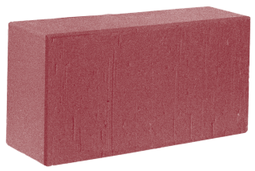
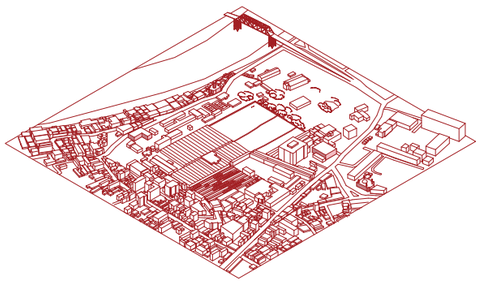
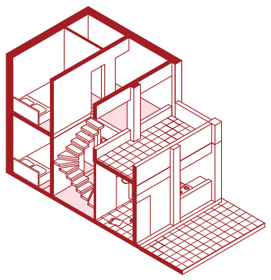
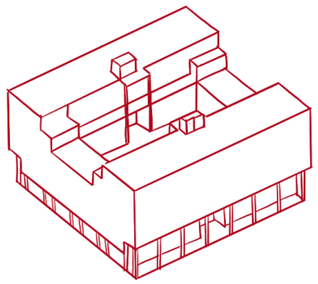
Coco de Bok
4807928

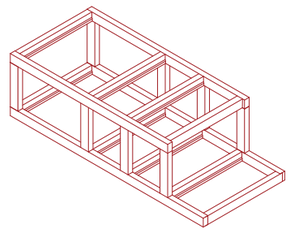
How can locally **sourced, sustainable building materials** be used to address **the housing crisis** in **Sylhet,** Bangladesh, by creating **climate-resilient,** and **affordable housing solutions?**

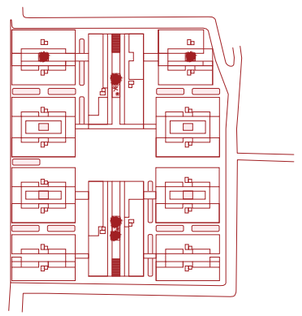












RESEARCH → SITE ANALYSIS → UNIT → CLUSTER → BUILDING TECHNOLOGY → MASTERPLAN

01 DESIGN BY RESEARCH

How can locally **sourced, sustainable building materials** be used to address **the housing crisis** in **Sylhet,** Bangladesh, by creating **climate-resilient,** and **affordable housing solutions?**

RESEARCH

EXISTING CULTURE

PART 1 - EXISTING MATERIALS

PART 1.1 - LEARNING FROM LOCAL HOUSING IN BANGLADESH

PART 2 - WASTE STREAMS WITH POTENTIAL

PART 3 - OPTIMIZED LOCAL MATERIALS

PART 4 - DESIGNING WITH THIS LOCAL MATERIAL TO MAKE AFFORDABLE HOUSING

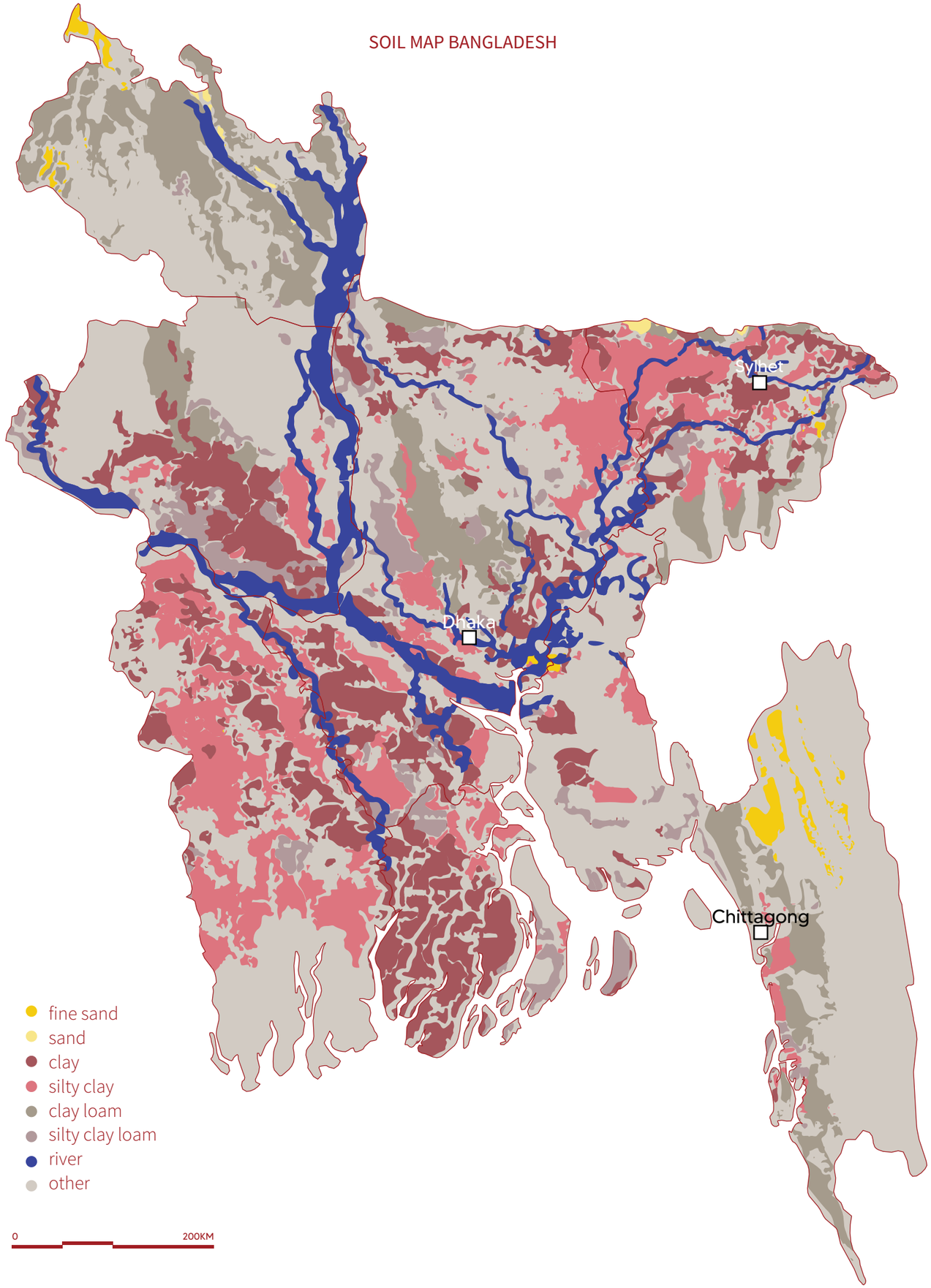
THE EXISTING MATERIAL - BRICK



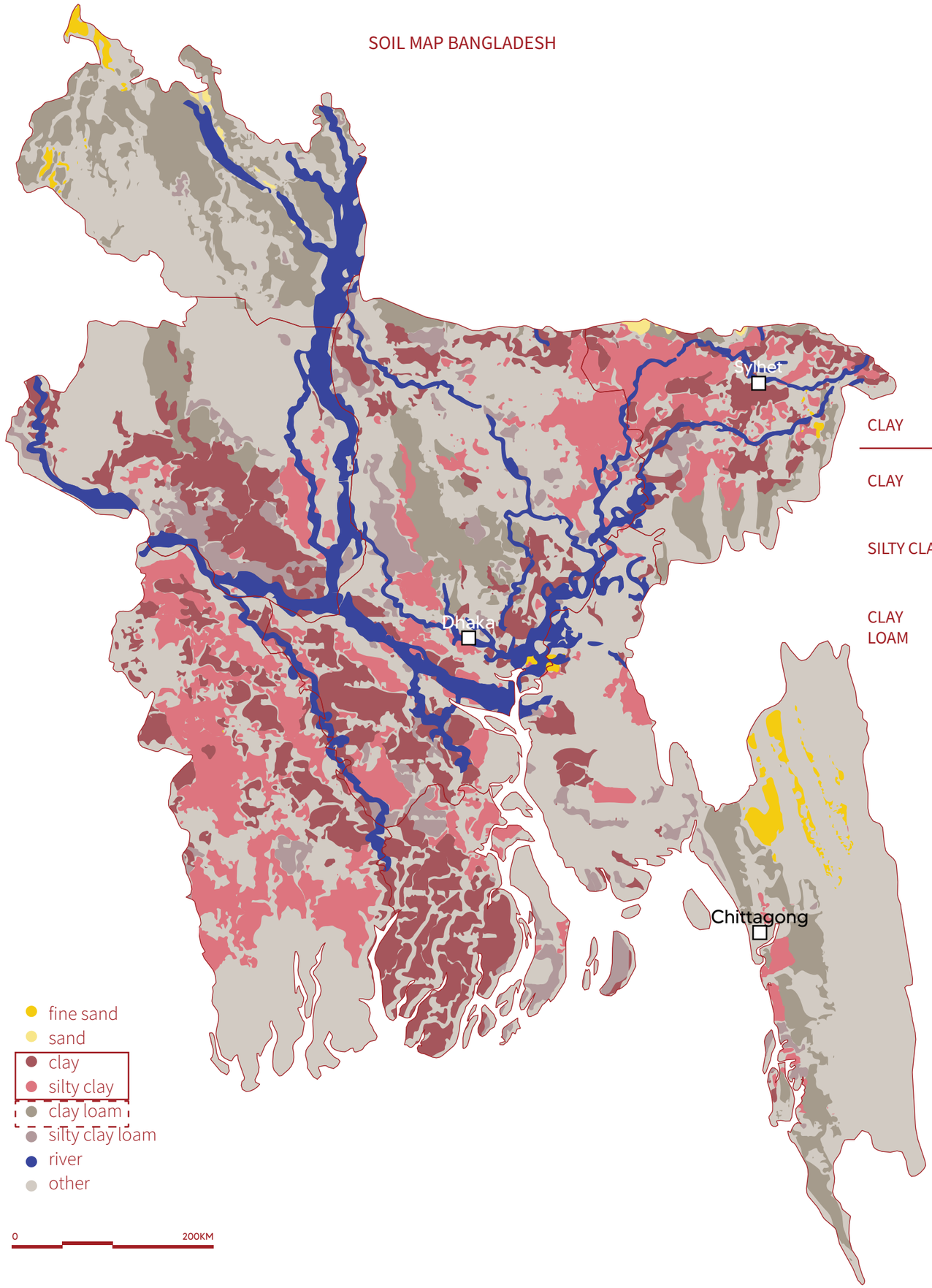
"we have hundreds and thousands of years of brick tradition. So, it's something culturally embedded in our geography. It's a delta, earth is our material."

- Marina Tabbasum

SOIL MAP BANGLADESH

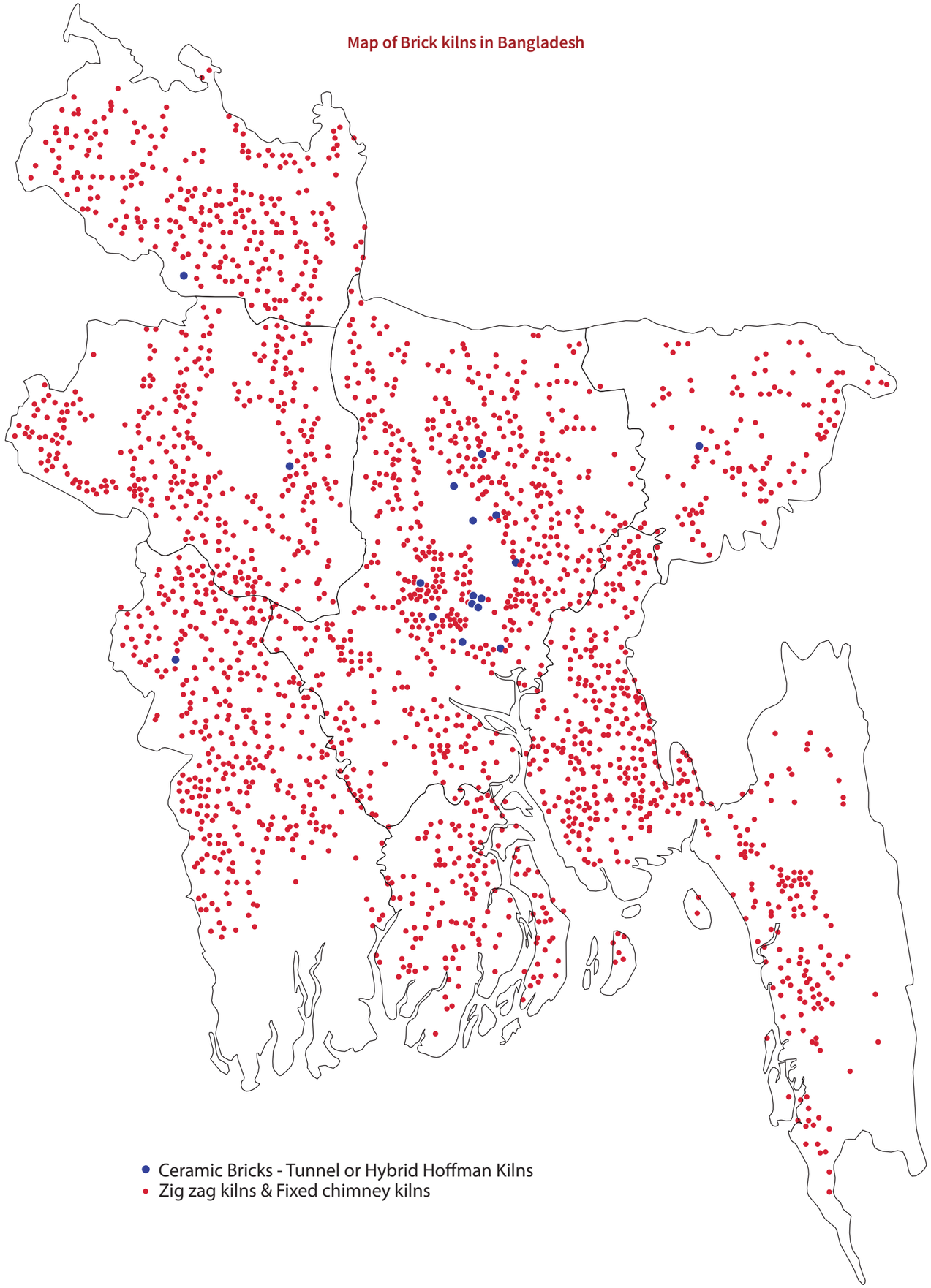


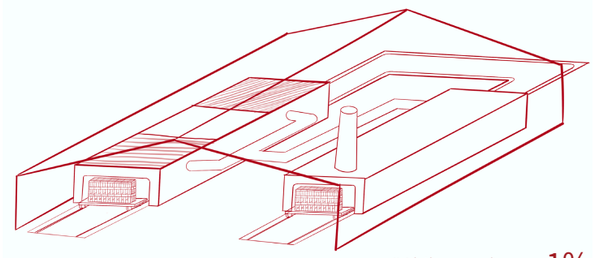
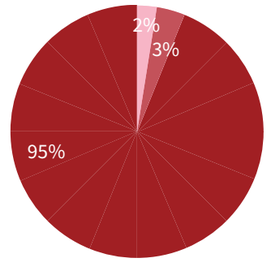
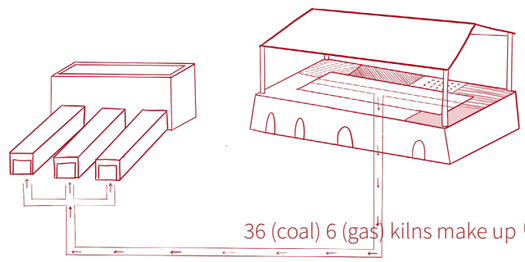
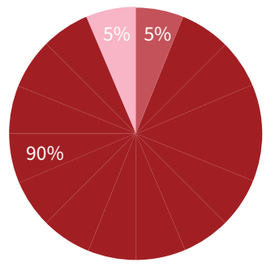
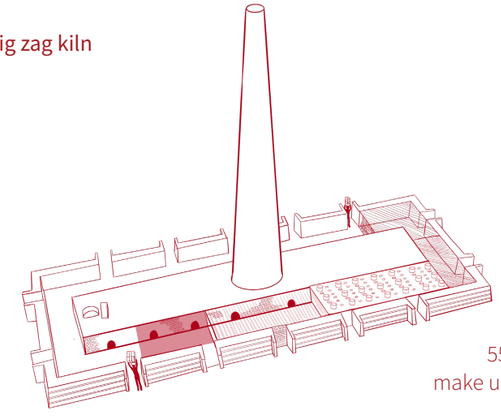
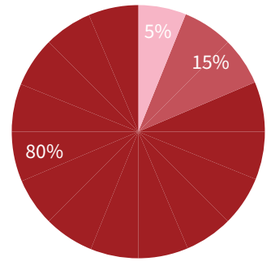
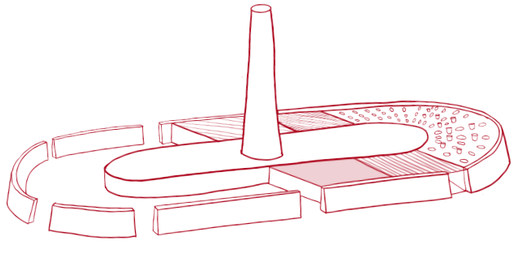
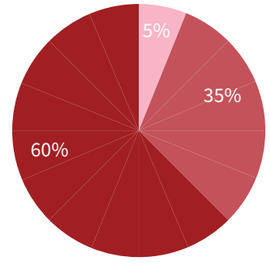
SOIL MAP BANGLADESH

