



PARTICIPATORY OF CO-LIVING

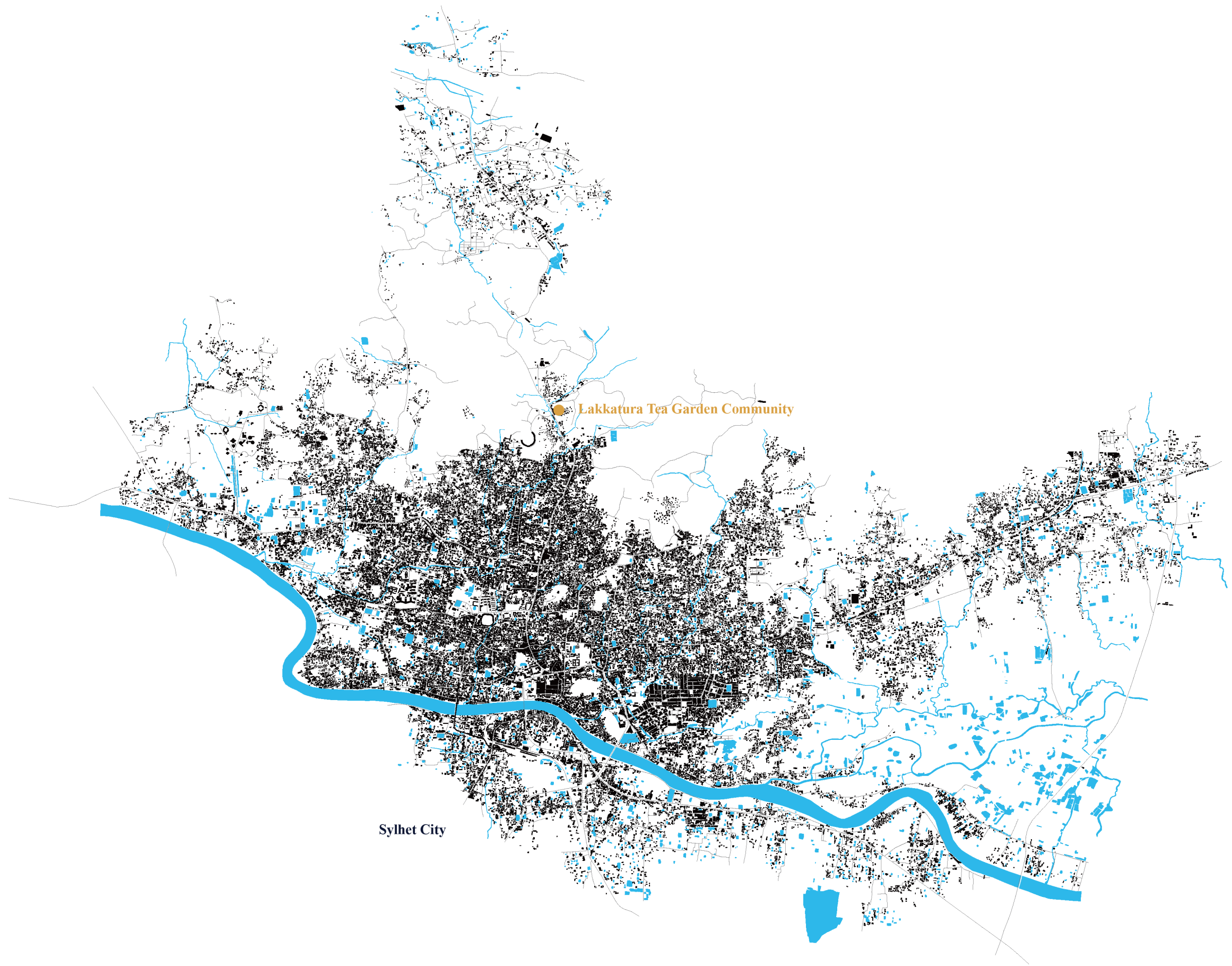
TU Delft

[An elderly-friendly affordable housing system for Lakkatura]

Lakkatura, Sylhet, Bangladesh

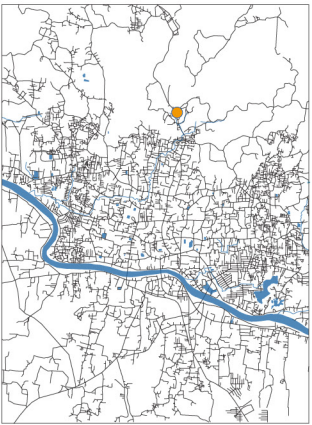
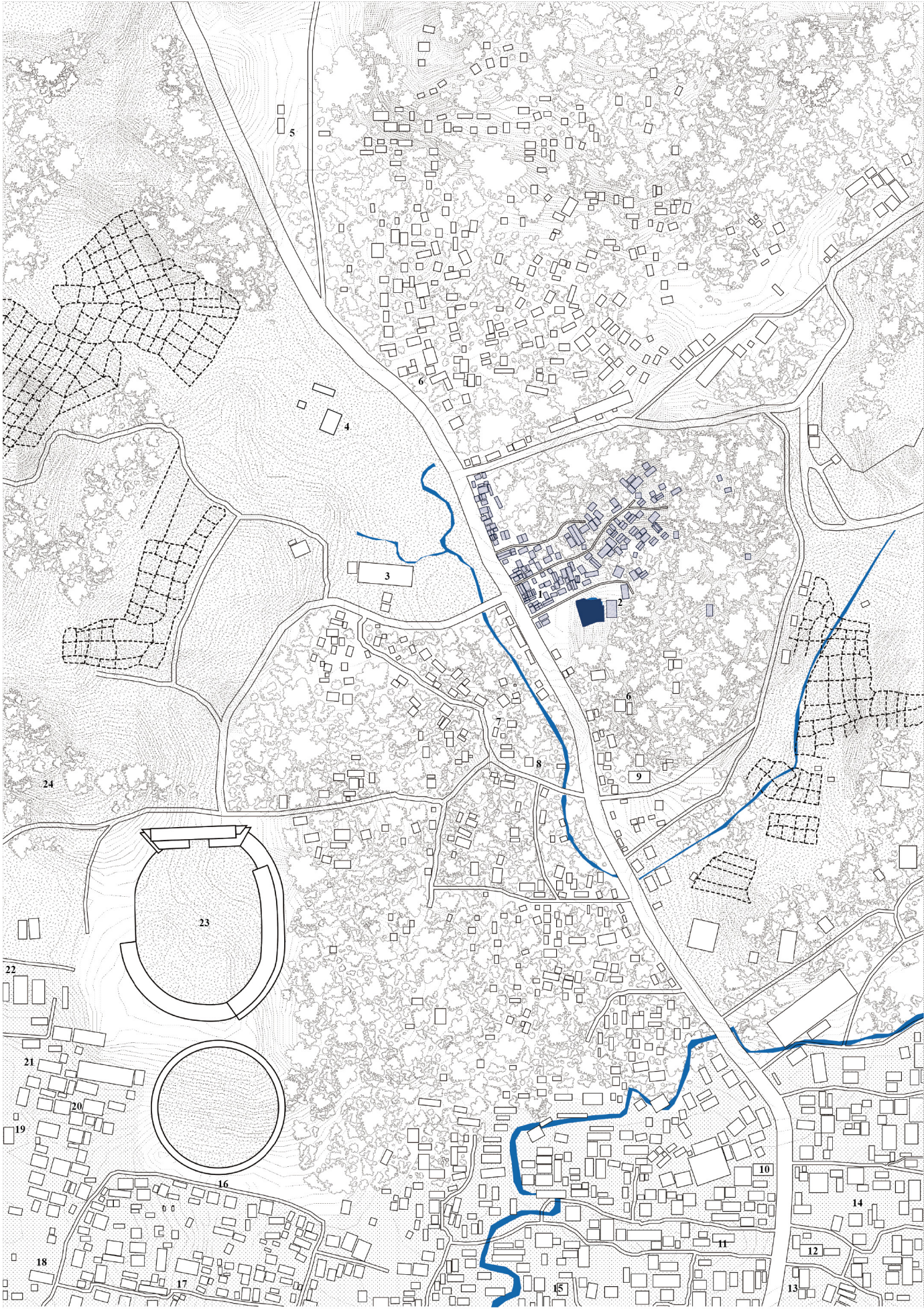
Lanxin He

5807891



0 0.35 0.7 1.4 2.1 2.8 Kilometers

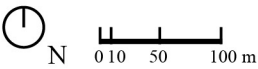
SITE LOCATION



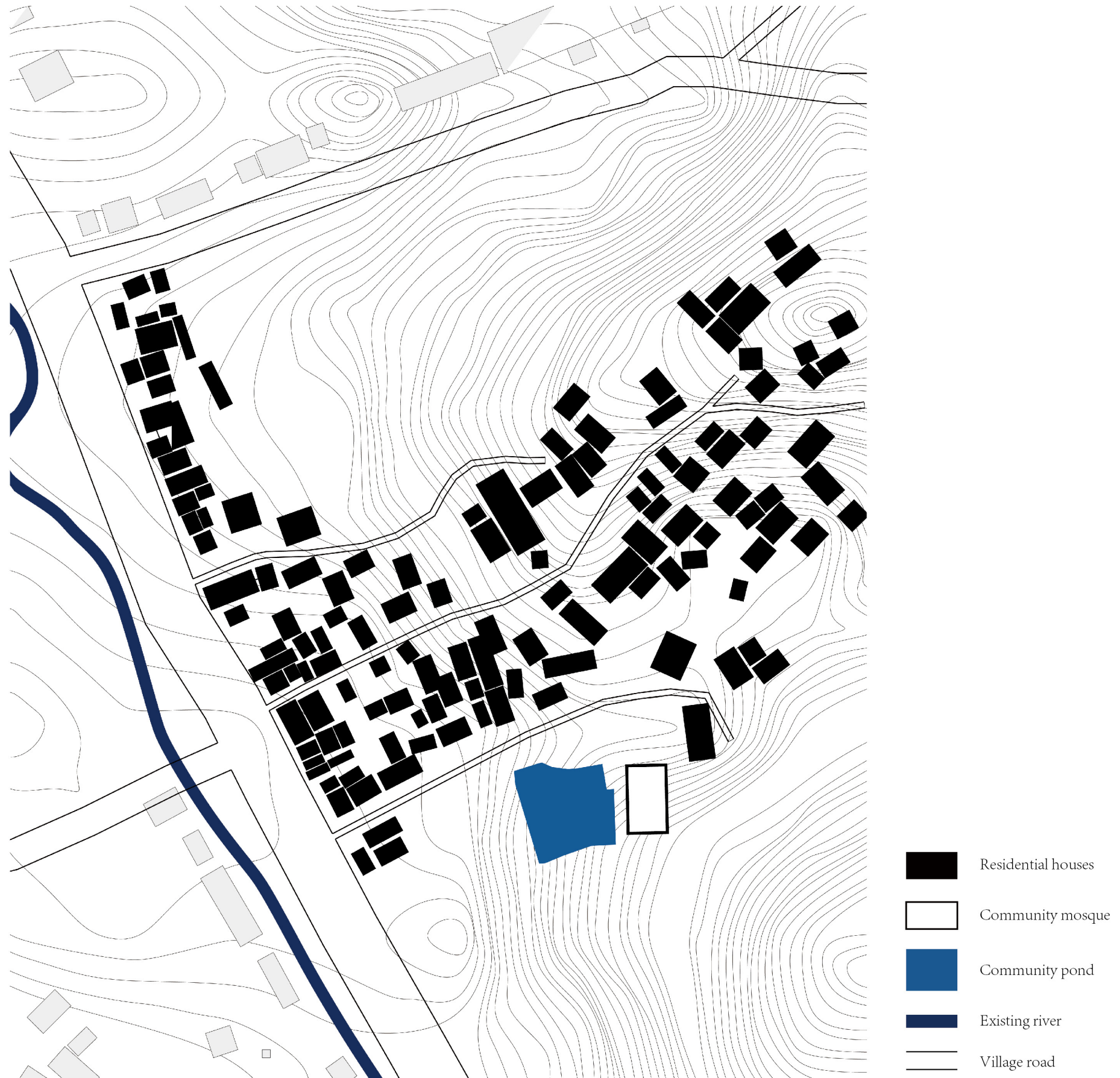
Lakkatura Tea Garden Community, Sylhet

- 1 Lakkatura Tea Garden Community
- 2 Lakkatura Muslim Moholla Jame Mosque
- 3 Sylhet Govt High School
- 4 Substation CEEC
- 5 Malinicherra Jame Mosque
- 6 Hindu temple
- 7 Lakkatura Tea Garden Health Center
- 8 Lakkatura Mosque
- 9 Lakkatura Primary School
- 10 Chowkidekhi Mosque
- 11 Syed Nasir Uddin Mosque
- 12 Al-Ansar Arbic & Bangla Teaching School
- 13 Mazar Gate
- 14 Pre-Cadet Academy
- 15 Syed Nasir Uddin School and College
- 16 Showpanloy
- 17 Badambagicha Jame Mosque
- 18 North Primahalla Jame Mosque
- 19 Syloti Language Center
- 20 Jamiatul Abrar
- 21 Bengali Language Center
- 22 Gous Uddin Government Primary School
- 23 Sylhet International Cricket Stadium
- 24 Lakkatura Tea Garden Mountain

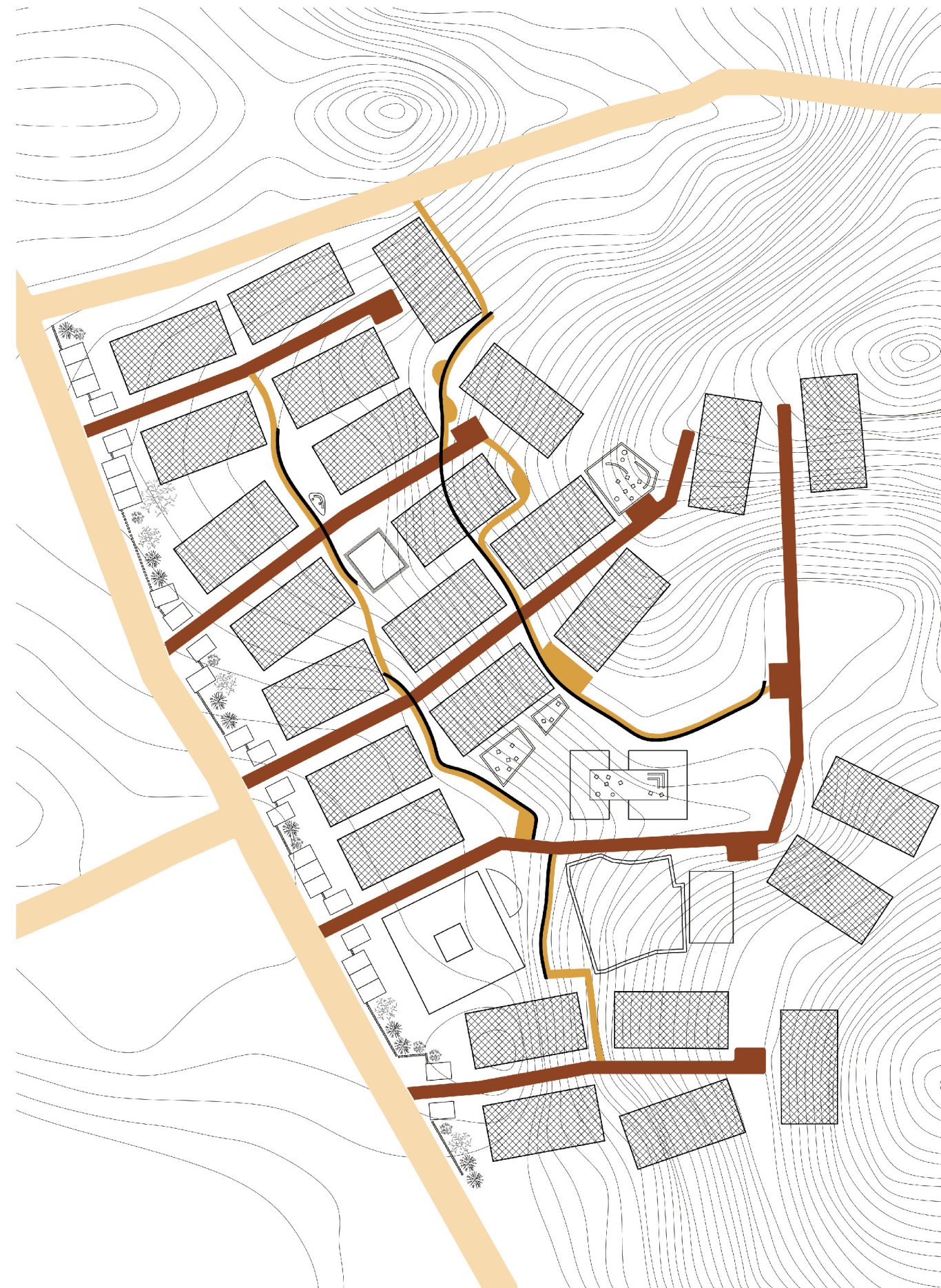
- Houses in Lakkatura Tea Garden Community
- Pond
- Stream
- Residential Houses
- Tree
- Farmland
- Road
- City Area
- Mountain Area
- Tea Garden
- Typology: Contour Line



SITE OVERVIEW

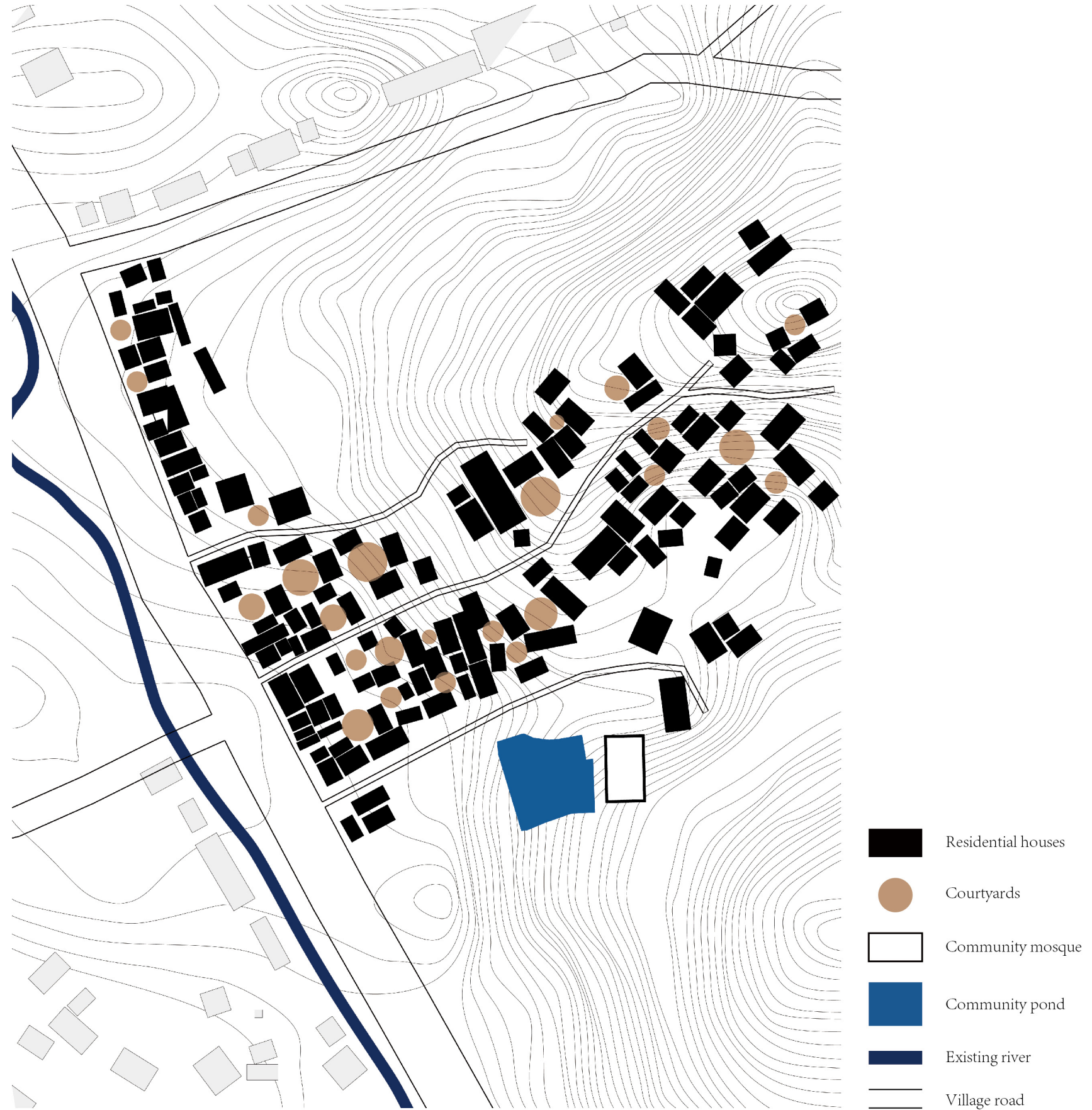


EXISTING COMMUNITY TYPOLOGY



- Village road
- Community internal road
- Community pavement
- Contour lines
- Pavement topography
- Dwelling cluster
- Area for Amenities

COMMUNITY CIRCULATION PROPOSAL



EXISTING COMMUNITY TYPOLOGY

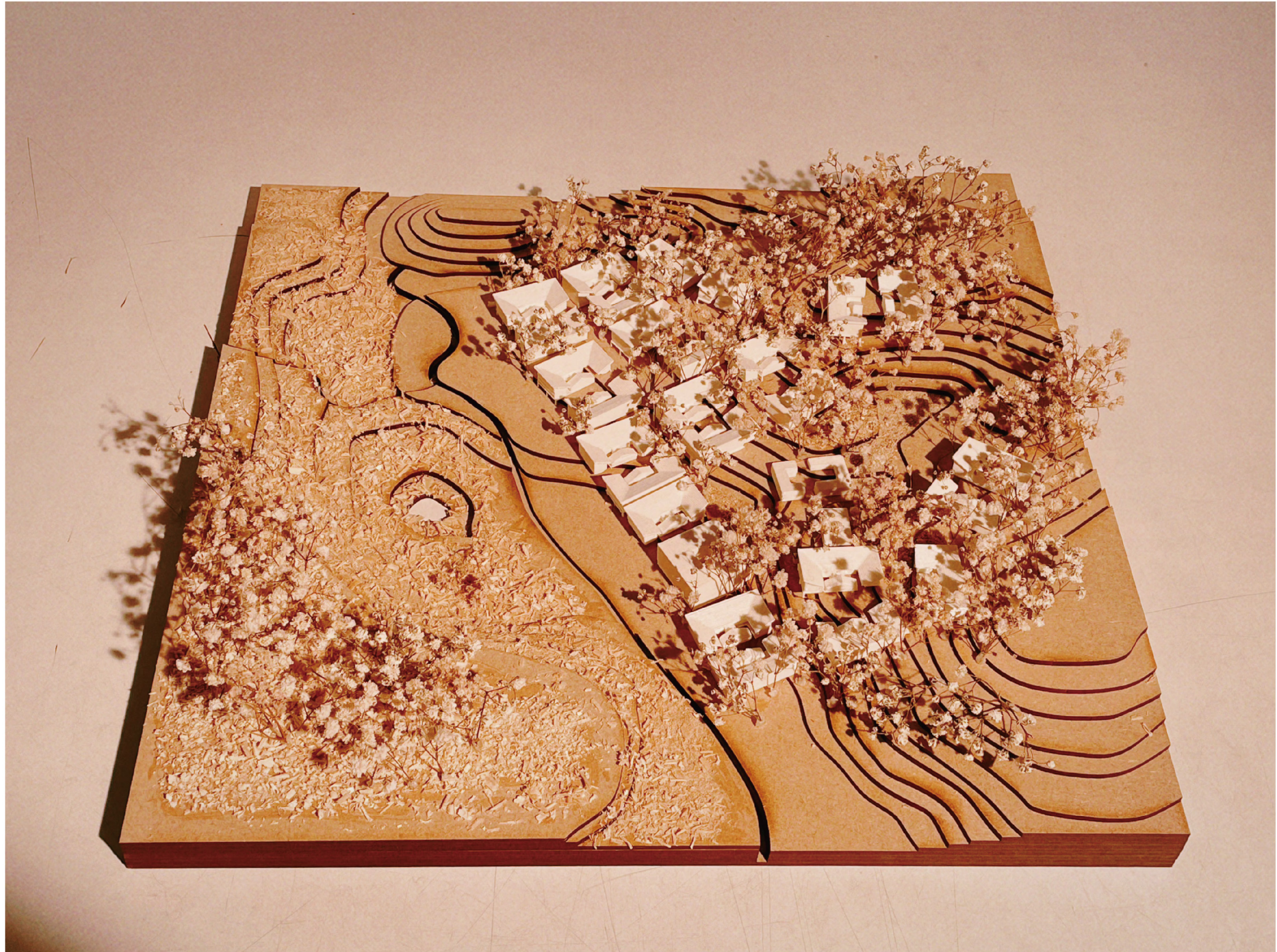
- Cluster
- Area for amenities
- Commercial area along the road
- Contour lines
- River
- Circulation road and pavement
- Community pond

I have followed the original road layout of the community, adding parallel roads along the contour lines. Smaller roads connect the area and follow the natural contours to make walking easier for pedestrians. I've also expanded the original community hub around the mosque to strengthen its role as a central gathering point.

Additionally, because the existing houses are mainly courtyard-style, I have continued this tradition in my design. The housing clusters are arranged in a U-shape with central courtyards to support community interaction and gathering.

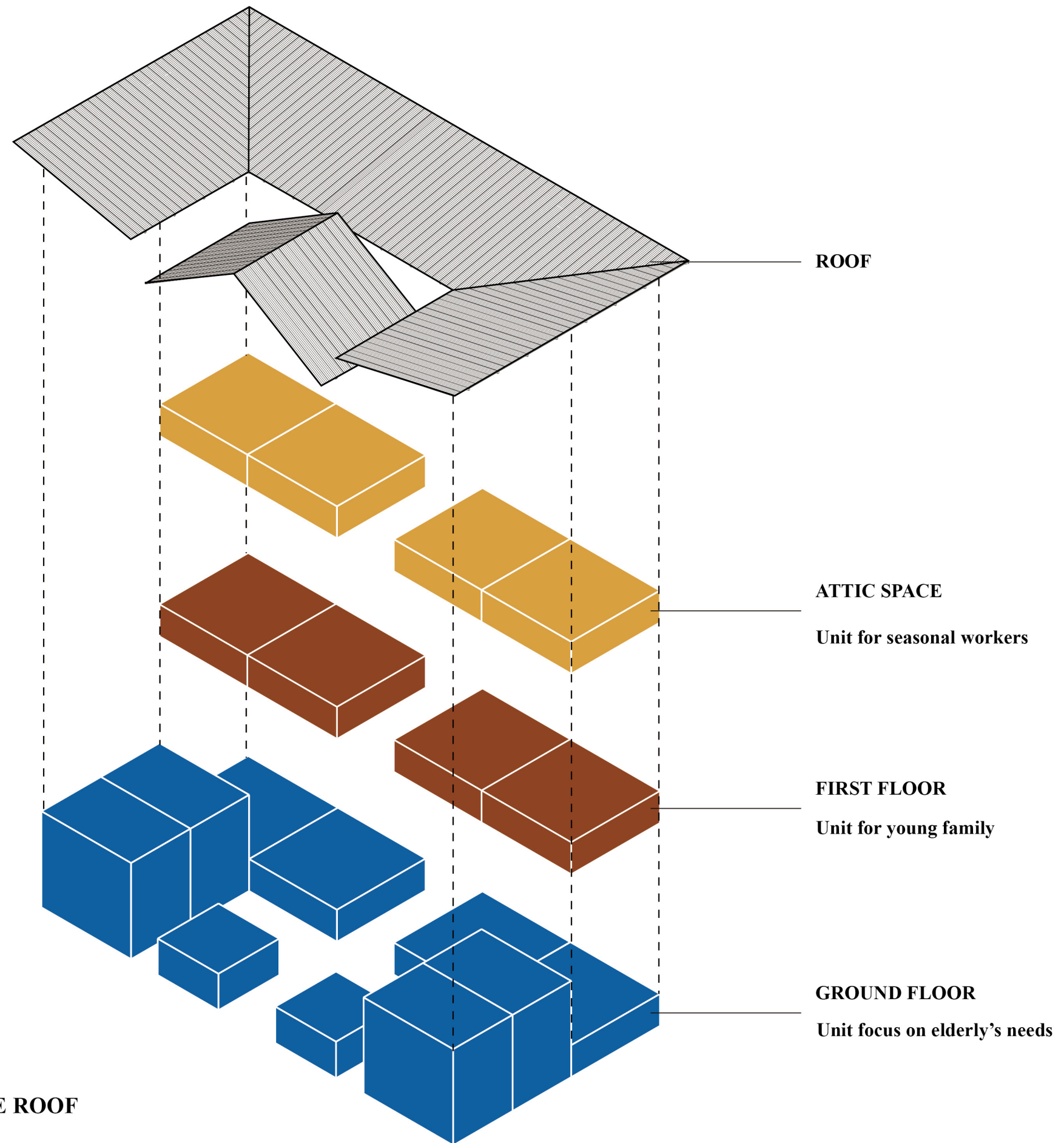
HYPOTHESIS



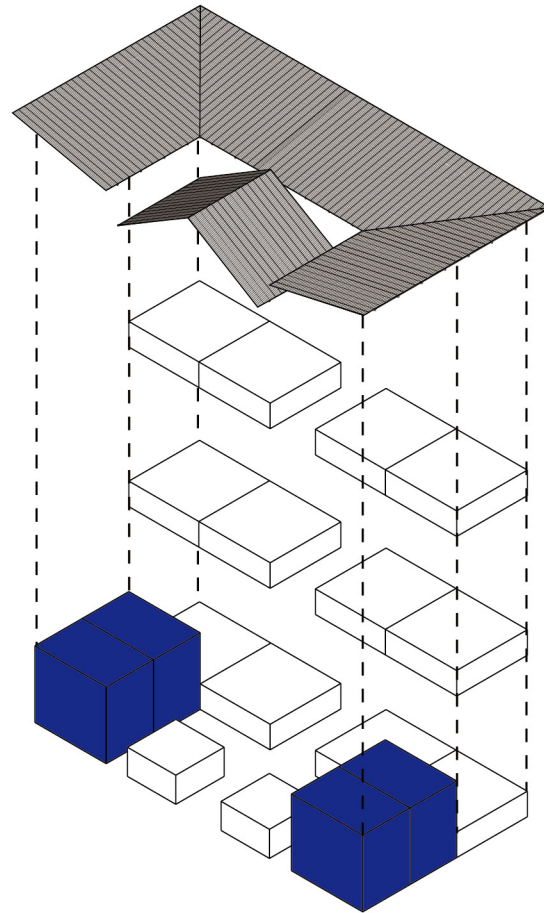


SITE MODEL WITH PLANNING





UNIT ASSEMBLY - LIVE UNDER THE SAME ROOF



Housing unit 1:

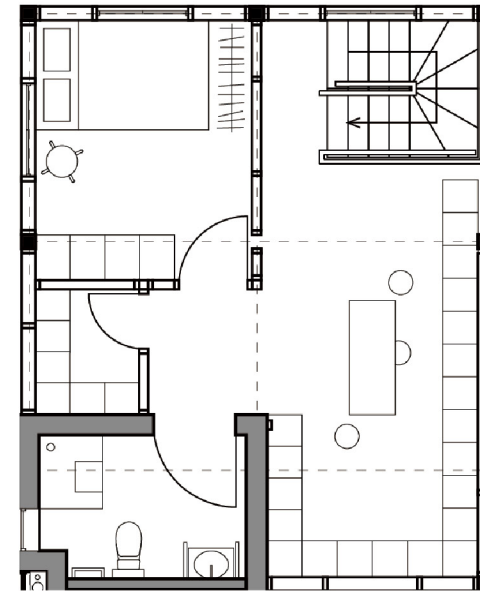
Three-floor unit with 4 bedrooms

Target: Big family with different generations

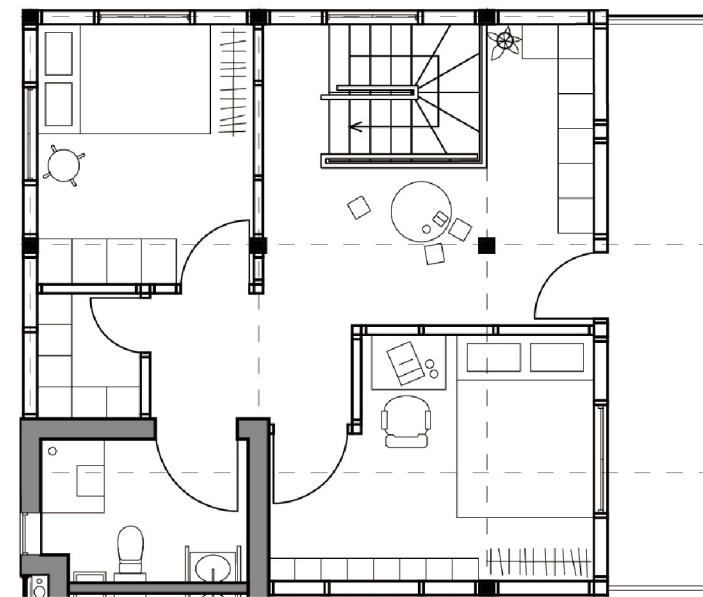
Area: 100 m²

Residents: Maximum 8 people
12.5 m² per person

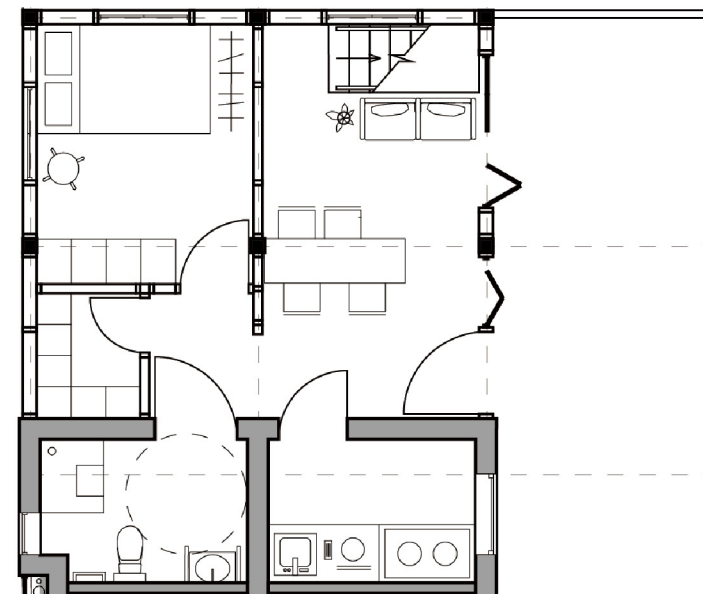
Elderly facilities: Accessible toilet
Elderly room on the ground floor



