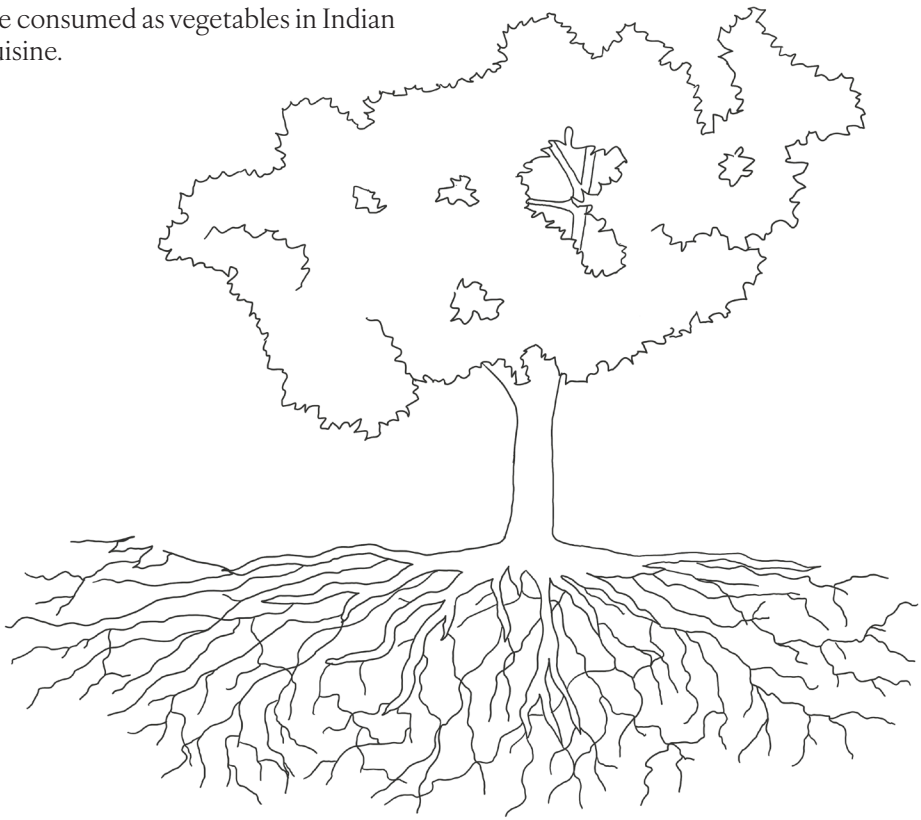
Vegetation - Indian Blackberry

Scientific name: Syzygium cumini
Size: 12 - 30 m
Location: Along riverbank
2nd use: Fruits



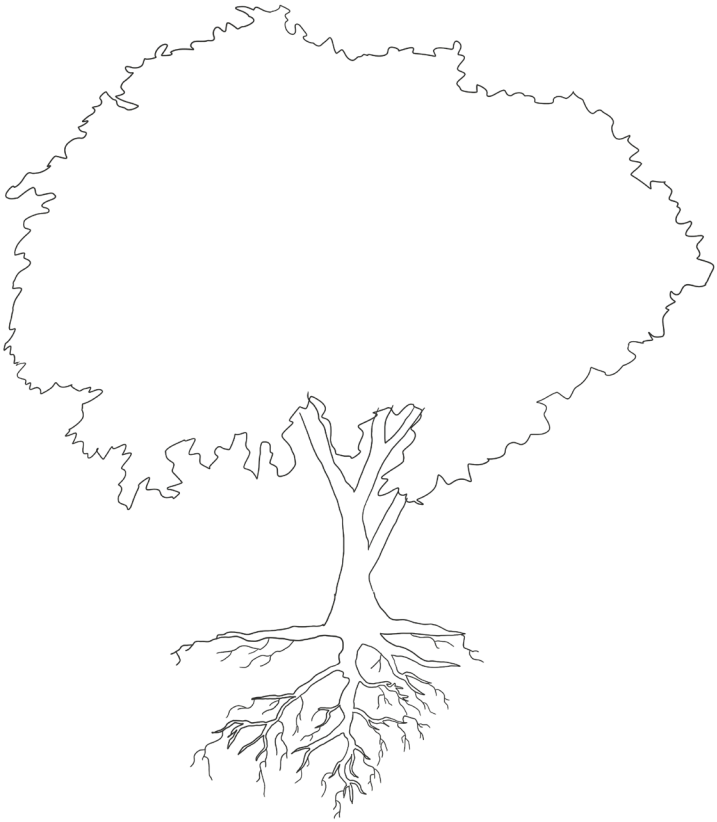
Vegetation - Neem Tree

Scientific name: Azadirachta Indica
Size: 15 - 20 m
2nd use: Dried neem leaves are commonly used to repel insects from clothes stored in cupboards and in containers holding rice and wheat. Additionally, the young shoots and flowers of the neem tree are consumed as vegetables in Indian cuisine.