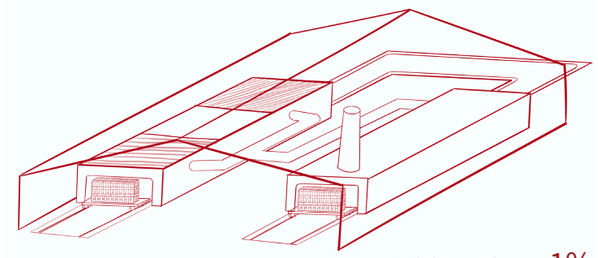
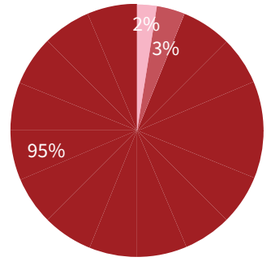
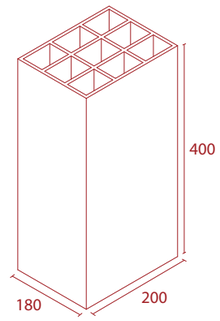
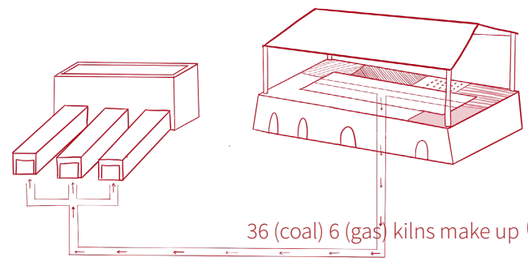
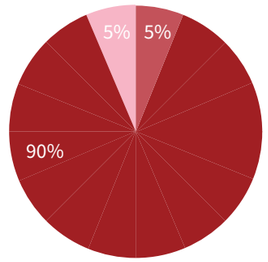
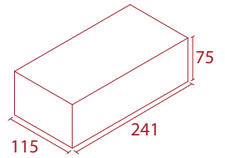
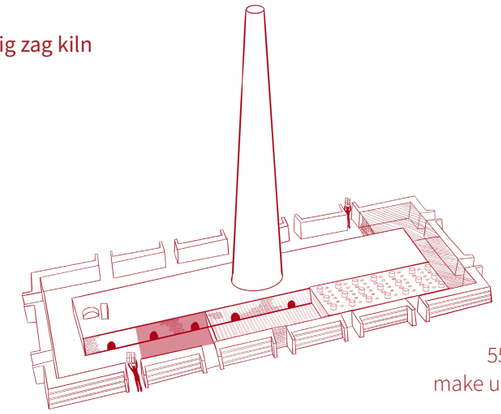
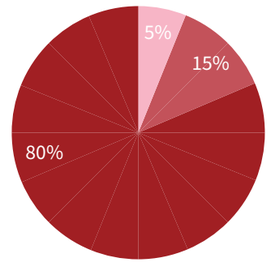
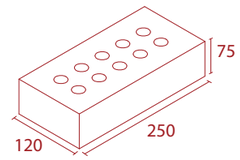
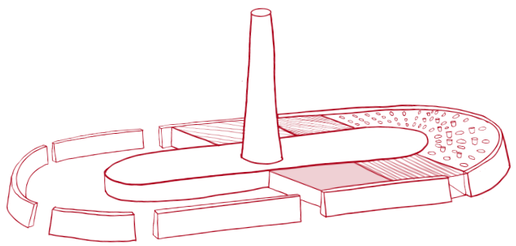
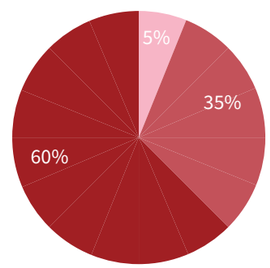
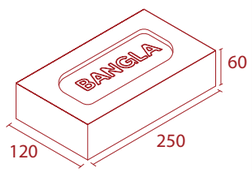


CLAY	USE IN FIRED BRICKS
CLAY	NEEDED IN BRICKS. MIN OF 30%, CERAMIC BRICKS CAN HAVE UP TO 60%
SILTY CLAY	CAN BE USED AS CLAY BUT OFTEN NEEDS TO BE MIXED WITH SAND OR GROG BECAUSE MORE VULNERABLE FOR CRACKING
CLAY LOAM	CAN BE USED BUT NEEDS TO EXCEED 30% CLAY CONTENT.

Map of Brick kilns in Bangladesh



KILN TYPOLOGY	CLIMATE IMPACT	PRODUCTION EFFICIENCY
Tunnel Kiln  81kilns make up **1%**	PARTICULATE EMISSIONS <50 mg/m³ EMBODIED ENERGY 1.40 MJ/Kg	
Hybrid Hoffman Kiln  36 (coal) 6 (gas) kilns make up **0.5%**	PARTICULATE EMISSIONS <100 mg/m³ EMBODIED ENERGY 1.20 MJ/Kg	
zig zag kiln  5524 kilns make up **70%**	PARTICULATE EMISSIONS 300-800 mg/m³ EMBODIED ENERGY 1.03 MJ/Kg	
Fixed chimney kiln  2235 kilns makes up **28%**	PARTICULATE EMISSIONS 1000+ mg/m³ EMBODIED ENERGY 1.30 MJ/Kg	

KILN TYPOLOGY	CLIMATE IMPACT	PRODUCTION EFFICIENCY	PRICE (taka/brick)	COMPRESSIVE STRENGTH (MPa)
Tunnel Kiln  81kilns make up **1%**	PARTICULATE EMISSIONS <50 mg/m³ EMBODIED ENERGY 1.40 MJ/Kg		HOLLOW BRICK 	50 - 80 taka	5 - 15 Mpa
Hybrid Hoffman Kiln  36 (coal) 6 (gas) kilns make up **0.5%**	PARTICULATE EMISSIONS <100 mg/m³ EMBODIED ENERGY 1.20 MJ/Kg		CERAMIC BRICK 	20 - 30 taka	15 - 23 Mpa
zig zag kiln  5524 kilns make up **70%**	PARTICULATE EMISSIONS 300-800 mg/m³ EMBODIED ENERGY 1.03 MJ/Kg		PERFORATED BRICK 	30 - 40 taka	10 - 20 Mpa
Fixed chimney kiln  2235 kilns makes up **28%**	PARTICULATE EMISSIONS 1000+ mg/m³ EMBODIED ENERGY 1.30 MJ/Kg		BANGLA BRICK 	CLASS 1 : 10 - 13 taka CLASS 2 : 5 - 10 TAKA	CLASS 1 : 10 Mpa CLASS 2 : 7 Mpa

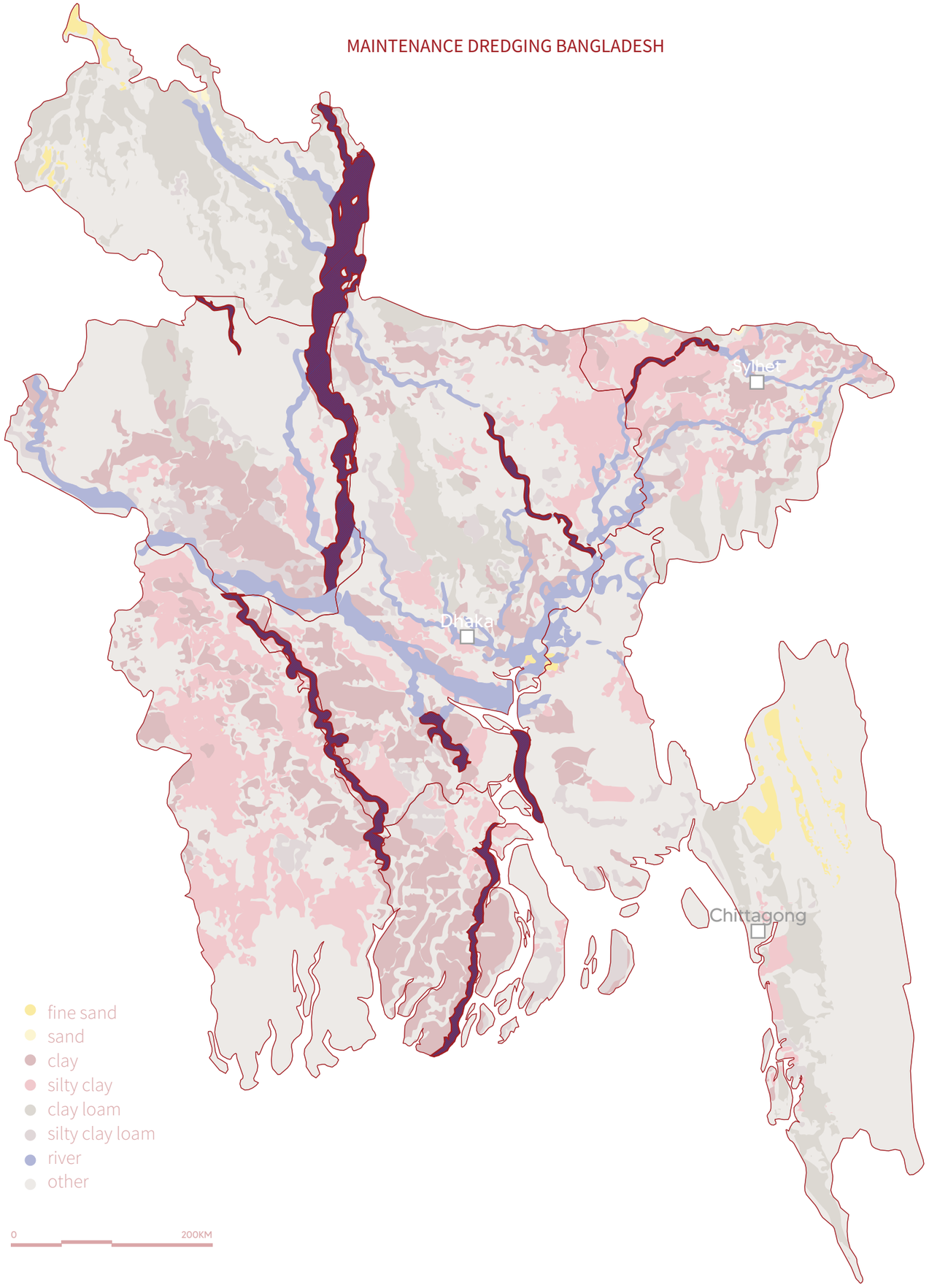
COLOR	RED	BROWN	GRAY	YELLOW
CHEMICAL COMPOSITION	**HIGH IRON CONTENT** Fe_2O_3 (Iron 3 oxide)	**ORGANIC MATTER** THAT IS BURNED OFF DURING FIRING. Addition of organic matter means less fuel is needed as it becomes internal fuel this can also make bricks browner. **MANGANESE COMPOUNDS** MnO_2 or Mn_3O_4 in clay	**ADDITIVES SUCH AS** **Fly ash, sand, grog**	**HIGH LIME CONTENT** (and low iron) Lime ($CaCO_3$ / CaO)
FIRING ATMOSPHERE	**Oxidizing (with oxygen)** Stabilizes $Fe^3 \rightarrow Fe_2O_3$	**Oxidizing (with oxygen)** Stabilizes $Fe^3 \rightarrow Fe_2O_3$	**Reduce oxygen in kiln to reduce oxidization** $Fe_2O_3 \rightarrow Fe_3O_4$ or FeO	**Reduce oxygen in kiln to reduce oxidization** $Fe_2O_3 \rightarrow Fe_3O_4$ or FeO

RELEVANT TO BANGLADESH

COLOR	RED	BROWN	GRAY	YELLOW
CHEMICAL COMPOSITION	**HIGH IRON CONTENT** Fe_2O_3 (Iron 3 oxide)	**ORGANIC MATTER** THAT IS BURNED OFF DURING FIRING. Addition of organic matter means less fuel is needed as it becomes internal fuel this can also make bricks browner. **MANGANESE COMPOUNDS** MnO_2 or Mn_3O_4 in clay	**ADDITIVES SUCH AS** **Fly ash, sand, grog**	**HIGH LIME CONTENT** (and low iron) Lime ($CaCO_3$ / CaO)
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MAINTENANCE DREDGING BANGLADESH



CERAMIC / AUTO BRICK



/per brick	Ceramic Brick - tunnel kiln
Compressive strength (Mpa)	21
Water Apsorption (%)	8-15
Firing shrinkage (%)	< 8
Bulk density (Kg/m3)	1200 -1800
Embodied energy (Mj)	1.2

(Asdrubali et al., 2023)
(Greentech Knowledge et al., 2017)

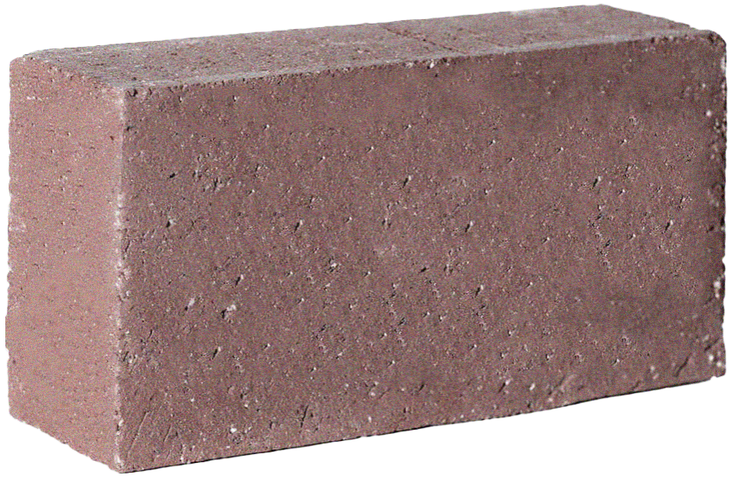
TANNERY SLUDGE (10% BRICK)



/per brick	Kiln	Lab
Compressive strength (Mpa)	16.3	21
Water Apsorption (%)	18	10
Firing shrinkage (%)	10	6.3-9.1
Bulk density (Kg/m3)	1500	1580-1670
Embodied Energy (Mj)	0.8	0.8
Energy saved due to inner fuel (%)	15	15
Energy saved (Mj)	0.367	0.367

(Juel et al., 2017)
(Armia Ghrairi et al., 2024)
(Nida, 2021)

DREDGED SLUDGE (10-15%) BRICK



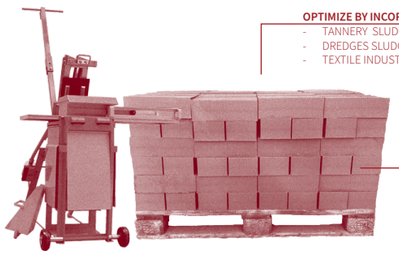
/per brick	10 % Dredged material	Water permeable pavement bricks: 20% Dredged material
Compressive strength (Mpa)	6-10	5-10
Water Apsorption (%)	15-20	15-30
Firing shrinkage (%)	< 8	4-10
Bulk density (Kg/m3)	1200 -1800	1200 -1800
Embodied energy (Mj)	1.2	1.2
Water permeability (mm/s)		2-5

(Manap et al., 2016)

FEASIBILITY TIMELINE

BUILDING MATERIALS

OPTIMIZE BY INCORPORATING 10 % WASTE STREAM
- TANNERY SLUDGE
- DREDGES SLUDGE
- TEXTILE INDUSTRY SLUDGE



PRODUCTION : On site production, with a small production initial investement is around 2000 USD for an auram press.
RAW MATERIALS **:** easily accessible
CLIMATE : Need to be protected from the rain.
APPLICATION : walls and vault floors that are protected from the rain, when stabilized it can be used for exterior walls. Not wet areas.
LOAD BEARING: max 4 stories. Earth blocks are very heavy meaning it is not suitable for higher rise buildings

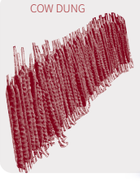
COMPRESSED EARTH BLOCKS & COMPRESSED STABILIZED EARTH BLOCKS

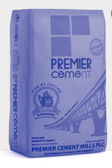
MAIN MATERIALS
15 - 30 % CLAY
50 - 70 % SAND
10-20% SILT (if present)
5 - 25 % WATER

FIBERS
FOR INCREASE IN ELASTICITY AGAINST CRACKING
- JUTE
- COCONUT COIR
- BAMBOO FIBERS



STABILIZERS 5-15%
COW DUNG
CEMENT
LIMESTONE
- LINGIN
- RICE HUSK







PRODUCTION : Similar to vernacular and traditional mud housing except now for interior finishing.
RAW MATERIALS **:** easily accessible
CLIMATE : regulates temperature inside.
APPLICATION : Interior wall finishing. Not applicable for wet areas.



PRODUCTION : Same as conventional bricks
RAW MATERIALS **:** easily accessible
CLIMATE : water resistant
APPLICATION : walls and vault floors
LOAD BEARING: max 4 stories

TANNERY SLUDGE BRICKS

MAIN MATERIALS
30 - 50 % CLAY
20-30% SILICA (found in sand)
10% SILT
10% TANNERY SLUDGE

DREDGED SLUDGE BRICKS

MAIN MATERIALS
30 - 50 % CLAY
20-30% SILICA (found in sand)
10% SILT
10 - 15% DREDGED SOIL

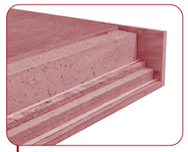
MORTAR



CEMENT OR LIME MORTAR

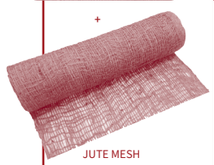
EARTH PLASTER





PRODUCTION : It is mixed, pumped and poured the same way as conventional cement screed.
RAW MATERIALS **:** easily accessible
CLIMATE : regulates temperature inside.
APPLICATION : Screed on top of floors.

\+



JUTE MESH

MUD PLASTER

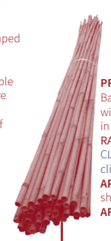
MAIN MATERIALS
10 - 30 % CLAY
50 - 70 % SAND
10-50 % WATER

EARTH SCREED

MAIN MATERIALS
10 % CLAY
60 - 70 % EARTH
10-25 % WATER
5 - 15% LIME
1 % SODIUM SALT ADDITIVE
3 % FIBER OF CHOICE



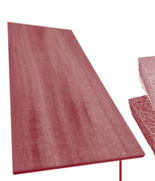
PRODUCTION : grows in many parts of Bangladesh, the weaving and crafting with bamboo is already widely practiced in Bangladesh
RAW MATERIALS **:** easily accessible
CLIMATE : interior use is best. Not very climate resistant.
APPLICATION : Interior cladding, shutters, doors flooring, furniture.
AFFORDABILITY : cheap



BAMBOO - SMALLER APPLICATION

SPECIES MELOCANNA BACCIFERA - accounts for 70-80 % of all bamboo in Bangladesh

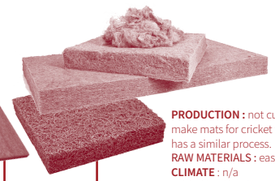
PRODUCTION : growd in Bangladesh
RAW MATERIALS **:** asily accessible
CLIMATE : interior use is best. Not very climate resistant. Not applicable fro window frames due to high moisture absorption and expanding and shrinking.
APPLICATION : Interior cladding, intrior or exterior shutters only the paneling, doors flooring, furniture.
AFFORDABILITY : expensive



HARD WOOD - SMALLER APPLICATION

SPECIES TEAK, SAL & MAHOGANY

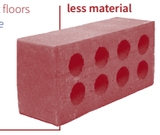
BIO BASED INSULATION



PRODUCTION : not currently existent but they do make mats for cricket from coconut coir which has a similar process.
RAW MATERIALS **:** easily accessible
CLIMATE : n/a
APPLICATION : thermal and acoustic insulation.