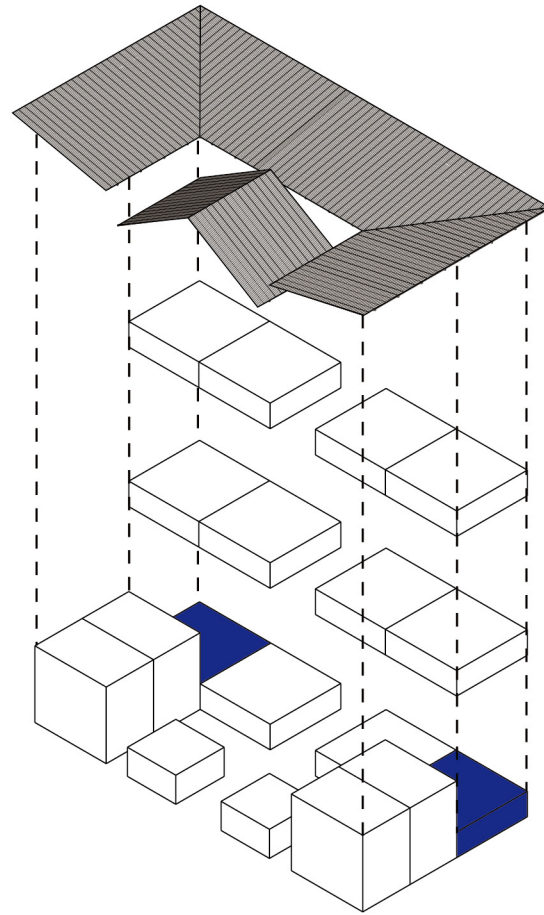
Attic space plan



First floor plan



Ground floor plan



Housing unit 2:

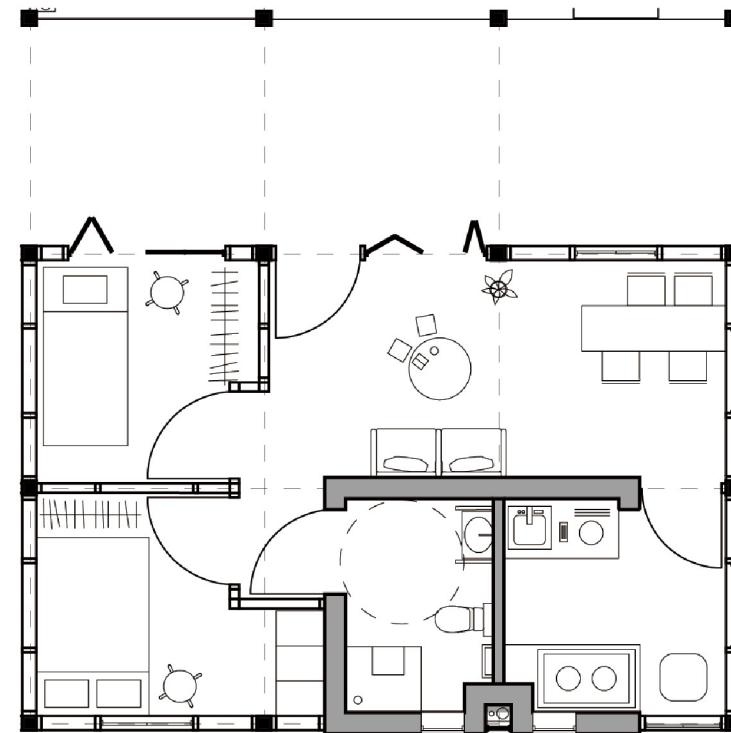
One-floor unit with 2 bedrooms

Target: Family with different generations

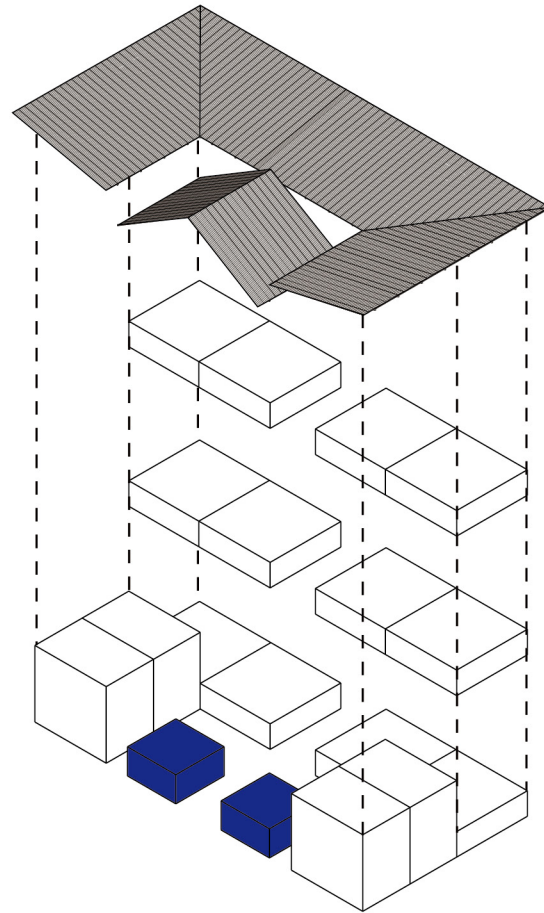
Area: 37.5 m²

Residents: Maximun 4 people
9.375 m² per person

Elderly facilities: Accessible toilet
Better to be located on the ground floor



Ground floor plan



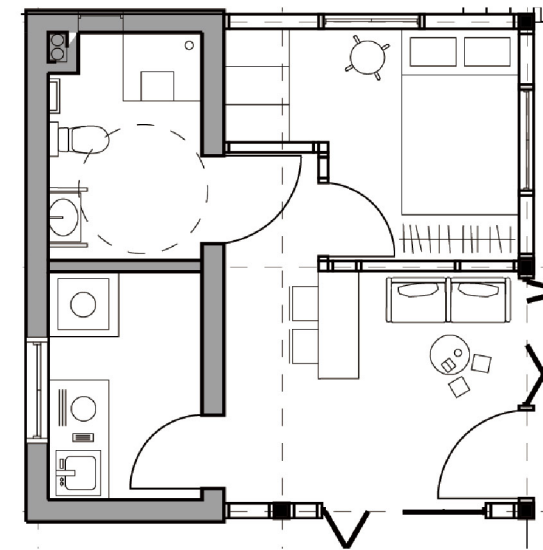
Housing unit 3:

One-floor unit specially for single elderly/elderly with special needs

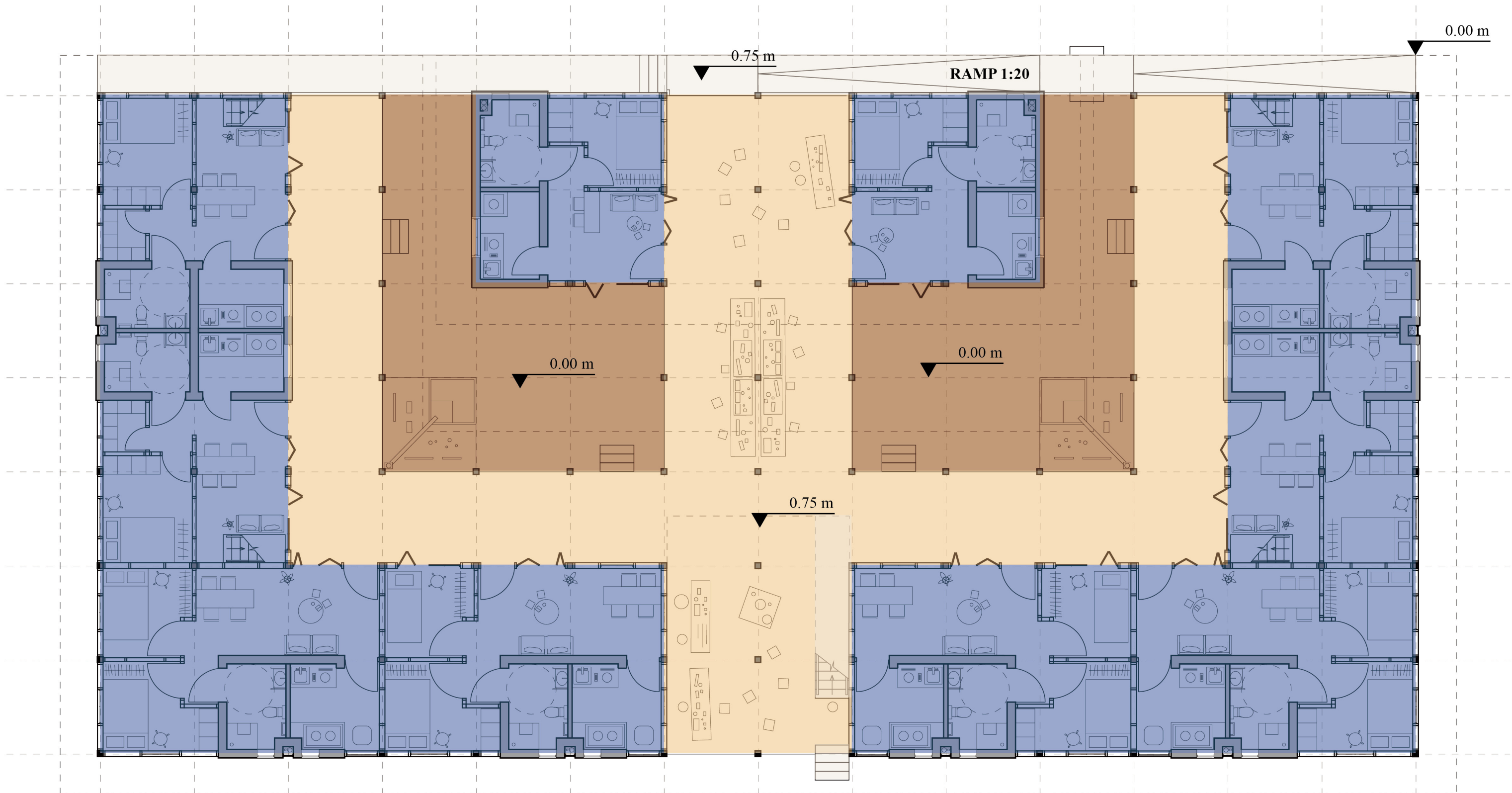
Area: 25 m²

Residents: Maximum 2 people
12.5 m² per person

Elderly facilities: Accessible toilet
Located on the ground, independent unit



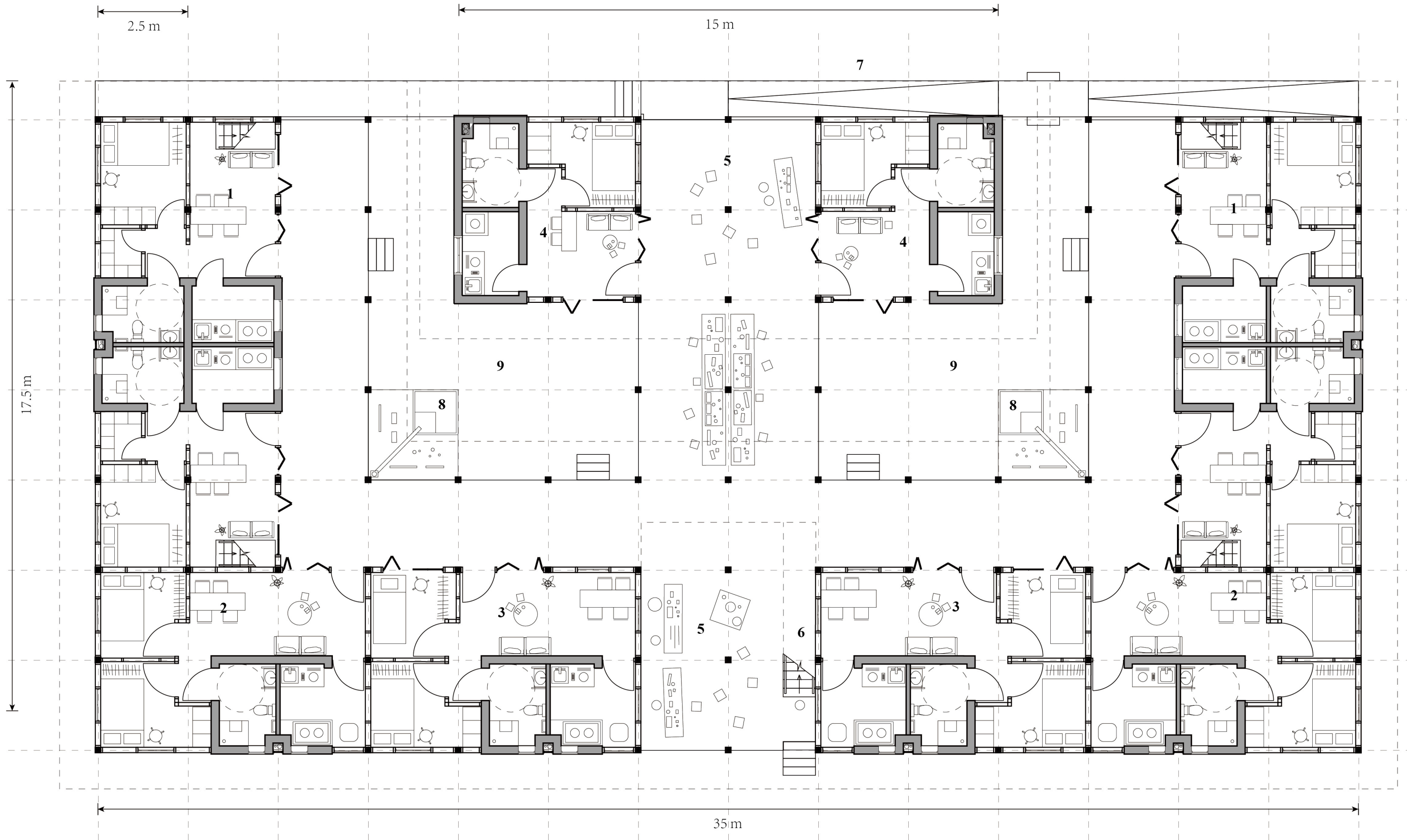
Ground floor plan



- Common space
- Living space
- Household space
- Circulation space

GROUND FLOOR PLAN
1:100

Number of unit: 12 family unit + 2 elderly unit + 8 worker unit per cluster
 Number of people: Maximum 84 people
 Residential area: 512.5 m² for ground floor area;
 1212.5 m² floor area
 Common area: 237.5 m²

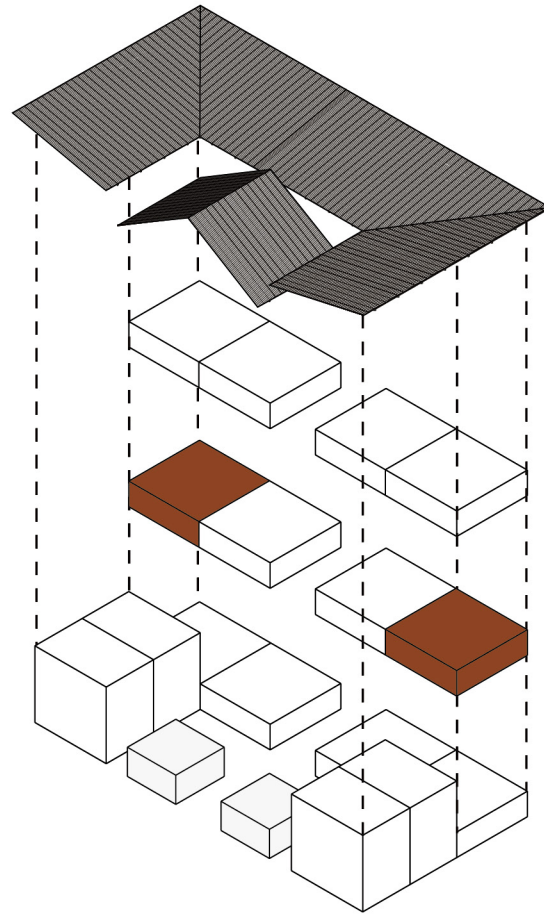


- 1 UNIT 1
- 2 UNIT 2
- 3 UNIT 3
- 4 ELDERLY UNIT
- 5 COMMON SPACE
- 6 PUBLIC STAIRCASE
- 7 RAMP FOR WHEELCHAIR
- 8 WATER TANK & CLUSTER LAUDARY
- 9 SHARED HOUSEHOLD SPACE

GROUND FLOOR PLAN

1:100

Number of unit: 12 family unit + 2 elderly unit + 8 worker unit per cluster
 Number of people: Maximum 84 people
 Residential area: 512.5 m² for ground floor area;
 1212.5 m² floor area
 Common area: 237.5 m²



Housing unit 4:

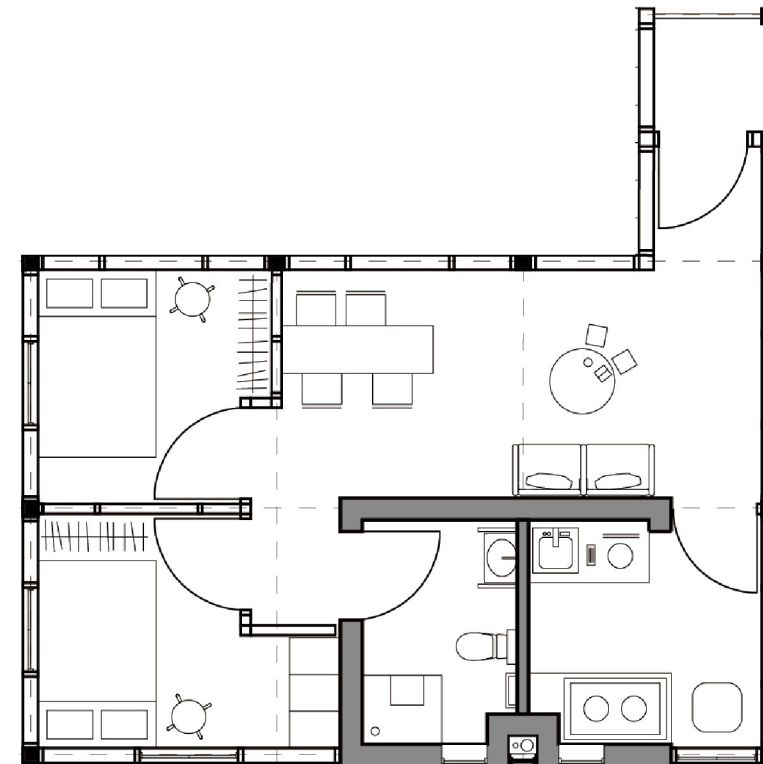
One-floor unit with 2 bedrooms

Target: Young family

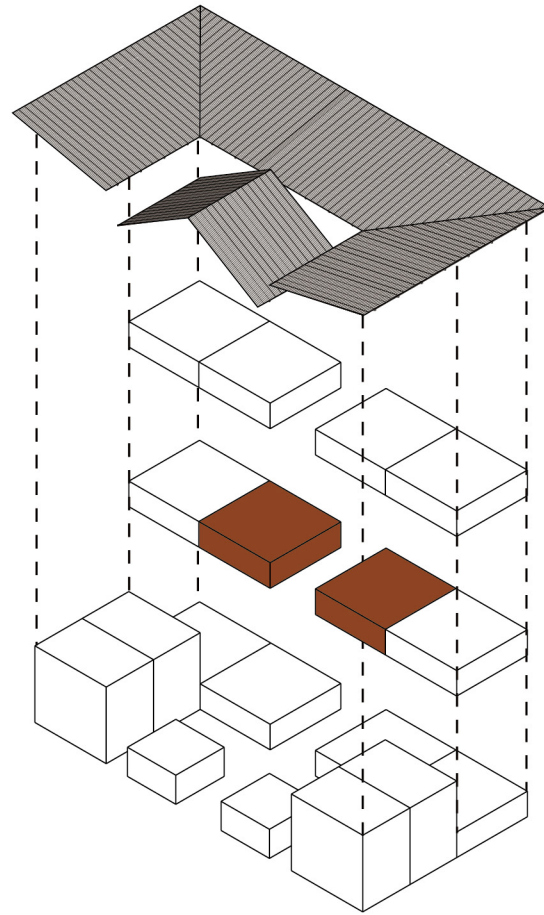
Area: 40.625 m²

Residents: Maximum 4 people
10.15 m² per person

Younger generation' family can be located on the upper floors



First floor plan



Housing unit 5:

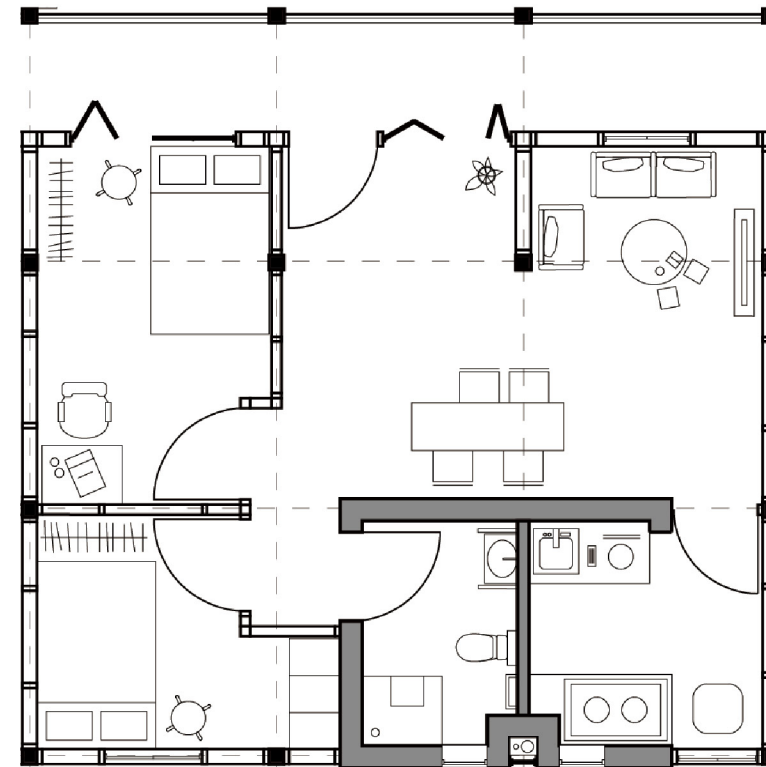
One-floor unit with 2 bedrooms

Target: Young family

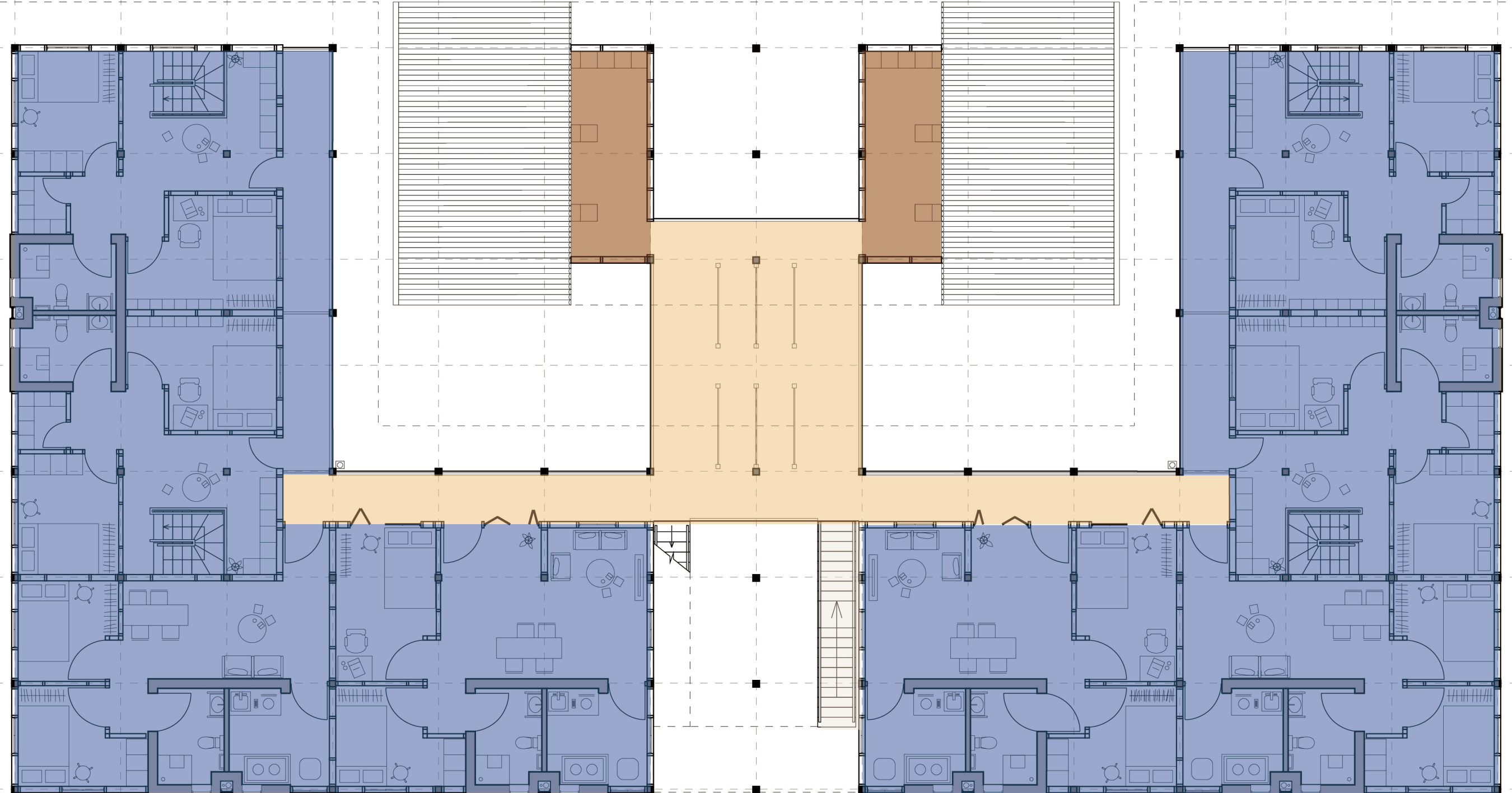
Area: 46.88 m²





Residents: Maximun 4 people
11.7 m² per person

Younger generation' family can be located on the upper floors



First floor plan

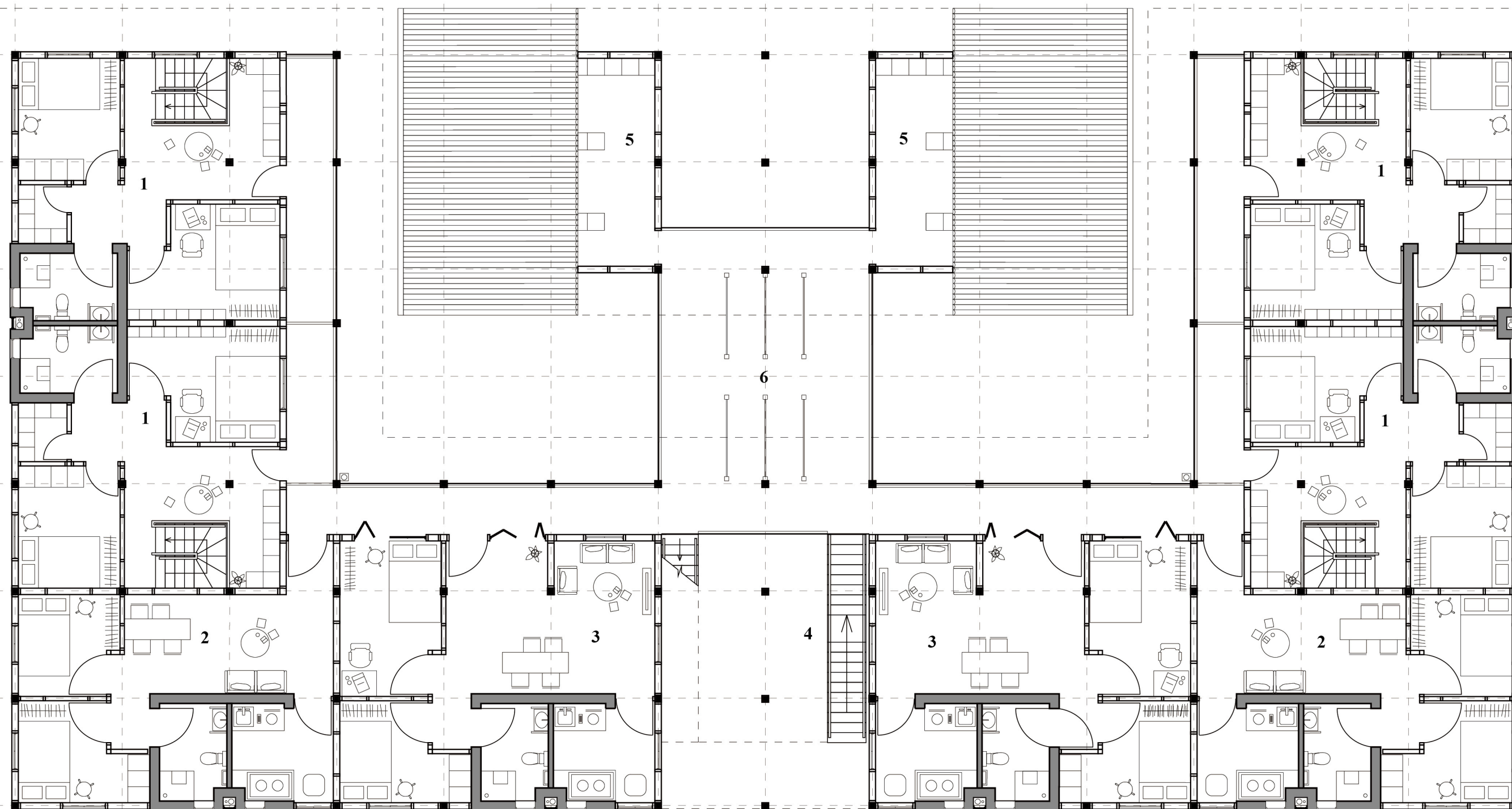


-  Common space
-  Living space
-  Storage space
-  Circulation space

FIRST FLOOR PLAN

1:100

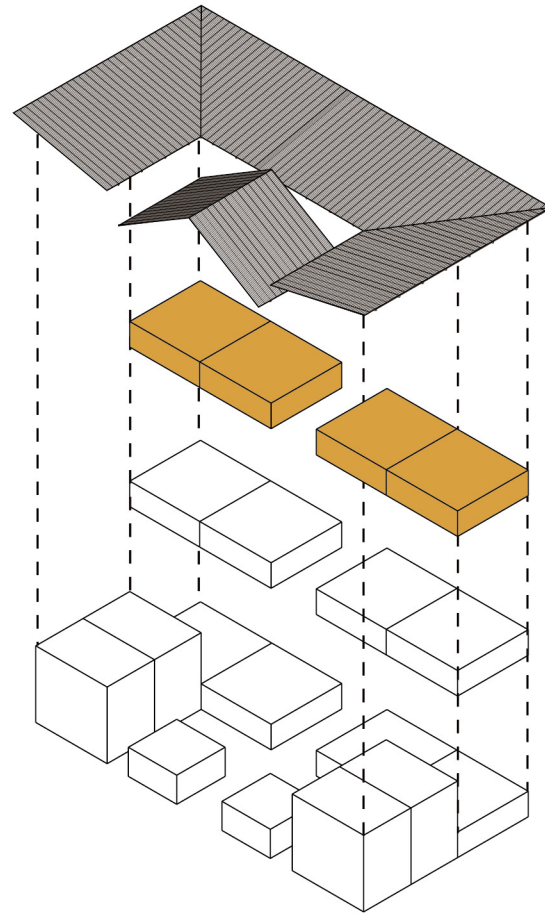
2.5 m



- 1 UNIT 1
- 2 UNIT 2
- 3 UNIT 3
- 4 PUBLIC STAIRCASE
- 5 STORAGE AREA
- 6 TERRACE

FIRST FLOOR PLAN

1:100



Housing unit 7:

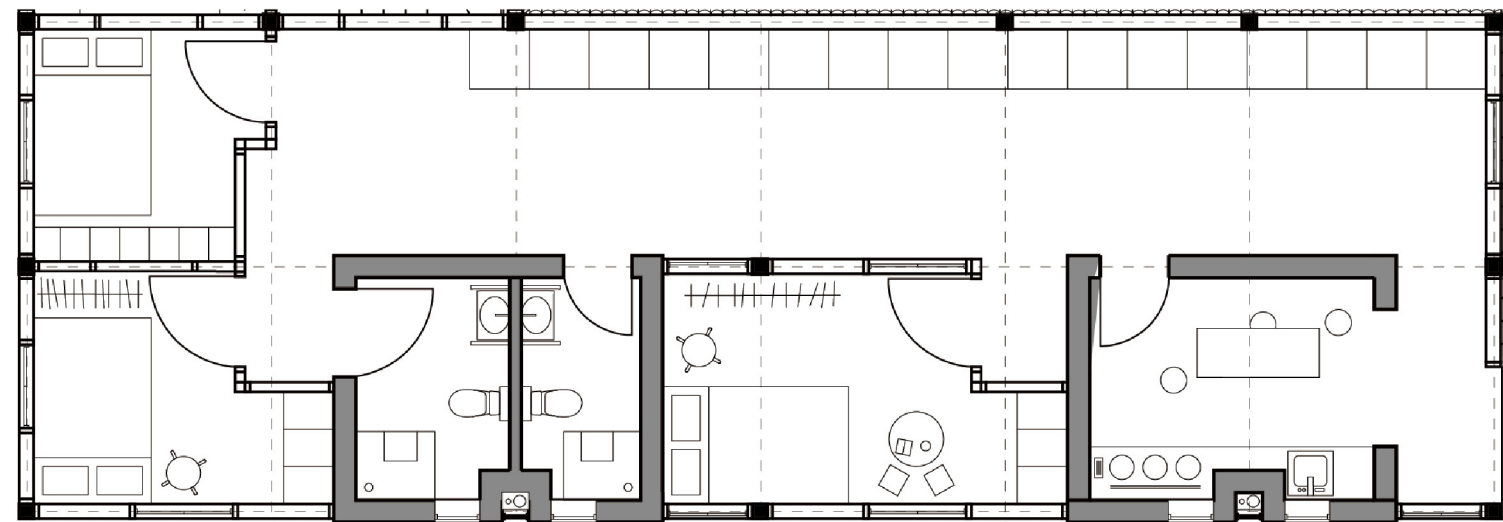
Individual room with shared facility space