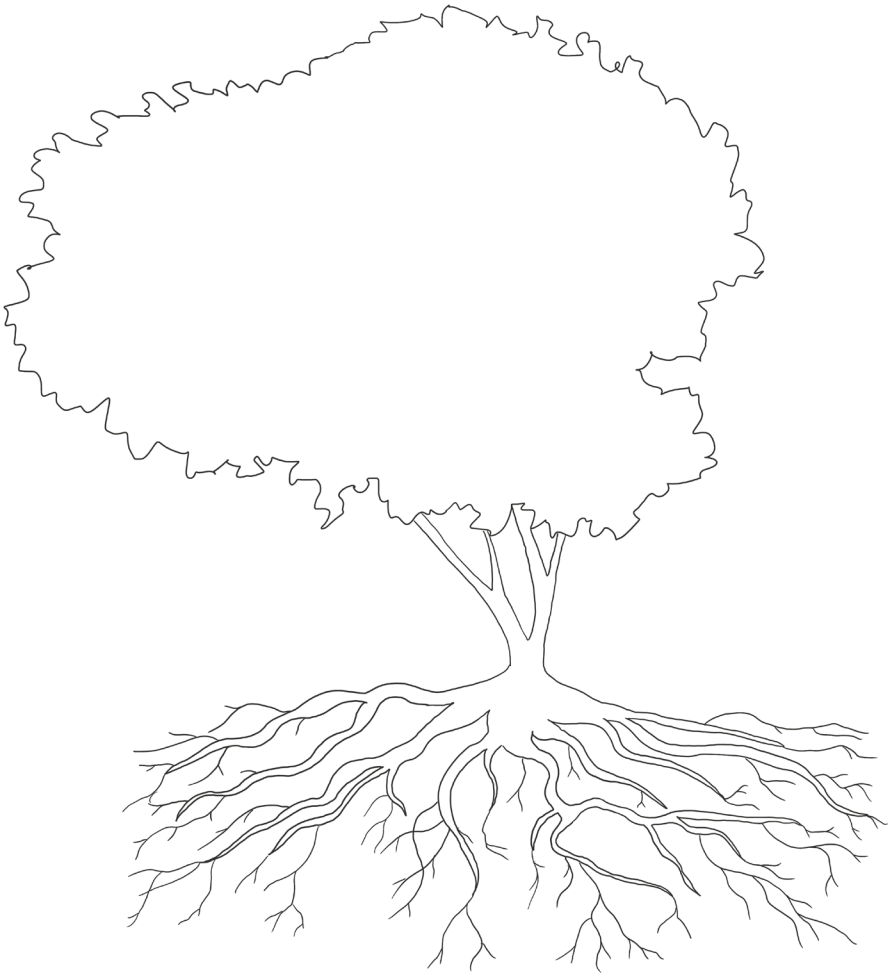
Vegetation - Mango tree

Scientific name: Mangifera Indica
Size: 15 - 30 m
Location: Well drained soil
2nd use: Fruits