PRODUCTION : Same as conventional bricks, the only problem is the 10% substitute has to be tested as you need a certain water and clay content to not make it crack. These bricks are more vulnerable to cracking when changing the composition due to the holes.
RAW MATERIALS **:** Raw materials easily accessible
CLIMATE : water resistant
APPLICATION : walls and vault floors
LOAD BEARING: not applicable

uses up to 20% less material



10% WASTE SLUDGE PERFORATED BRICK

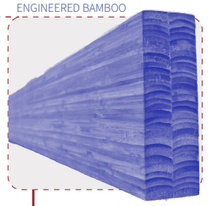


PRODUCTION : Bamboo gros fast and easily in Bangladesh, it also already gets used in the construction industry, but only for temporary scaffolding.
RAW MATERIALS **:** Bamboo, easily accessible
CLIMATE : Needs treatment against insects, fire safety, fungal growth and water resistance. Bamboo soaks up water.
APPLICATION : For interior applications it works really well, it has a very high tensile strength but is not durable in climate resistance, and for large projects labor intensive as each bamboo culm is different.
LOAD BEARING: max 3 storeys

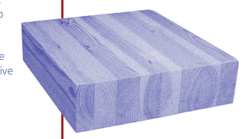
BAMBOO CONSTRUCTION

SPECIES BAMBUSA BALCOOA

ENGINEERED BAMBOO



Wood is not widely accessible, and expensive in Bangladesh. Only construction that uses wood is prefab Bangla baton houses which go max 2 storeys high. Both engineerd Bamboo and wood use the similar production. Production is using High-pressure lamination presses, needs a large investment, as currently a non existent industry.



ENGINEERED WOOD GLULAM, CLT & DLT

MAIN MATERIALS
- SOFT WOODS (spruce, pine or fir in Europe)
- ADHESIVES (like MUF or PUR)

KEY
- NOT FEASIBLE YET
- FEASIBLE AND SUITABLE FOR BANGLADESH
- THINGS IN BLUE MEAN EITHER A CHALLENGE THAT MAKES IT LESS SUITABLE, OR NOT LOCAL

NOT FEASIBLE

INNOVATIVE

DRY STACKING - PLASTIC 3D PRINTED INTERLOCKING PARTS

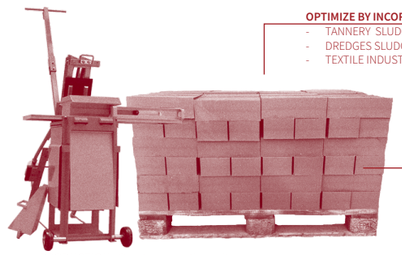


FEASIBILITY

RAW MATERIALS

FEASIBILITY TIMELINE

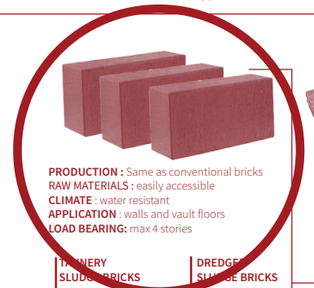
BUILDING MATERIALS



PRODUCTION : On site production, with a small production initial investement is around 2000 USD for an auram press.
RAW MATERIALS **:** easily accessible
CLIMATE : Need to be protected from the rain.
APPLICATION : walls and vault floors that are protected from the rain, when stabilized it can be used for exterior walls. Not wet areas.
LOAD BEARING: max 4 stories. Earth blocks are very heavy meaning it is not suitable for higher rise buildings

COMPRESSED EARTH BLOCKS & COMPRESSED STABILIZED EARTH BLOCKS

OPTIMIZE BY INCORPORATING 10 % WASTE STREAM
- TANNERY SLUDGE
- DREDGES SLUDGE
- TEXTILE INDUSTRY SLUDGE



PRODUCTION : Same as conventional bricks
RAW MATERIALS **:** easily accessible
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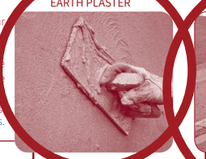
TANNERY SLUDGE BRICKS

DREDGED SLUDGE BRICKS

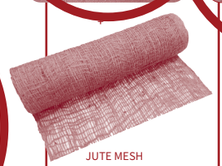
PRODUCTION : Similar to vernacular and traditional mud housing except now for interior finishing
RAW MATERIALS **:** easily accessible
CLIMATE : regulates temperature inside
APPLICATION : Interior wall finishing. Not applicable for wet areas.

MUD PLASTER

EARTH PLASTER

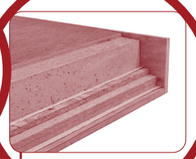


JUTE MESH

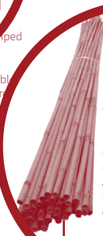


PRODUCTION : It is mixed, pumped and poured the same way as conventional cement screed.
RAW MATERIALS **:** easily accessible
CLIMATE : regulates temperature inside.
APPLICATION : Screed on top floors.

EARTH SCREED

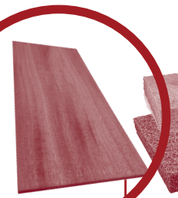


PRODUCTION : grows in many parts of Bangladesh, the weaving and crafting with bamboo is already widely practiced in Bangladesh
RAW MATERIALS **:** easily accessible
CLIMATE : interior use is best. Not very climate resistant.
APPLICATION : Interior cladding, shutters, doors flooring, furniture.
AFFORDABILITY : cheap



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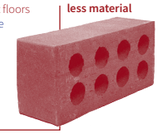
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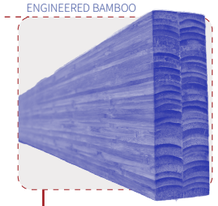
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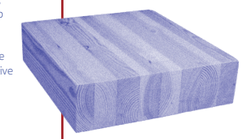
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INNOVATIVE

FEASIBILITY

MAIN MATERIALS
15 - 30 % CLAY
50 - 70 % SAND
10-20% SILT (if present)
5 - 25 % WATER

FIBERS
FOR INCREASE IN ELASTICITY AGAINST CRACKING
- JUTE
- COCONUT COIR
- BAMBOO FIBERS



STABILIZERS 5-15%
COW DUNG
CEMENT
LIMESTONE
- LIGNIN
- RICE HUSK



MAIN MATERIALS
30 - 50 % CLAY
20-30% SILICA (found in sand)
10% SILT
10% TANNERY SLUDGE

MAIN MATERIALS
30 - 50 % CLAY
20-30% SILICA (found in sand)
10% SILT
10 - 15% DREDGED SOIL

MORTAR



CEMENT OR LIME MORTAR

MAIN MATERIALS
10 - 30 % CLAY
50 - 70 % SAND
10-50 % WATER

MAIN MATERIALS
10 % CLAY
60 - 70 % EARTH
10-25 % WATER
5 - 15% LIME
1 % SODIUM SALT ADDITIVE
3 % FIBER OF CHOICE



DRY STACKING - PLASTIC 3D PRINTED INTERLOCKING PARTS



RAW MATERIALS

MATERIAL PASSPORT



4,568.4 m³ concrete
in columns and beams

3118 m³ concrete
in foundations

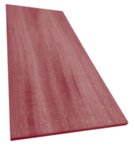
7,686.4 m³
of concrete



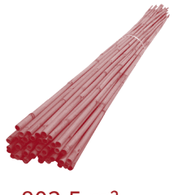
700,000 kg in columns and beams

250,500 kg in columns and beams

950,000 kg
recycled steel from
Ship breaking Yard



3,825.8 m²
of Mahogany



803.5 m²
of Bamboo

Rat trap walls

Perforated
double facade



188,180 bricks
9,944 m2
Tannery Sludge bricks

Catalan Brick
vaulted floors



2,020,780
1,345,996 bricks
50,910 m2
Dredged sludge bricks



5,922,072 bricks
80,028 m2
Ceramic and tannery
sludge bricks

Outside
pavement

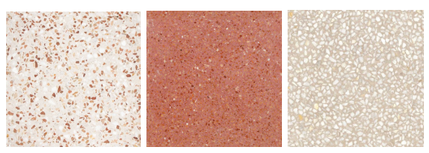


791,151 bricks
14,000 m2
Water permeable
Dredged sludge bricks

8,908,215
total bricks



2494 m²
Glass with aluminium frame



33,910.92 m²
Terrazzo finishing

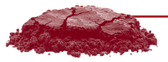
MATERIAL ORIGIN MAP



TANNERY SLUDGE

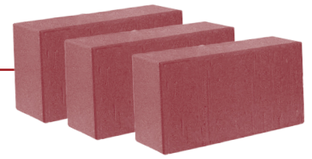
Leather Industry center of Bangladesh

214 KM TO BRICK KILN



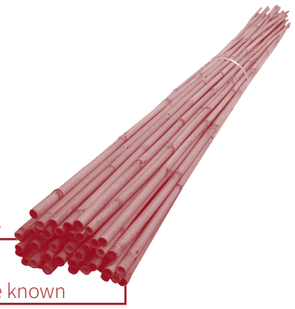
DREDGED SOIL

20-50 KM



49 KM

Production : Hybrid Hoffman Kiln, Only supplier in this region. (The rest are mostly in Dhaka)



government-managed protected forest - only harvest bamboo with permission

Commercial/private known plantations

14 KM

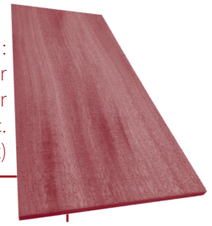
Khadim Nagar National Park

Sylhet

Green Soil Auto Bricks

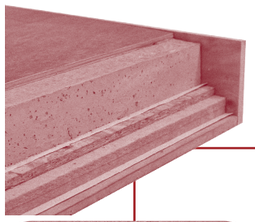
Moulvibazar

0 KM



Suppliers :
Rajshahi Timber
Shuvo Timber
Suppliers etc.
(multiple in Sylhet)

60 KM



EARTH SCREED & EARTH PLASTER



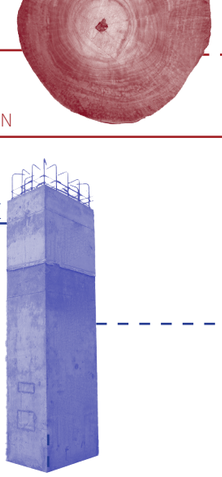
EARTH, MUD & SAND

0 KM

Soil used from excavated parking, and dredged soil from maintenance dredging. Sand from Sylhet. Clay from Sylhet