Target: Seasonal workers

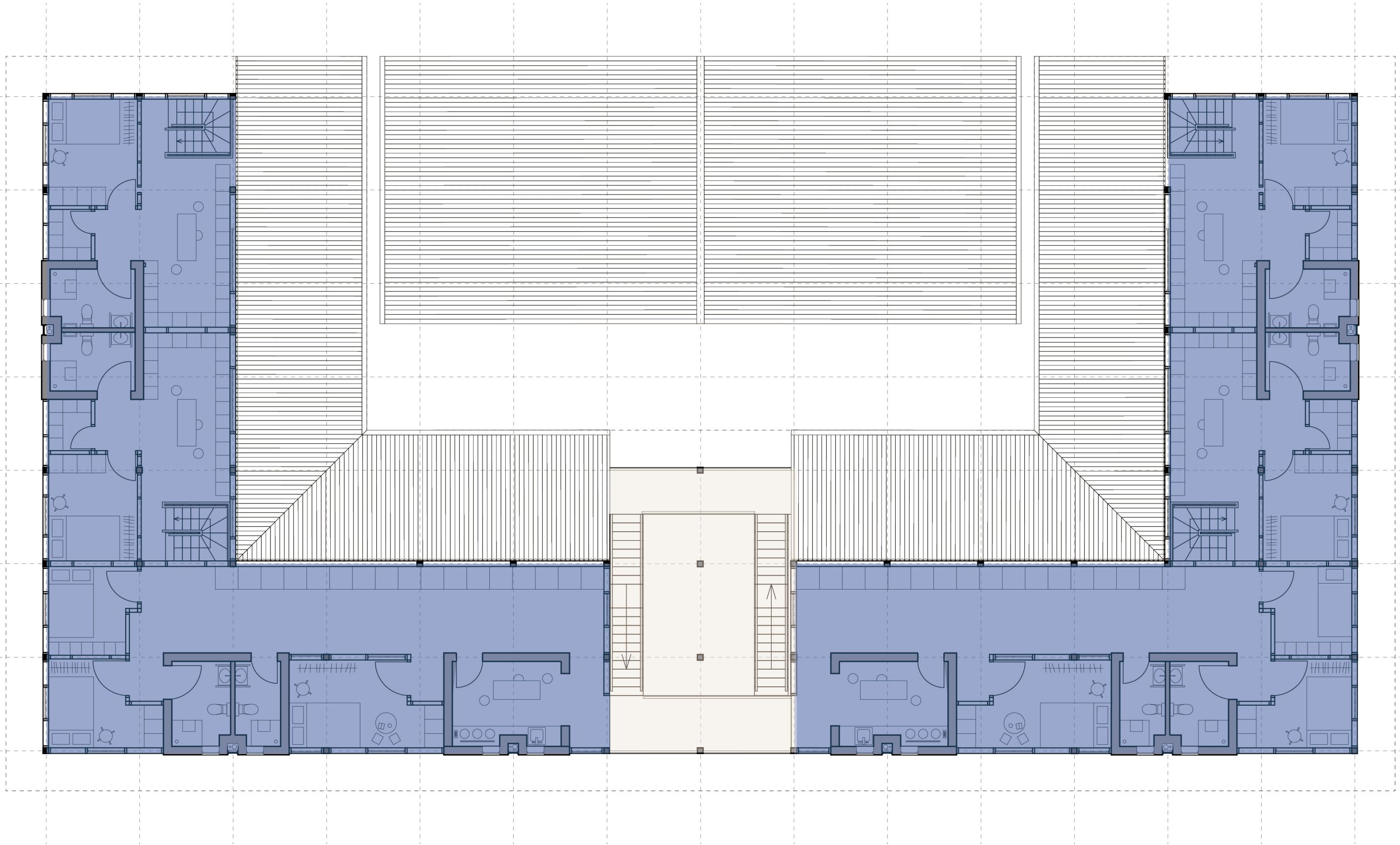
Area: 75 m²



Residents: Maximum 6 people
12.5 m² per person

Seasonal workers can be located on the attic space



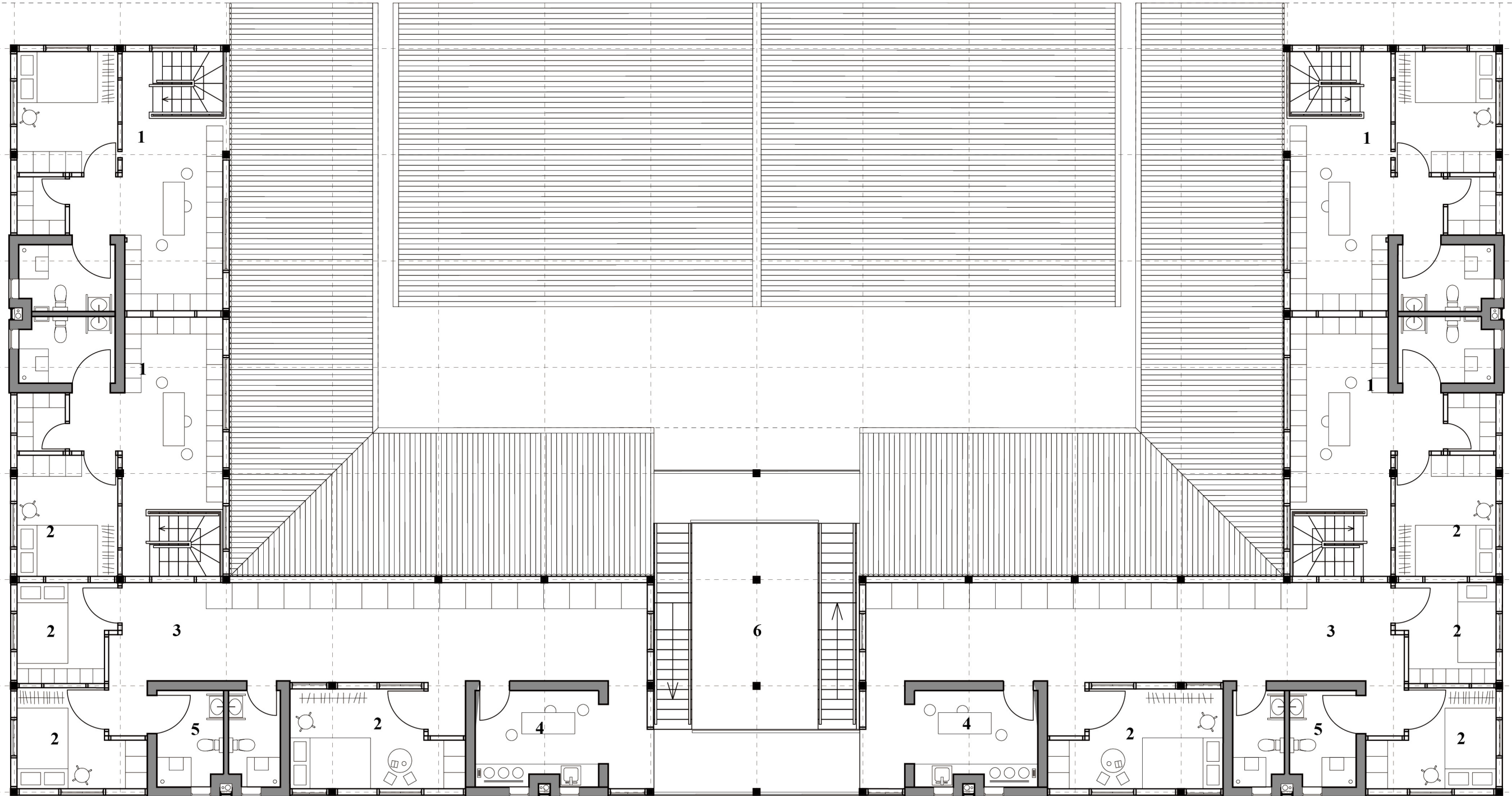
Attic space plan



-  Living space
-  Circulation space

ATTIC PLAN
1:100

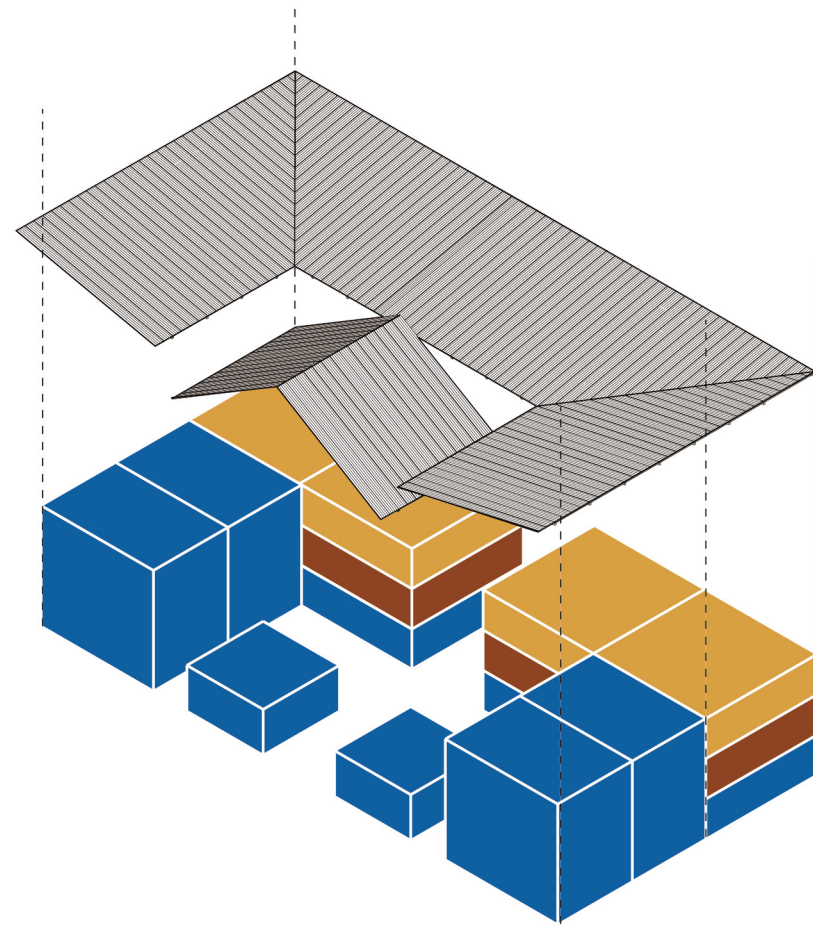
2.5 m



- 1 UNIT 1
- 2 WORKER UNIT
- 3 SHARED SPACE
- 4 SHARED KITCHEN
- 5 TOILET
- 6 PUBLIC STAIRCASE

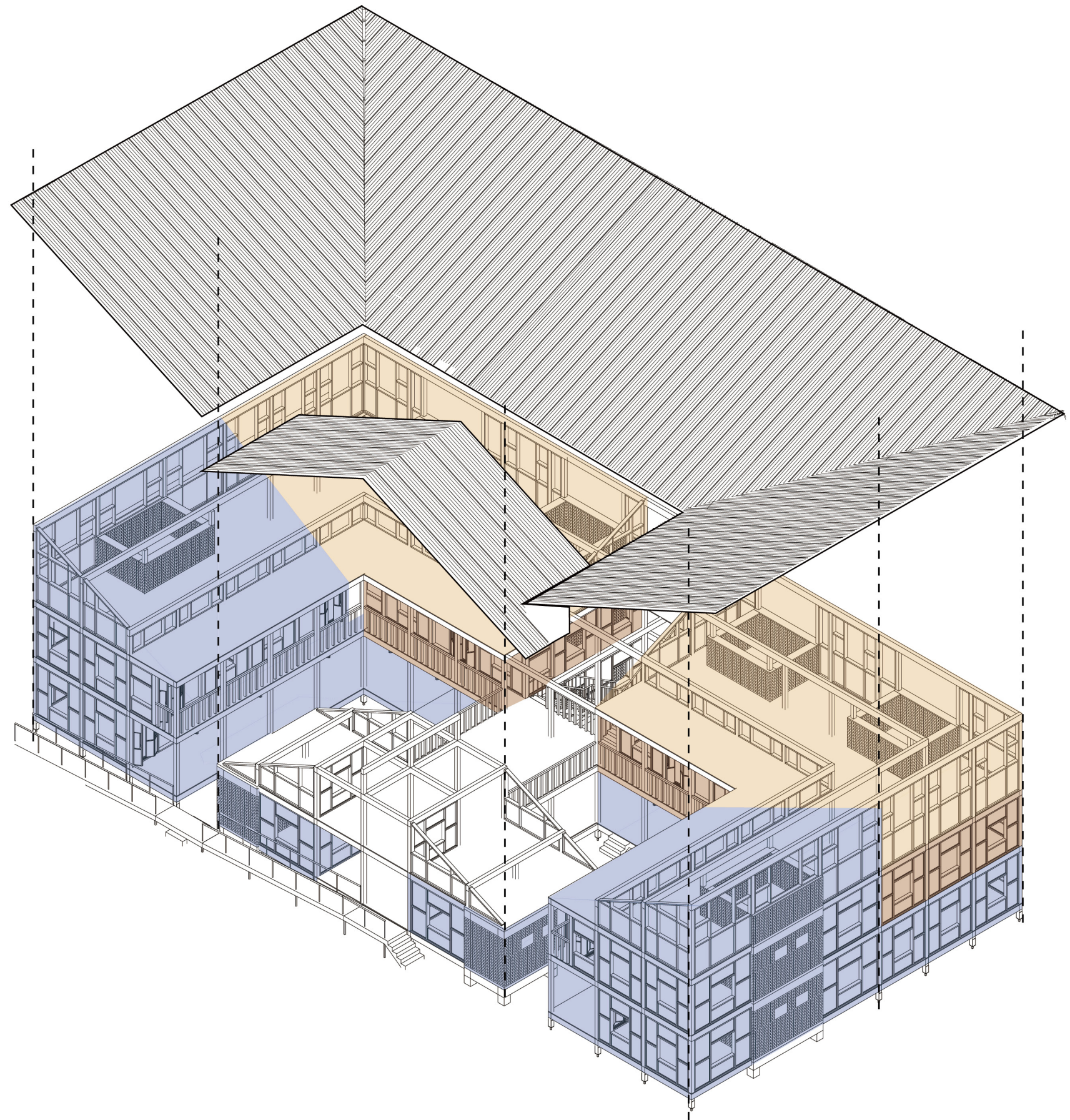
ATTIC PLAN

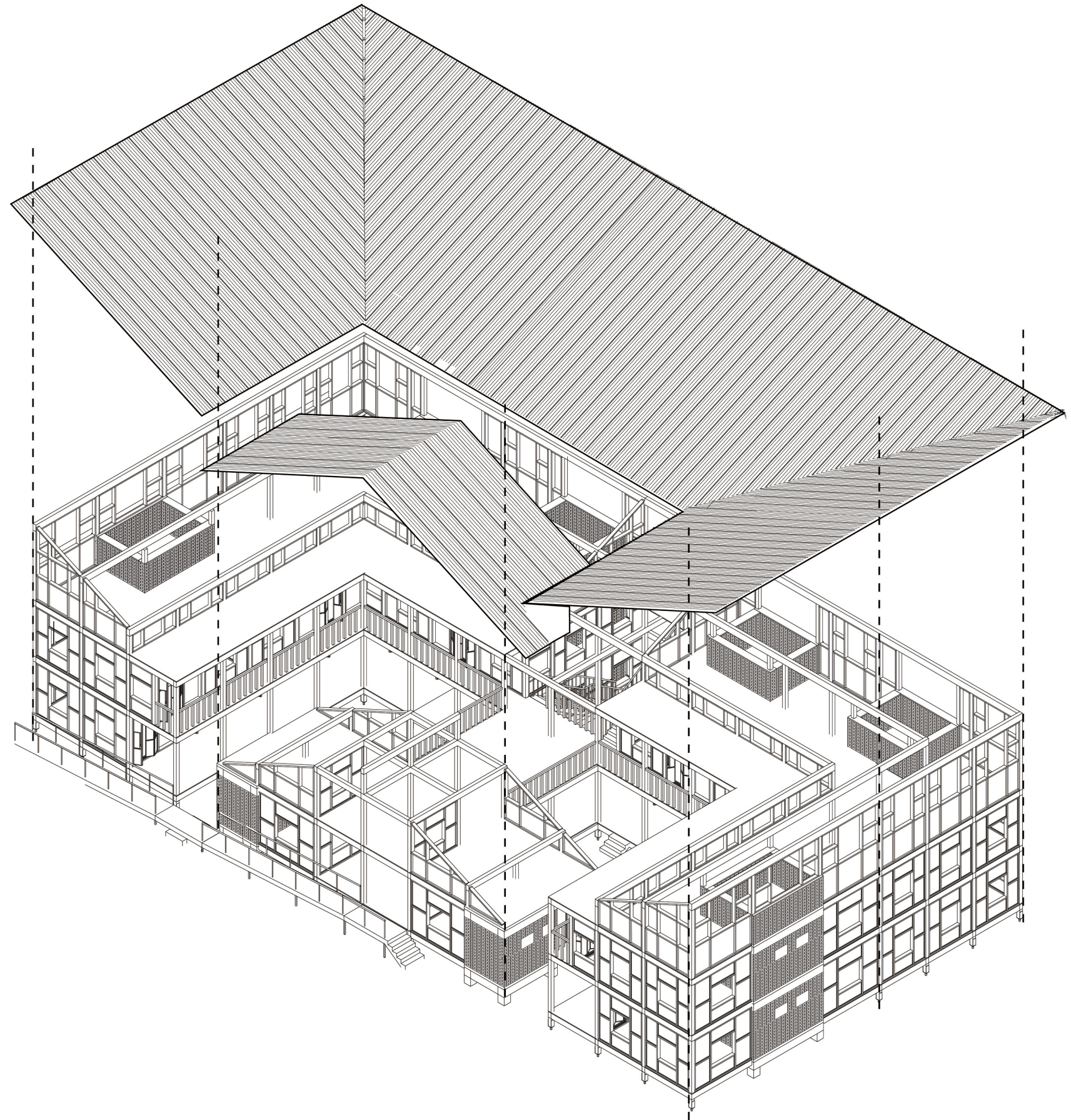
1:100



- Unit for seasonal workers
- Unit for young family
- Unit focus on elderly's needs

CLUSTER - LIVE UNDER THE SAME ROOF





Number of dwelling cluster: **26** in total;

12 family unit + **2** elderly unit + **8** worker unit per cluster

Number of different unit types: **6**

Average floorspace area: **1312.5 m2 floor area** per cluster;

237.5 m2 common area per cluster

Percent of dwelling space/cluster space: **84.7%**

CLUSTER - PROGRAMATIC DATA







GROUND FLOOR PLAN

1:210

Social-Spatial Data

Existing situation

Community area: 5.7 ha

Original residents: 124 family; 744 people
250 seasonal workers

Original density: 130.5 (residents/ha)
26.3 (units/ha)

Original FSI: 0.15
Original GSI: 0.15

New community planning

Community area: 5.7 ha

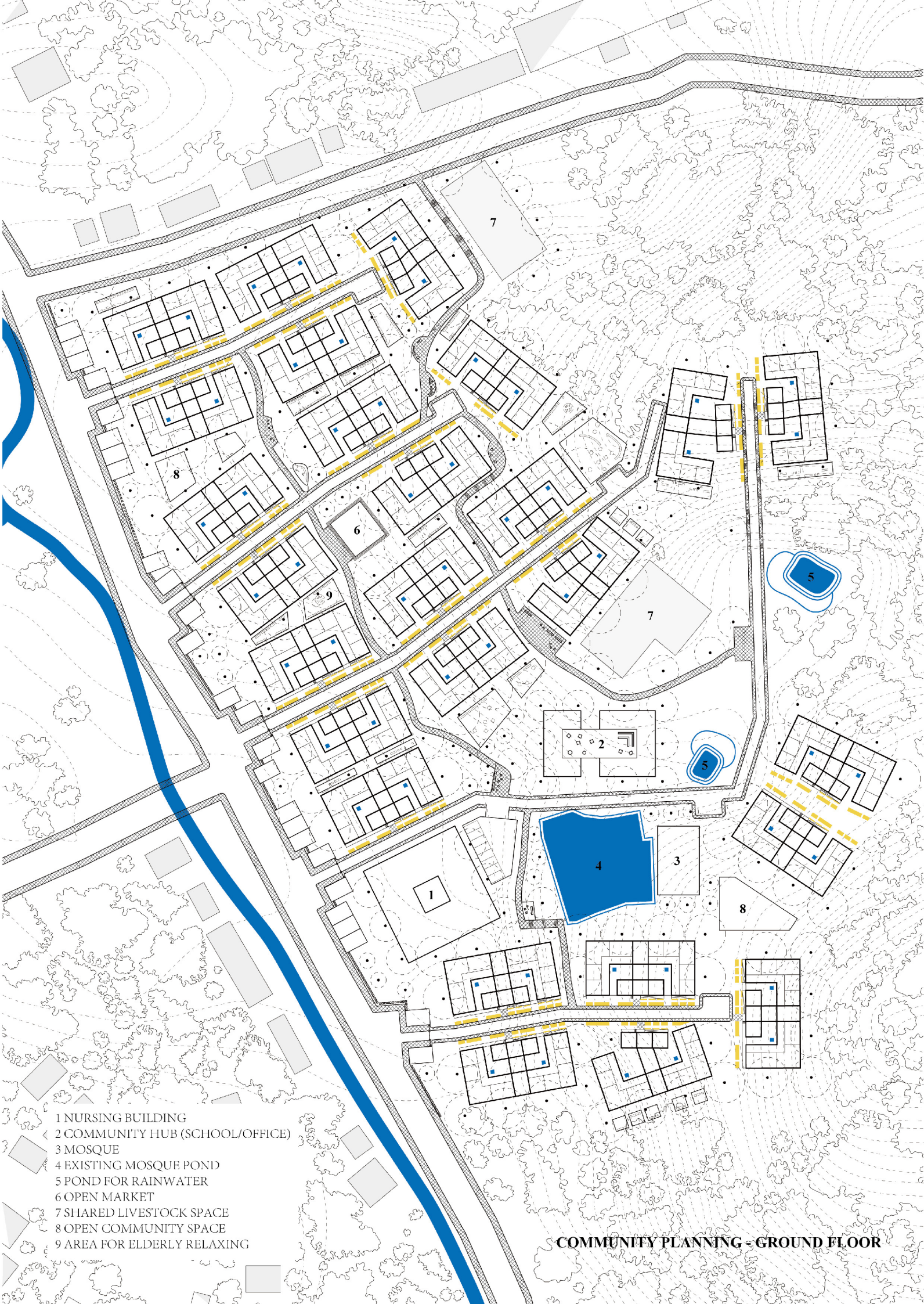
Residents: 364 families+416 workers; 3146 people
Including 104 single elderly people

Density: 551.92 (residents/ha)
100.35 (units/ha)

FSI: 0.6
GSI: 0.33

Area for Amenities: 11190.5 m2
Ratio of amenities/resident: 37.8 (m2/person)

Ratio of open space/resident: 16.36 (m2/person)





DEVELOPMENT PHASES



**PHASE 1:
TEMPORARY APARTMENT & COMMERICAL**

There will be a building functioning as a temporary apartment for residents in Lakkatura. During the construction period, people can move into the apartment for a transition. Commercial units along the community road will also be built in the first period.



**PHASE 2:
CLUSTERS ON FLAT LAND**

The construction of the whole community will be in several parts. Clusters locating near the road and relatively on flat land will be built first.



**PHASE 3:
CLUSTERS IN THE HILL**

The whole construction of new housing system.

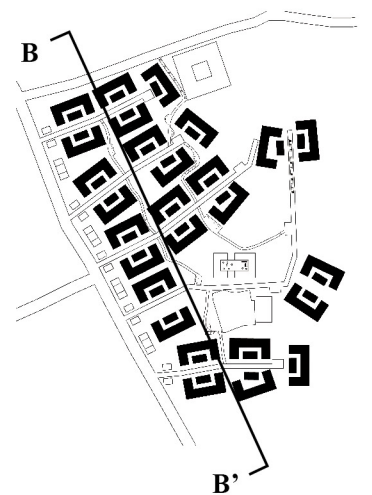


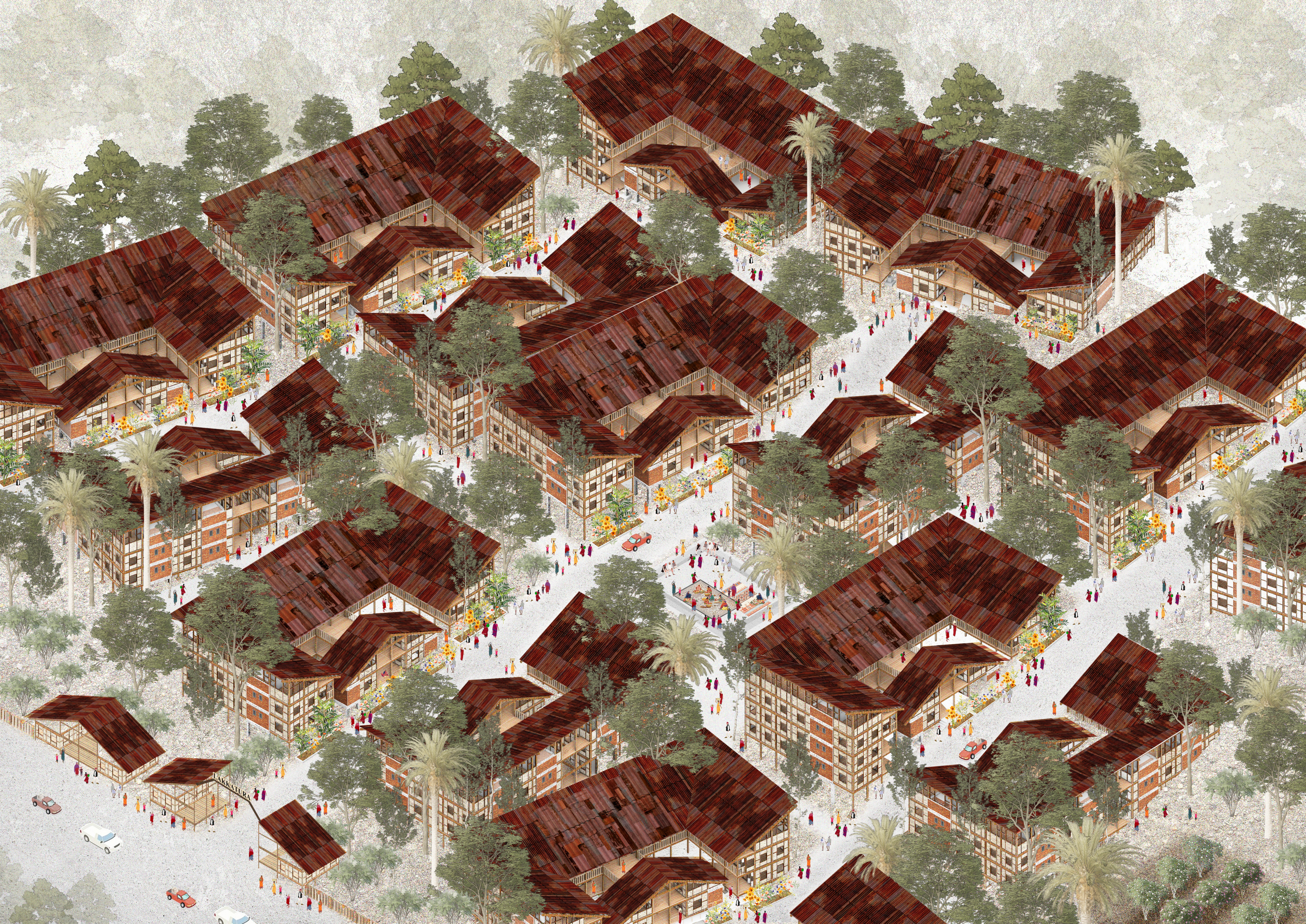
**PHASE 4:
NURSING & COMMUNITY HUB**

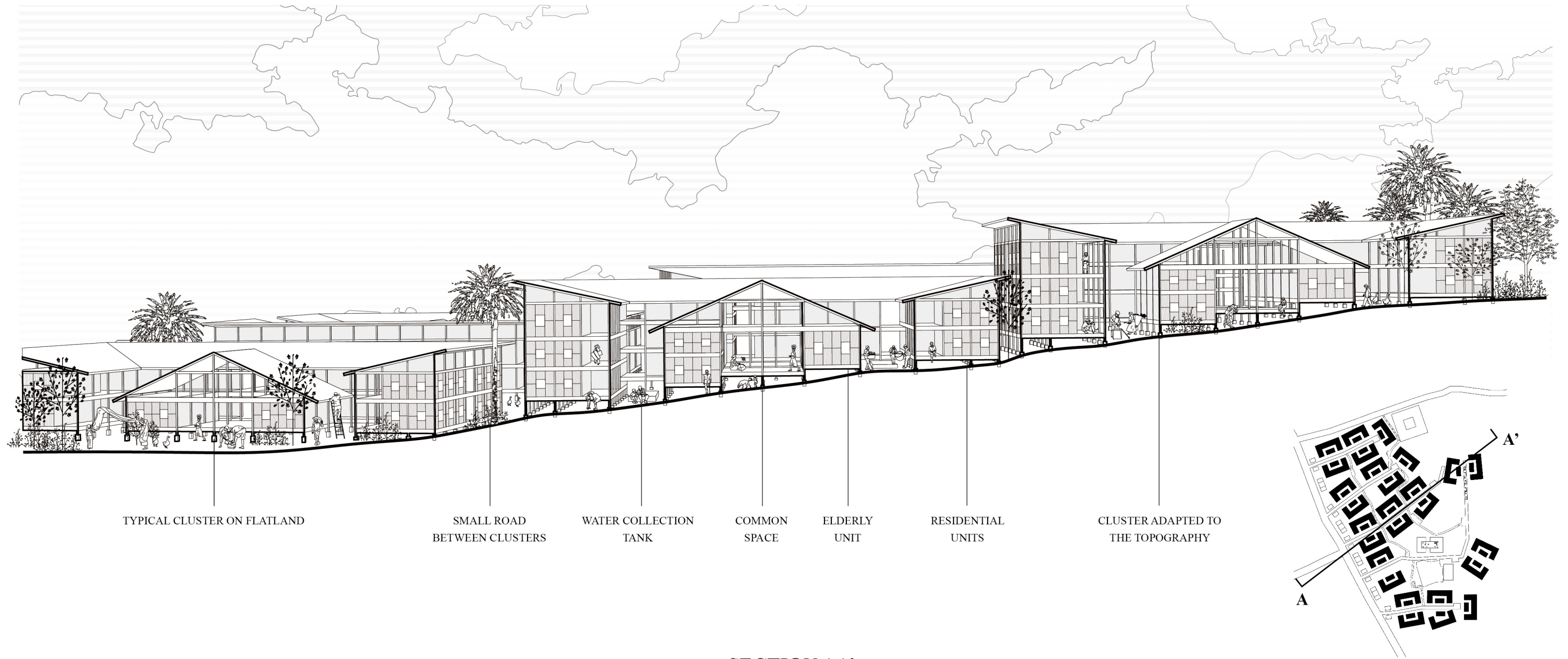
After the construction of housing clusters, the temporary apartment will be changed into a nursing building for those dependent elderly people. There will be medical care service especially for them. One community hub will be built next to the mosque, also functioning as additional housing area for seasonal workers during tea harvest time.