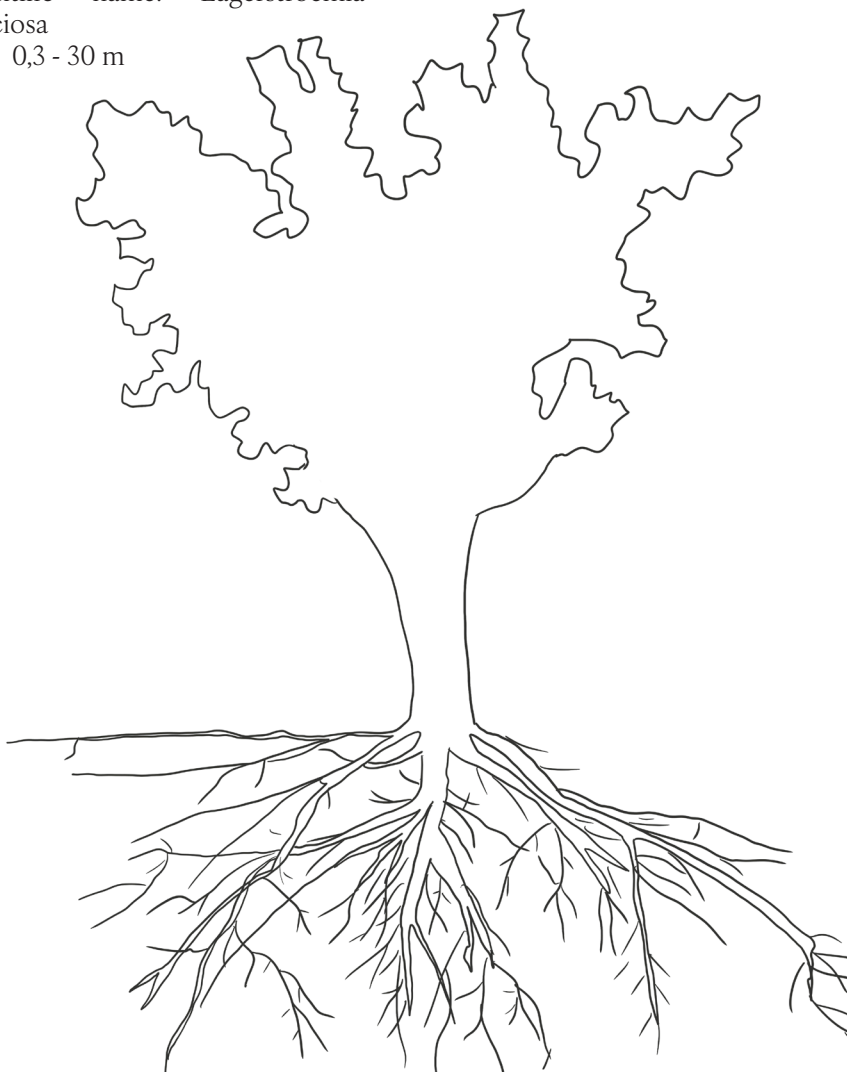
Vegetation - Golden Shower

Scientific name: Cassia Fistula
Size:
Location:
2nd use: Herbs & spices



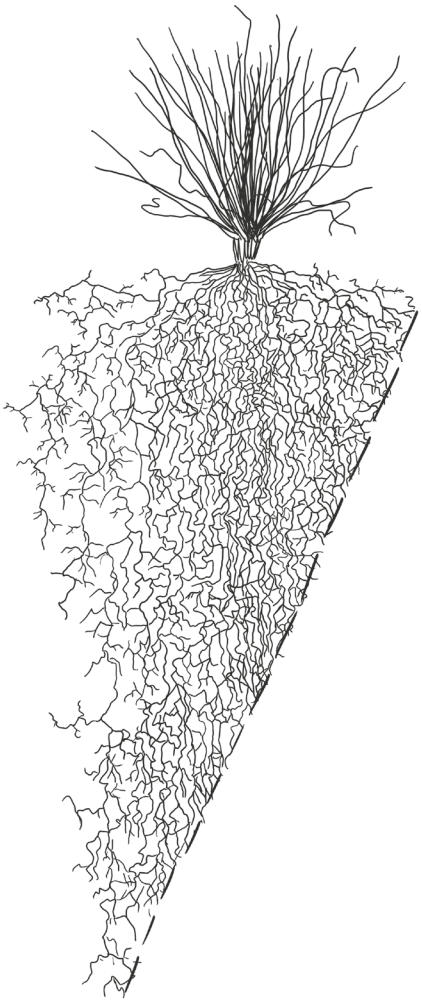
Vegetation - Crape Myrtle

Scientific name: Lagerstroemia Speciosa
Size: 0,3 - 30 m

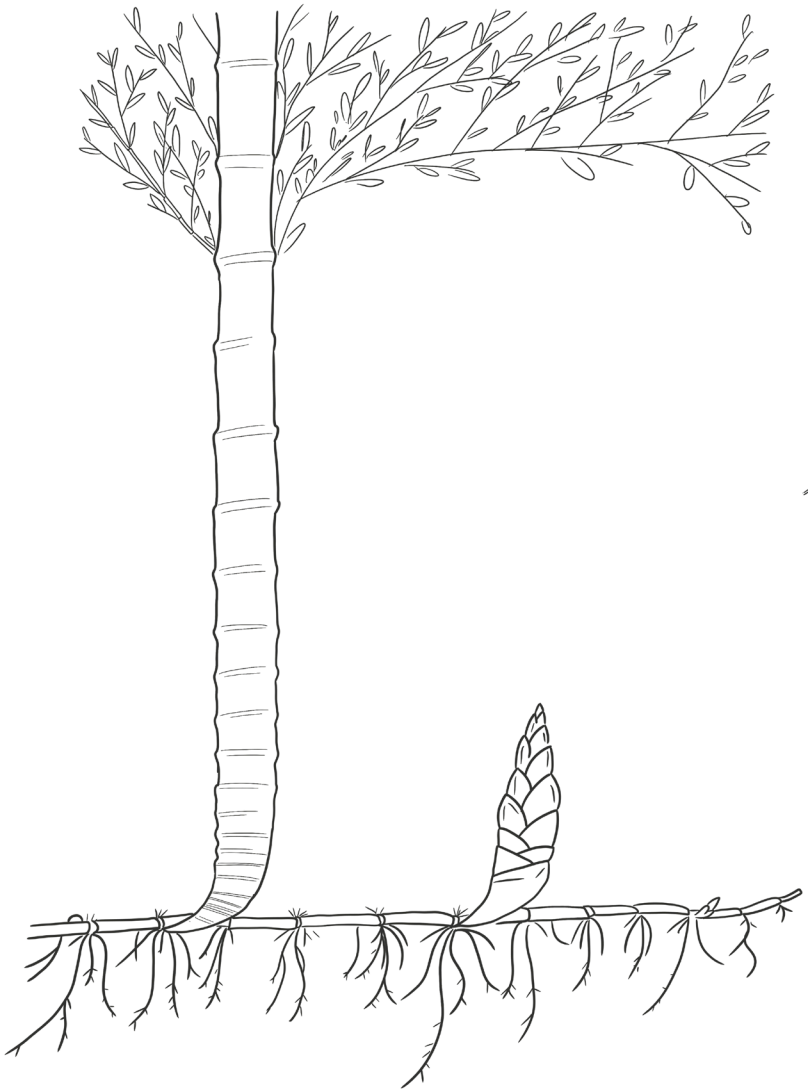


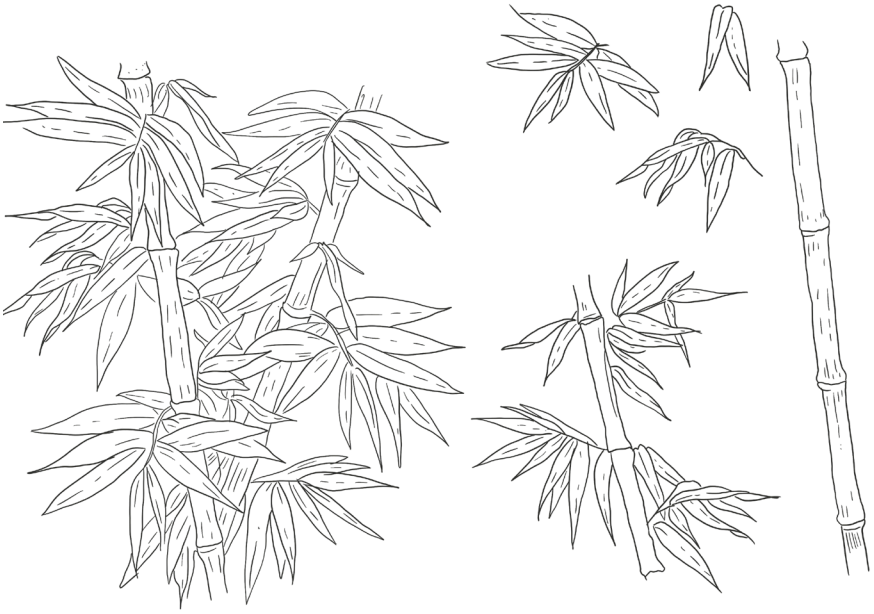
Vegetation - Vetiver grass

Scientific name: Chrysopogon Zizanioides
Location: wetland

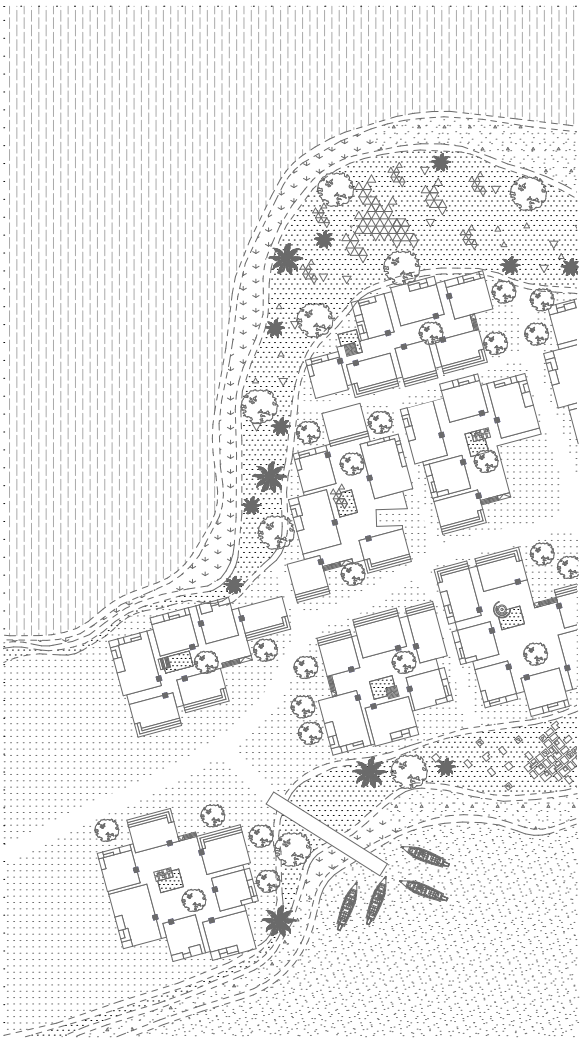


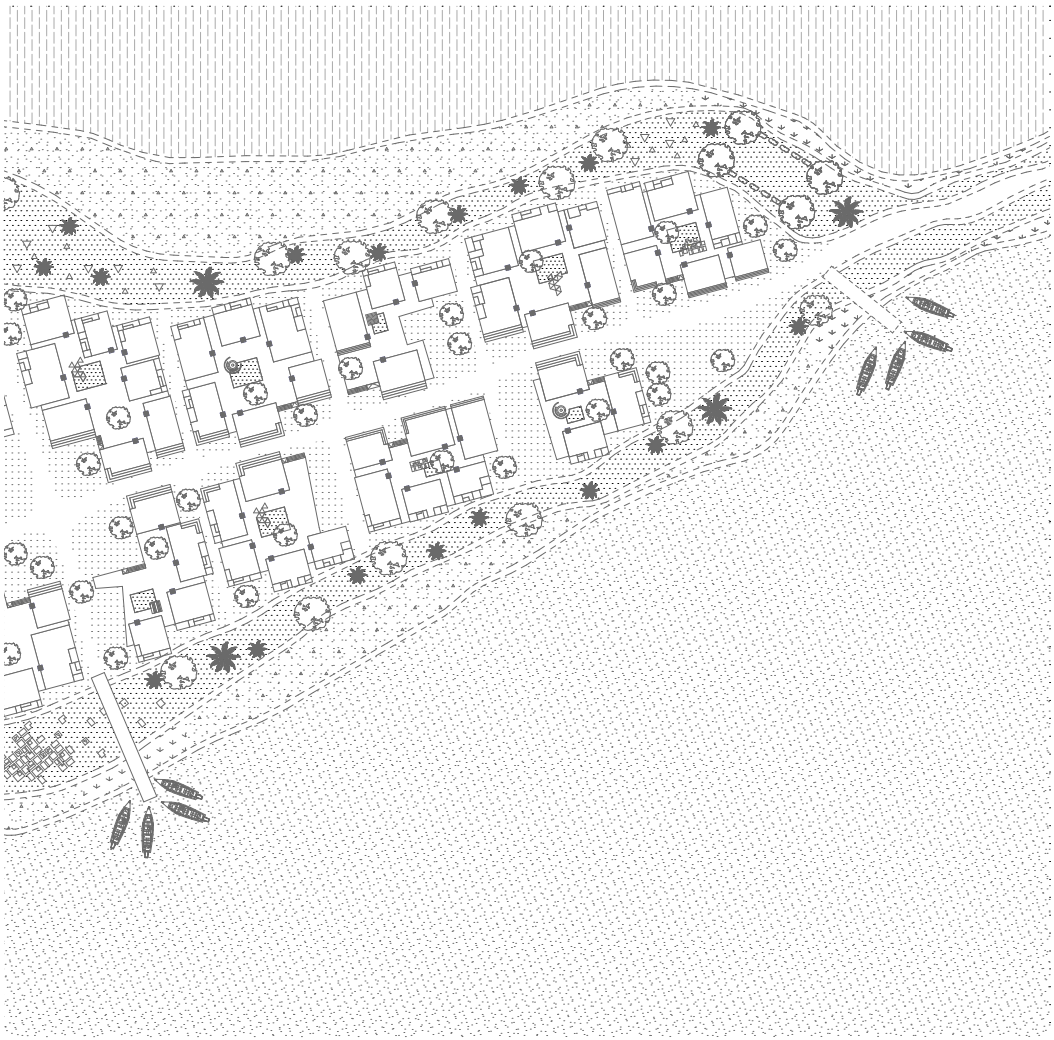
Vegetation - Bamboo





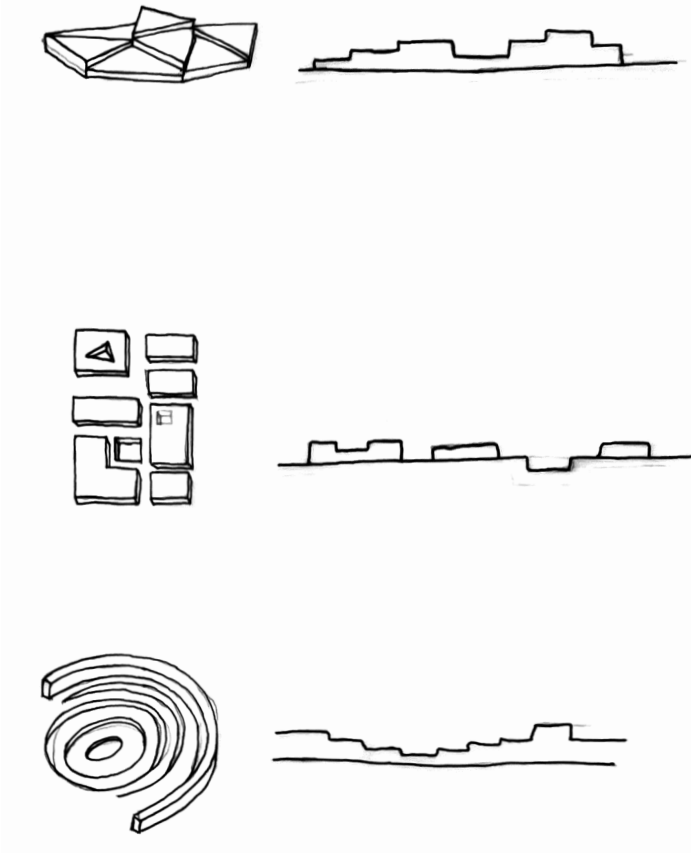
Landscape design

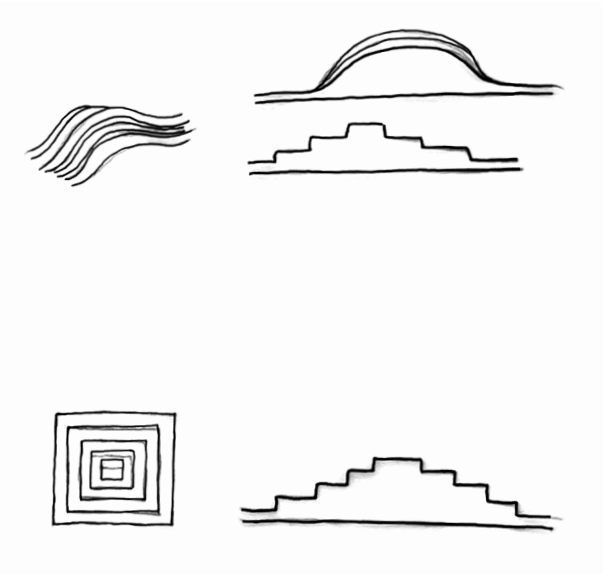


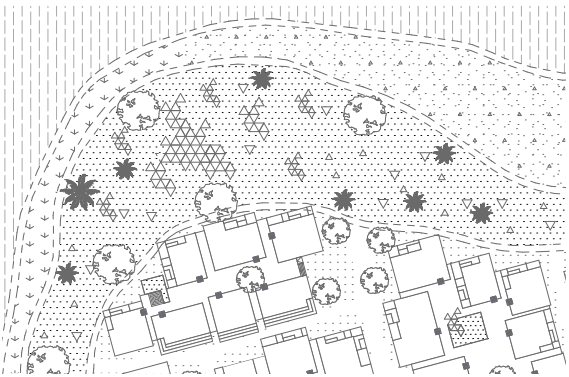


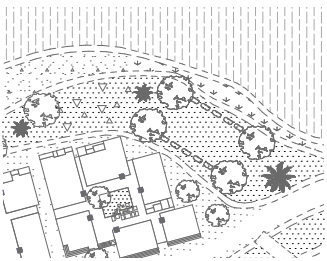
Play elements