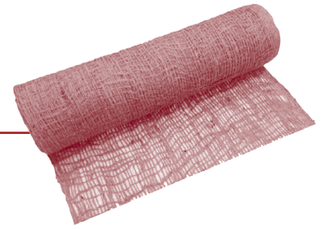
Hemayetpur

Dhaka



CAST ON SITE

PLANTATION



JUTE PLANTATION

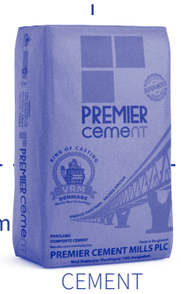
Chittagong

LIME ADDITIVE ONLY FOR THE PLASTER

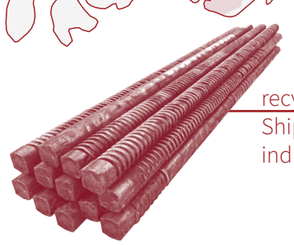


LIMESTONE

3000+ KM imported from Vietnam



CEMENT

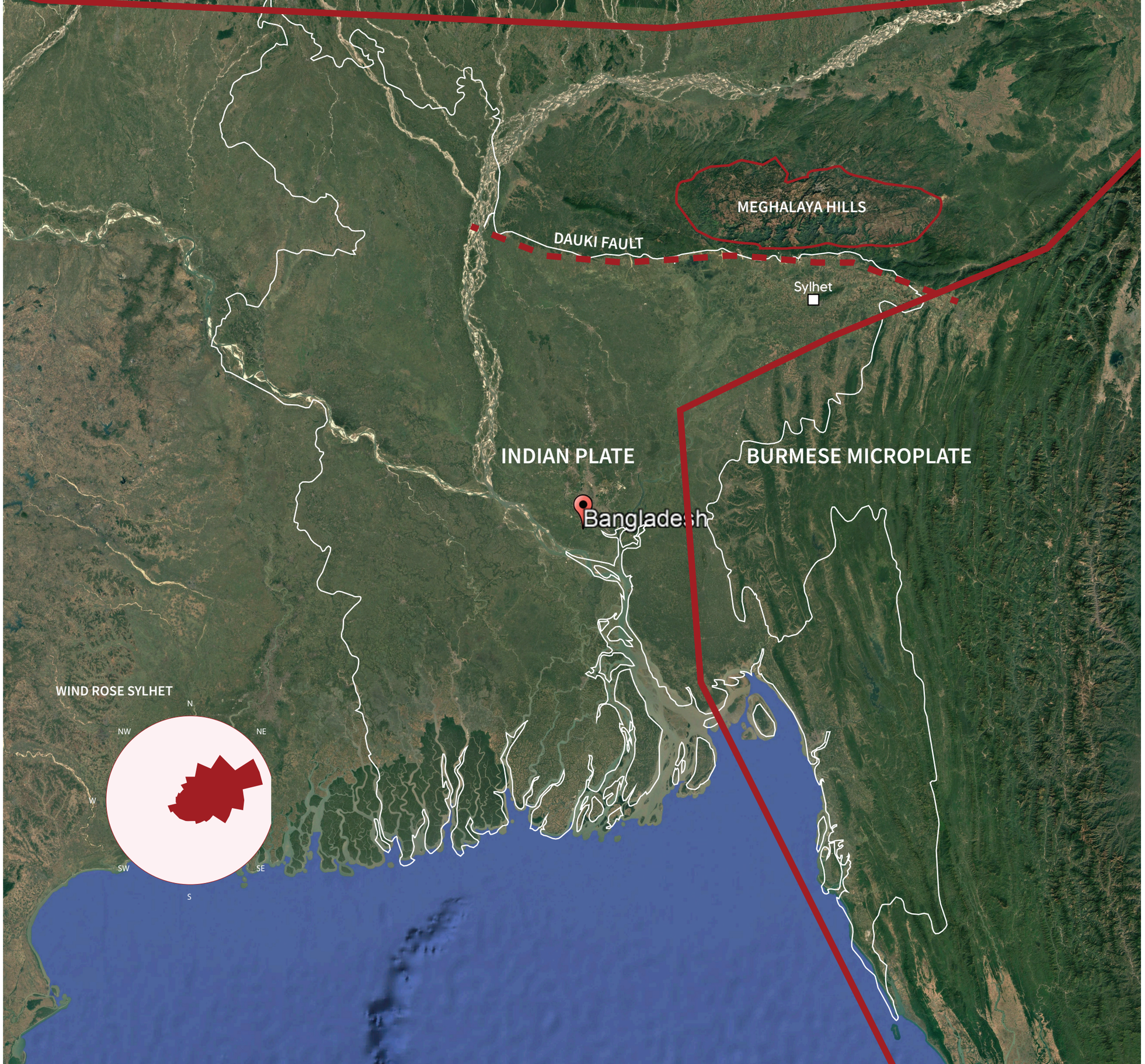


recycled steel from Ship breaking Yard. A large industry in Chittagong

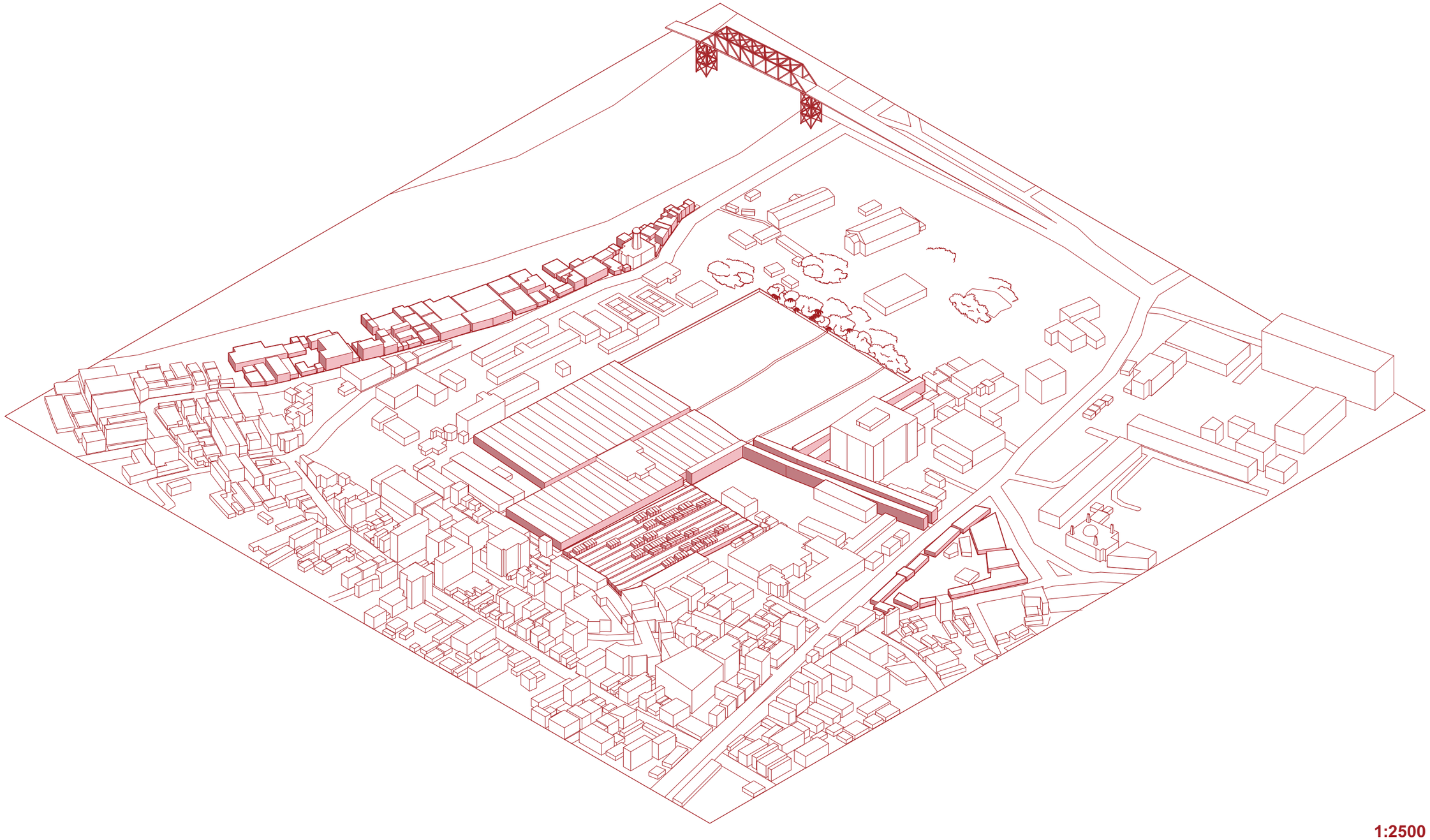
360 KM TO SYLHET

0 200KM




MEGHALAYA HILLS
DAUKI FAULT
Sylhet
INDIAN PLATE
BURMESE MICROPLATE
Bangladesh
WIND ROSE SYLHET
N
NW
NE
W
SW
SE
S

The location - Hawkers market
CURRENT MARKETS

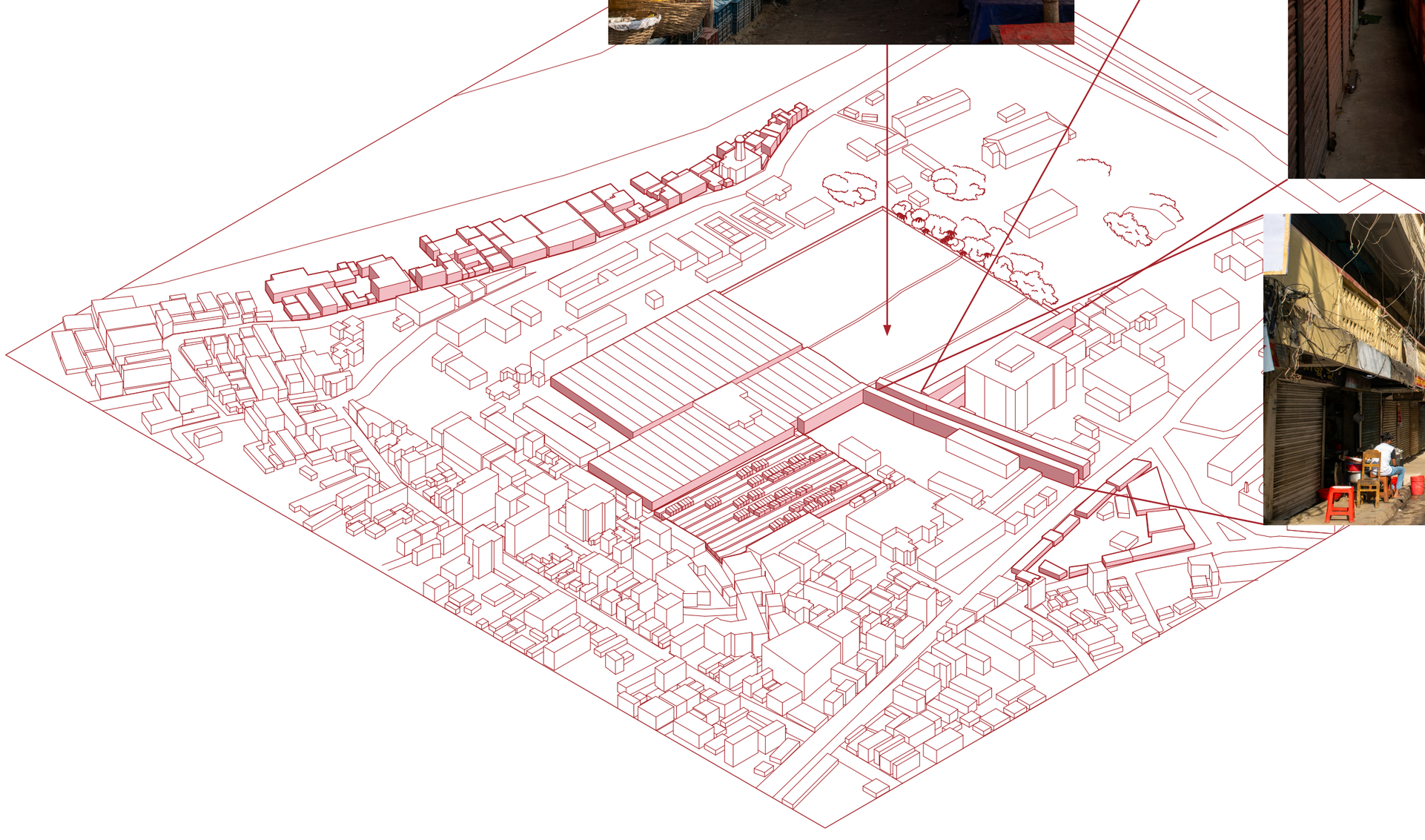


1:2500









1:2500













1:2500







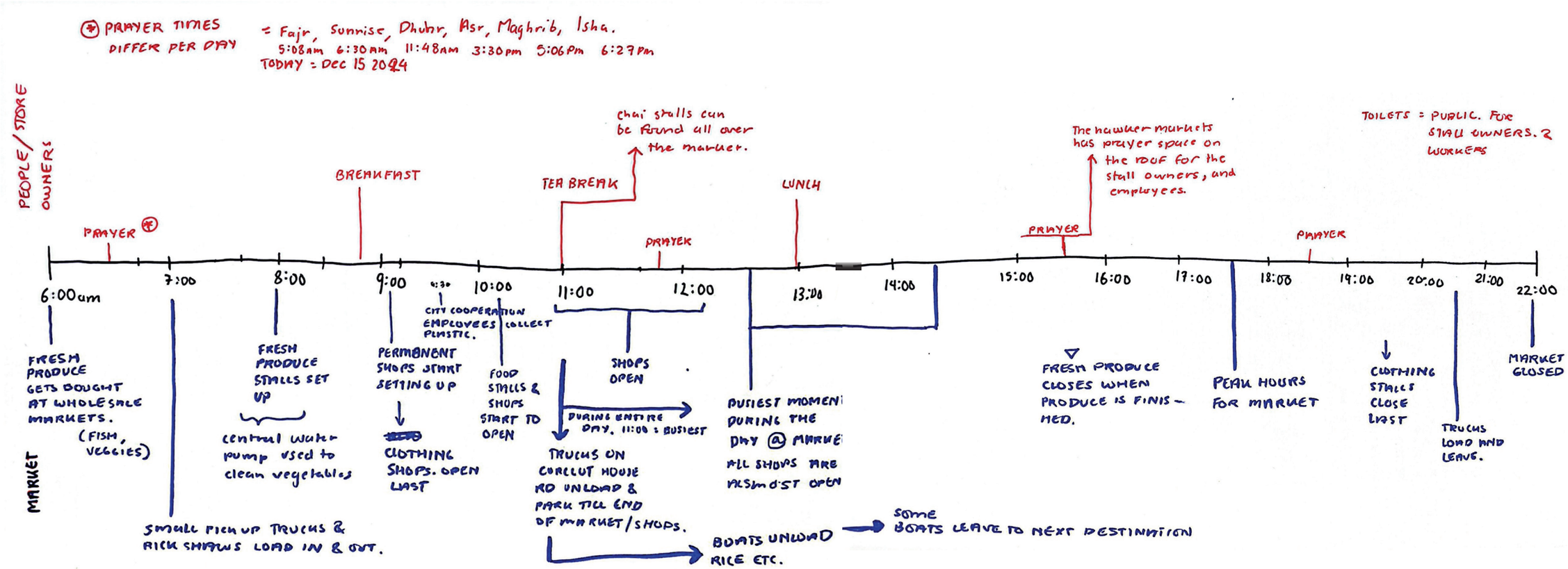






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MARKET TIMELINE

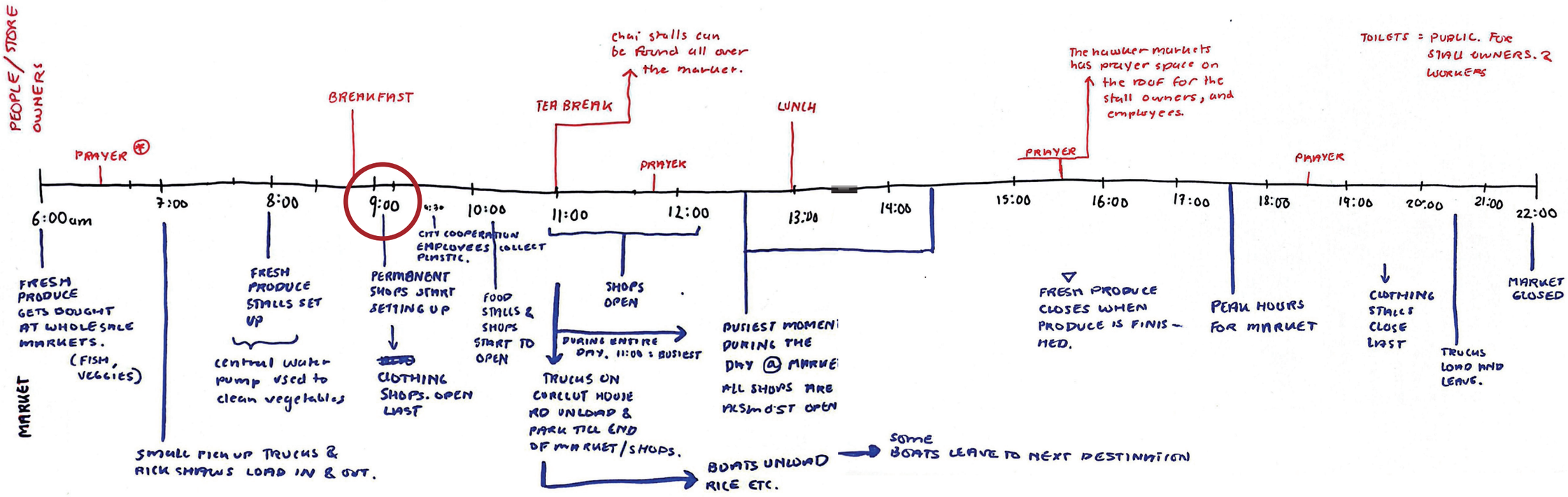








PRAYER TIMES DIFFER PER DAY = Fajr, Sunrise, Dhuhr, Asr, Maghrib, Isha.
5:08am 6:30am 11:48am 3:30pm 5:06pm 6:27pm
TODAY = Dec 15 2024











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TODAY = Dec 15 2024

PEOPLE/STORE OWNERS

BREAKFAST

TEA BREAK

chai stalls can be found all over the market.

LUNCH

The hawker-markets has prayer space on the roof for the stall owners, and employees.

TOILETS = PUBLIC. FOR STALL OWNERS. 2 WORKERS

PRAYER ⊕ PRAYER PRAYER PRAYER

6:00am 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00

CITY COOPERATION EMPLOYEES COLLECT

FRESH PRODUCE GETS BOUGHT AT WHOLESALE MARKETS. (FISH, VEGGIES)

MARKET

SMALL PICK UP TRUCKS & RICK SHAWS LOAD IN & OUT

FRESH PRODUCE STALLS SET UP

central water pump used to clean vegetables

ISIEST MOMEN RING THE Y @ MARKE L SHOPS ARE SMOST OPEN

TS UNLOAD ETC.

SOME BOATS LEAVE TO NEXT DESTINATION

FRESH PRODUCE CLOSES WHEN PRODUCE IS FINISHED.