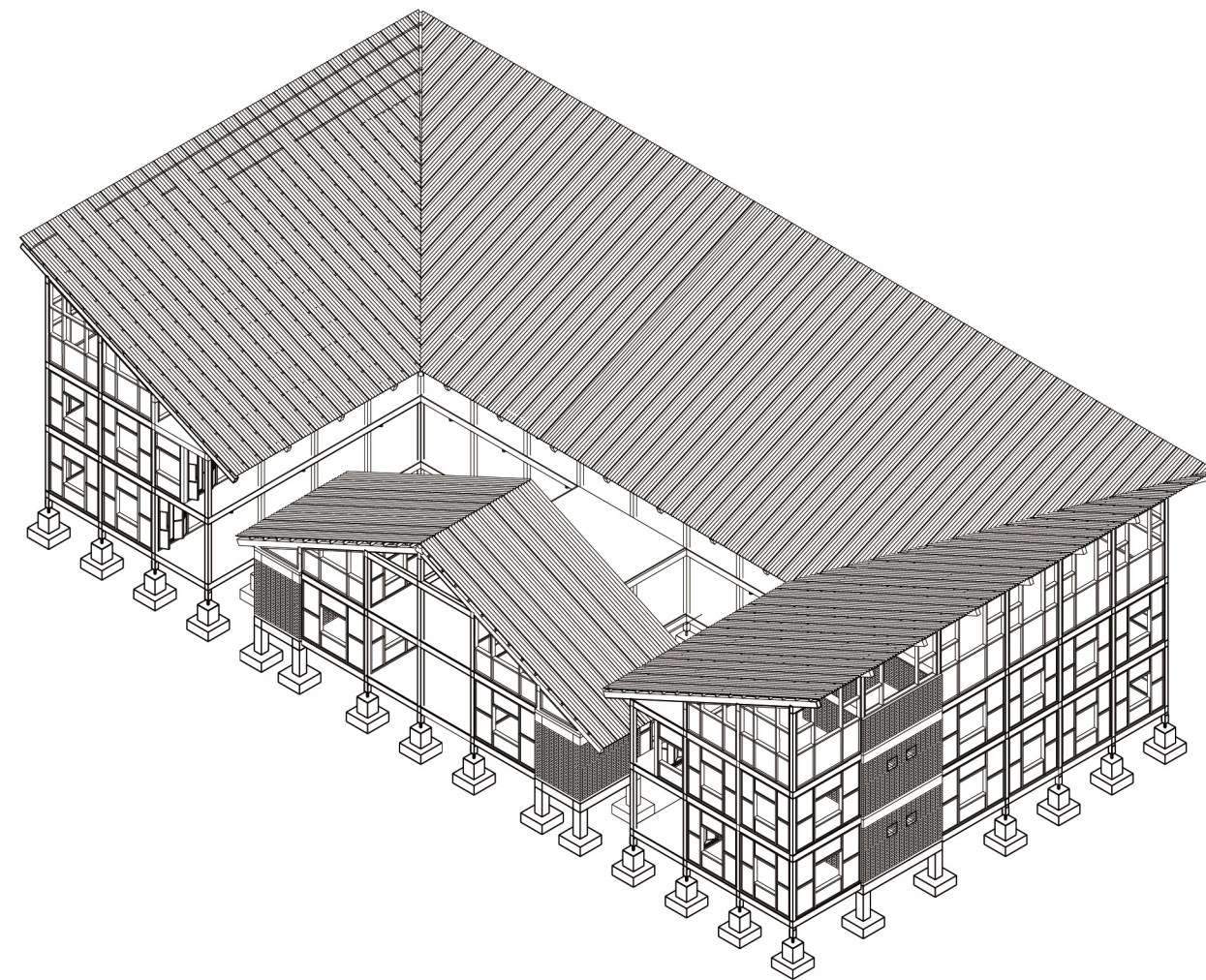
SECTION BB'



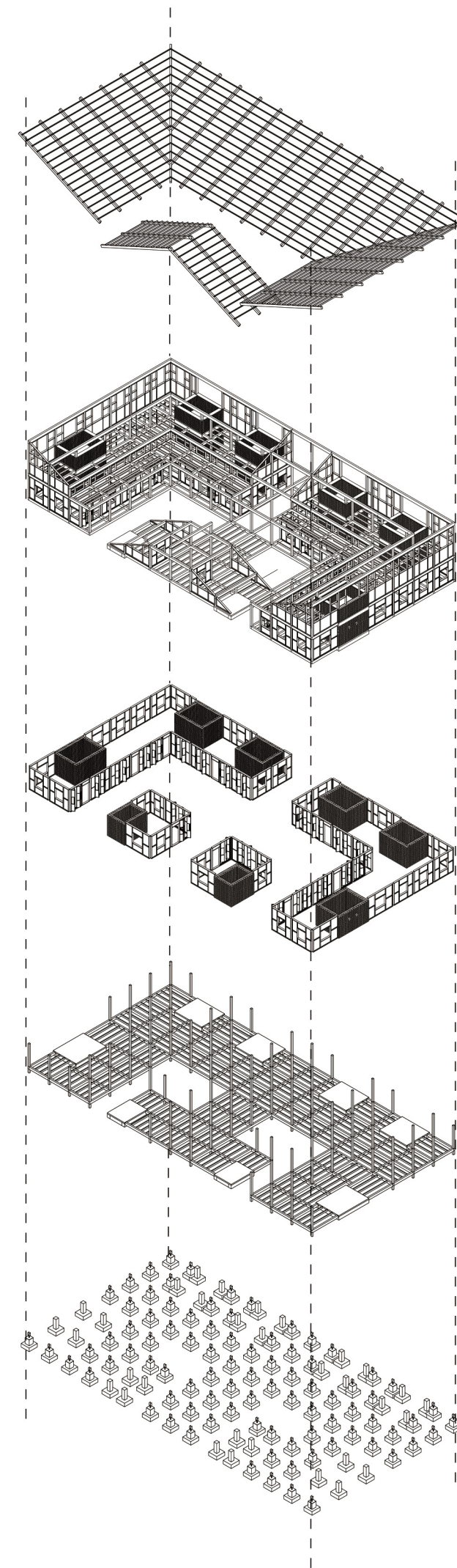




SECTION AA'



CLUSTER STRUCTURE



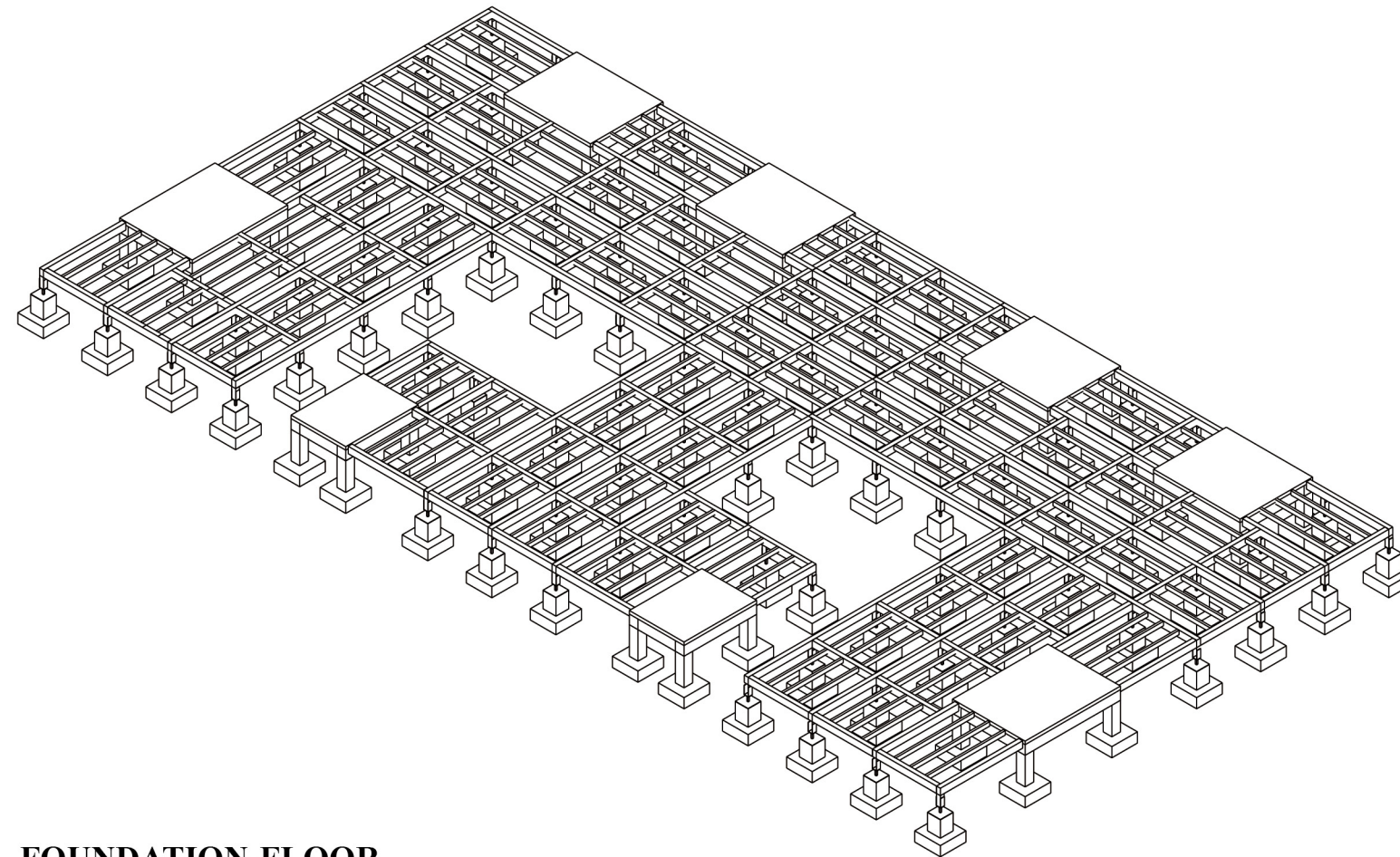
ROOF STRUCTURE

**FIRST FLOOR
ATTIC**

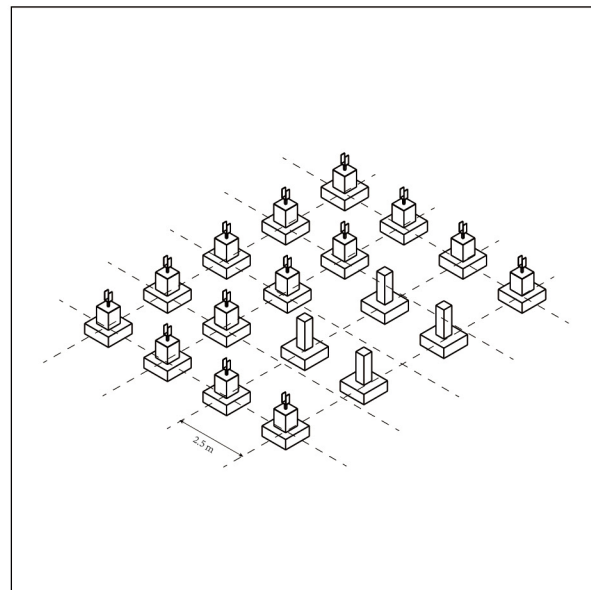
WALL SYSTEM

FLOOR - BEAM

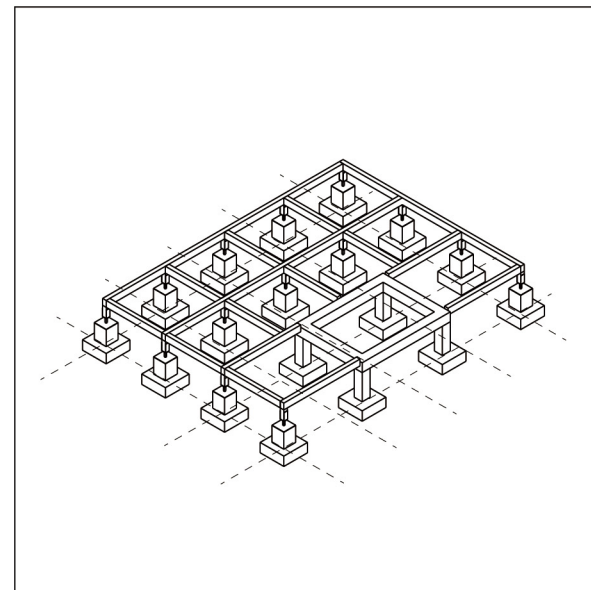
FOUNDATION



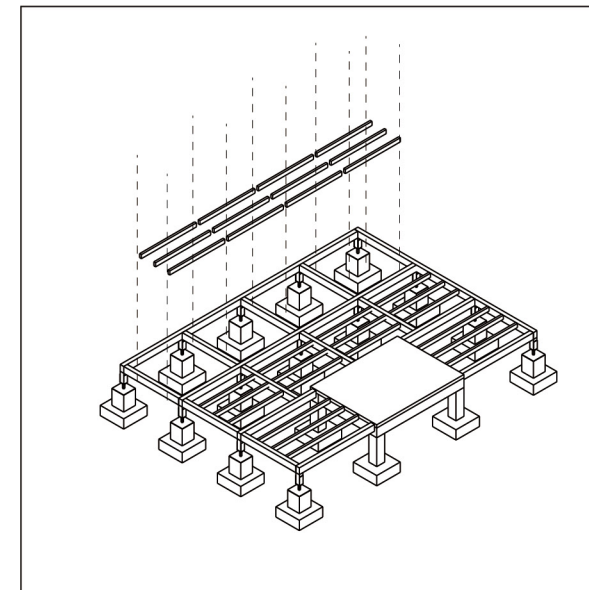
FOUNDATION-FLOOR



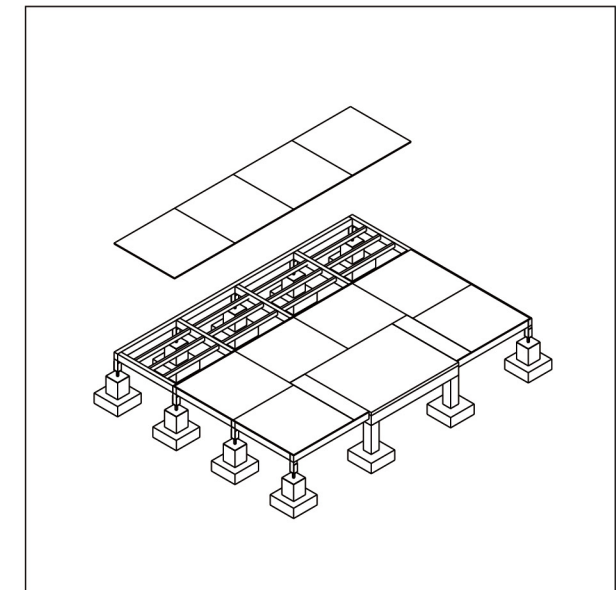
1 Base
Concrete footings are located following the grid.



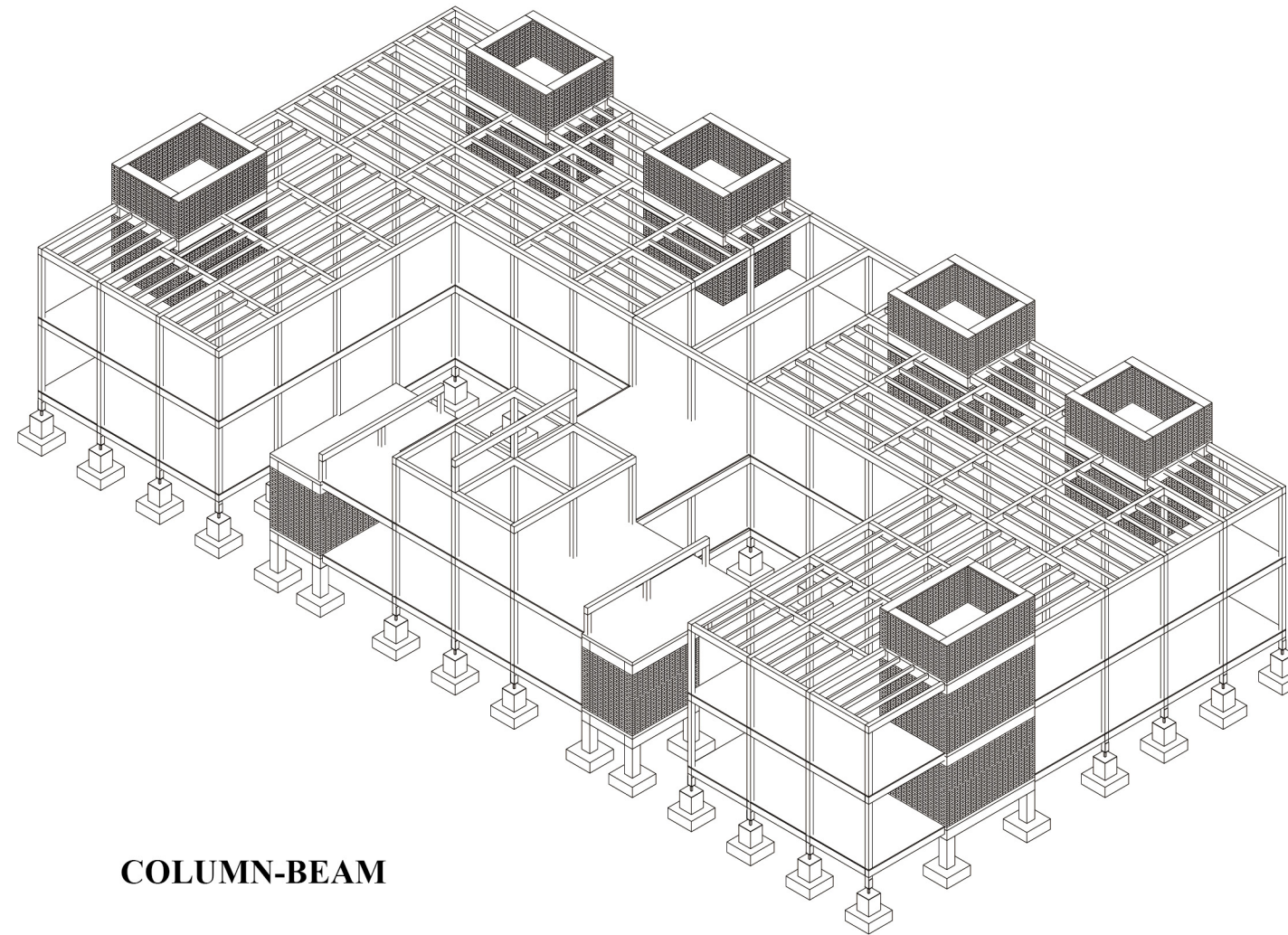
2 Floor main structure
Timber beams are nailed to the columns which connect to the base; concrete floor beam are poured to connect with the base.



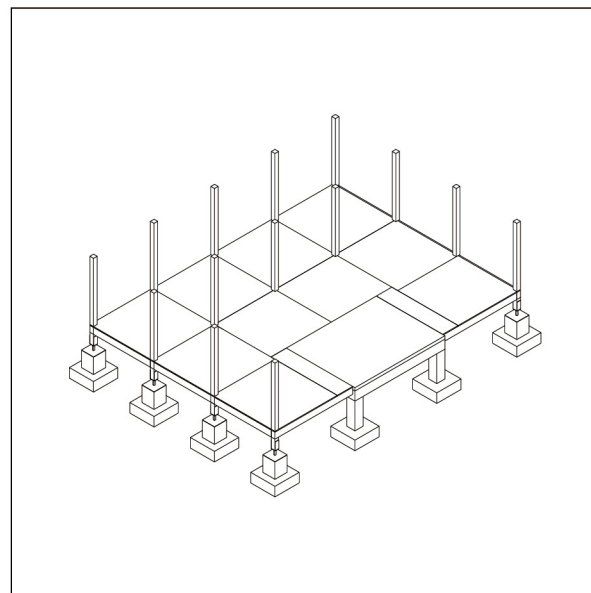
3 Floor substructure
Timber joists are connected to the beams as supporting elements for floor slab.



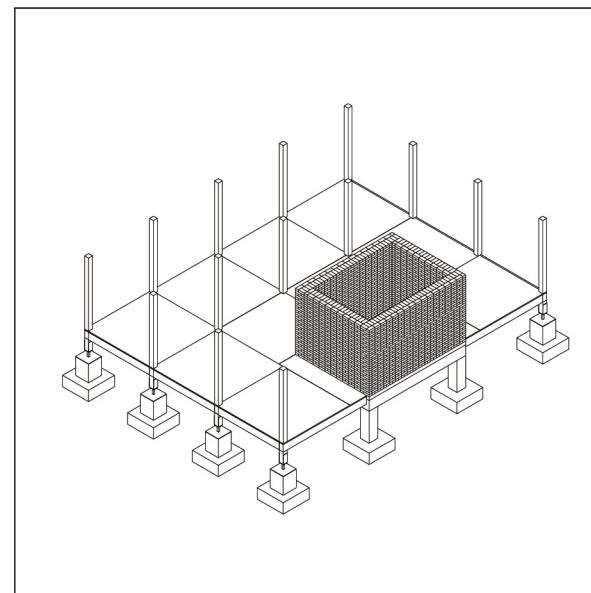
4 Flooring
Wooden subfloor slabs (Karo tree, thickness 32 mm) are located onto the floor supporting structure.



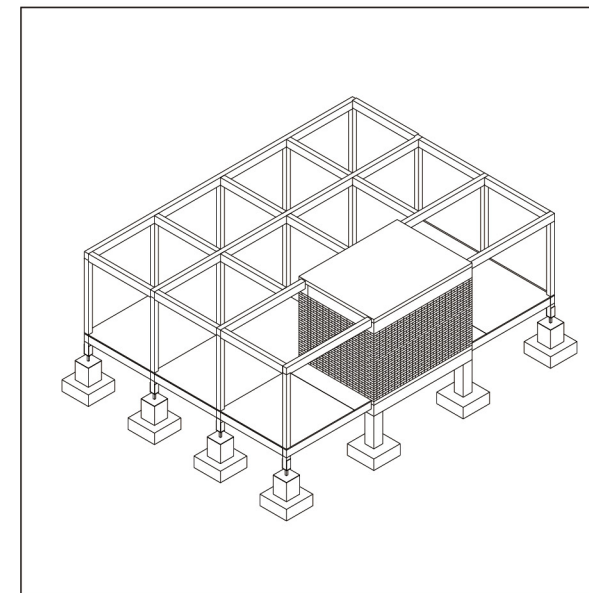
COLUMN-BEAM



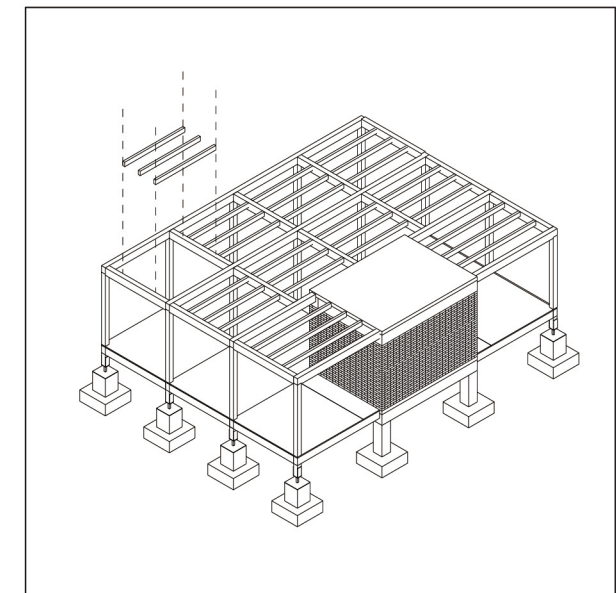
1 Column
After finishing the construction of foundation and floor, timber column (Ironwood) will be constructed on the floor structure.



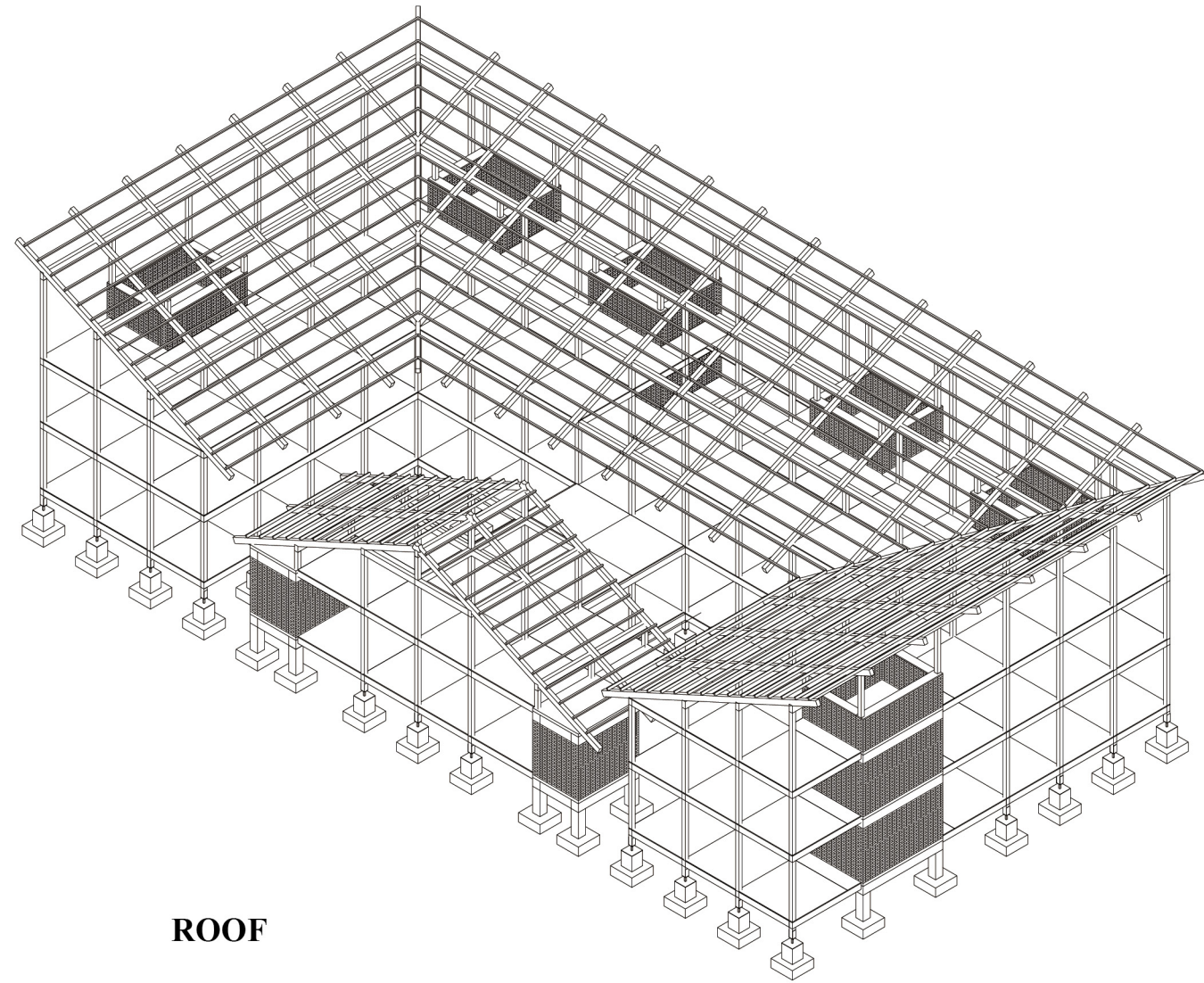
2 Brick load-bearing structure
Brick wall will be constructed on the concrete structure to build up the service core (toilet and kitchen).



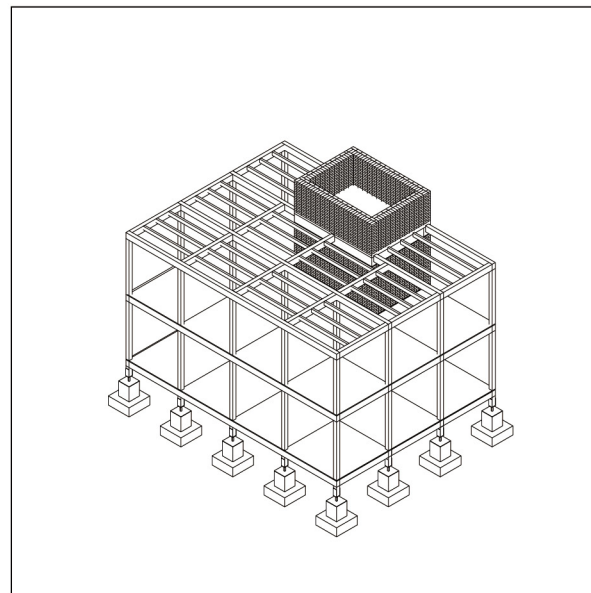
3 Beam
Timber beams are connected to the column system.



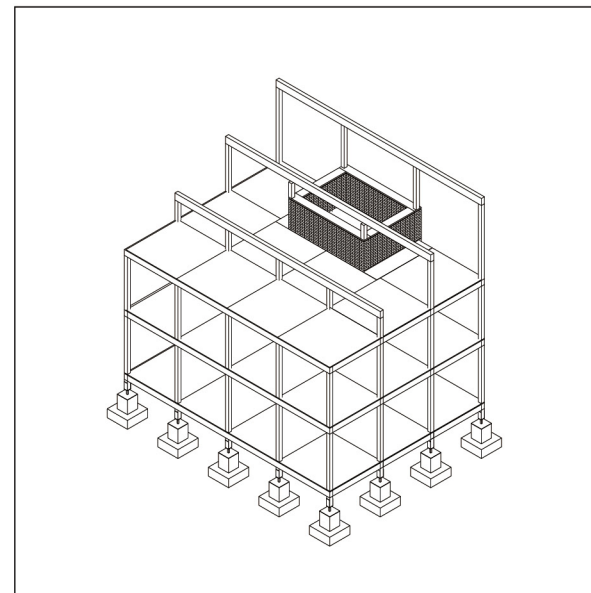
4 Beam substructure
Timber joists are added to hold the weight of floor slab.



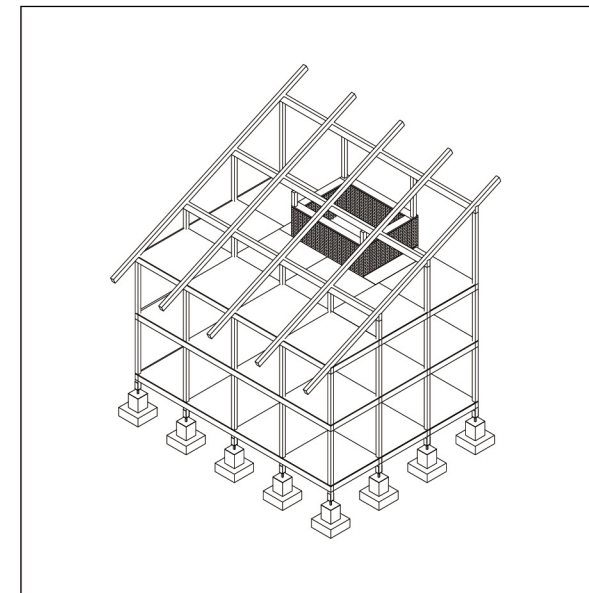
ROOF



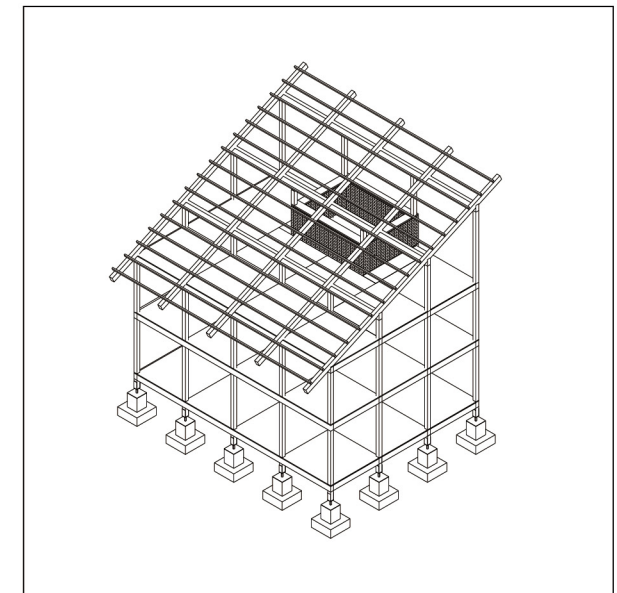
1 Column and beam
After finishing the construction of column and beam system, it comes to the construction of roof structure.



2 Roof beam
Timber columns and beams are located for the attic space to hold the weight of roof structure.



3 Rafters
Timber rafters are set on the roof beams in the angle of 25°.

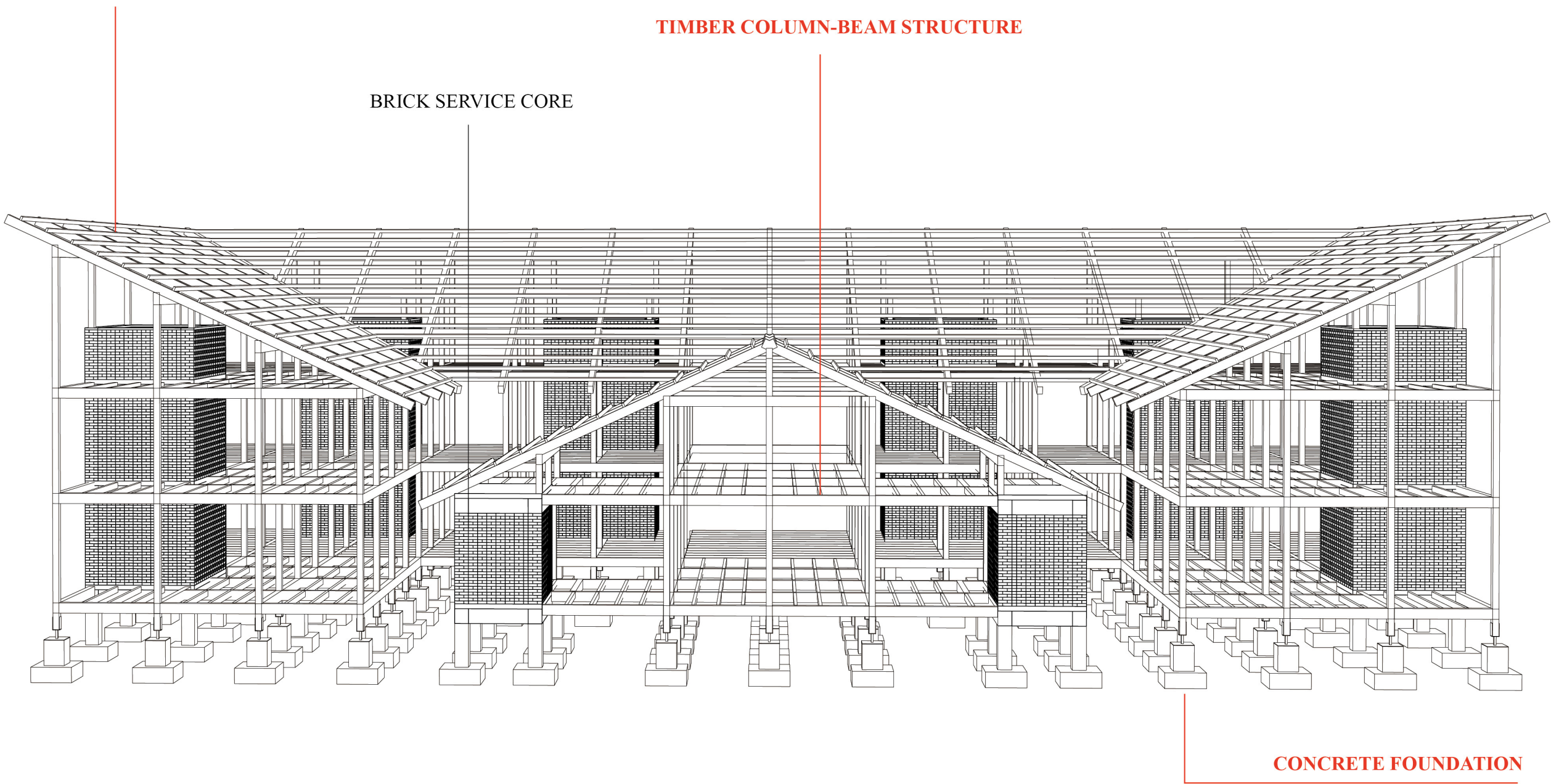


4 Purlin
Timber purlins are added to the rafters in order to support the roof envelope.

TIMBER ROOF STRUCTURE

TIMBER COLUMN-BEAM STRUCTURE

BRICK SERVICE CORE



CONCRETE FOUNDATION

MAIN STRUCTURE

BANGLA BATON ARCHITECTURE

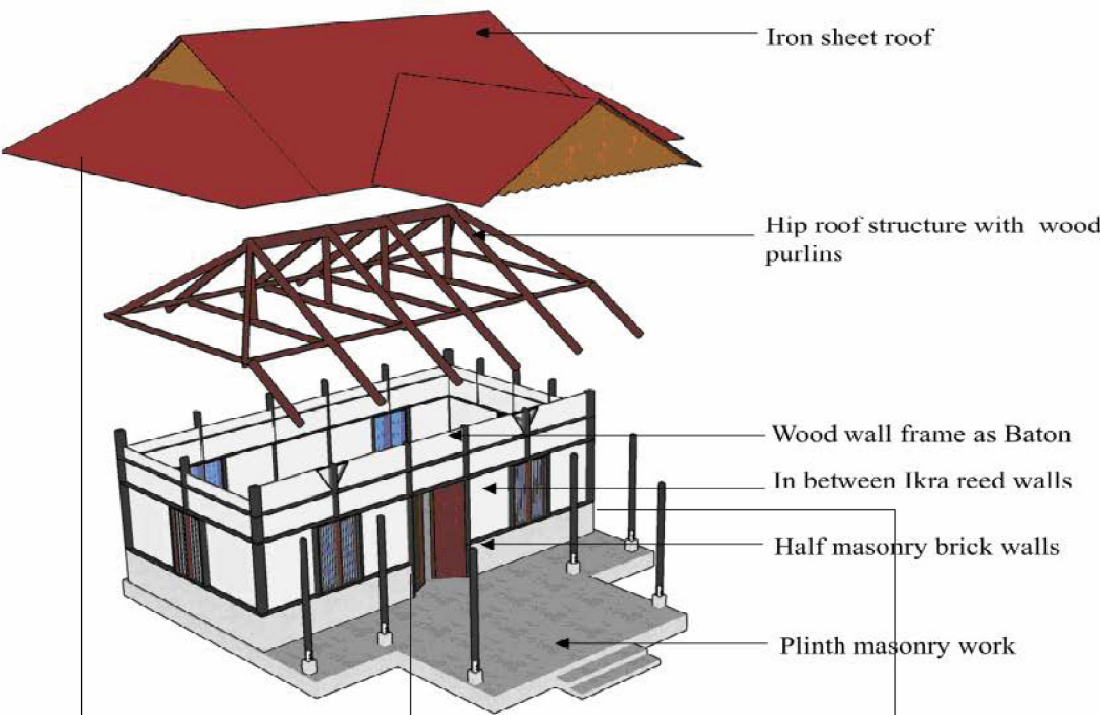
Bangla baton is a traditional architecture style in Sylhet region. It is easy for the local residents to build their houses with this style due to its modular construction technique.