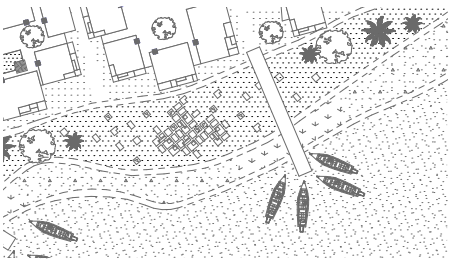
The playground features five distinct types of play elements designed to encourage creativity and imagination in children. Each element is intentionally simple, allowing children to transform and reinterpret them through their imaginative play. This approach fosters a dynamic and interactive environment where young minds can explore, invent, and enjoy playful experiences.











REFLECTION

Reflection - Beyond the Ripple

Global housing
The graduation topic focuses on the displacement of people globally, with a specific emphasis on Bangladesh. It examines various forms of displacement and the associated challenges faced by affected individuals. Additionally, the research explores innovative housing design approaches to develop an adaptable architecture that mitigates the consequences of large-scale displacement.

A key aspect of this study is investigating whether architecture can aid in the healing of trauma, particularly for children during and after floods. The research and design process examines architectural typologies, materials, and technologies to create meaningful spaces for transitional architecture.
Understanding the practical and visible dangers of floods is crucial for creating safer environments for residents. This involves exploring technological solutions and integrating landscape architecture to enhance living conditions. Equally important are the psychological and sociological dimensions of the issue. The research delves into the mental impact on children in these traumatic situations and explores how architecture and play can collaborate to aid in their healing process.

The process
Addressing this multifaceted issue requires thorough research across multiple dimensions. Initially, it was essential to understand the context of Bangladesh, specifically the Tanguar Haor region. As a group, we investigated various aspects including history and politics, territory and environment, society and economy, and design and technology to grasp a holistic view of the context. The field trip to Bangladesh was particularly enlightening, allowing us to observe daily life and activities, which shifted our usual European frame of reference to a more localized understanding.