PEAK HO FOR MA



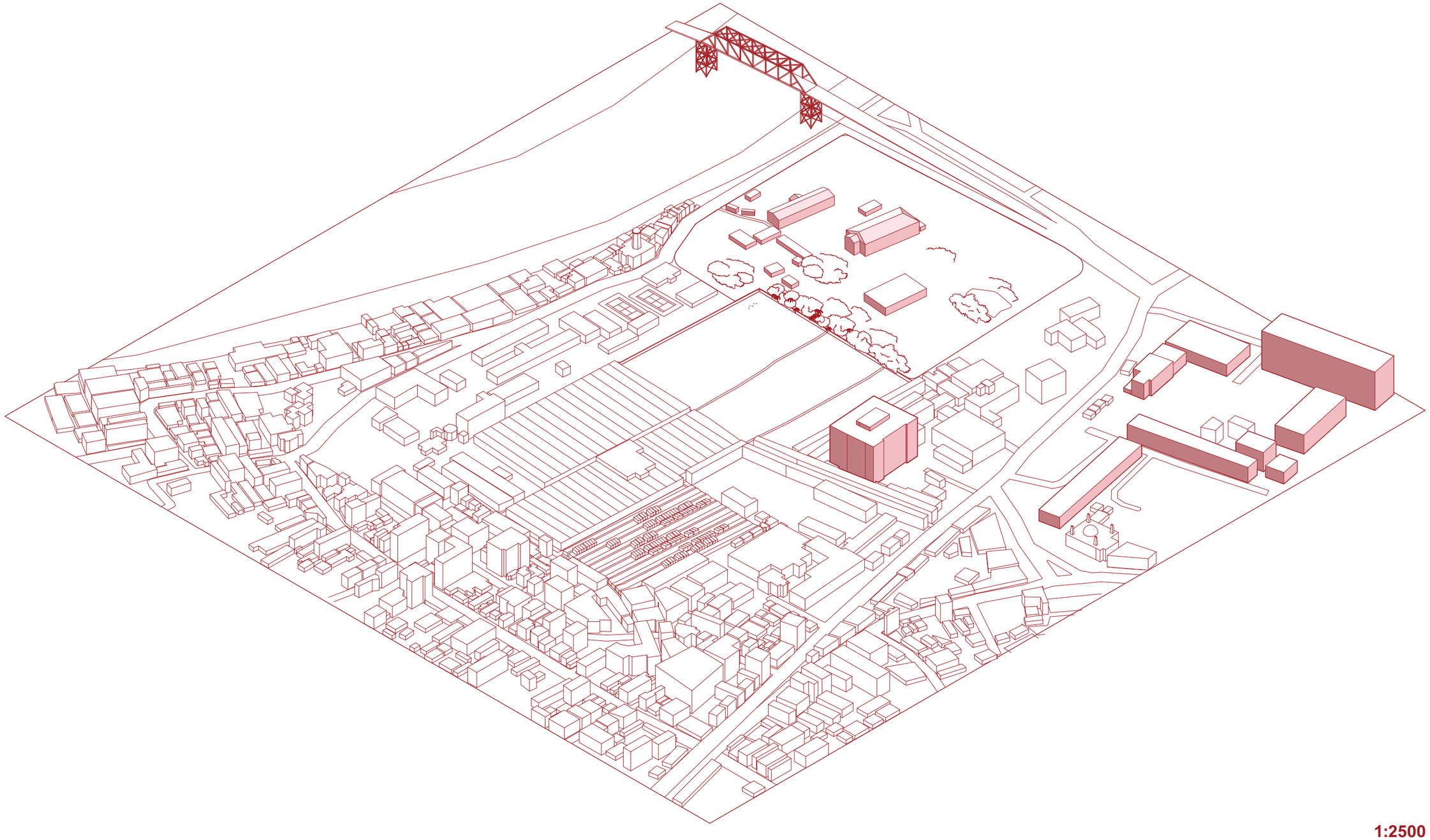


MARKET STORE FRONTS



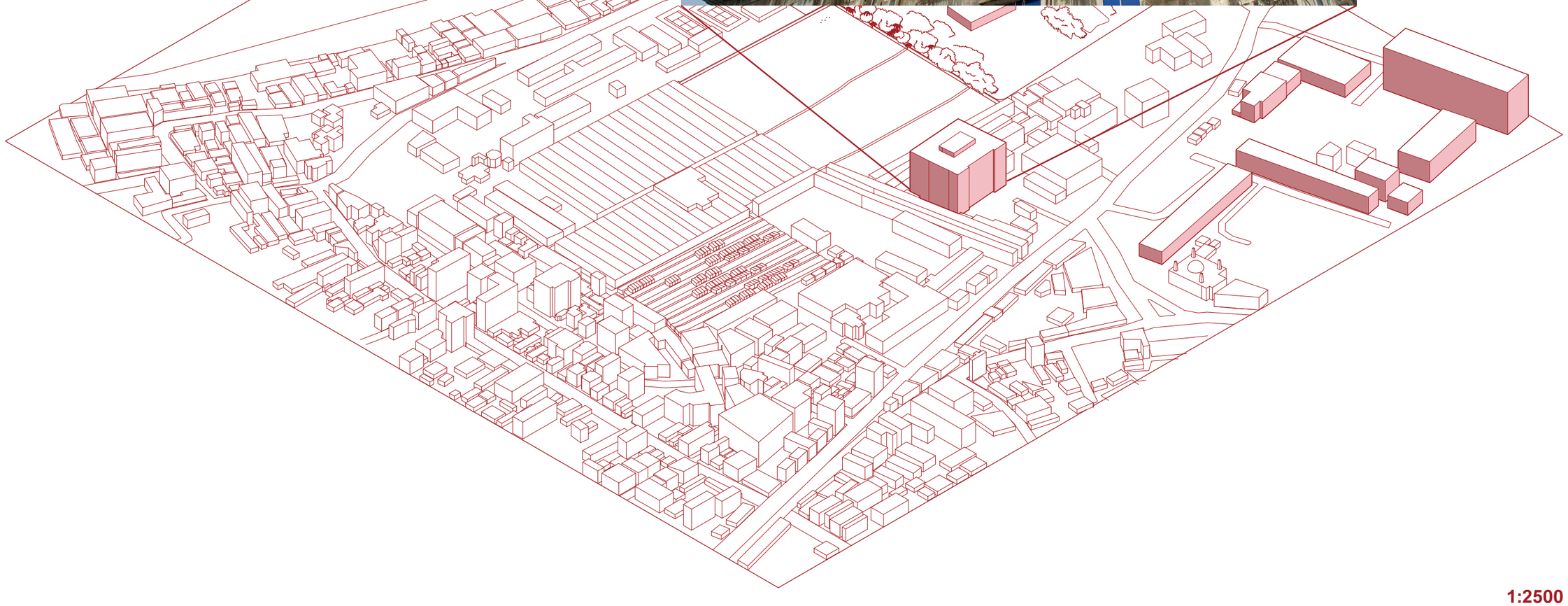


The location
GOVERNMENTAL BUILDINGS



1:2500





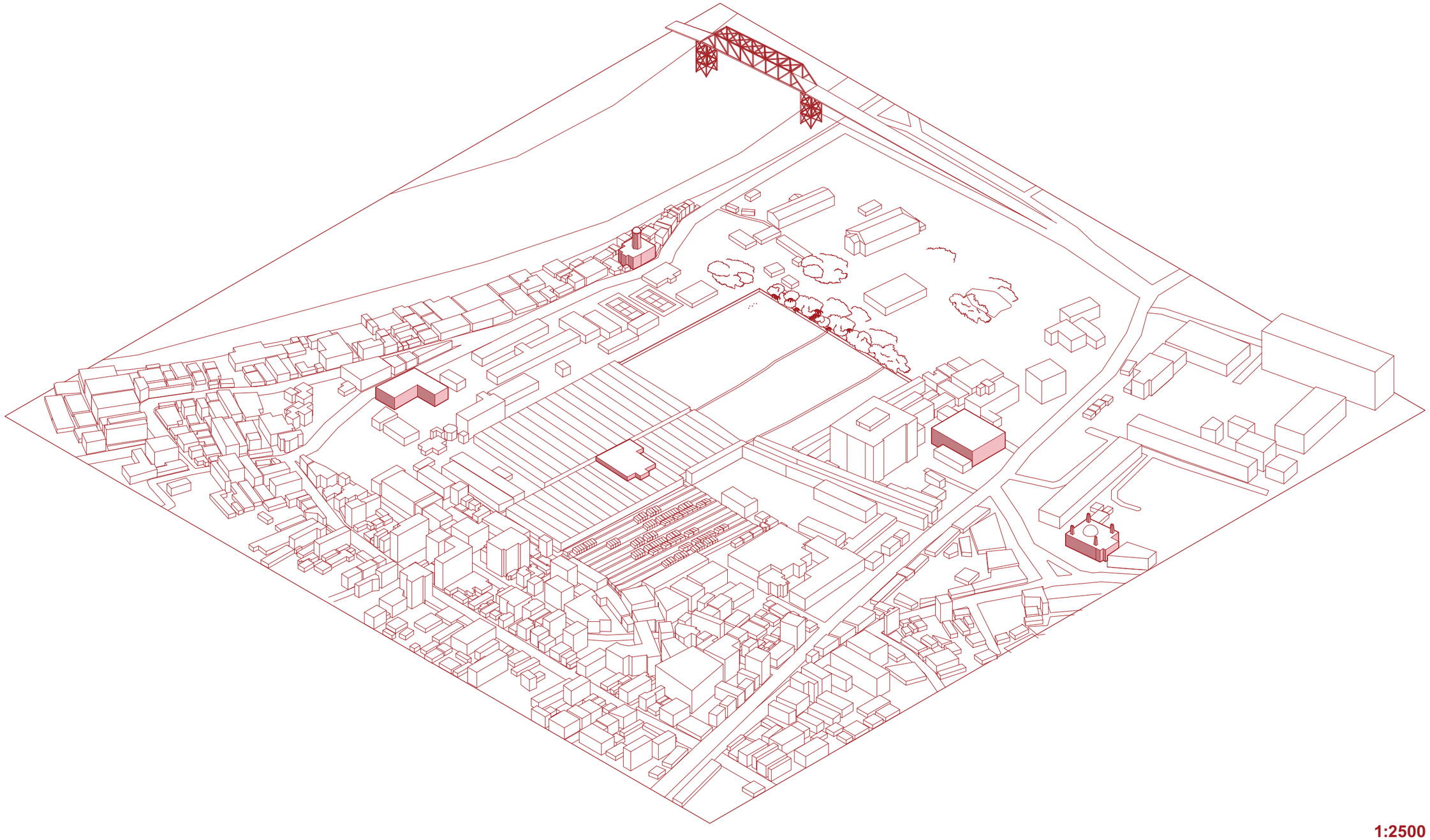
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The location
GOVERNMENTAL BUILDINGS



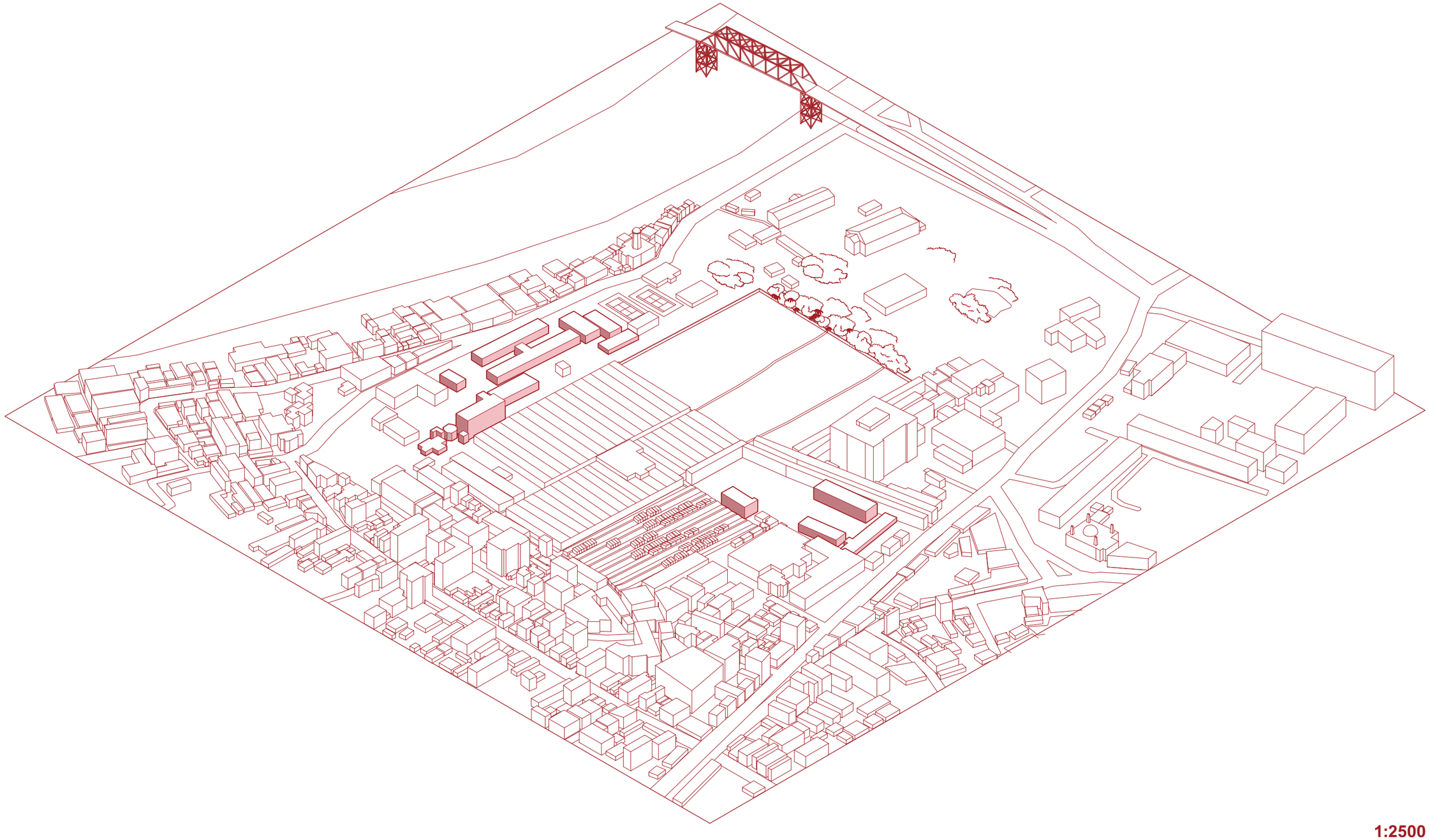
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The location
MOSQUES AND PRAYER ROOMS



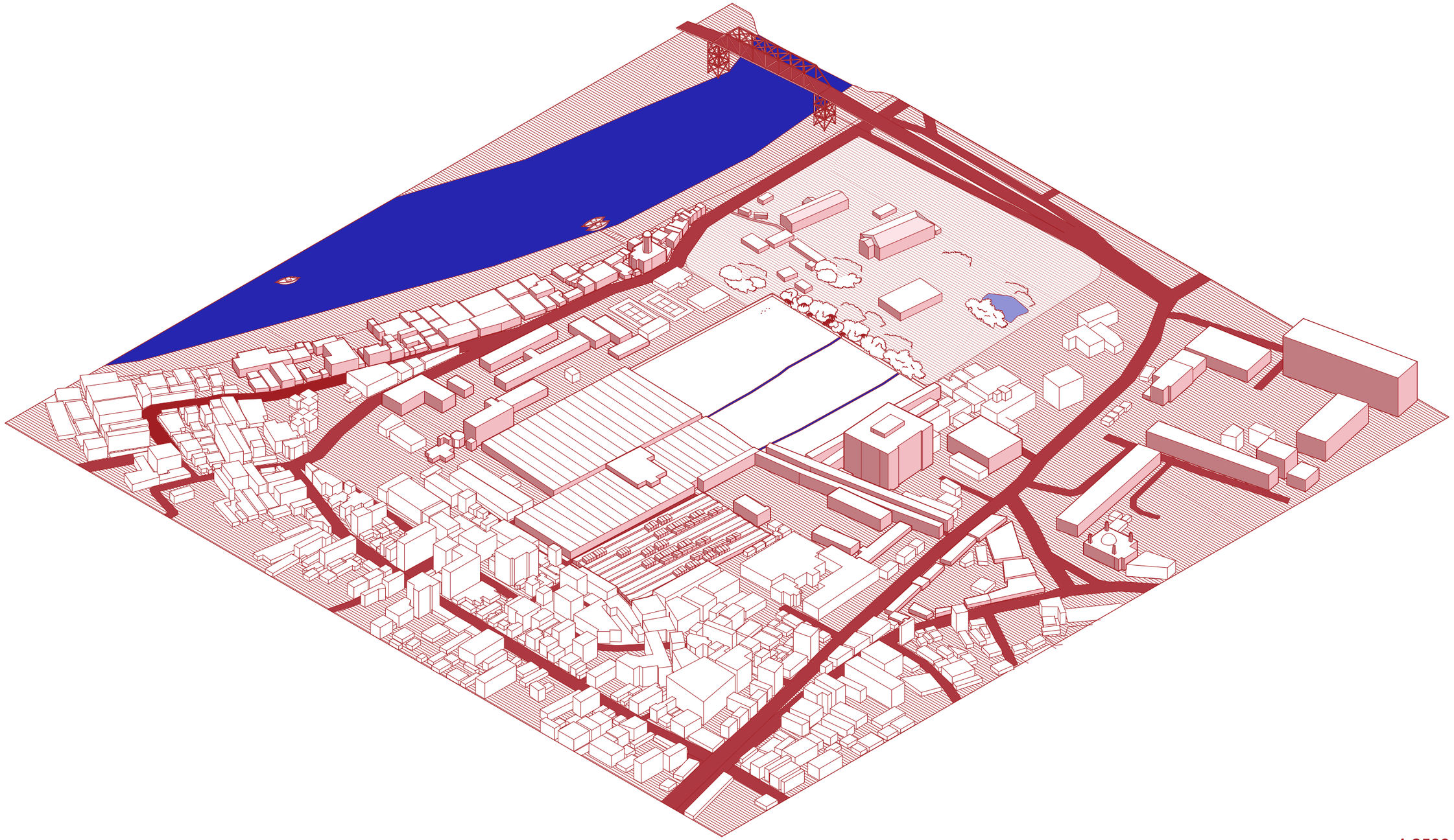
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The location
SCHOOLS



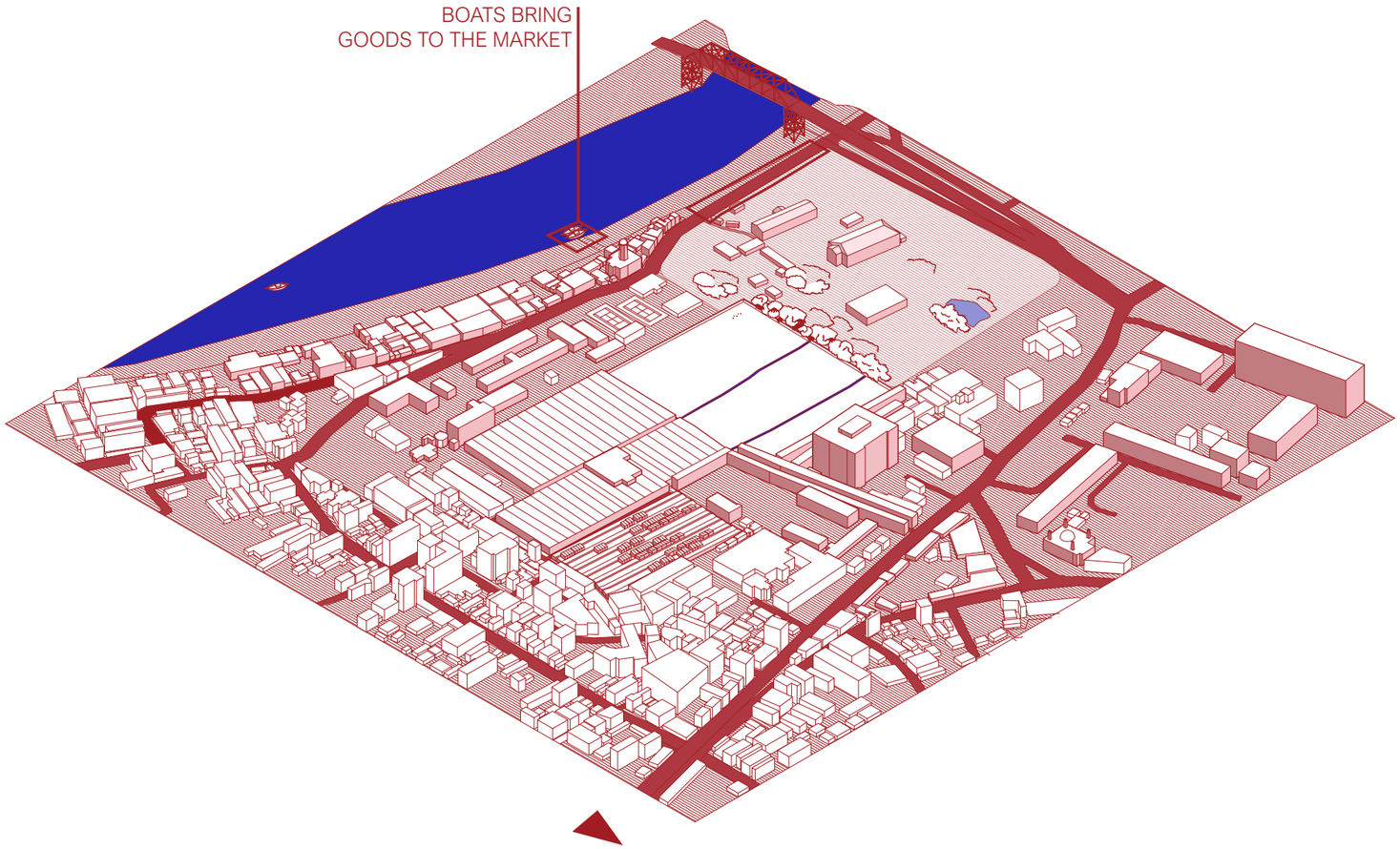
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The location