Front Elevation



Side Elevation



BRICK WALL

WOODEN COLUMN&BEAM

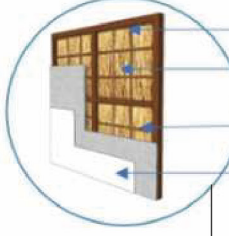
CI SHEET ROOF



Earthquake solution



Ventilator with Mosquito net



Light weight Frame structure

Wood panel
Ikra reed wall
Cement-mud plaster
Color coating



Day lighting and ventilation through high window



Pre fabricated, durable, modular construction



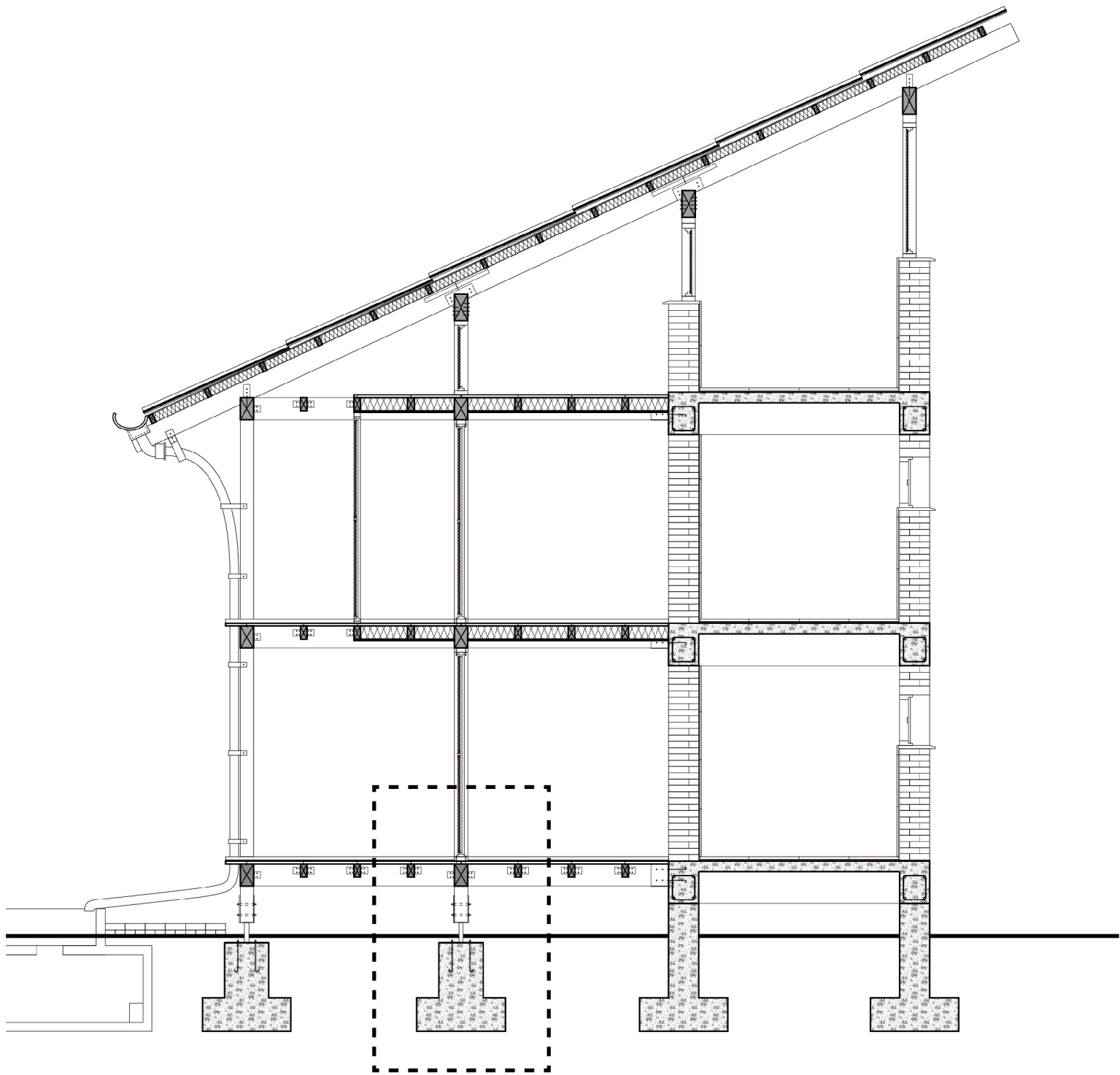
Low thermal material ceiling



Rain water collection system

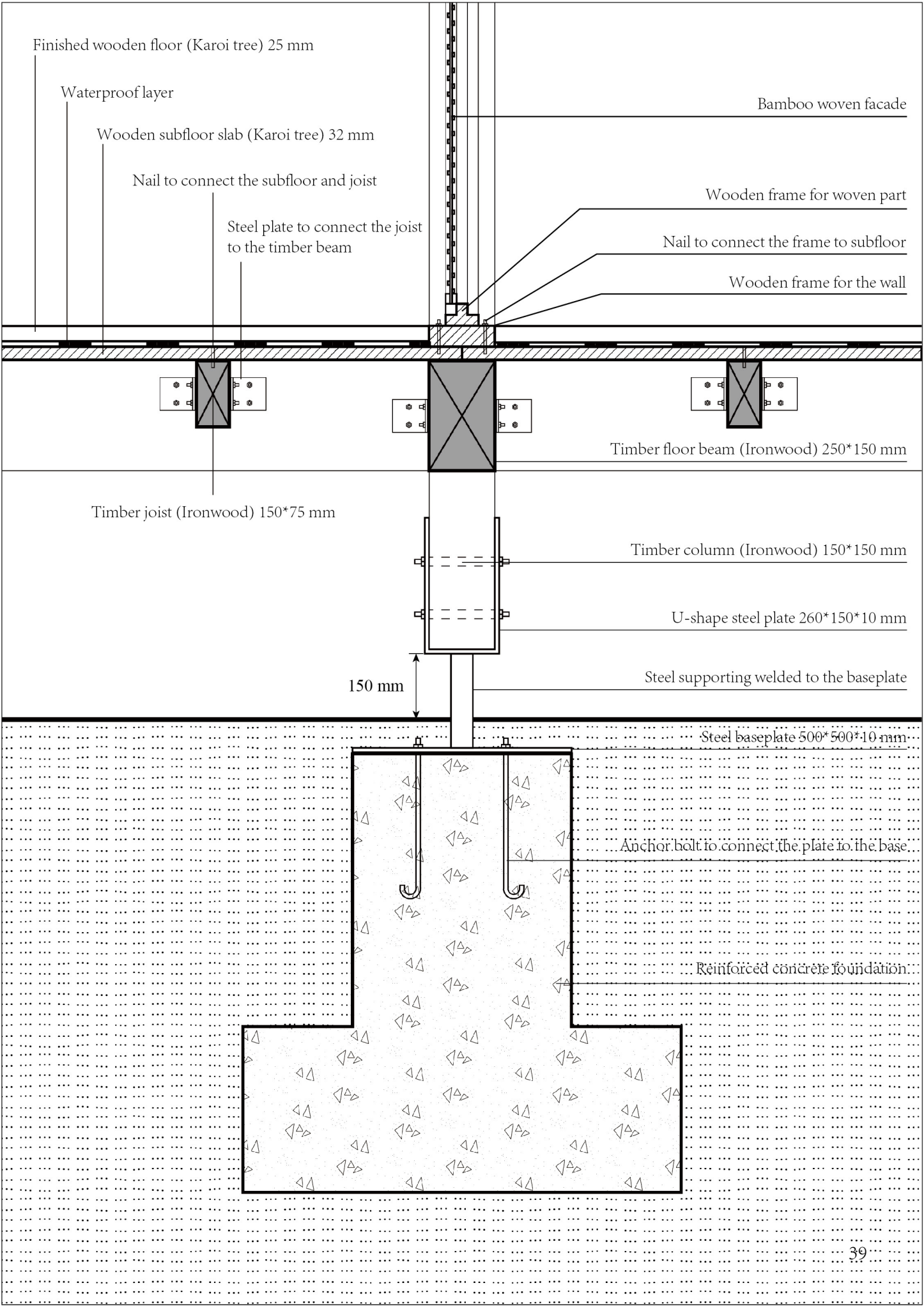
MASONRY FOUNDATION

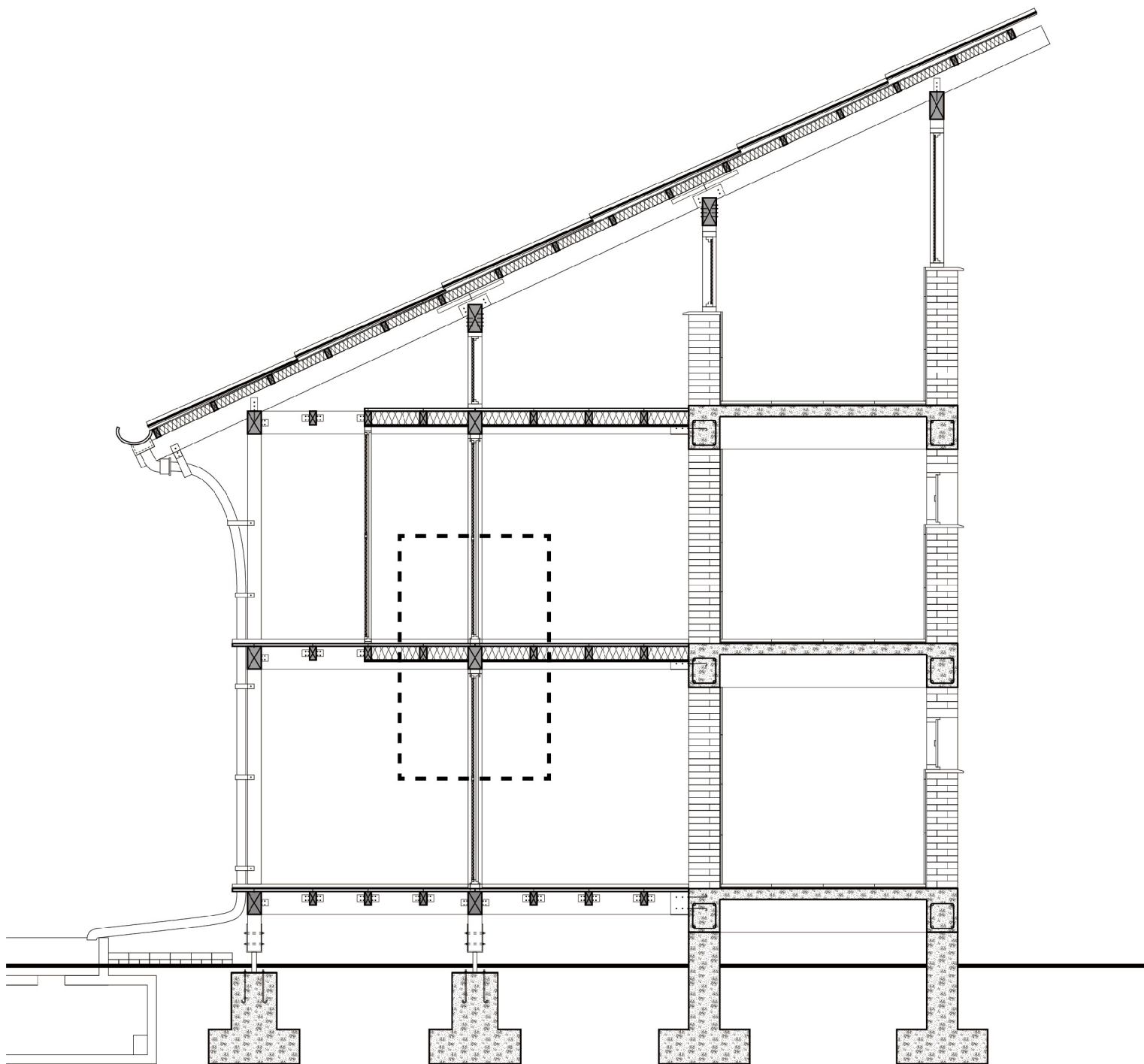
WOODEN FRAMED WALL



DETAIL SECTION - FOUNDATION 1

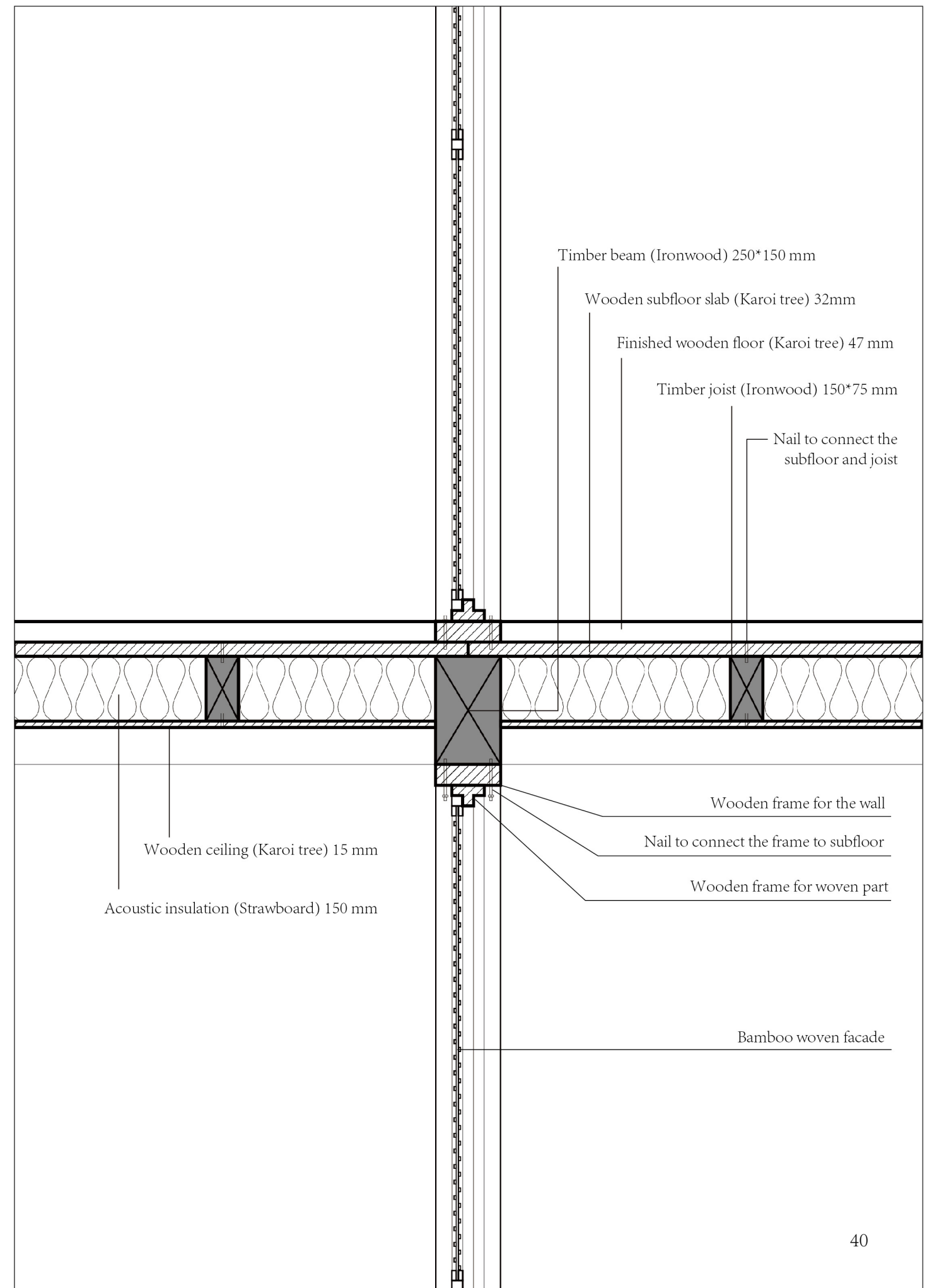
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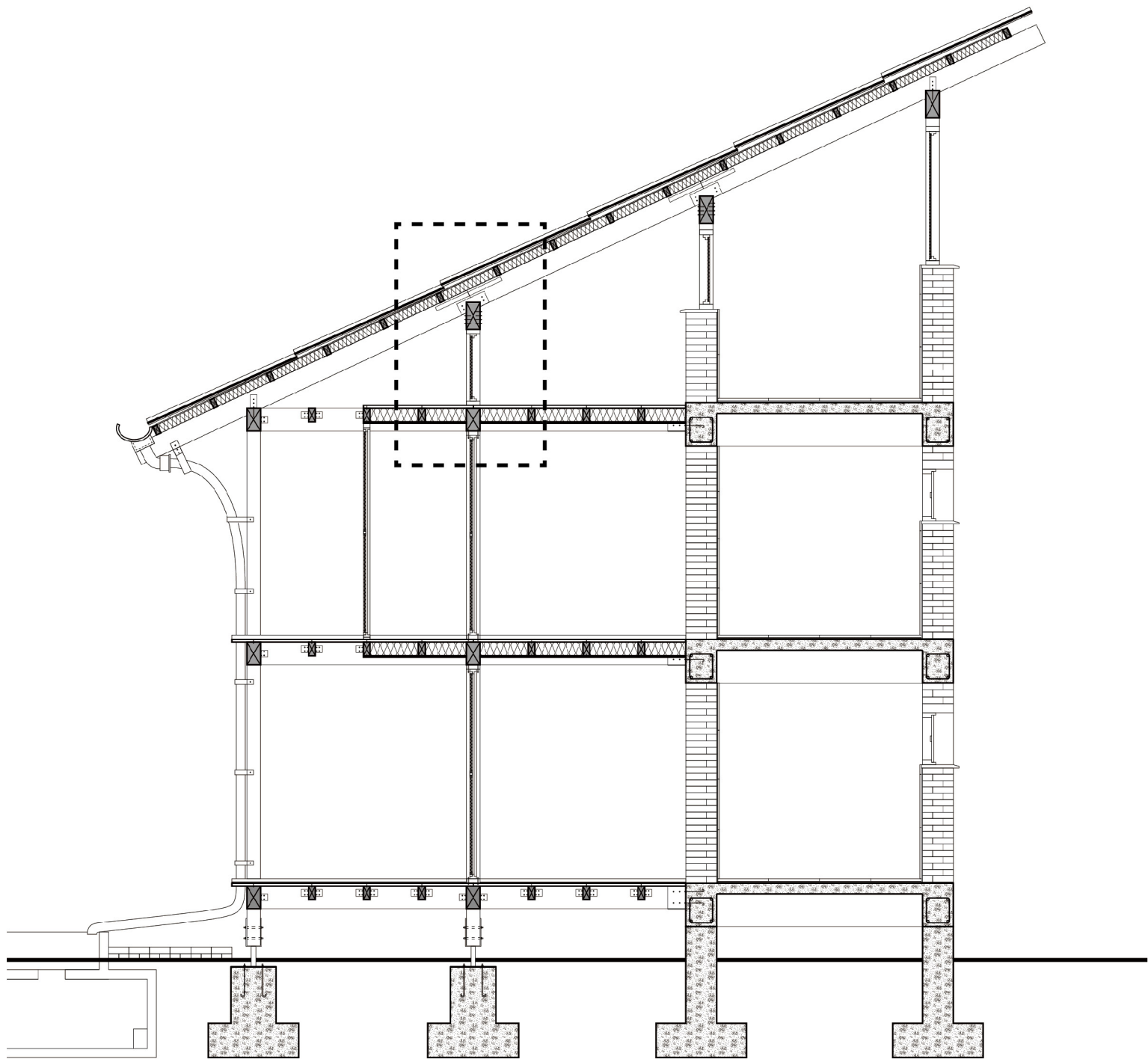




DETAIL SECTION - FLOOR AND WALL 1

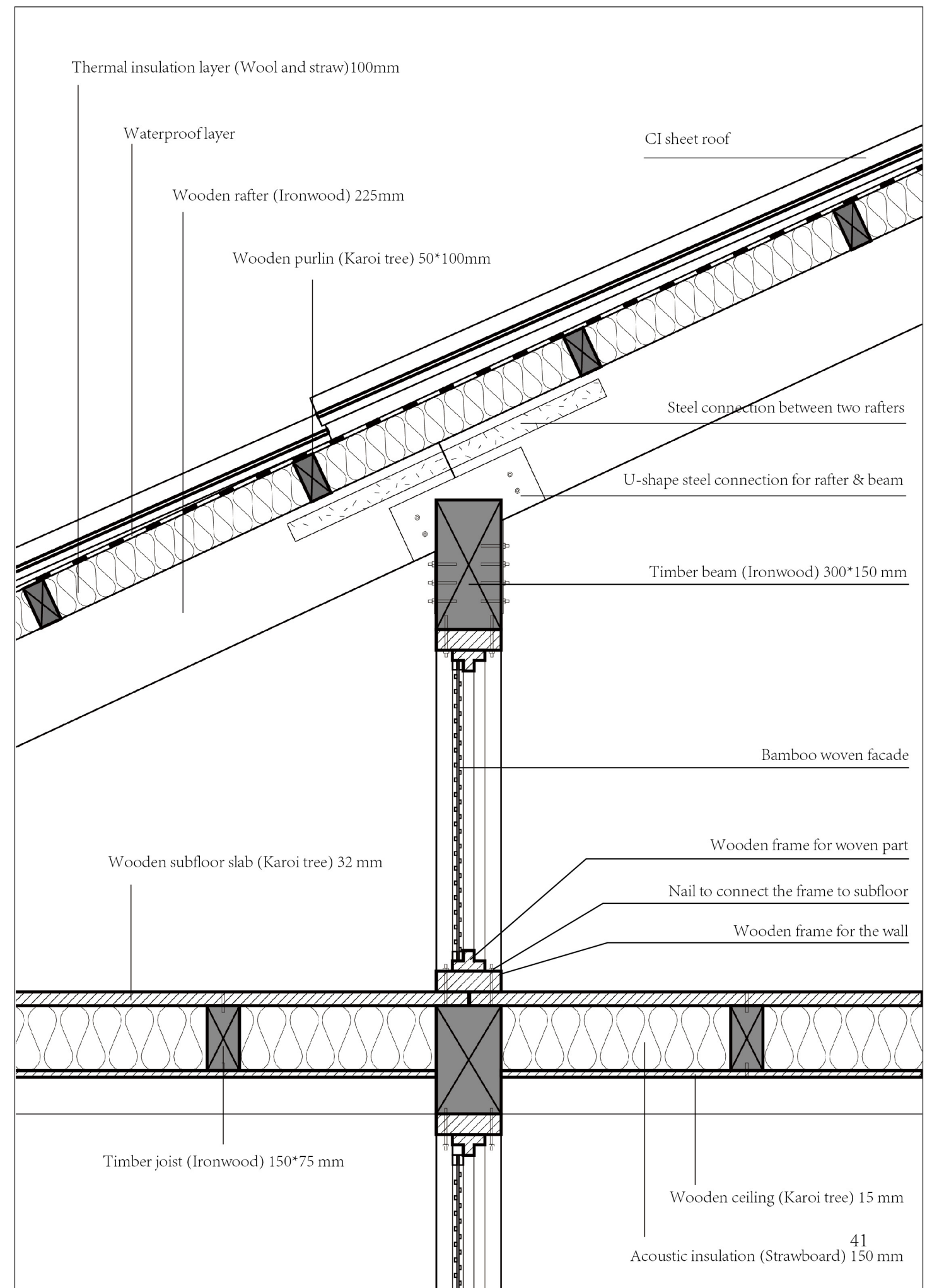
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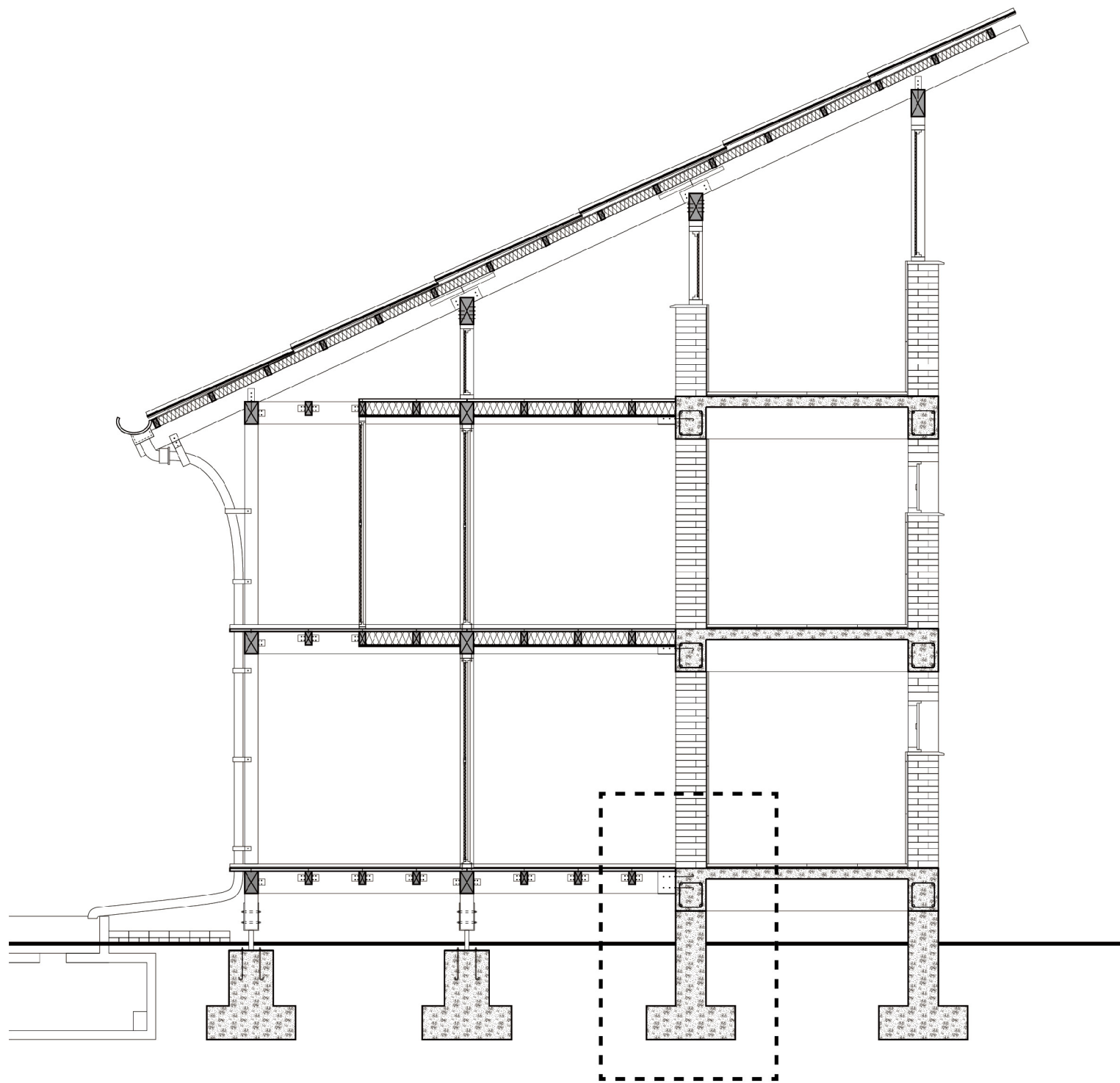