The research subsequently focussed on the trauma children endure during floods and how play can aid in emotional recovery. Integrating architecture with play emerged as a pivotal concept, leading to an exploration of landscape architecture within the design. This led to a design where the transition between indoor and outdoor spaces became more fluid, emphasizing both the playful and technological aspects of the landscape. Utilizing vegetation and soil bioengineering techniques to enhance the living environment into a safer one.

The focus on housing and various

case studies by architects like Charles Correa and Balkrishna Doshi significantly influenced the design. By examining past low-income housing projects, valuable lessons and inspiration were drawn, incorporating successful elements while addressing previous shortcomings. This comprehensive approach aimed to develop a design that is both innovative and contextually appropriate.

Methods

Various methods were employed within the project to identify solutions and address questions that arose during the research and design process. The project was conducted through an iterative process, where research and design were closely interlinked and mutually influential. This dynamic interaction led to the emergence of new ideas and topics, thereby enhancing both the design and the research.

Given the limited duration of fieldwork, literary research became a pivotal method for gaining a comprehensive understanding of various topics. Reliable sources such as essays, books, news articles, and journal publications were instrumental in comprehending the multifaceted issues and in identifying innovative design solutions. Additionally, mapping was utilized to visualize living conditions, providing a clearer understanding of the current housing situation and the unique needs of children during and after floods. Further, learning from previous projects also played a crucial role in this project. By examining and contrasting case studies, innovative strategies, and lessons learned were uncovered, offering insights into how past projects have addressed the challenges posed by floods and trauma. Field research, employing an ethnographic approach, was undoubtedly the most vital aspect of the research. This immersive method extended beyond literature review and case study analysis, providing an in-depth analysis of the socio-spatial factors influencing the flood resilience of low-income settlements. The field research revealed the intricacies of the community's response to natural disasters, offering a nuanced understanding of the challenges faced by children and the broader population. This comprehensive approach ensured a well-rounded exploration of the issues at hand, ultimately leading to more effective and contextually relevant design solutions.

Relevance

Ensuring a safe and healthy living environment globally, particularly in the face of increasing natural disasters such as floods, is an urgent imperative. This challenge is aggravated by climate change projections, which indicate a substantial rise in the frequency of 100-year floods by 2050. According to Arnell and Gosling (2014), such

floods are predicted to occur at least twice as often across 40% of the globe, impacting approximately 450 million flood-prone individuals and 430,000 km^2 of flood-prone cropland. Global flood risk is expected to increase by approximately 187%, underscoring the necessity for effective climate change mitigation measures.

To address this forthcoming crisis, global action focusing on flood resilience, climate change adaptation, affordable housing, and public space is essential. This project investigates a sustainable strategy that transcends geographical boundaries, providing a comprehensive solution tailored to the specific context of the Tanguar Haor region and serving as a blueprint for global implementation.

Existing literature and case studies reveal a critical gap in integrated design approaches for flood-resilient housing and post-flood trauma coping strategies, which this graduation project seeks to partially address. The project explores an innovative, integrated strategy that encompasses flood resilience, climate change adaptation, affordable housing, and public space, offering a viable solution for vulnerable communities. By integrating these elements, the project contributes meaningfully to the discourse on sustainable and resilient housing design, particularly for those most affected by the increasing threat of floods.

Planning

The project was undertaken through an iterative process, which initially posed challenges, particularly with the difficulty of starting the design phase without extensive, well-justified research. I questioned the basis of my design choices, which made the process initially daunting. However, I later found this iterative approach to be enlightening and highly effective, as it allowed for the emergence of new ideas and inspiration that might otherwise have been overlooked.

The project's context being abroad necessitated on-site fieldwork as a crucial component. The timing of this fieldwork had both advantages and drawbacks. Conducting fieldwork early in the project provided invaluable insights into the daily lives of the local population and a better understanding of the current housing situation. However, as the project progressed and new issues and ideas emerged, the challenge of conducting further research became apparent. This difficulty was exacerbated by the relative scarcity of (geo) information on Bangladesh, complicating the justification of certain findings and ideas. Ideally, a second field visit would have facilitated the validation of these new insights and reinforced the project's findings. However, logistical constraints made this impossible.

Thus, while the iterative process and early fieldwork offered significant benefits, they also highlighted the challenges of conducting comprehensive research in a foreign context with limited information.