1:2500

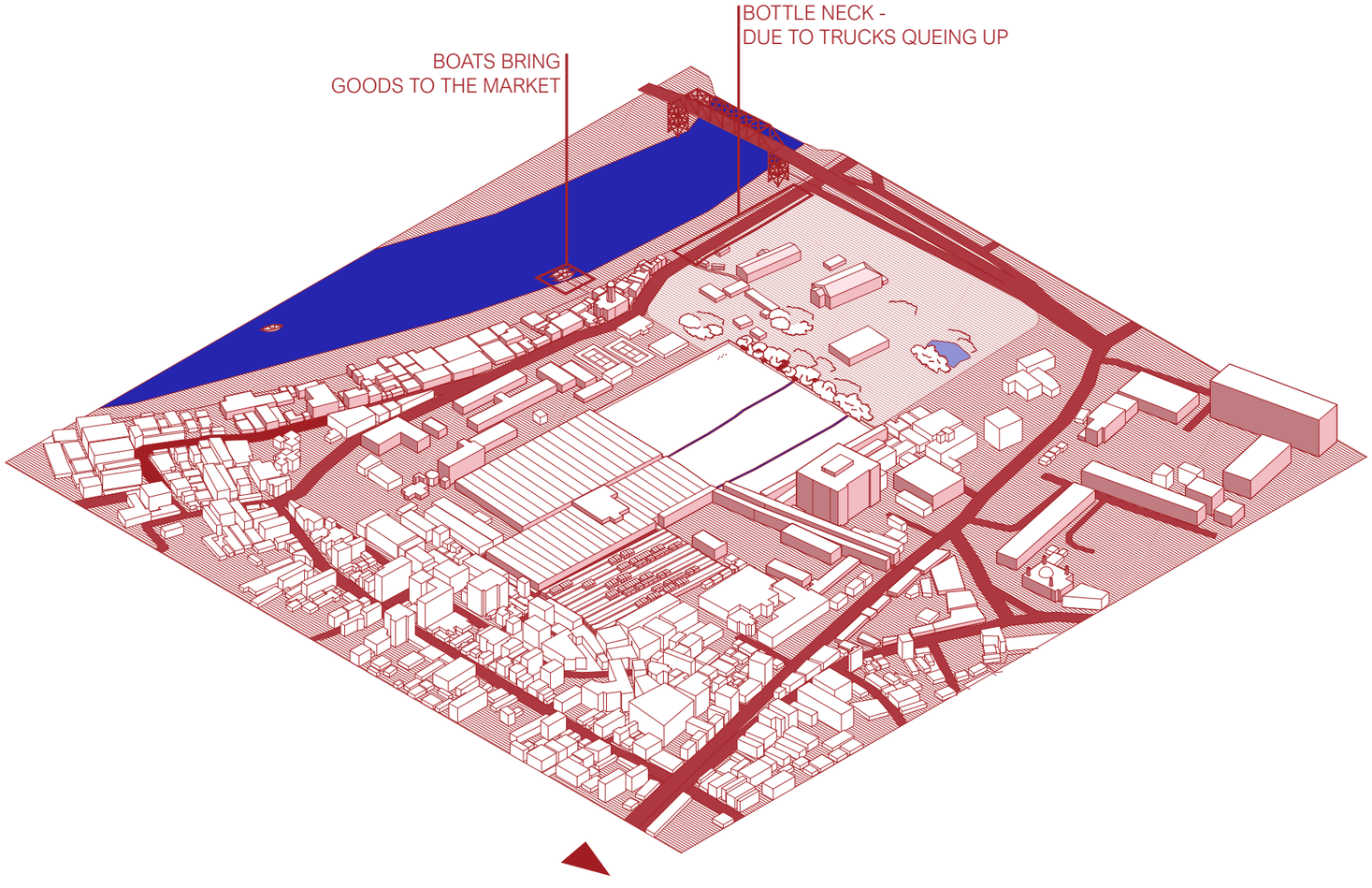
The location
TRAFFIC ANALYSIS







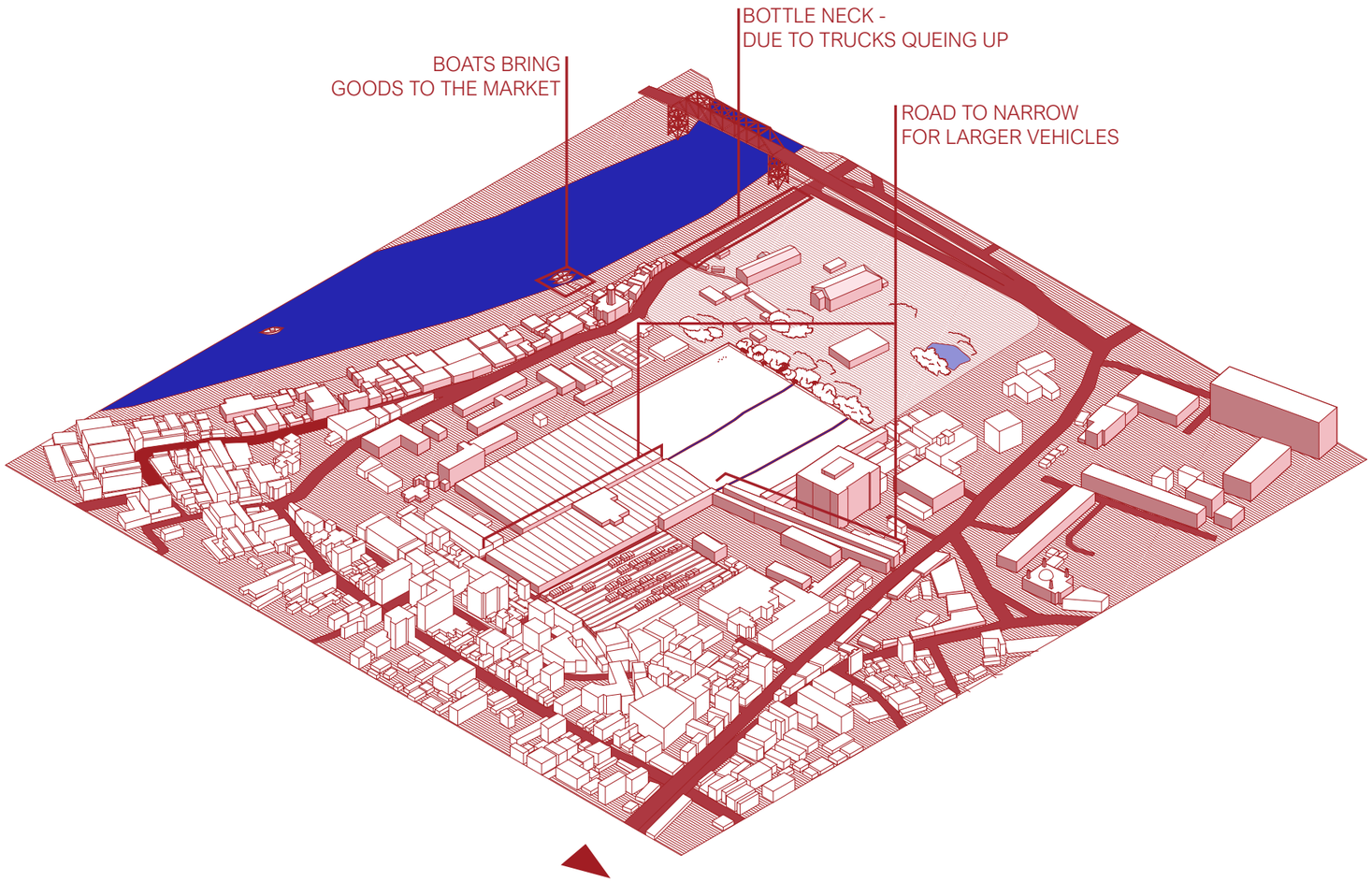
The location
TRAFFIC ANALYSIS







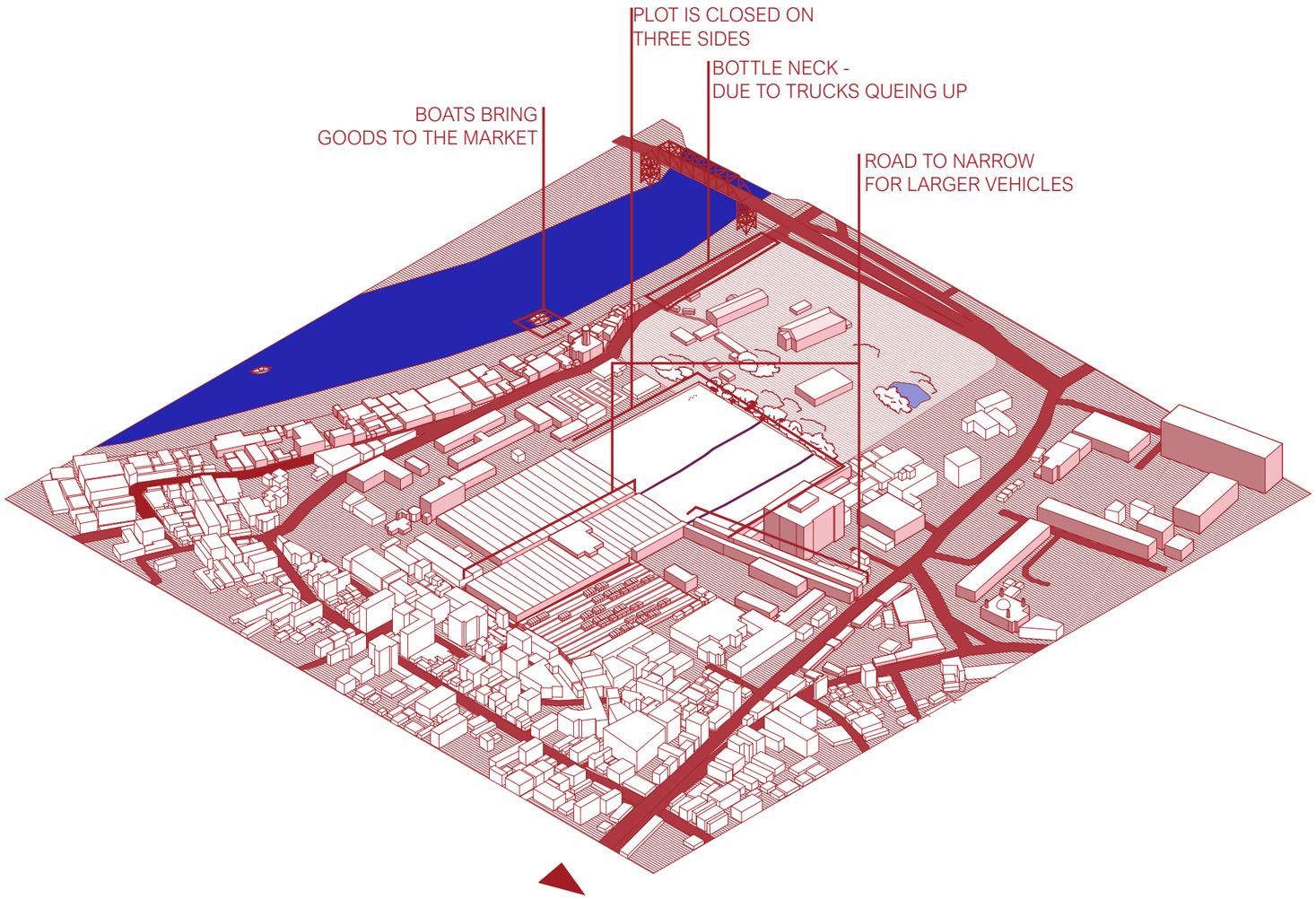
The location
TRAFFIC ANALYSIS







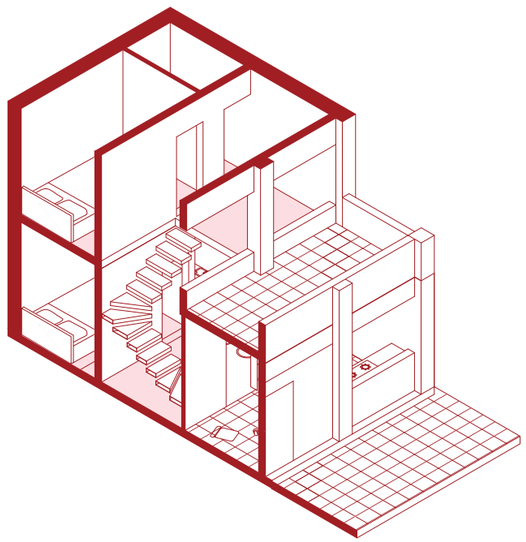
The location
TRAFFIC ANALYSIS



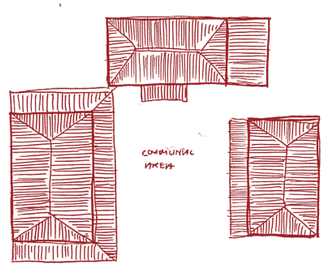




03 THE UNIT

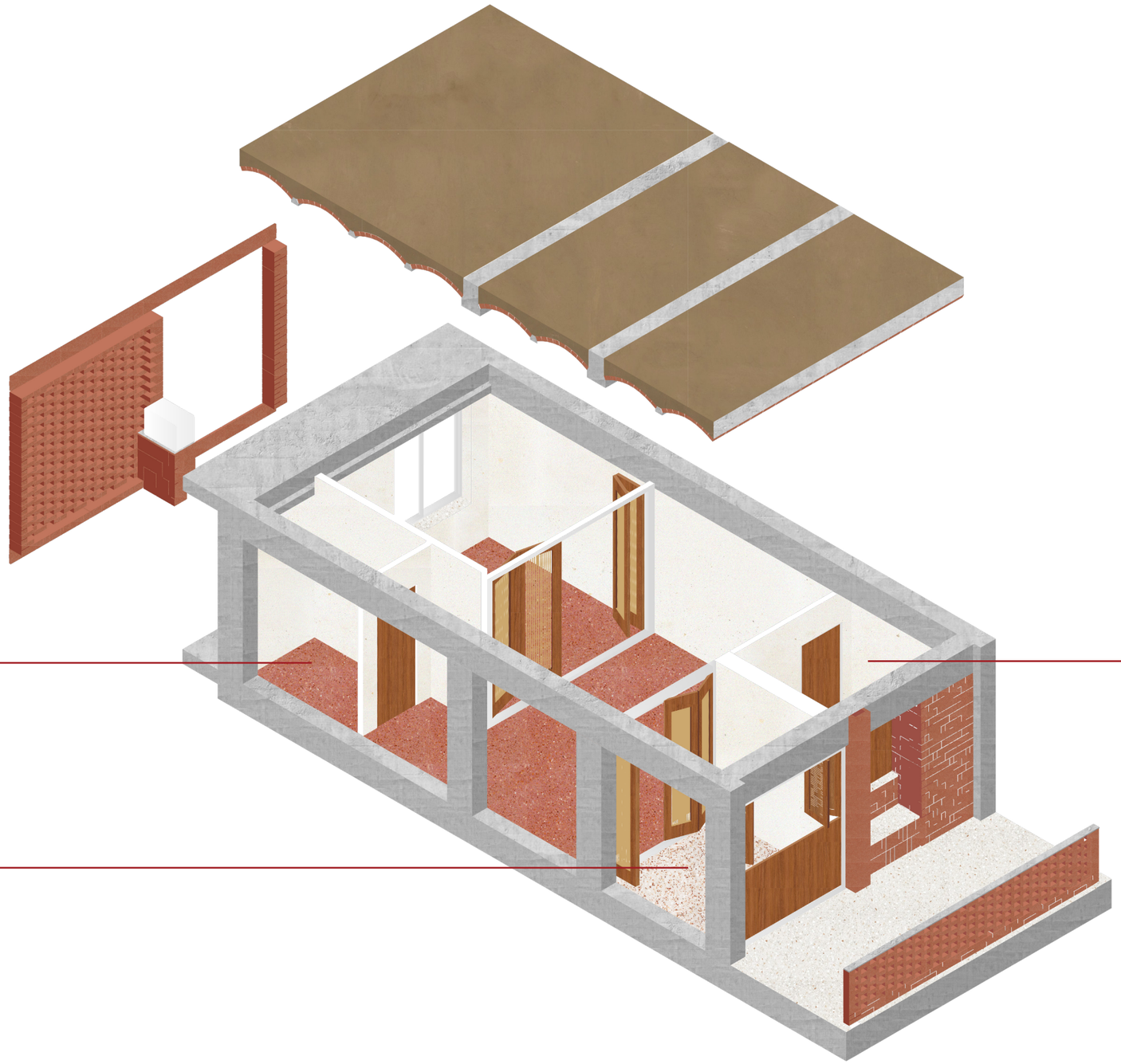


Learning from local housing in the village

	 BATHROOM & KITCHEN SEPERATE	 PLINTH & SEMI OUTSIDE SPACE	 COURTYARD - COMMUNAL SPACE
VILLAGE APPLICATION	Bathroom and Kitchen are always separate in the villages.	The raised plinths in combination with the roof overhang creates a veranda where the residents take off their shoes, and socialize with neighbors. This works as a buffer space from communal areas to private.	The Communal space in the village is also a space to dry clothes, and crops. And a space for children to play while the mothers sit on their plinth.
URBAN APPLICATION	Bathroom and Kitchen are always attached to the facade to get access from natural ventilation. The kitchen is always enclosed in a separate room.	Housing in the city also had a buffer space to remove your shoes, this was usually in the hallway connected to the stairs. In the cities this space is not a social space it is purely practical, which differs from the village.	A courtyard can easily be achieved in the urban scale, while not very common in the case studies we visited and analyzed. A rooftop is the communal space of mid to high rise buildings. Where the clothes are hung.
			