DETAIL SECTION - ROOF 1

1:10

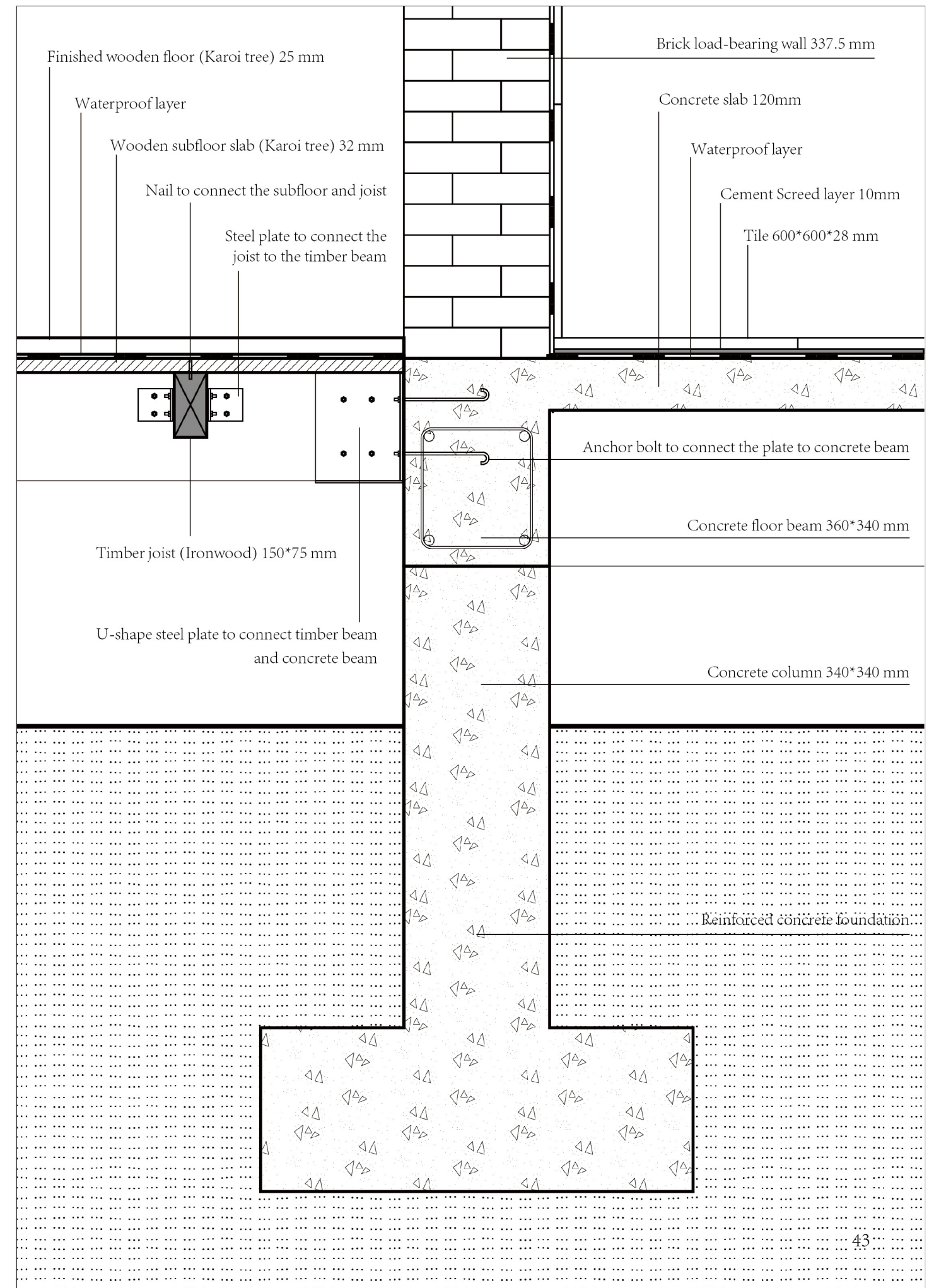


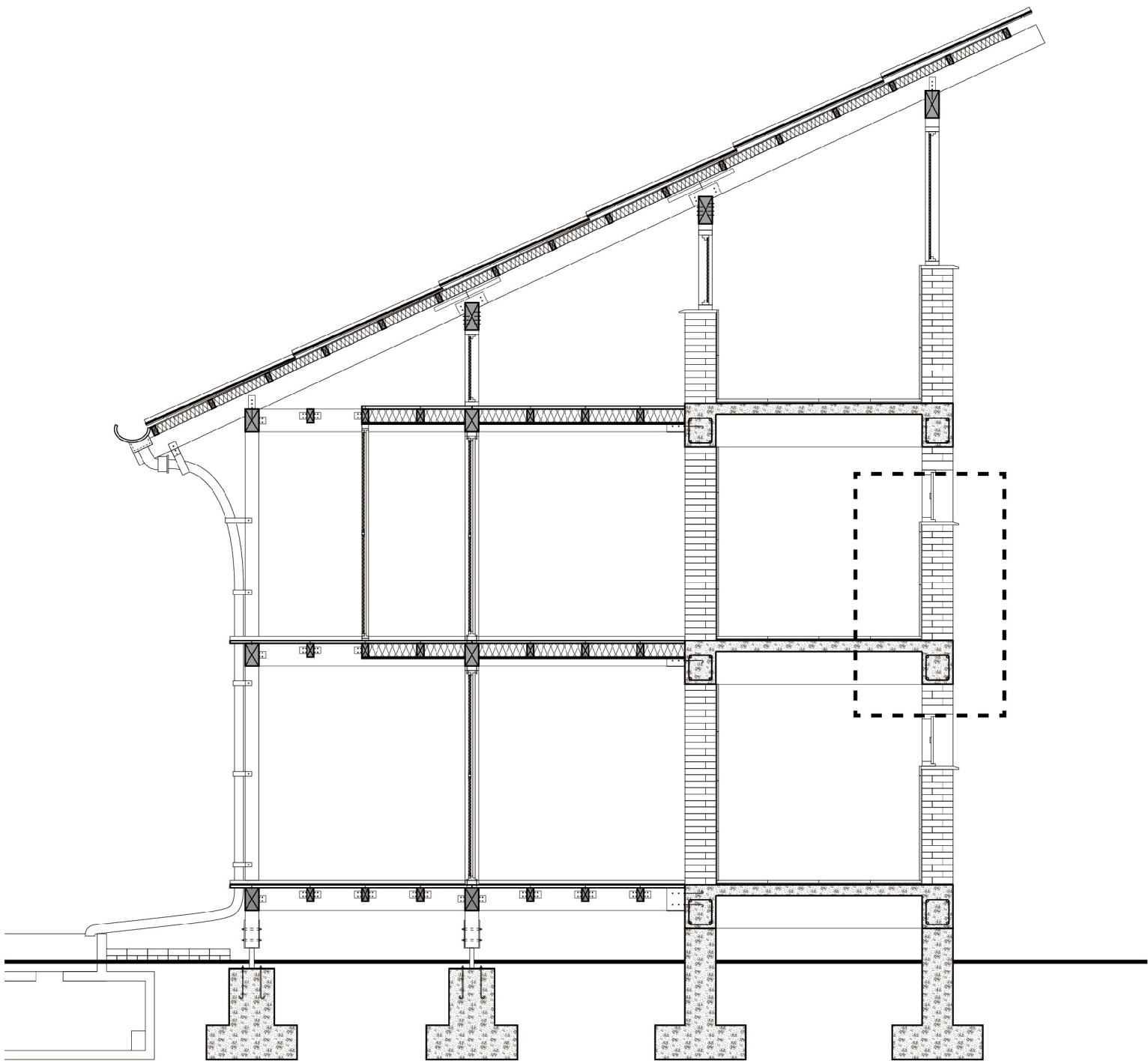




DETAIL SECTION - FOUNDATION 2

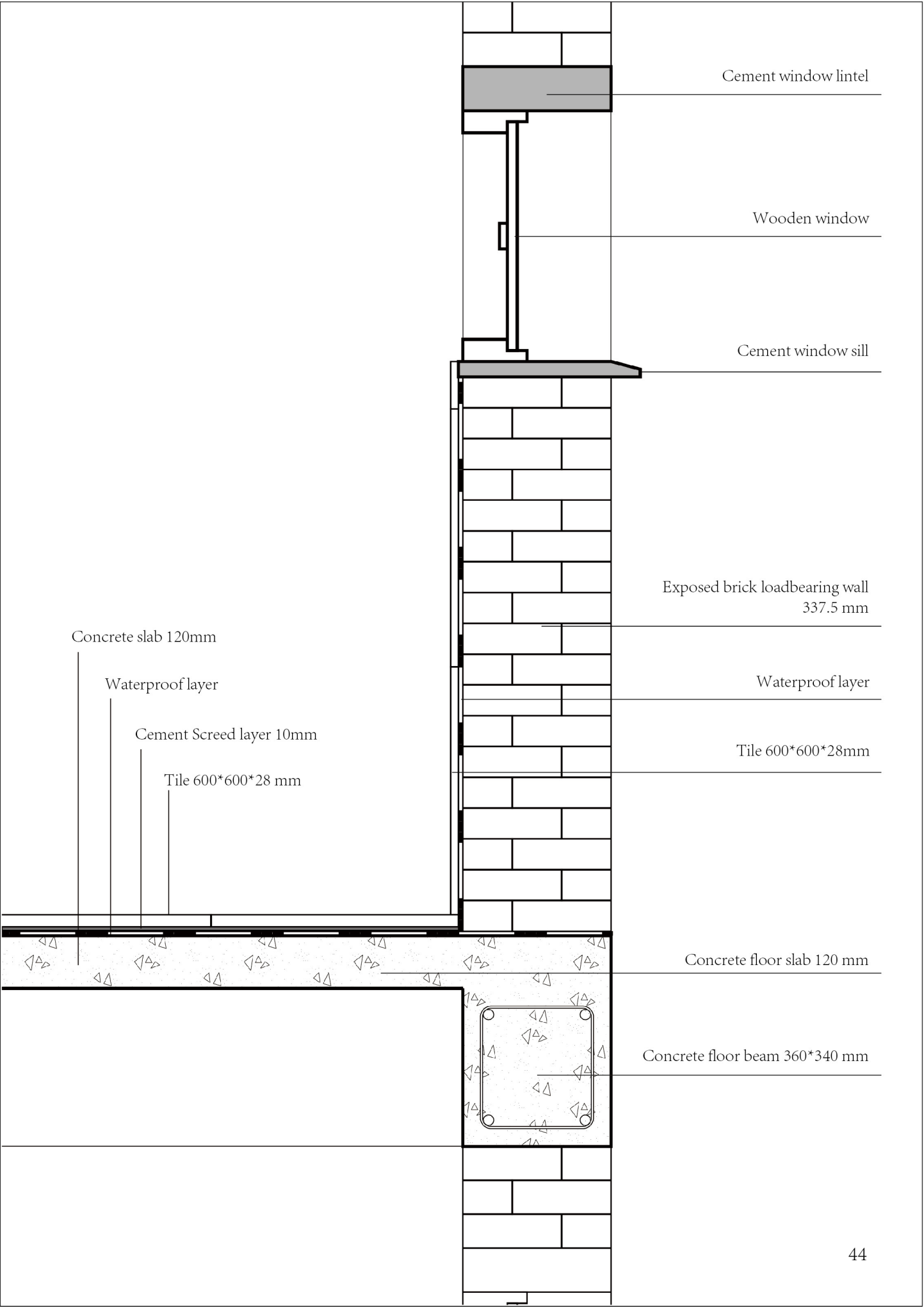
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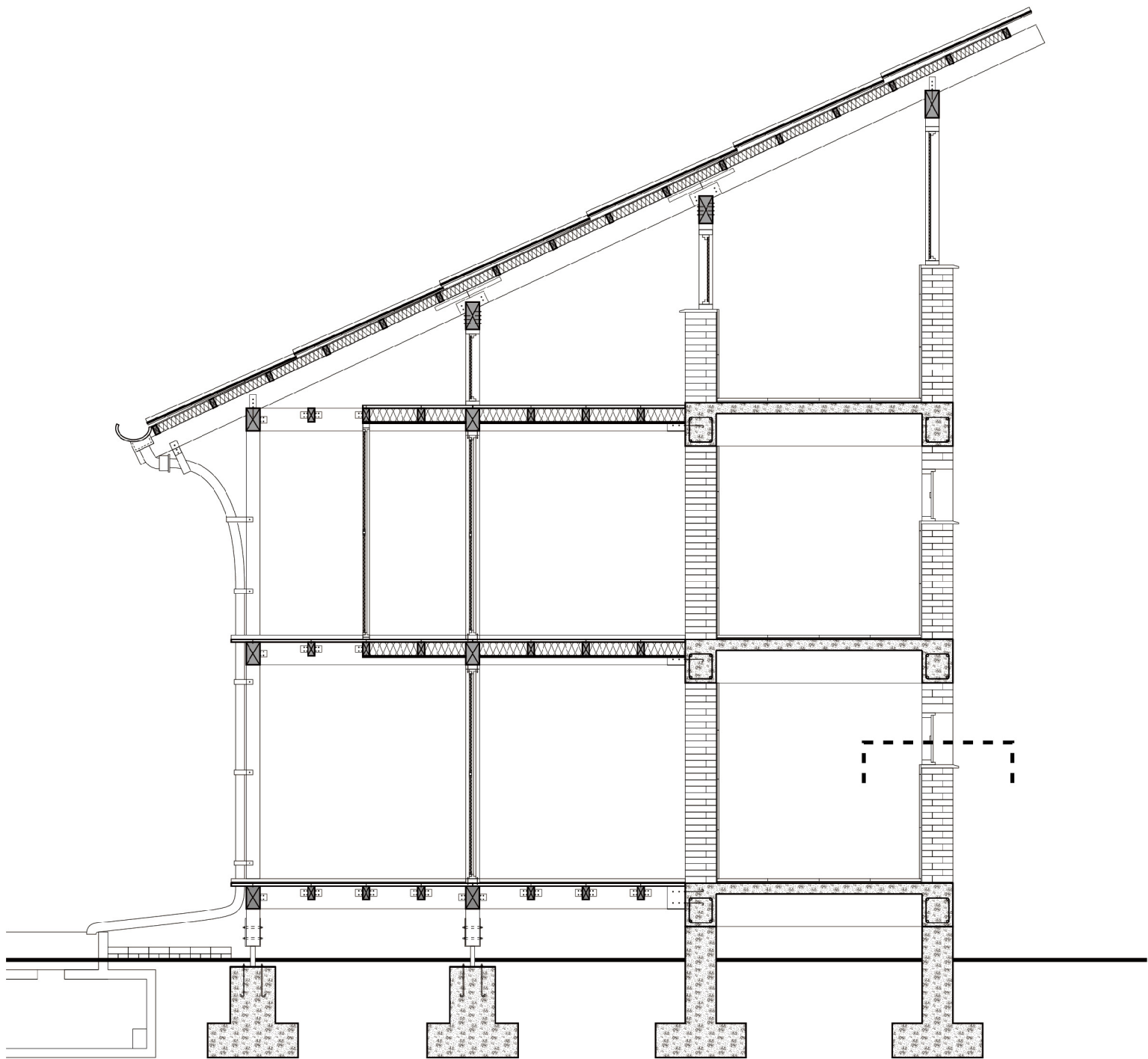




DETAIL SECTION - FLOOR AND WALL 2

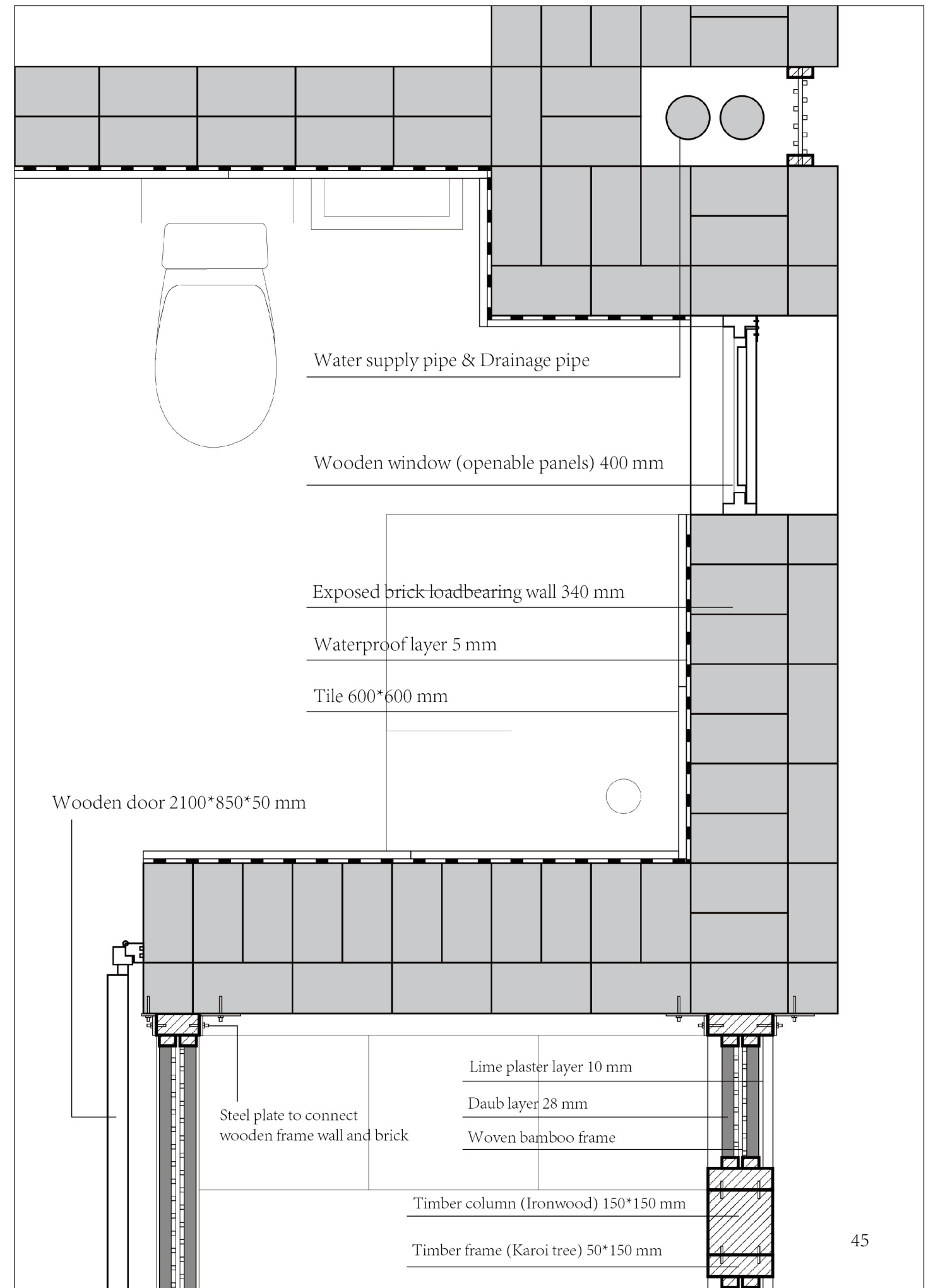
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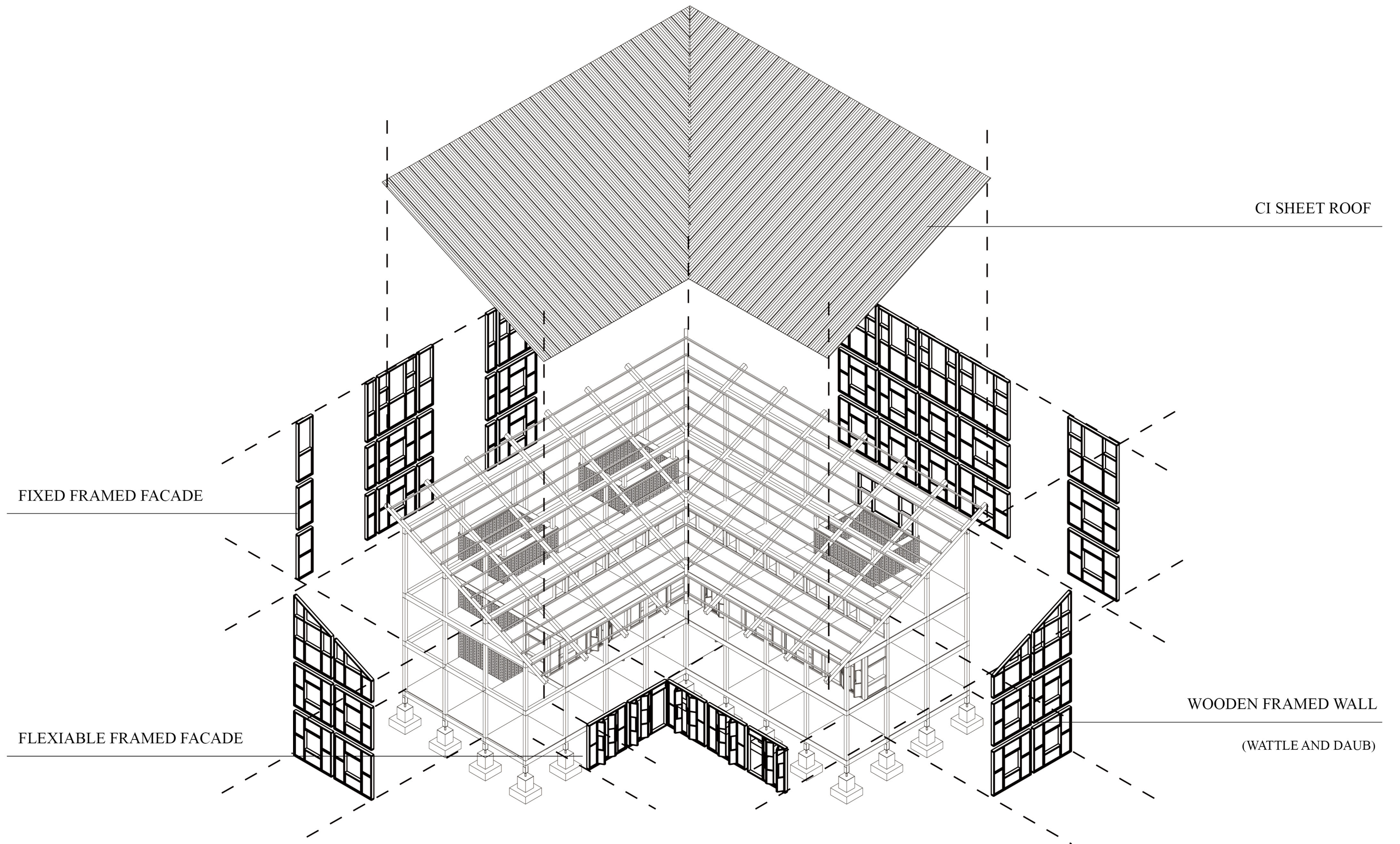


FRAGMENT PLAN - BRICK LOADBEARING WALL

1:10







BUILDING ENVELOPE

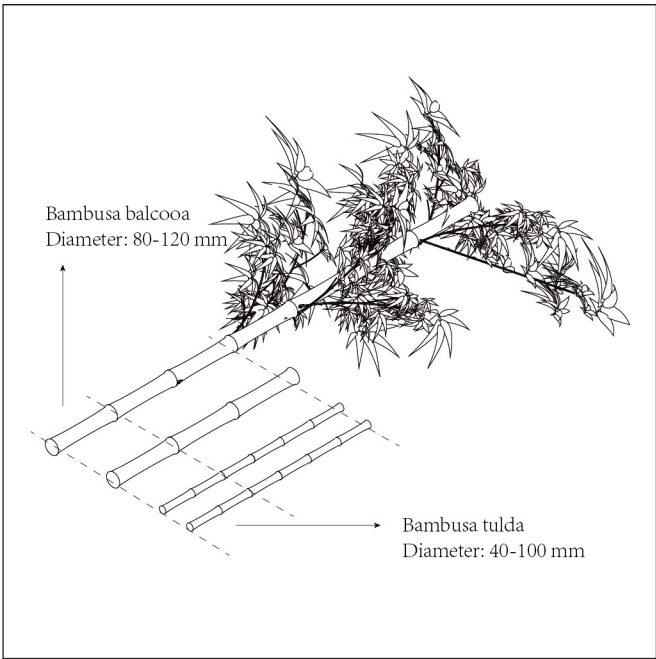
WATTLE AND DAUB CONSTRUCTION

Part 1: Prepare the framework and weave the wattle

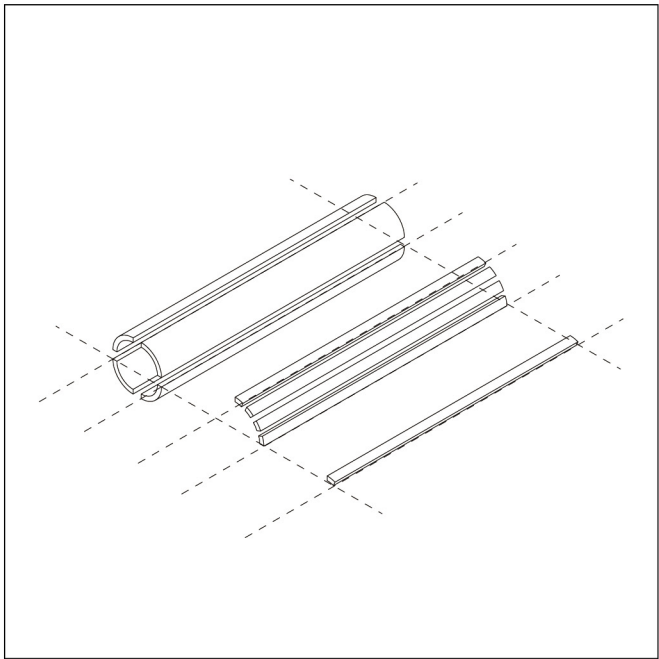
In this construction, the wall framework is made of wood, and the material of wattle is bamboo. Bascially two kinds of local bamboo will be used as the horizontal slats and weaving strips.



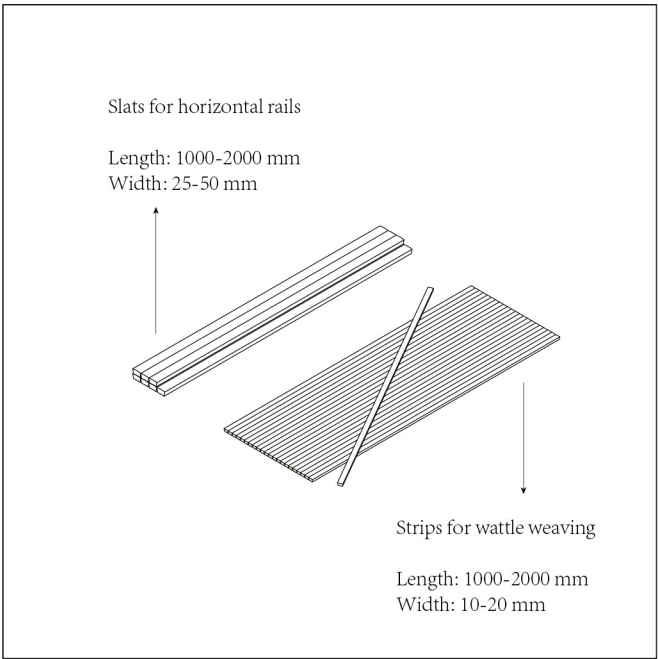
01 Bamboo forest



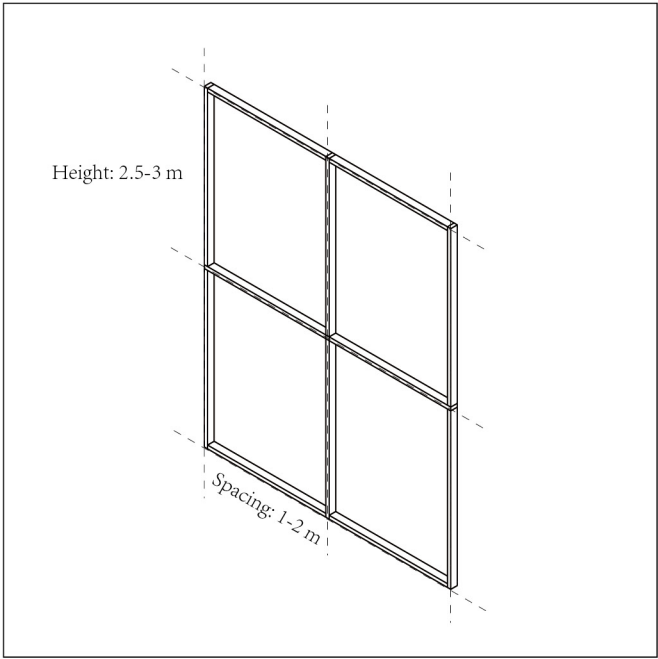
02 Cut down the bamboo



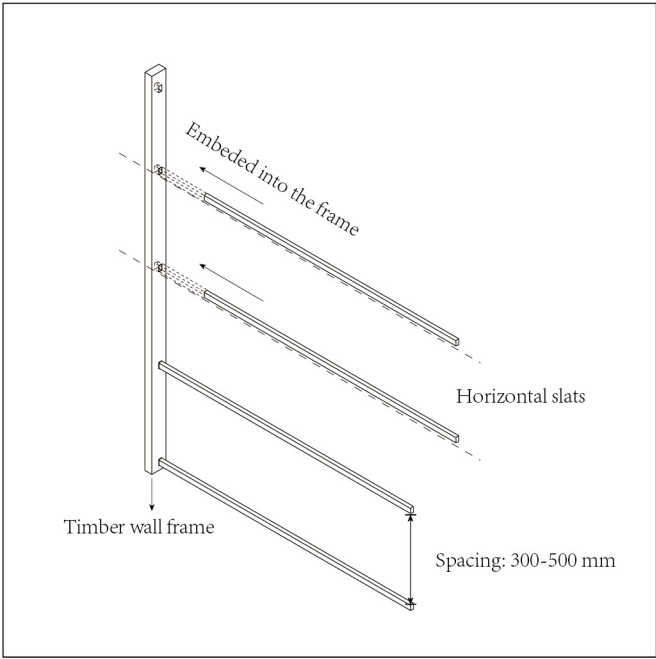
03 Cut the bamboo into slats



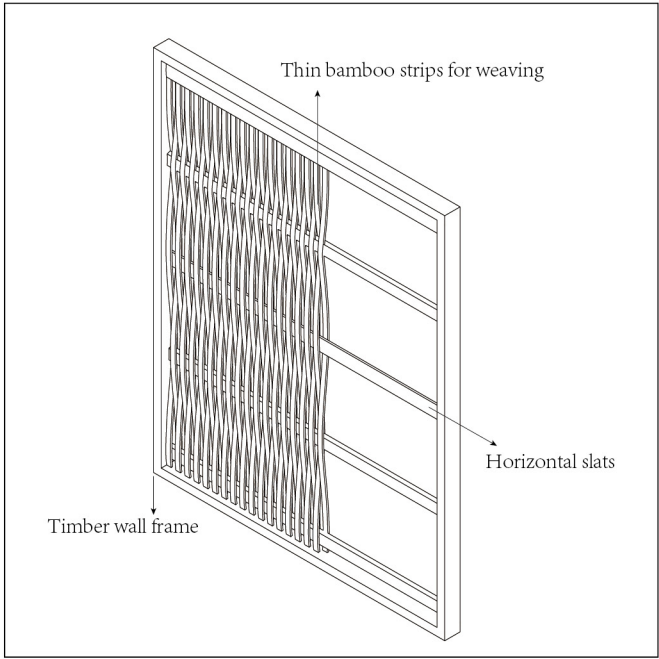
04 Bamboo slat dimention



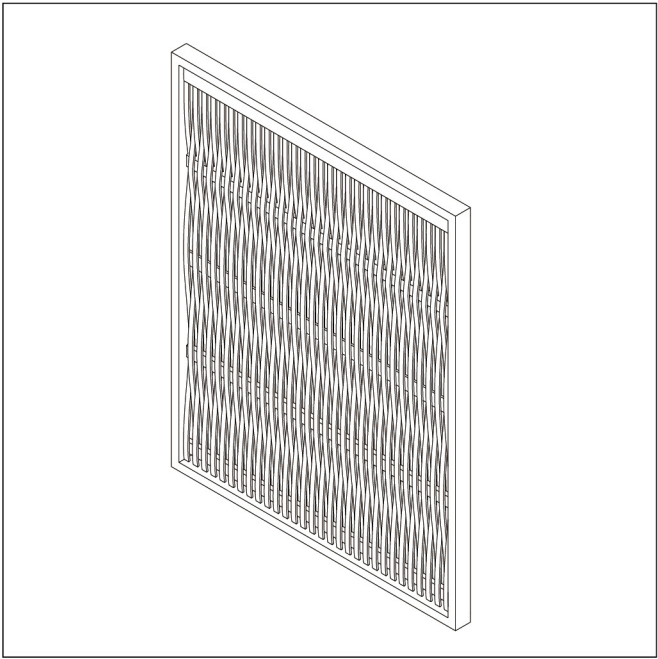
05 Bangla Baton wall frame dimention



06 Connect horizontal slats to wall frame



07 Weave the bamboo strips

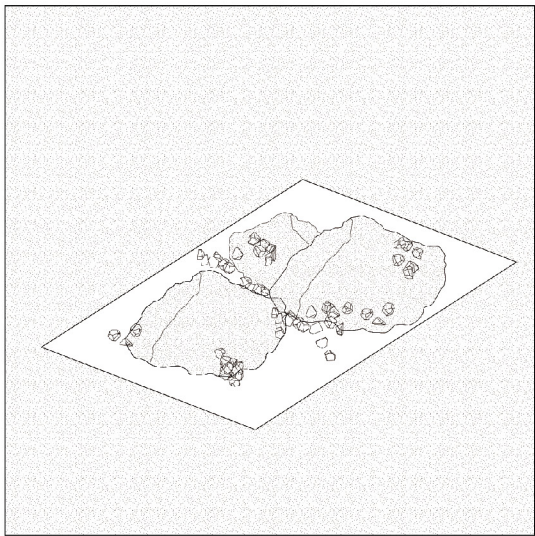


08 Wall framework and wattle

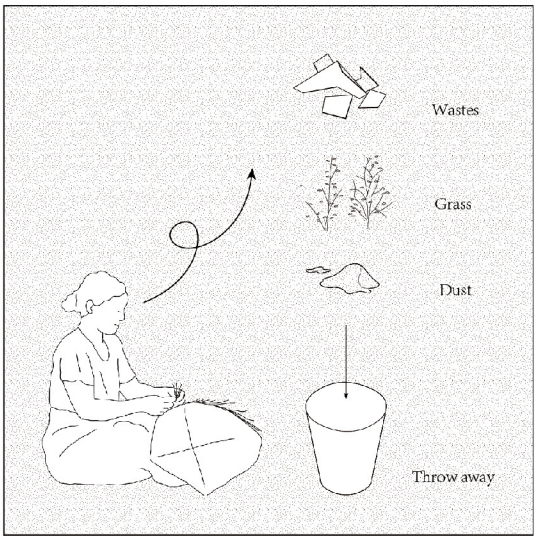
WATTLE AND DAUB CONSTRUCTION

Part 2: Prepare and apply the daub

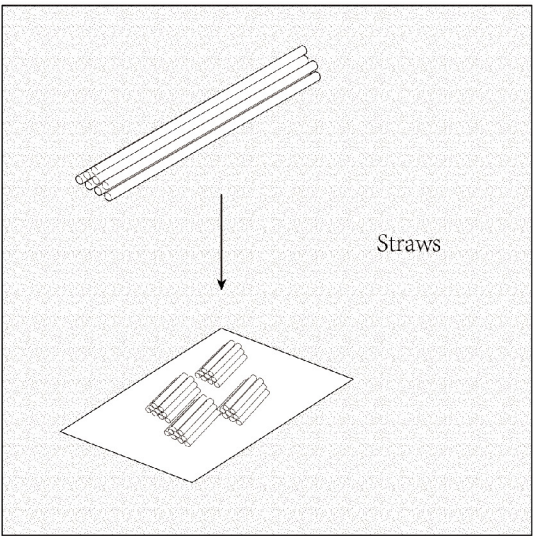
Materials of the daub are all natural sources from the local context, and are also easily used by local residents.