BIBLIOGRAPHY

IMAGES

Figure 01: Students of Graduation Global Housing 2023-2024

Figure 02: Students of Graduation Global Housing 2023-2024

Figure 03: Students of Graduation Global Housing 2023-2024

Figure 04: Students of Graduation Global Housing 2023-2024

Figure 05: Students of Graduation Global Housing 2023-2024

Figure 10: Students of Graduation Global Housing 2023-2024

Figure 14: Vastushilpa Foundation

Figure 18: Felipe Díaz Contardo

Figure 19: Doan Thanh Ha

Figure 21: Hiroyuki Oki

Figure 23: Hiroyuki Oki

Figure 24: Kurt Hörbst

Figure 25: Kurt Hörbst

Figure 26: Kurt Hörbst , Naquib Hossain, Alexandra Grill

Figure 2

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APPENDIX

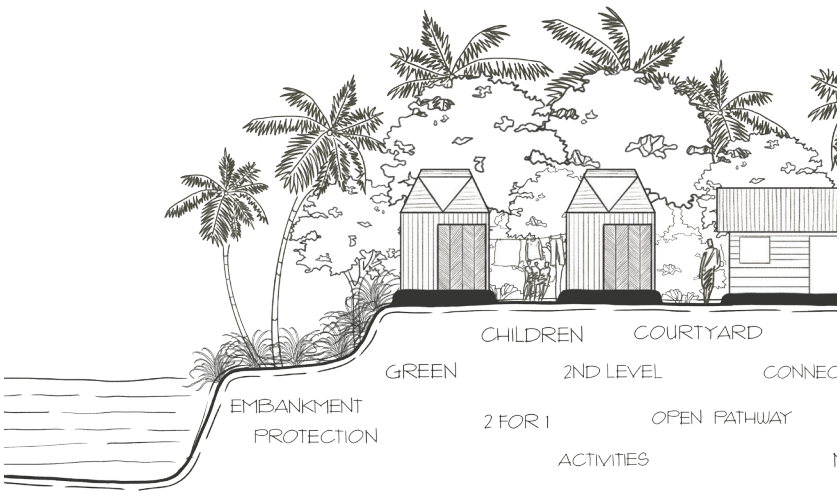
P1 PRESENTATION

P1 presentation

BEYOND THE RIPP

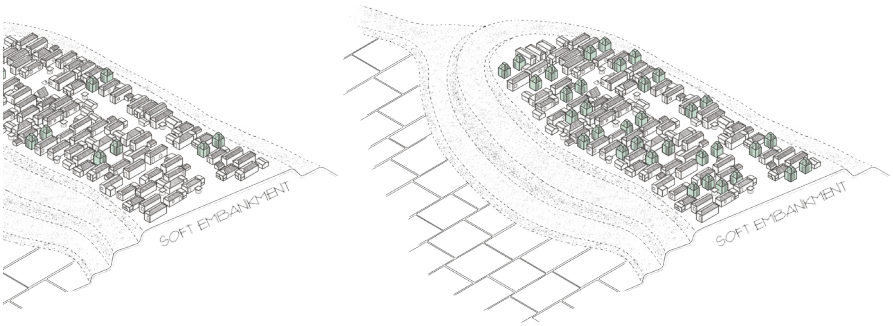
MANAGEMENT
PHASE 1

PHASE 2

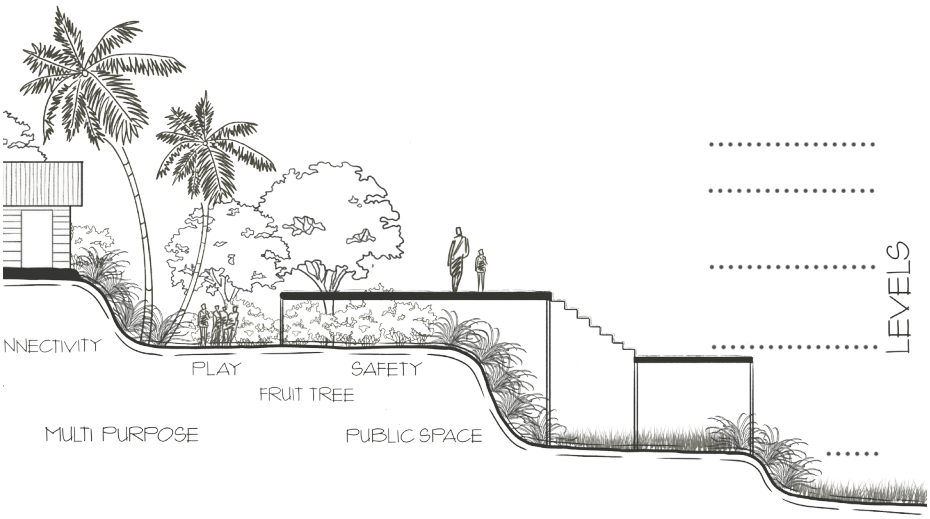


SASCHA ALBADA JELGERSMA – 5459391

PLE


SOFT EMBANKMENT
SOFT EMBANKMENT

PHASE 3


NNECTIVITY
PLAY
SAFETY
FRUIT TREE
MULTI PURPOSE
PUBLIC SPACE
LEVELS