UNIT MATERIALIZATION

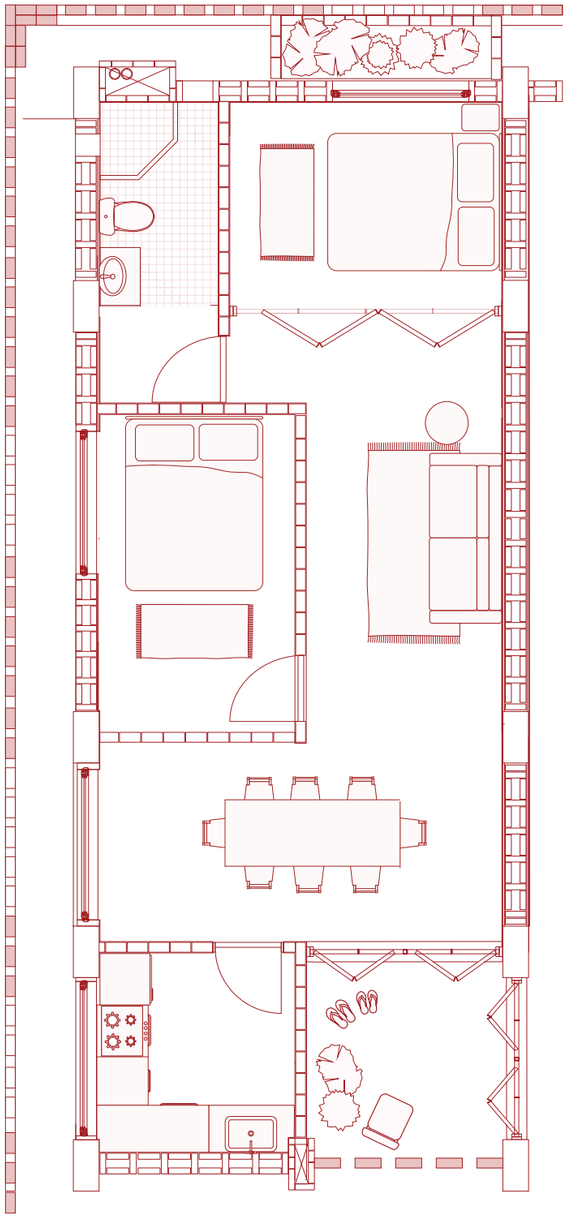
Low income unit



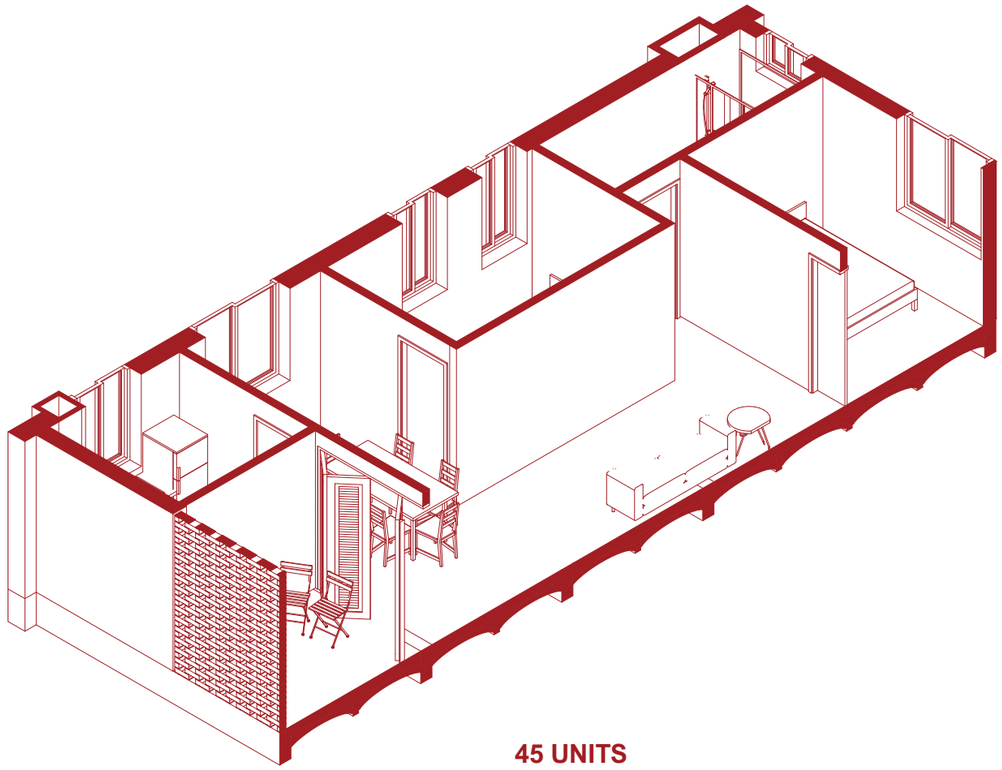
BATHROOM

KITCHEN

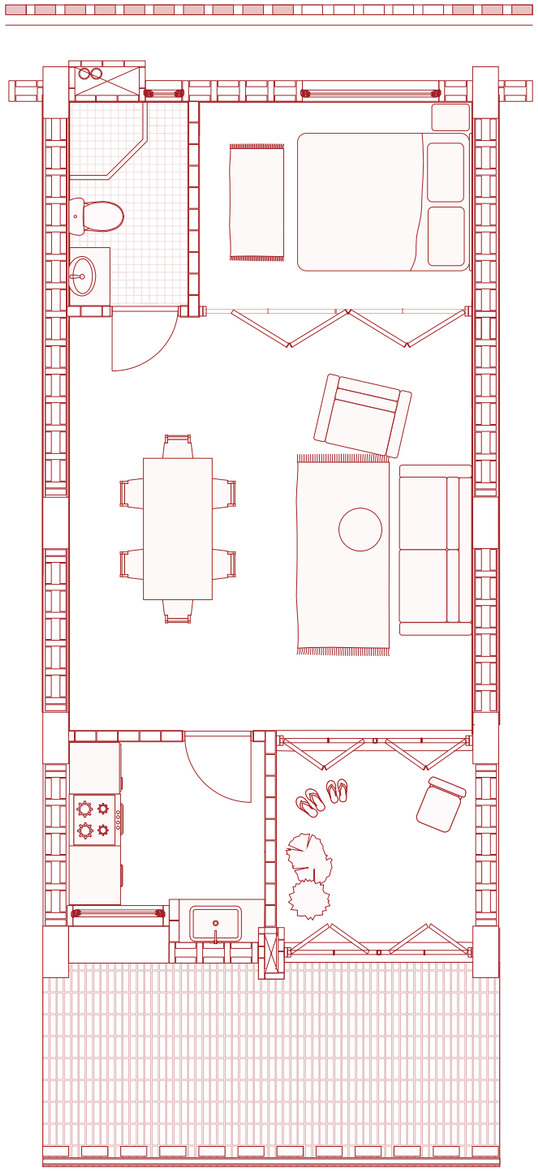
SEMI OUTSIDE SPACE

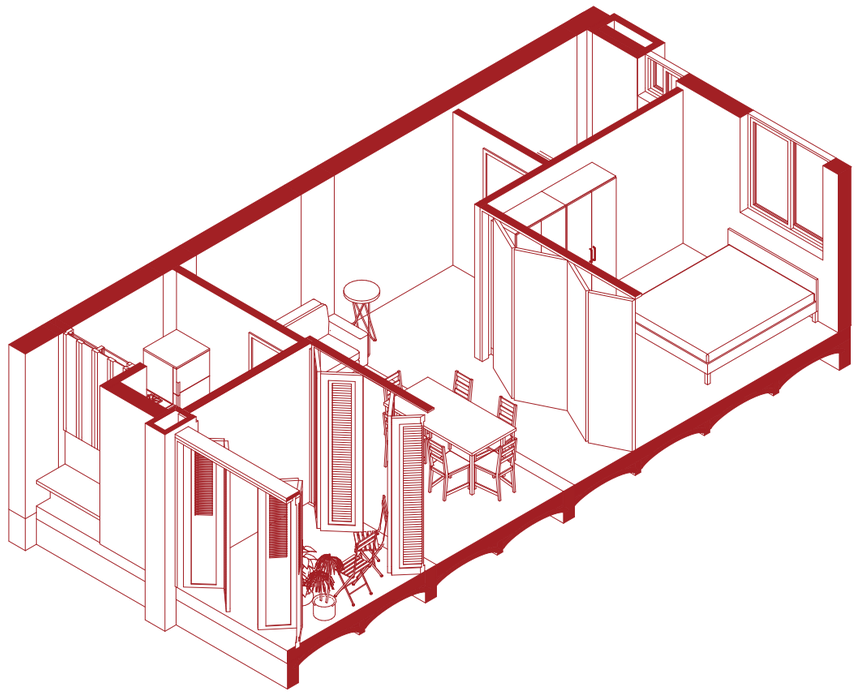


Low Income Loft
2 bedroom
55 m²
3 people per bedroom
about 7,5-10 m² per person



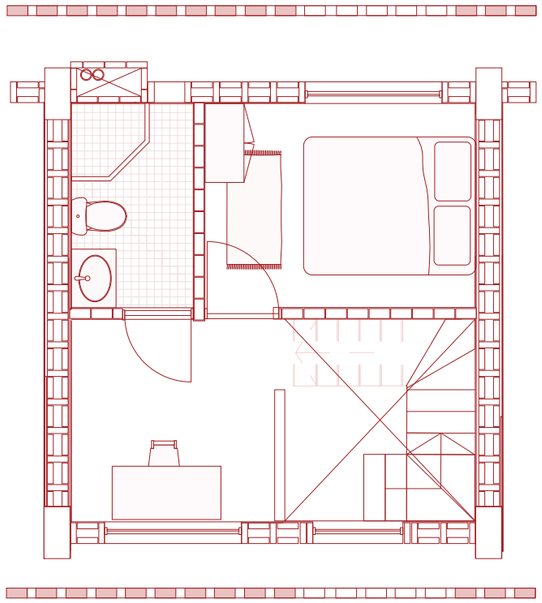
45 UNITS

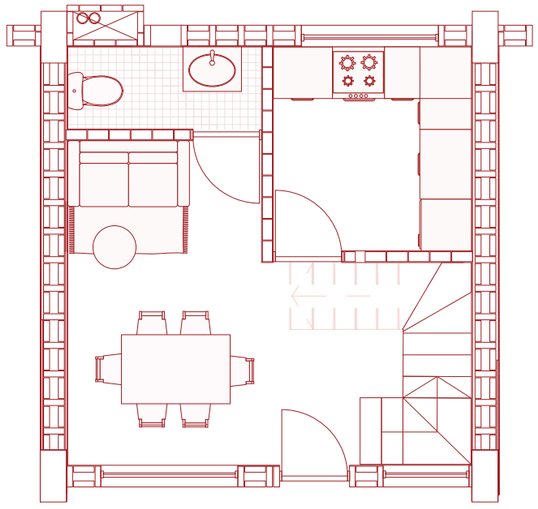




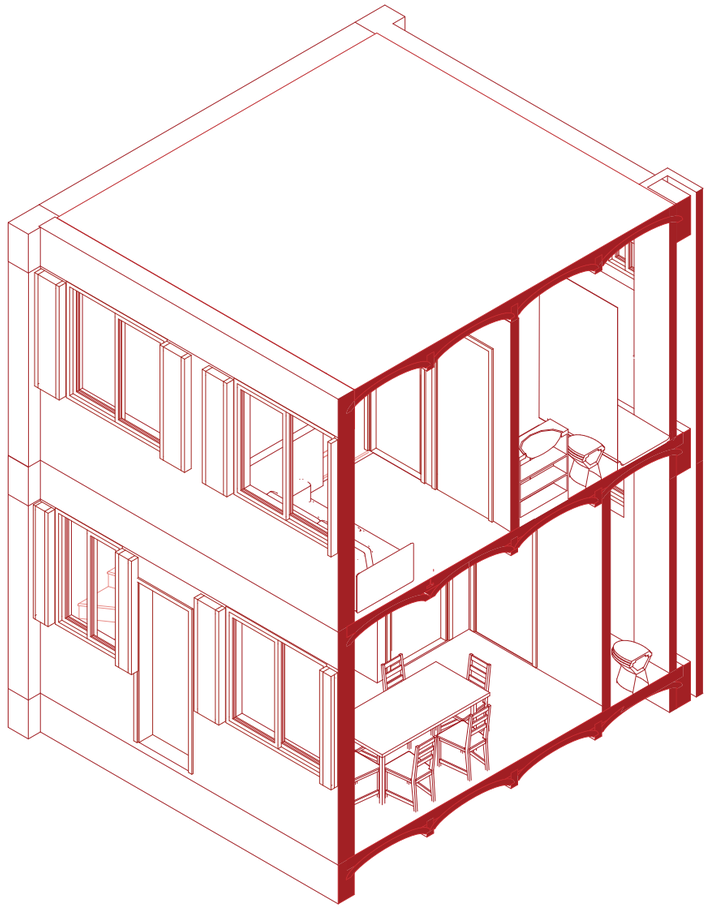
46 UNITS

Low Income Housing
45 m²
3 people per bedroom
about 7,5-10 m² per person





Studio Maisonette
42 m²
3 people per bedroom
about 14 m² per person



36 UNITS

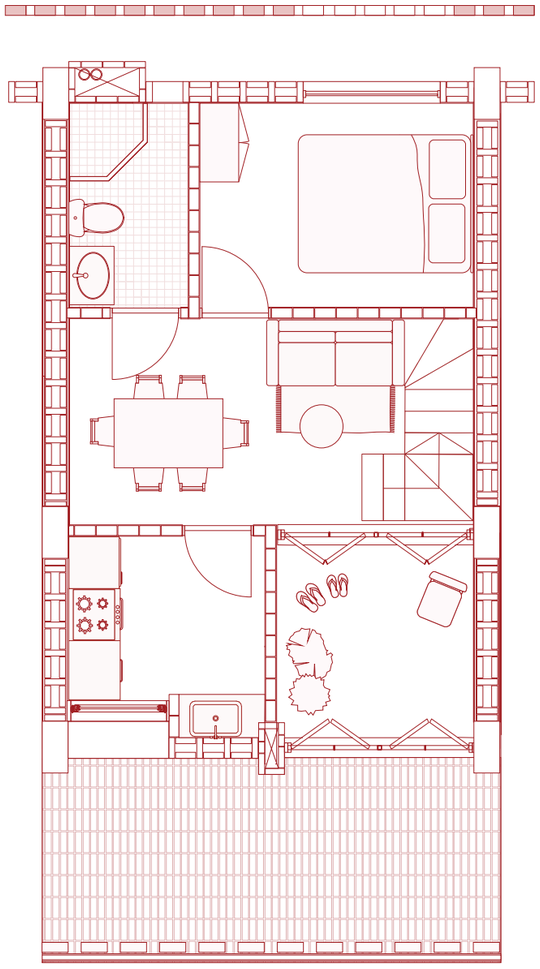


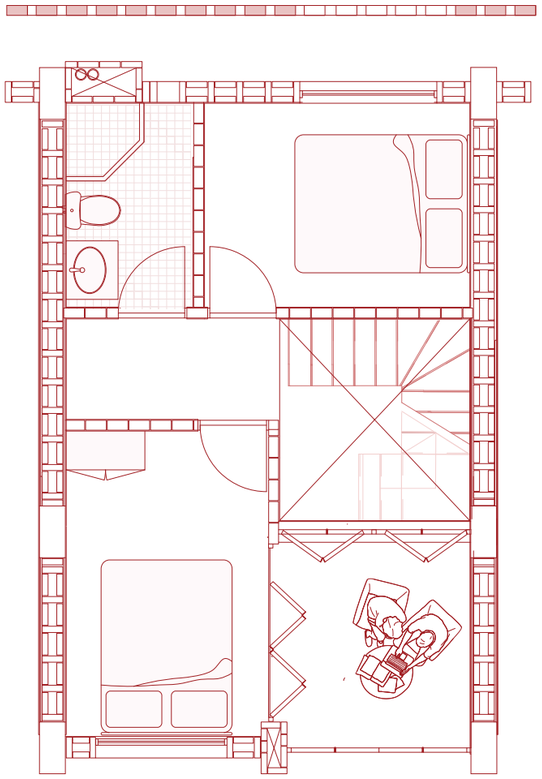
POSSIBLE RESIDENTS

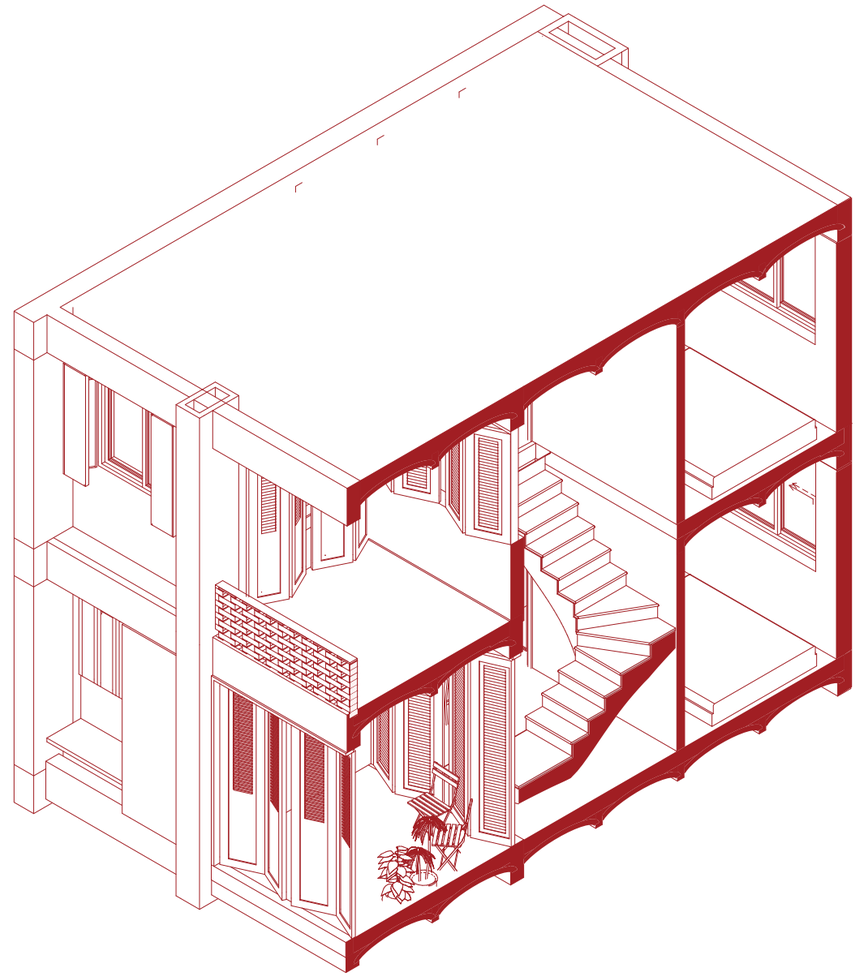




SHOP EMPLOYEES, OR OWNERS WHO'S FAMILY IS IN THE VILLAGE

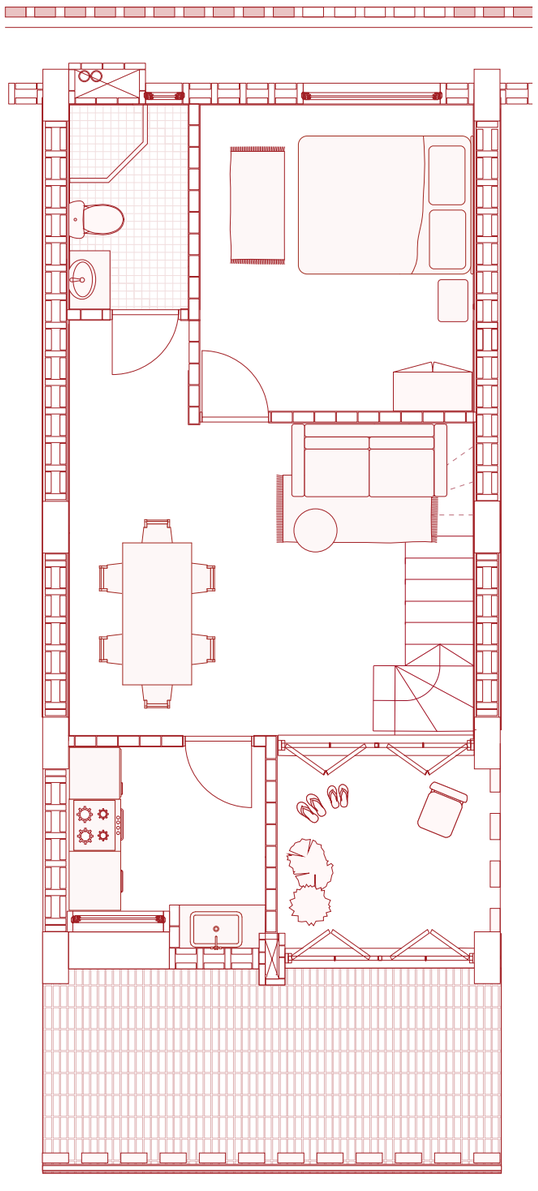


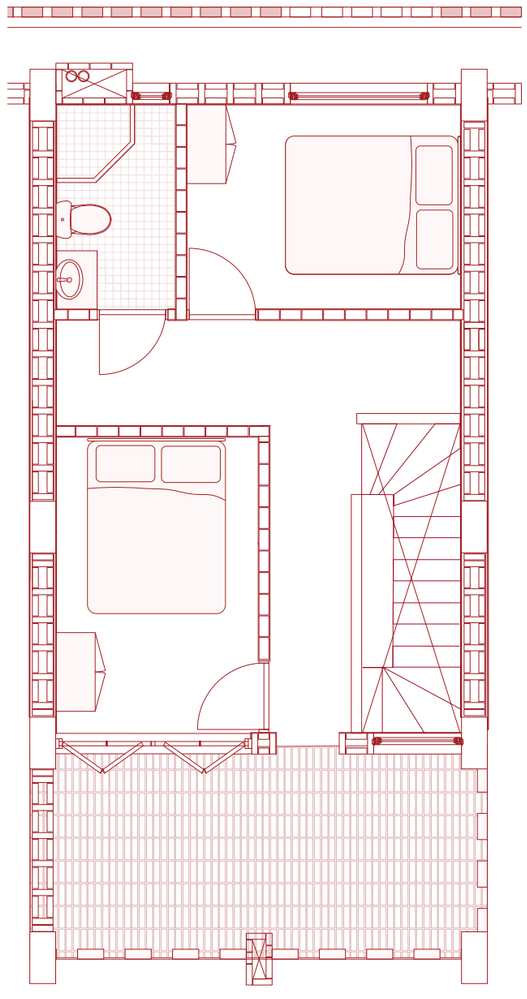


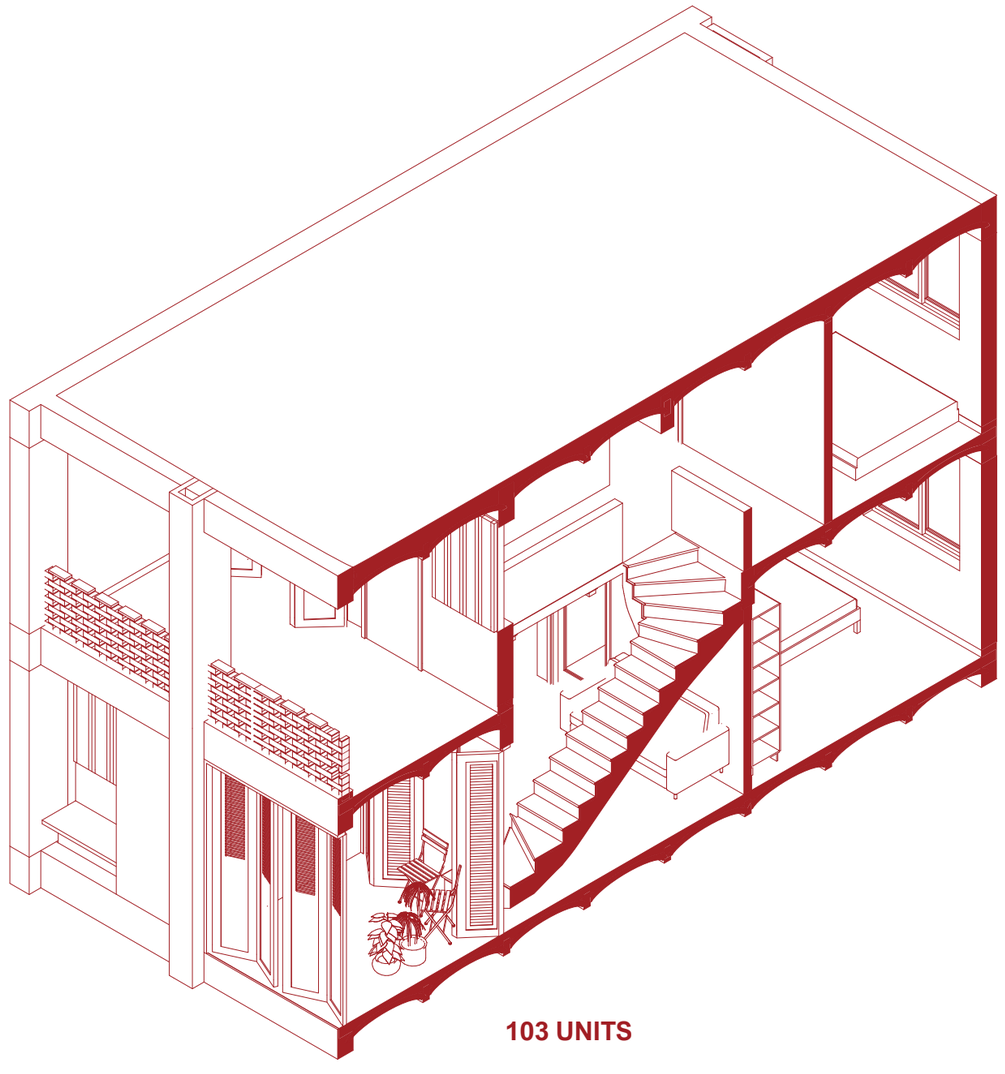


Family Maisonette #1
66 m²
3 people per bedroom
about 11 m² per person

59 UNITS







103 UNITS

Family Maisonette #3
92 m²
3 people per bedroom
about 10 m² per person

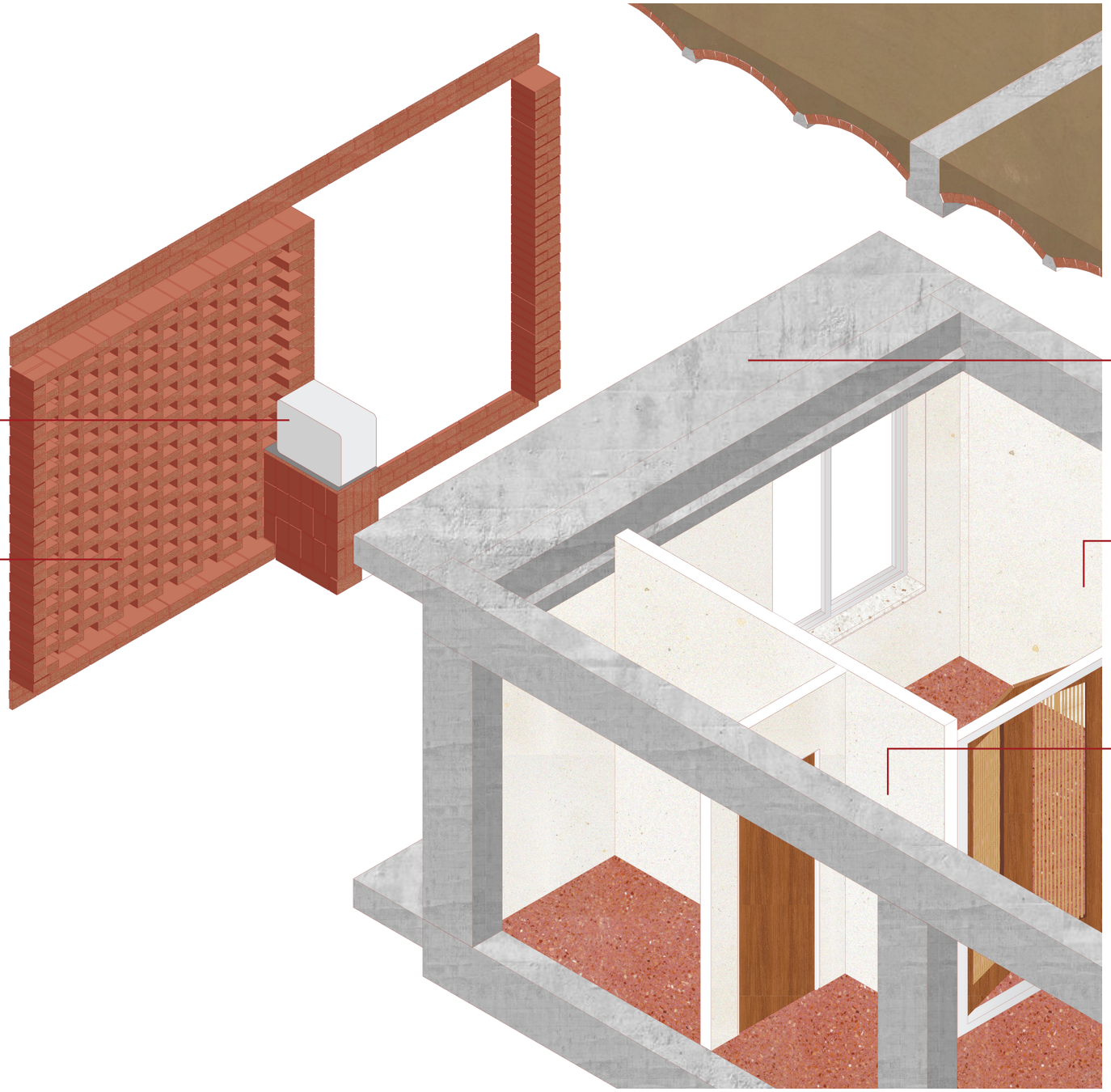
POSSIBLE RESIDENTS



SHOP OWNERS AND THEIR FAMILY AND GRANDPARENTS,
OR GOVERNMENTAL WORKERS

OPTIONAL
This is designed to hide airco units and to still make the accessible from the window

TANNERY SLUDGE BRICKS