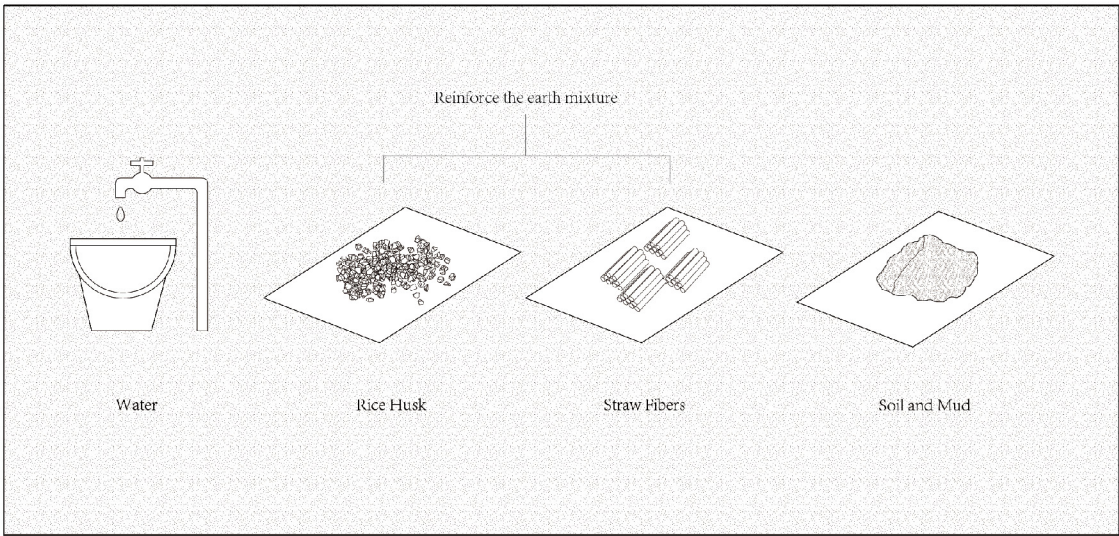
01 Soil and mud from the field



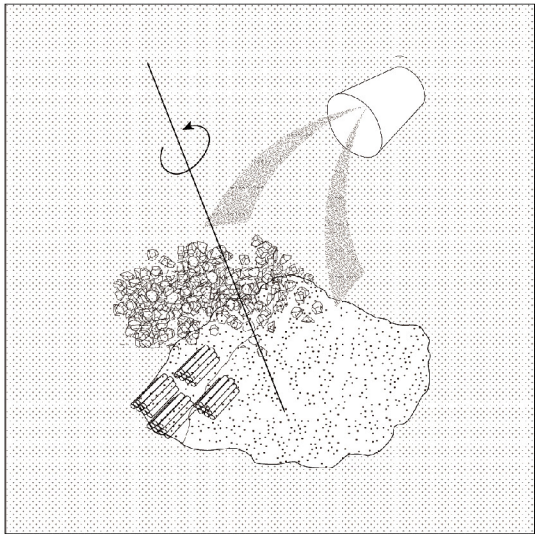
02 Remove debris



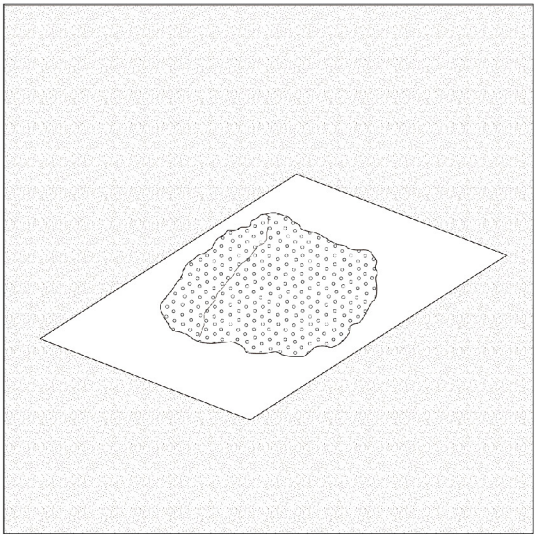
03 Cut the straws into pieces



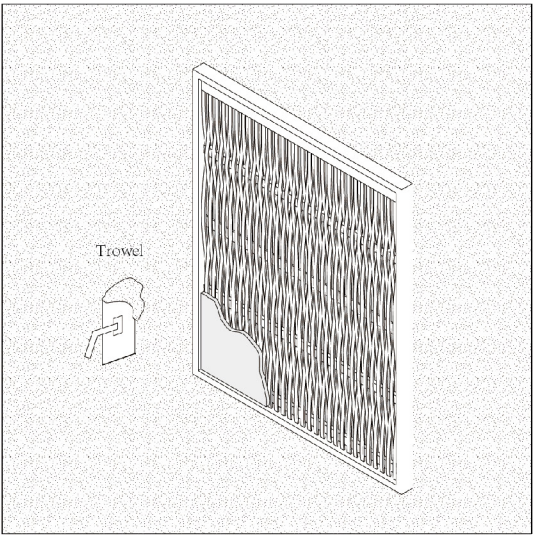
04 Material for the daub



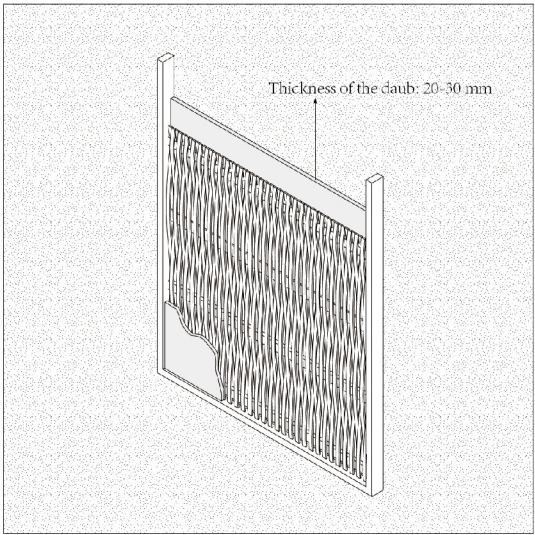
05 Mix and stir the material



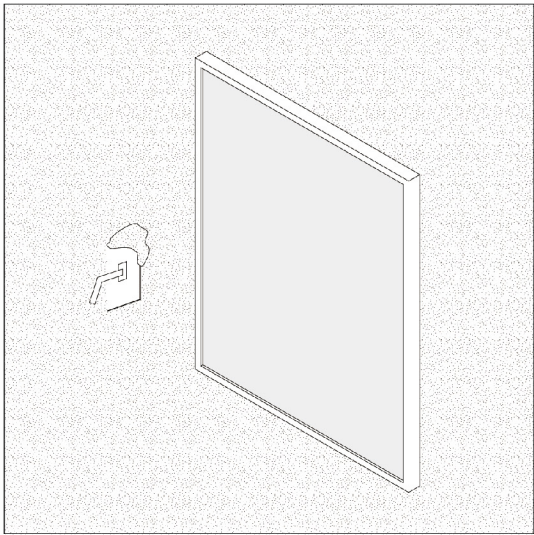
06 Set the mud for 2-3 days



07 Plaster the daub to the woven lattice



08 The daub mixture to both sides

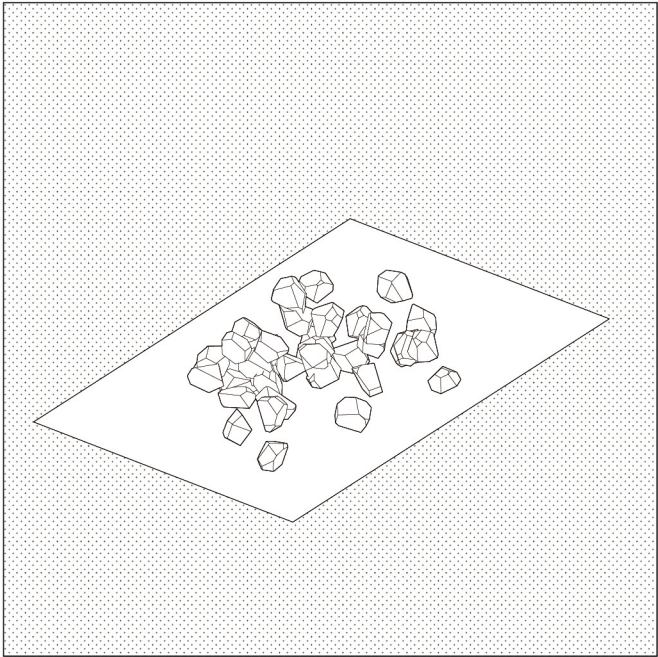


09 Smooth the surface

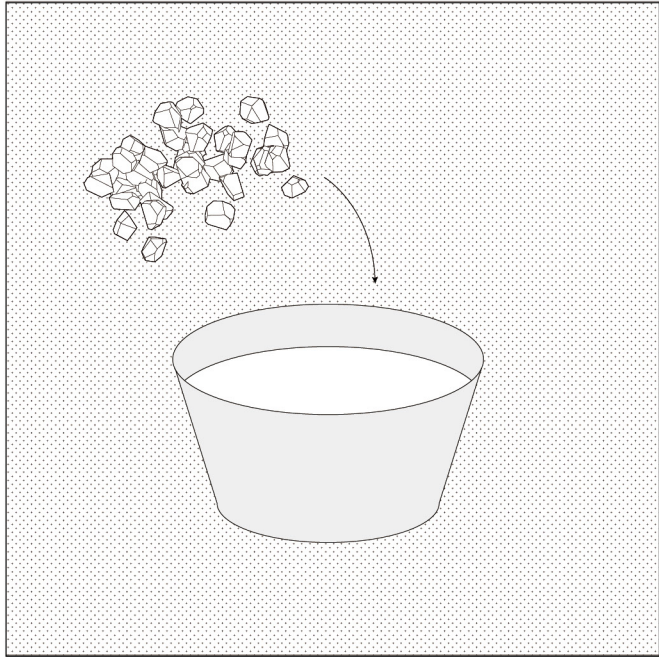
WATTLE AND DAUB CONSTRUCTION

Part 3: Plaster and finish the wall

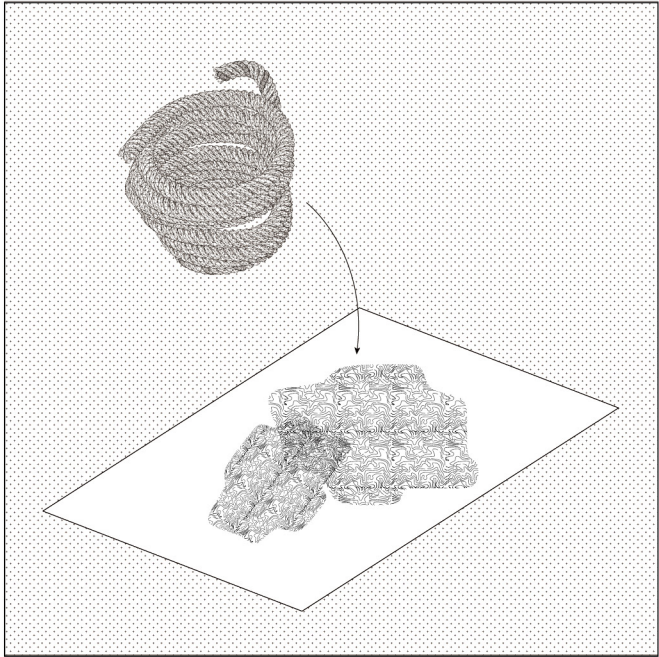
In order to prevent the cracking and ensure a stronger wall, lime plasters are applied to the walls. It is also breathable, allowing moisture to evaporate rather than becoming trapped, which can help prevent issues like mold and dampness.



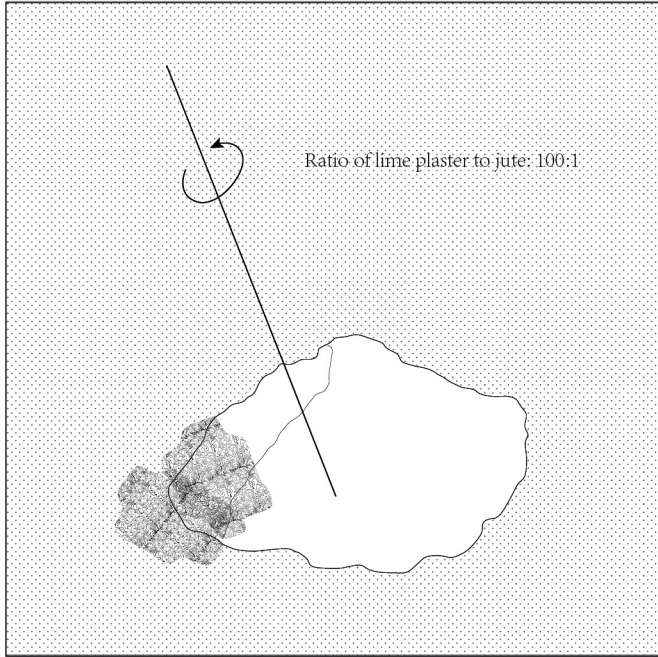
01 Limestones



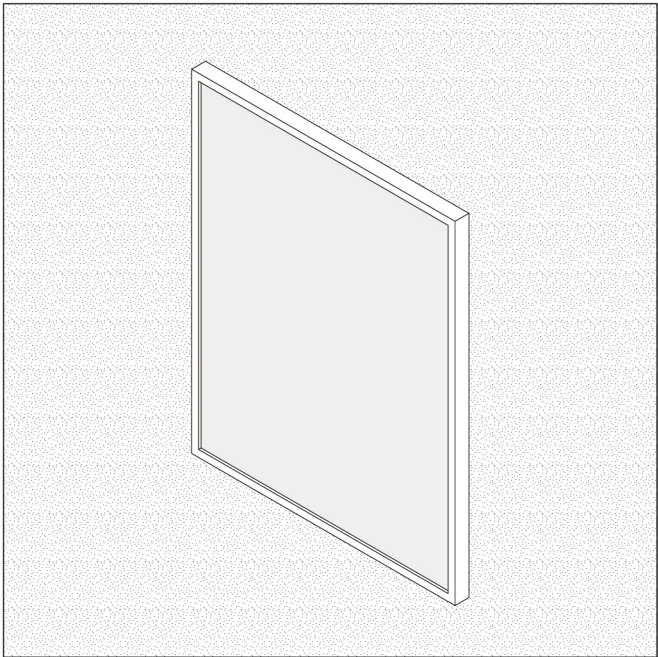
02 Put the limestones into the water



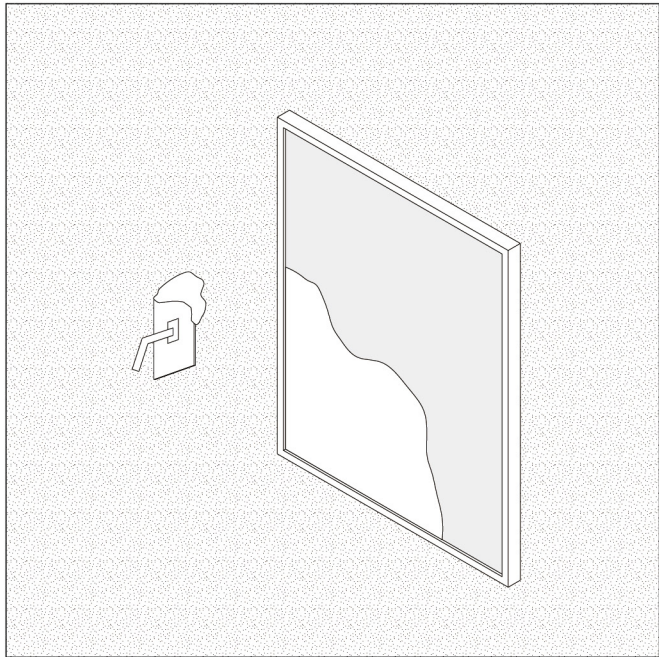
03 Cut the jute rope into strands



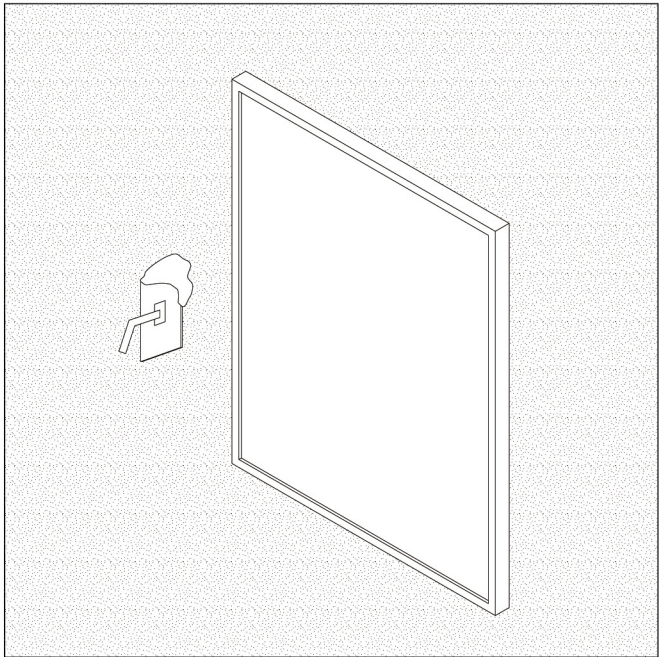
04 Mix lime plaster with jute



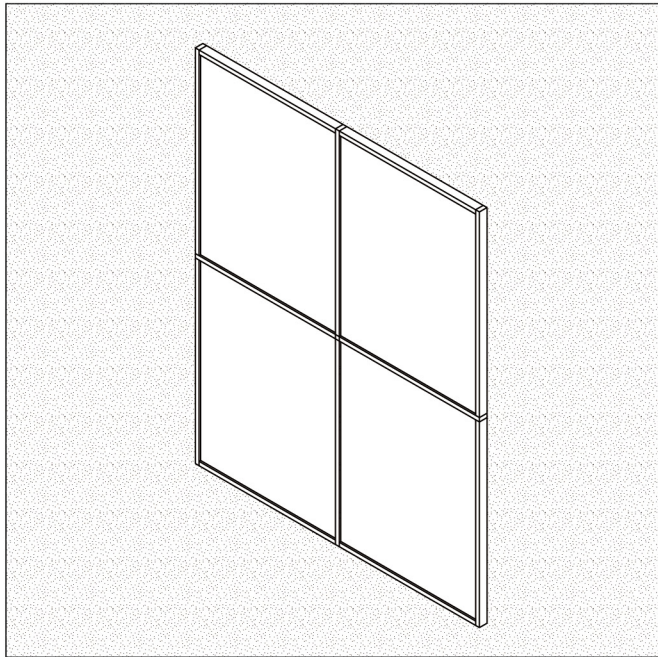
05 Set the daub until semi-dry state



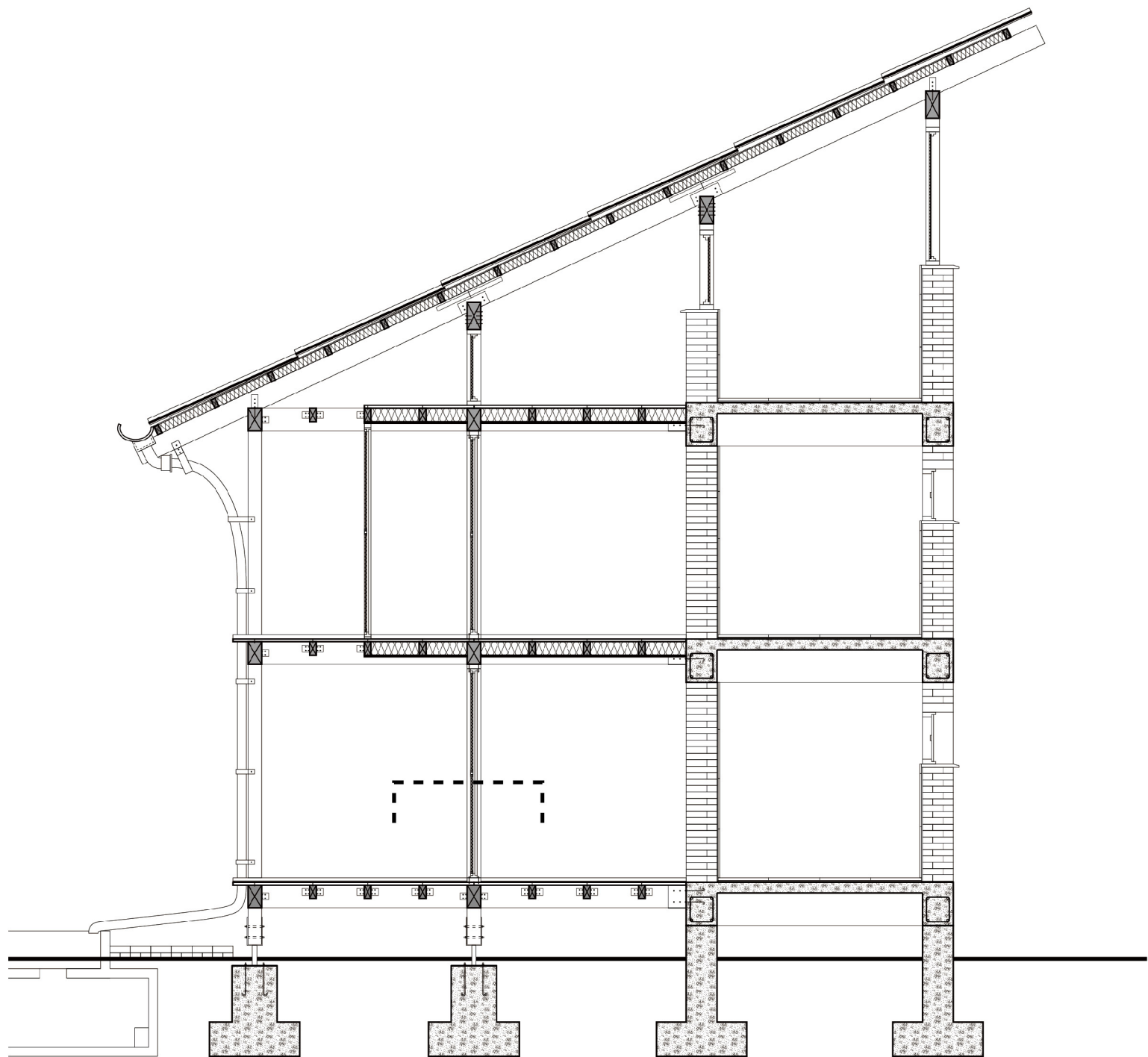
06 Plaster the lime on daub wall



07 Lime plaster for 6 times

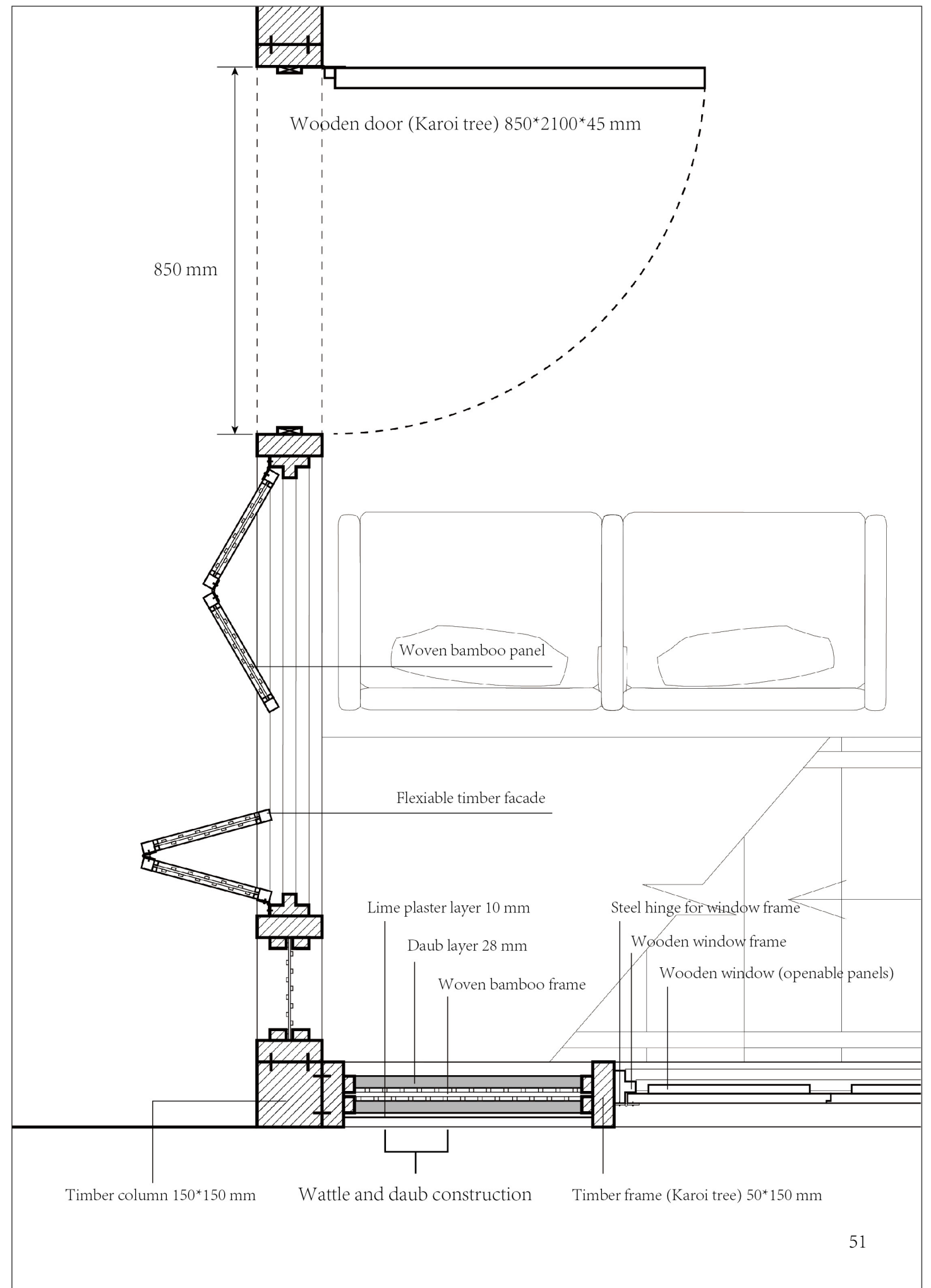


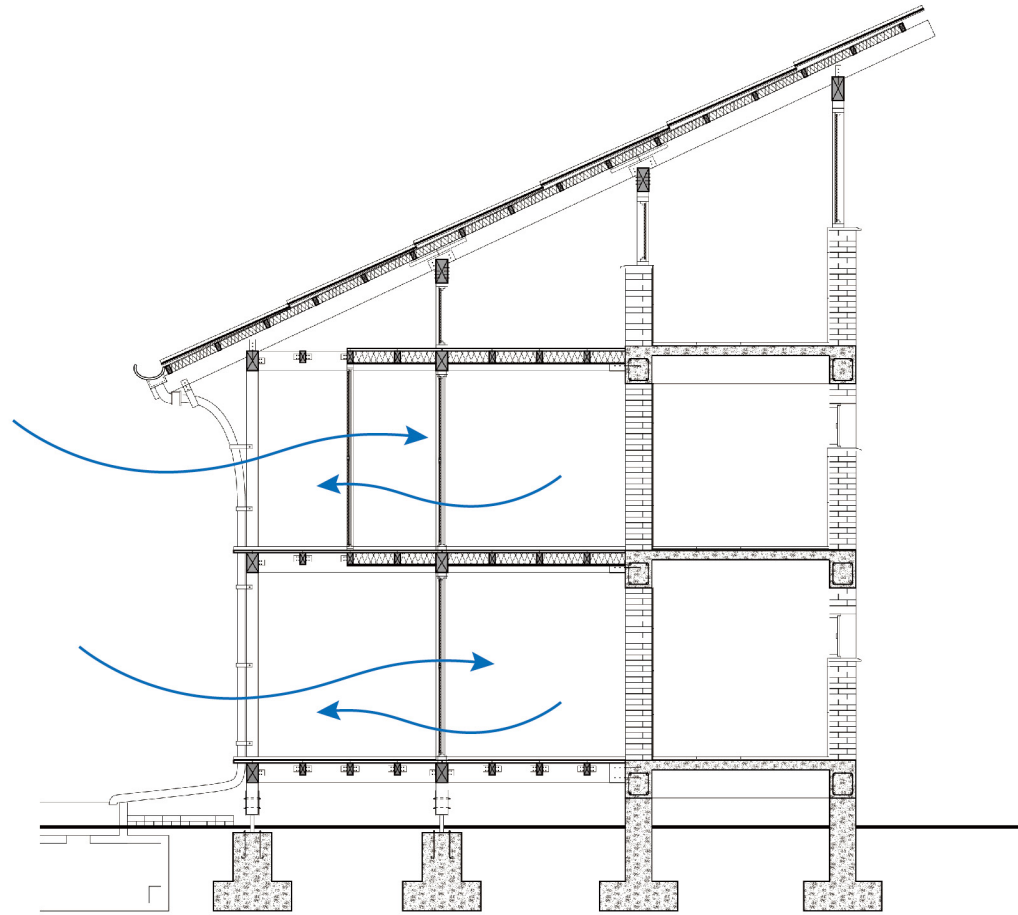
08 Cure and dry the wall



FRAGMENT PLAN - WOODEN FRAMED WALL

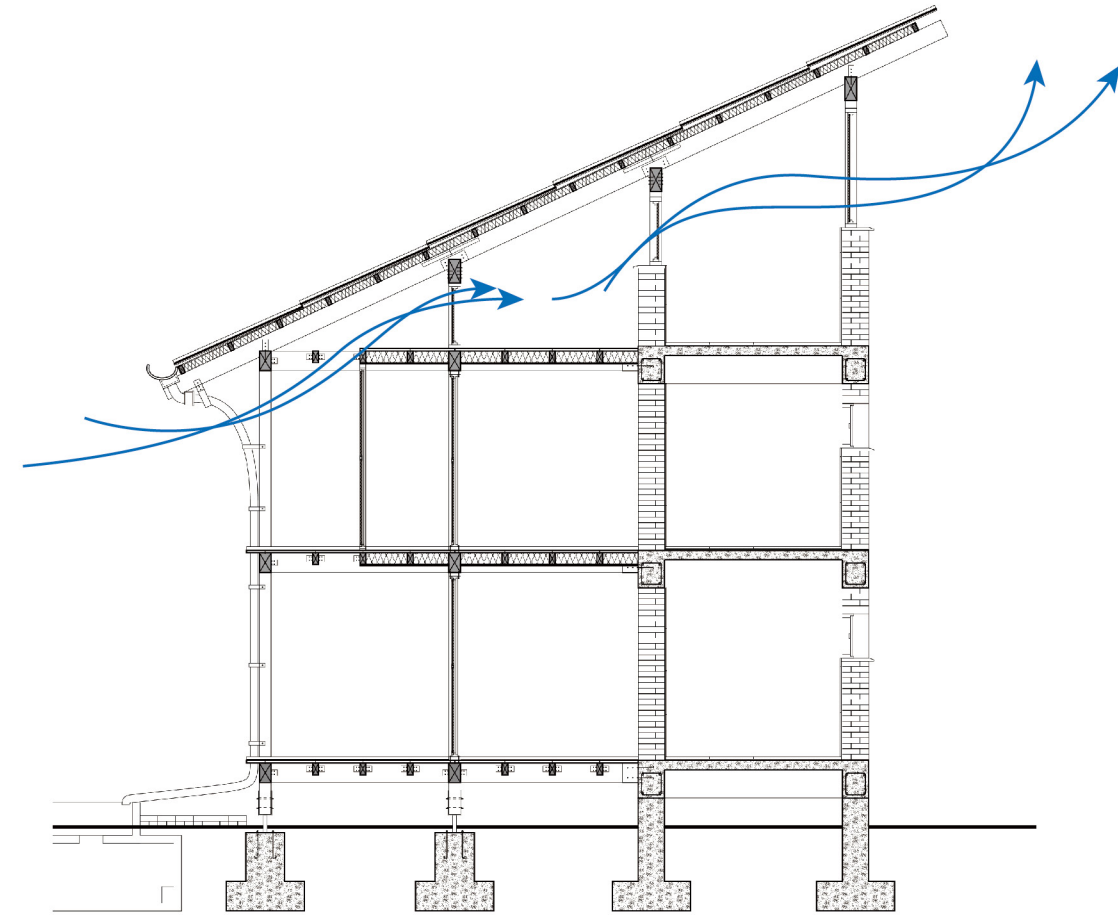
1:10





BAMBOO FOLDING FACADE

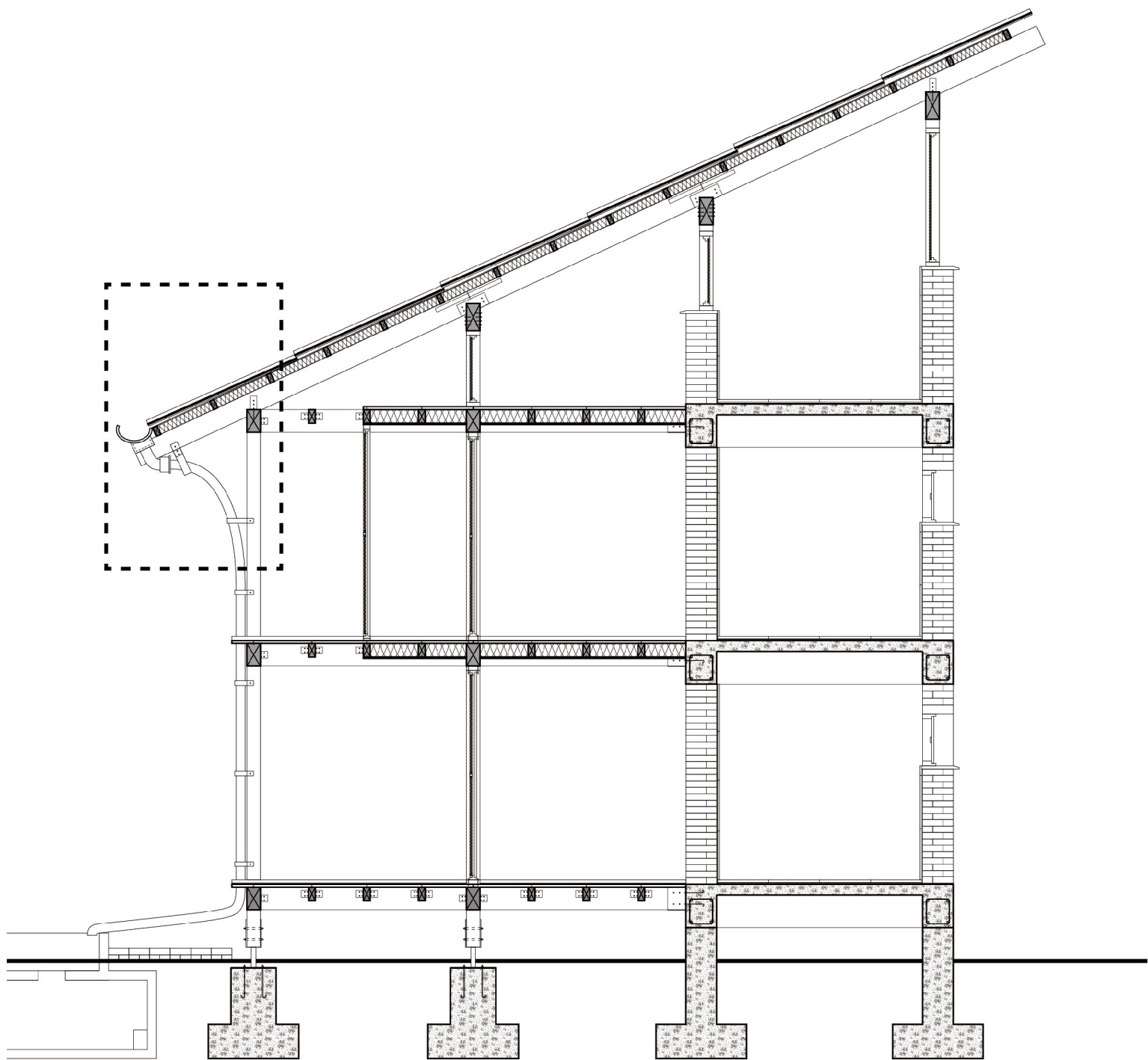
The woven bamboo facade and folding walls could enhance the air circulation between the interior and exterior space, creating better ventilation conditions indoors.



SLOPE ROOF

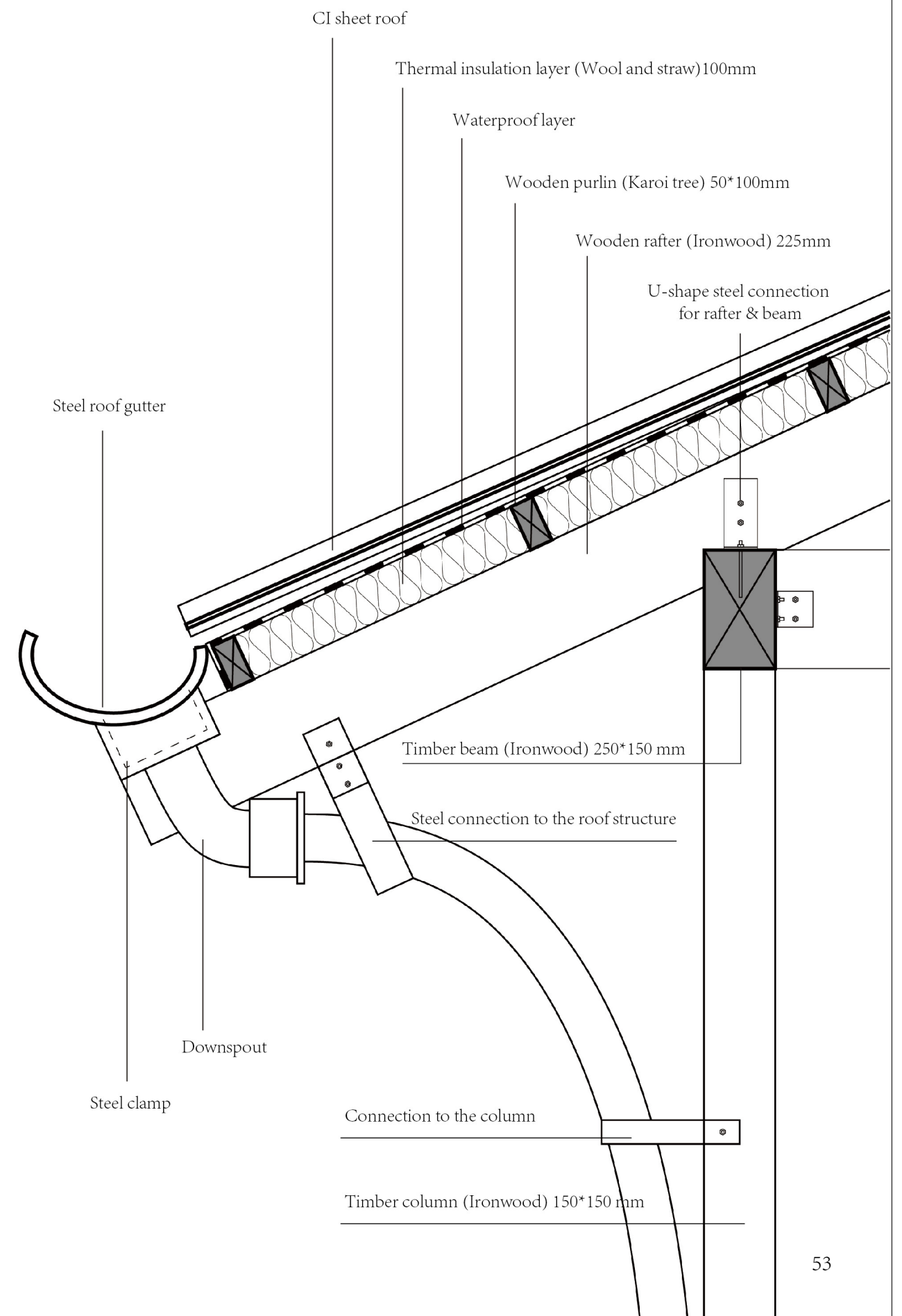
By raising the roof, spaces could be created to let fresh air into the upper attic space. This design could increase the capacity of natural ventilation to cool down the interior space since the CI sheet roof will generate heat due to its metal characteristic.

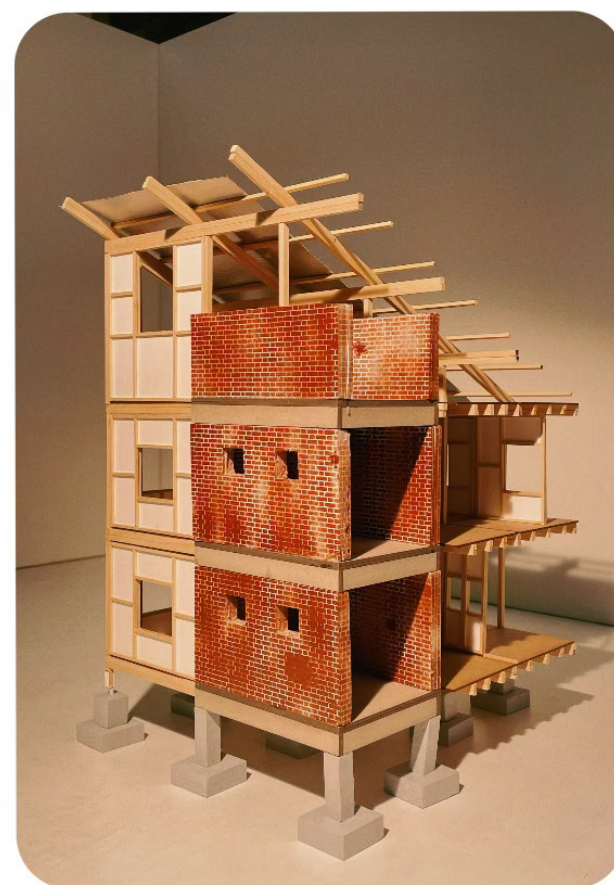
CLUSTER VENTILATION



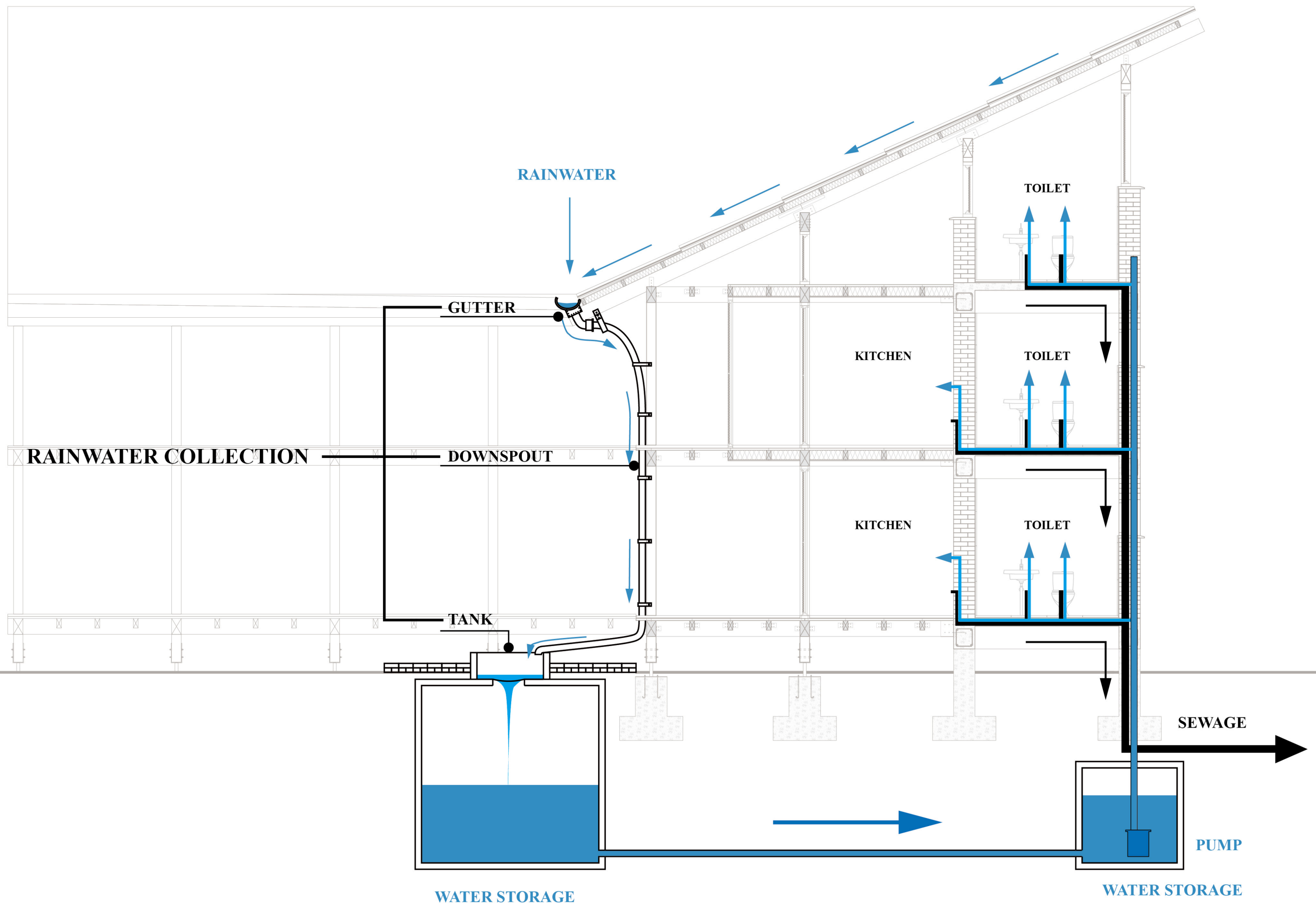
DETAIL SECTION - ROOF 2

1:10



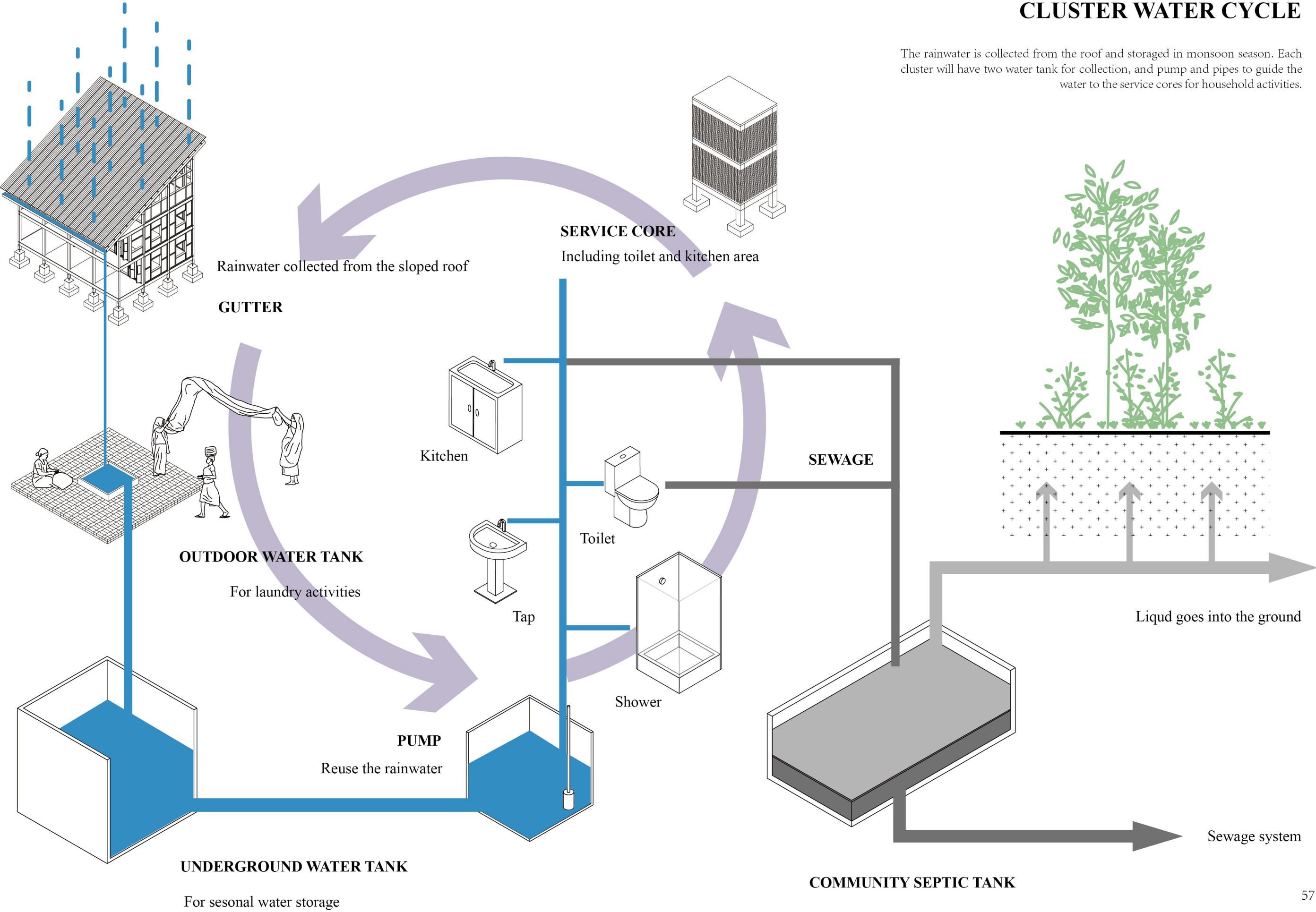






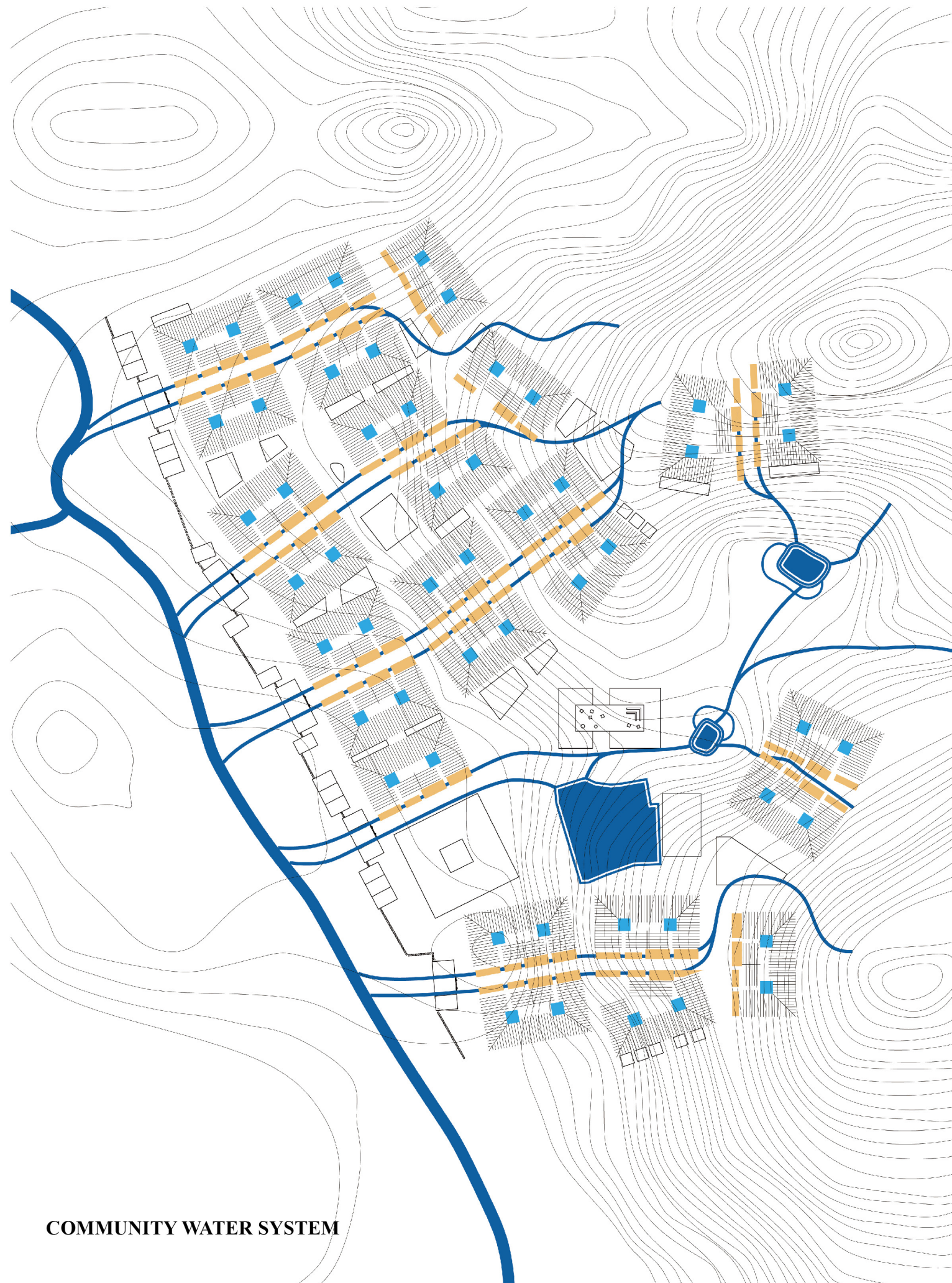
CLUSTER WATER CYCLE

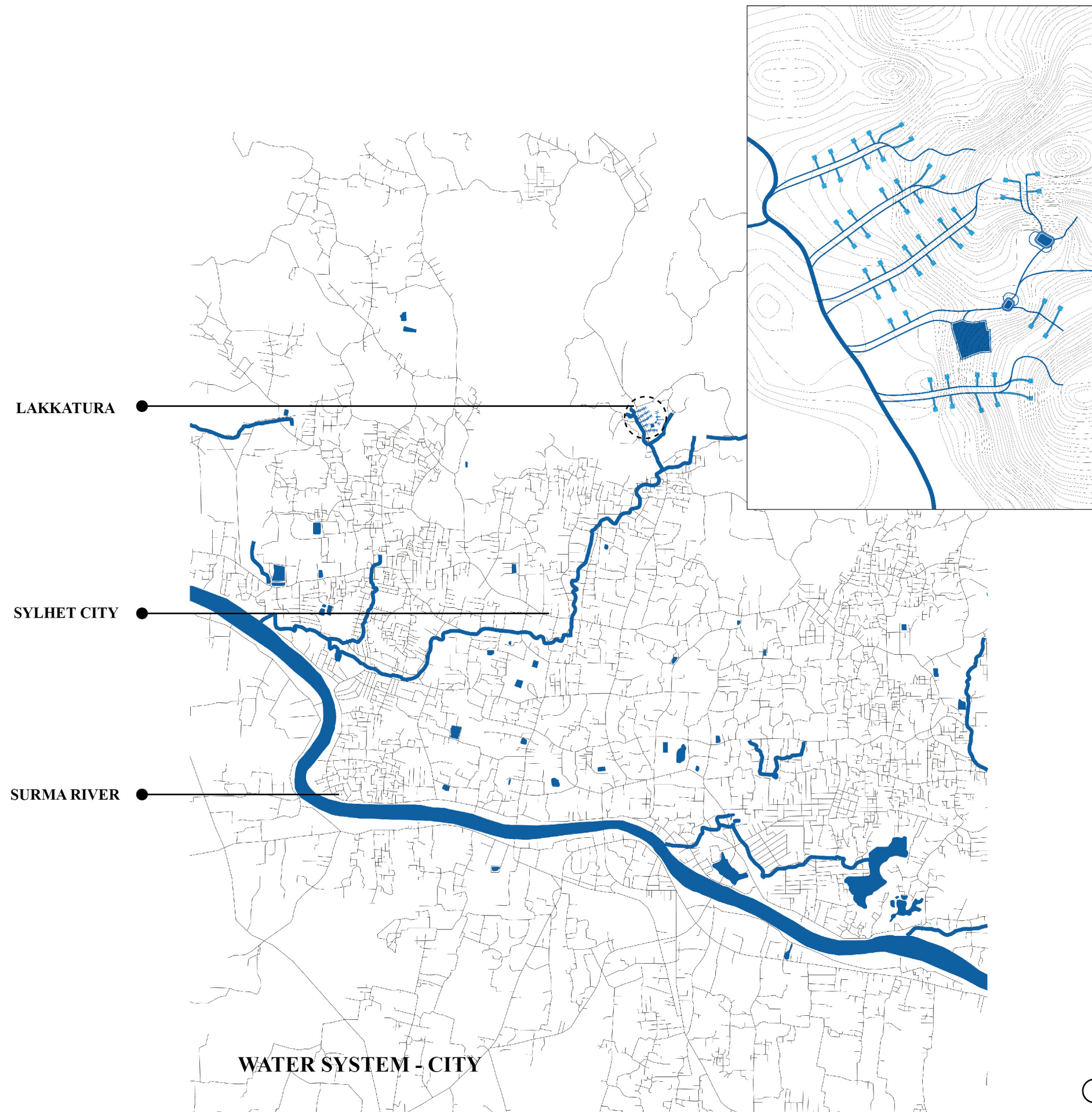
The rainwater is collected from the roof and stored in monsoon season. Each cluster will have two water tank for collection, and pump and pipes to guide the water to the service cores for household activities.



- Cluster water collection
- Community water planning
- Vegatable planting space
- Contour lines
- Dwelling cluster

COMMUNITY WATER SYSTEM



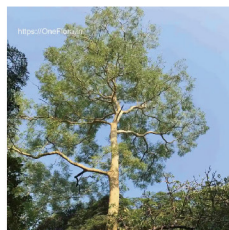




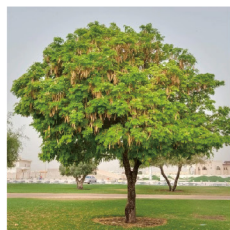


SHADE TREE

Shade tree is a strategy for tea garden to modular the environment of the tea ecosystem.



Sada koro
(*Albizia procera*)



Kalo koro
(*Albizia lebbek*)



Sissoo
(*Dalbergia sissoo*)



Akashmoni
(Golden shower)



LANDSCAPE STRATEGY



FRUIT TREE

There are some fruit trees in Sylhet are also tall and evergreen, which could provide both shading and fruit production for the community residents.



Mango
(*Mangifera indica*)



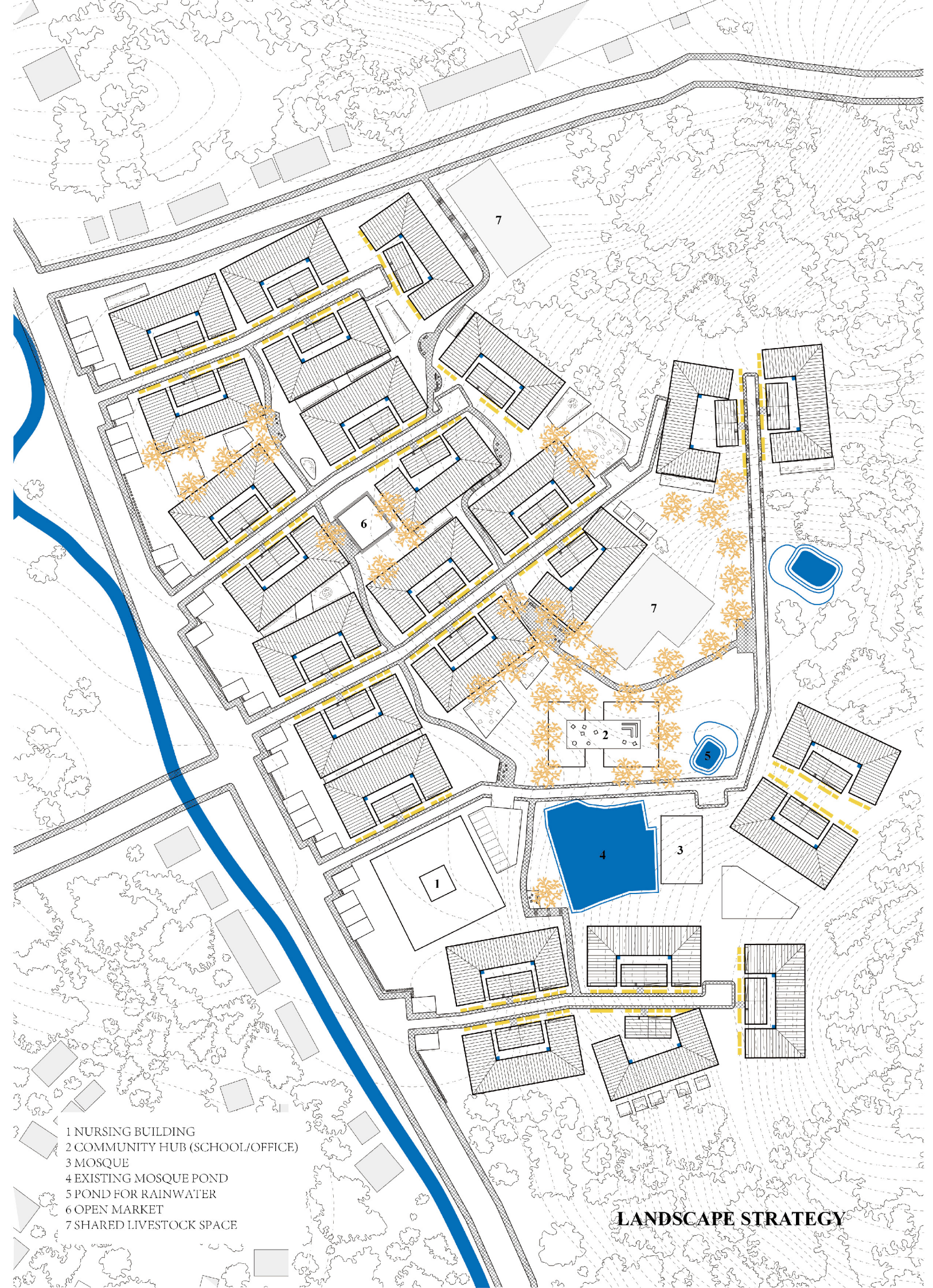
Jackfruit
(*Artocarpus heterophyllus*)



Guava
(*Psidium guajava*)

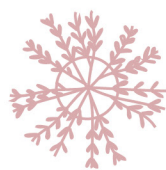


Litchi
(*Litchi chinensis*)



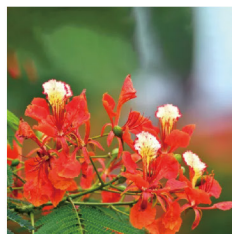
- 1 NURSING BUILDING
- 2 COMMUNITY HUB (SCHOOL/OFFICE)
- 3 MOSQUE
- 4 EXISTING MOSQUE POND
- 5 POND FOR RAINWATER
- 6 OPEN MARKET
- 7 SHARED LIVESTOCK SPACE

LANDSCAPE STRATEGY



FLOWER TREE

There are some common flowers and flower trees grow in Sylhet listed below, which are suitable to grow in the community.



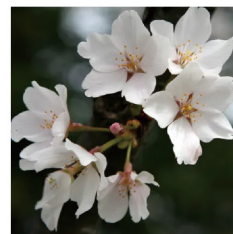
Royal poinciana
(*Delonix regia*)
Height: 12 m



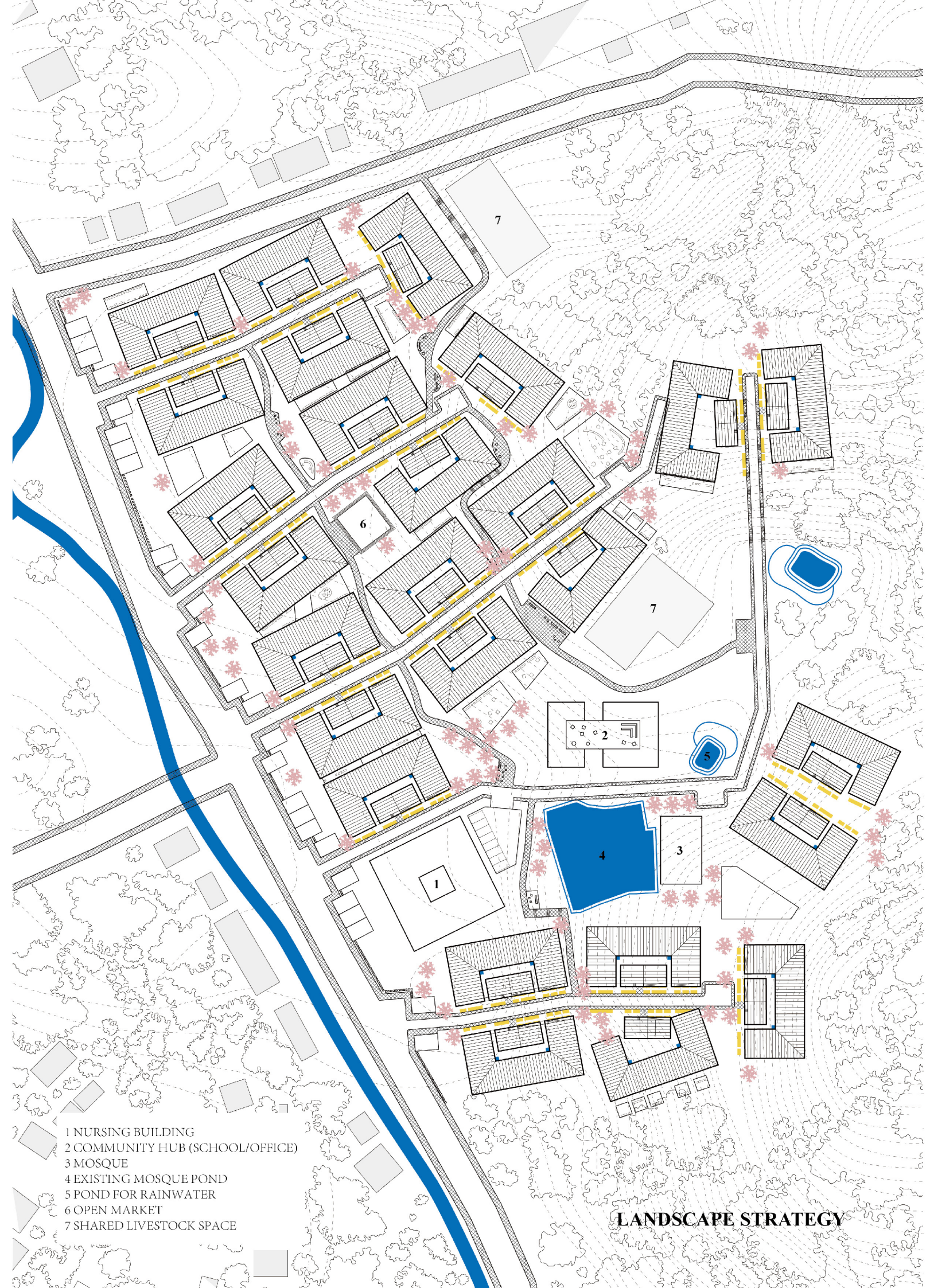
Rose of sharon
(*Hibiscus syriacus*)
Height: 2-4 m

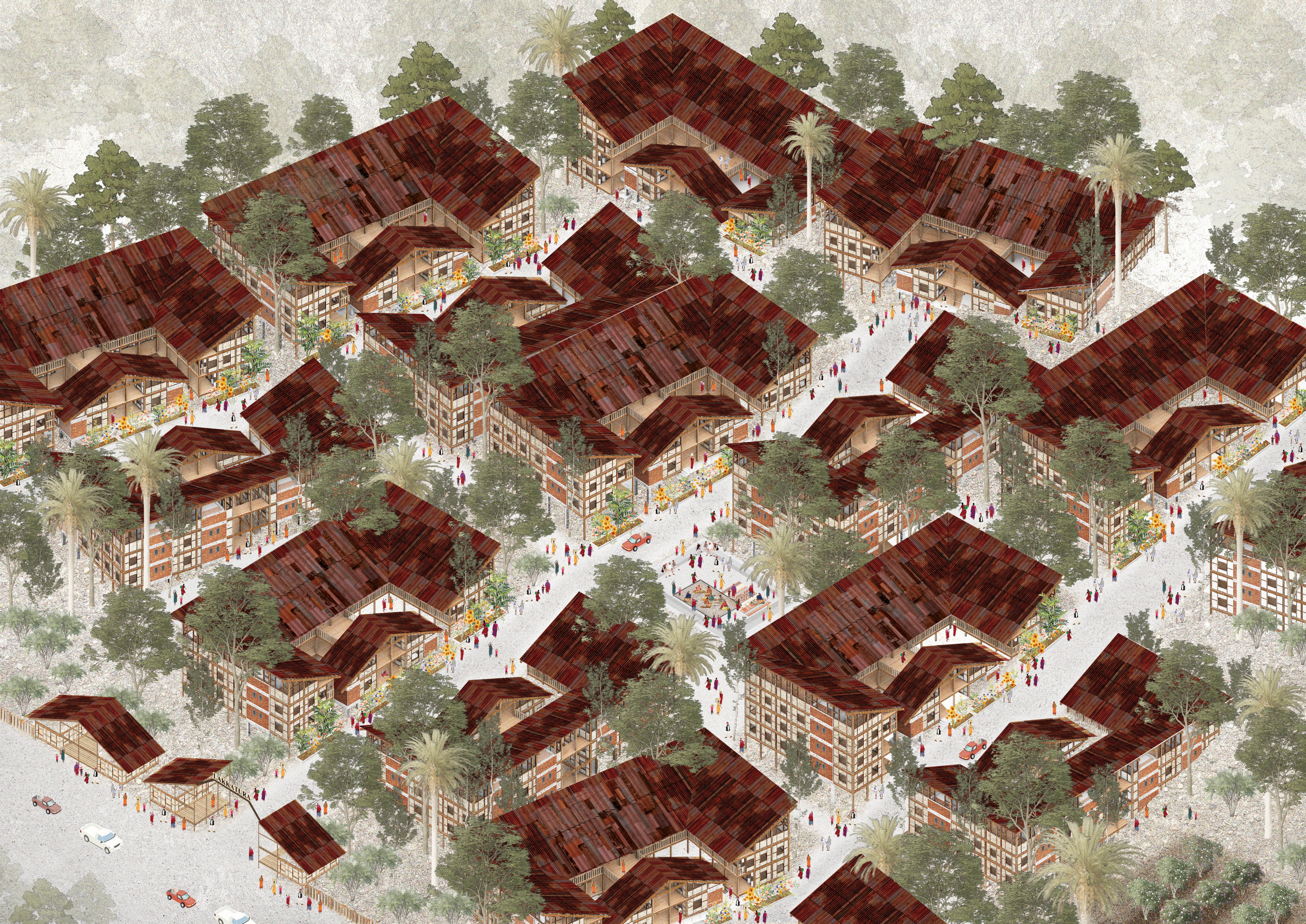


Black locust
(*Robinia pseudoacacia*)
Height: 27 m



Japanese cherry
(*Prunus serrulata*)
Height: 3-8 m







COMMUNITY PLAN FOR KUCHAI