best against weathering and reaction to salts from rain.



DOUBLE FACADE
This perforated facade works as a protective layer around the buidling, from direct sunlight, and heavy rain.

BEDROOM

BATHROOM


প্রিমিয়ার ব্যাংক
প্রিমিয়ার ব্যাংক
MIDO



MATERIALIZATION

BRICK TERRAZZO
Gradiant of floors reflecting their function.

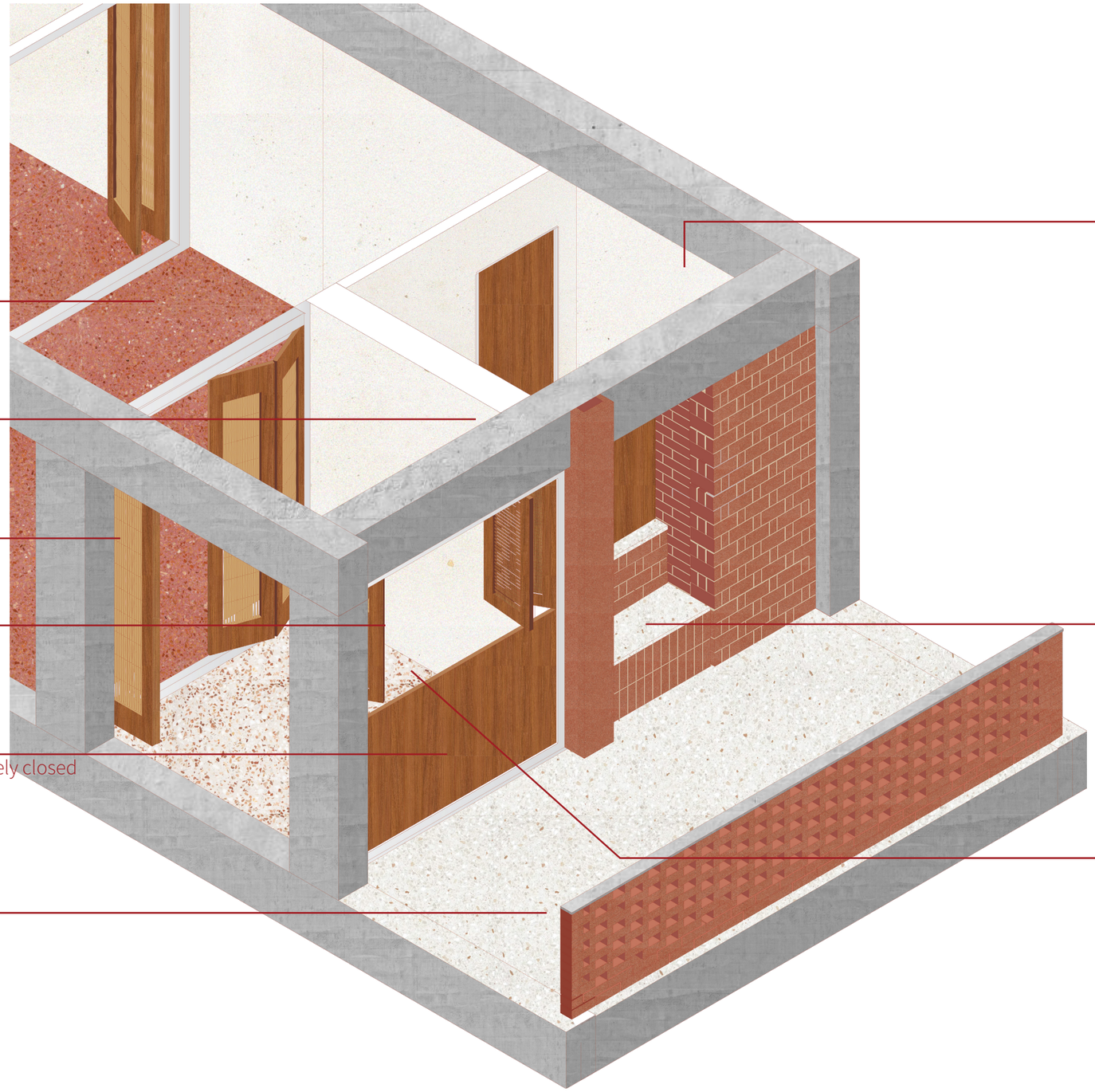
EARTH PLASTER
Containing lime to make it water resis

BAMBOO INFILL
open to allow ventilation

MAHOGANY SEMI OPEN PANELING
for ventilation even when closed

MAHOGANY SOLID PANELING
Bottom half of the folding door is completely closed for privacy and affordability

SANDED BEIGE TERRAZZO
Reflects sun and reduces heat



FUNCTION

KITCHEN
On courtyard side, all the kitchens of the building are facing the courtyard to increase privacy for the more private rooms.

SITTING NOOK
This nook is both to provide seating outside along the gallery also embracing interaction between neighbors. The main reason is to protect the window from rain, and direct sunlight.

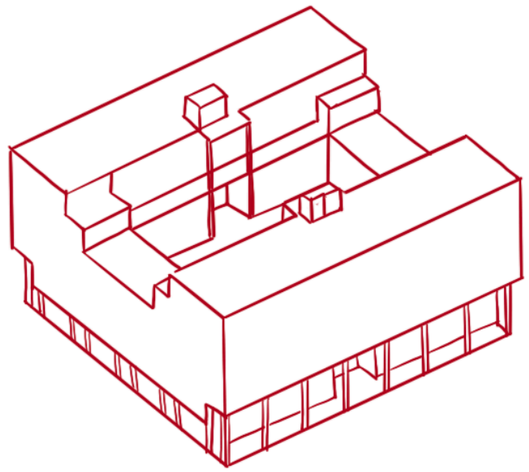
SEMI OUTSIDE SPACE
works as a second semi outside living area. People can remove their shoes interact with neighbors. Creates a fluid transition to the more private areas of the home



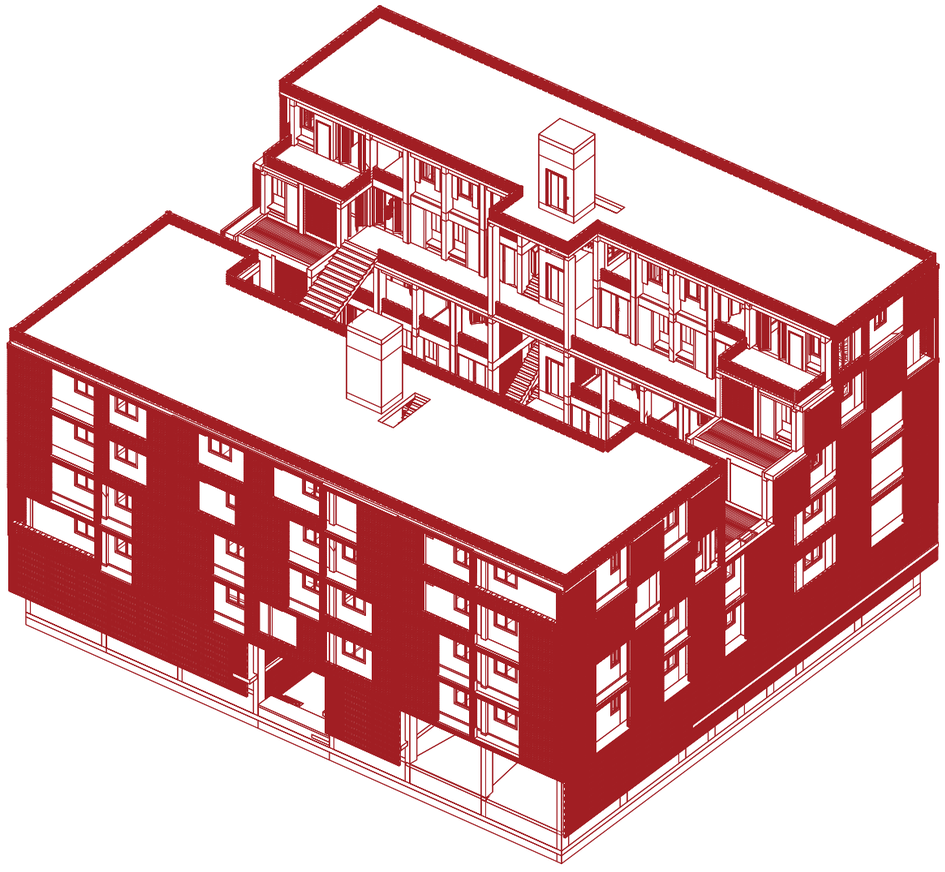
Clustering functions connected to the courtyard



04 CLUSTER



PARKING CLUSTER

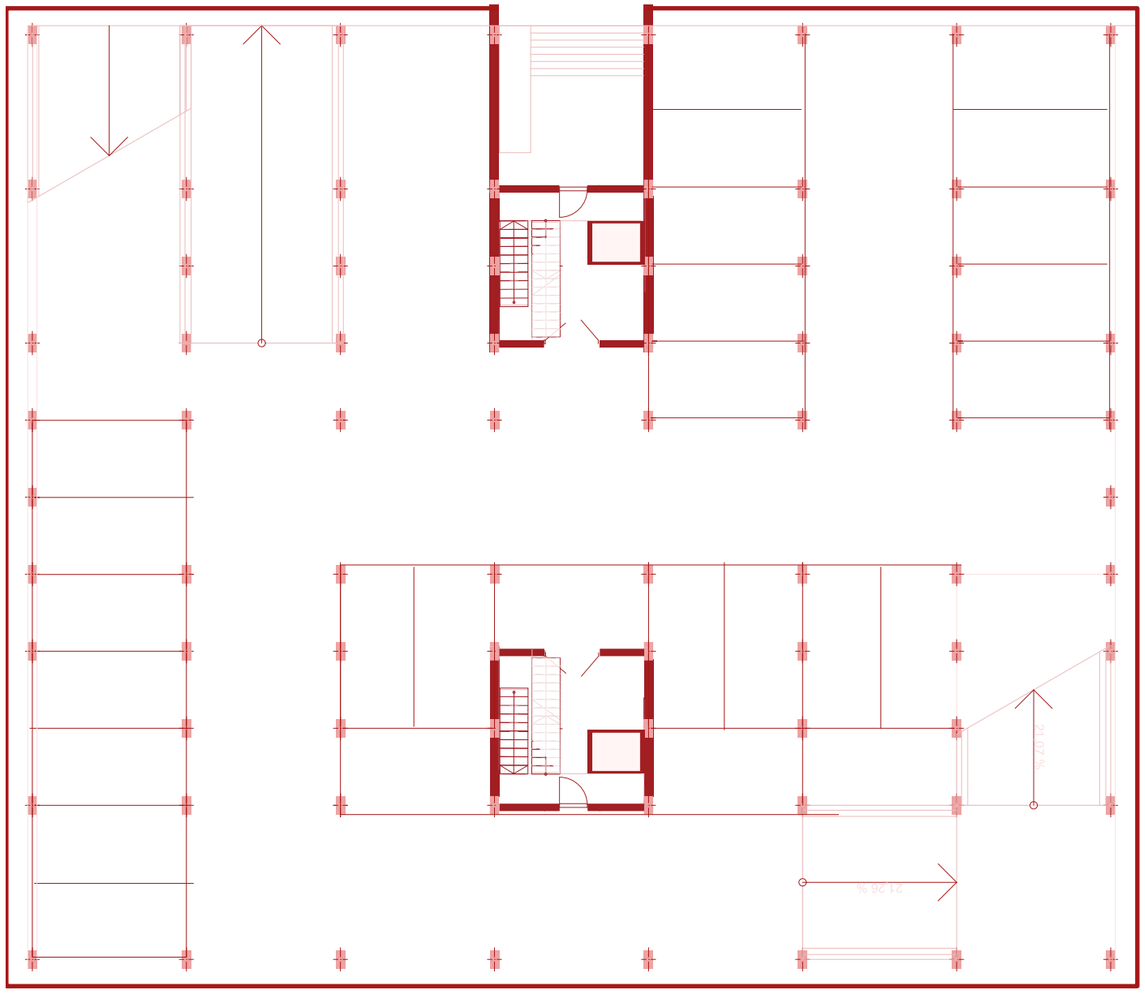




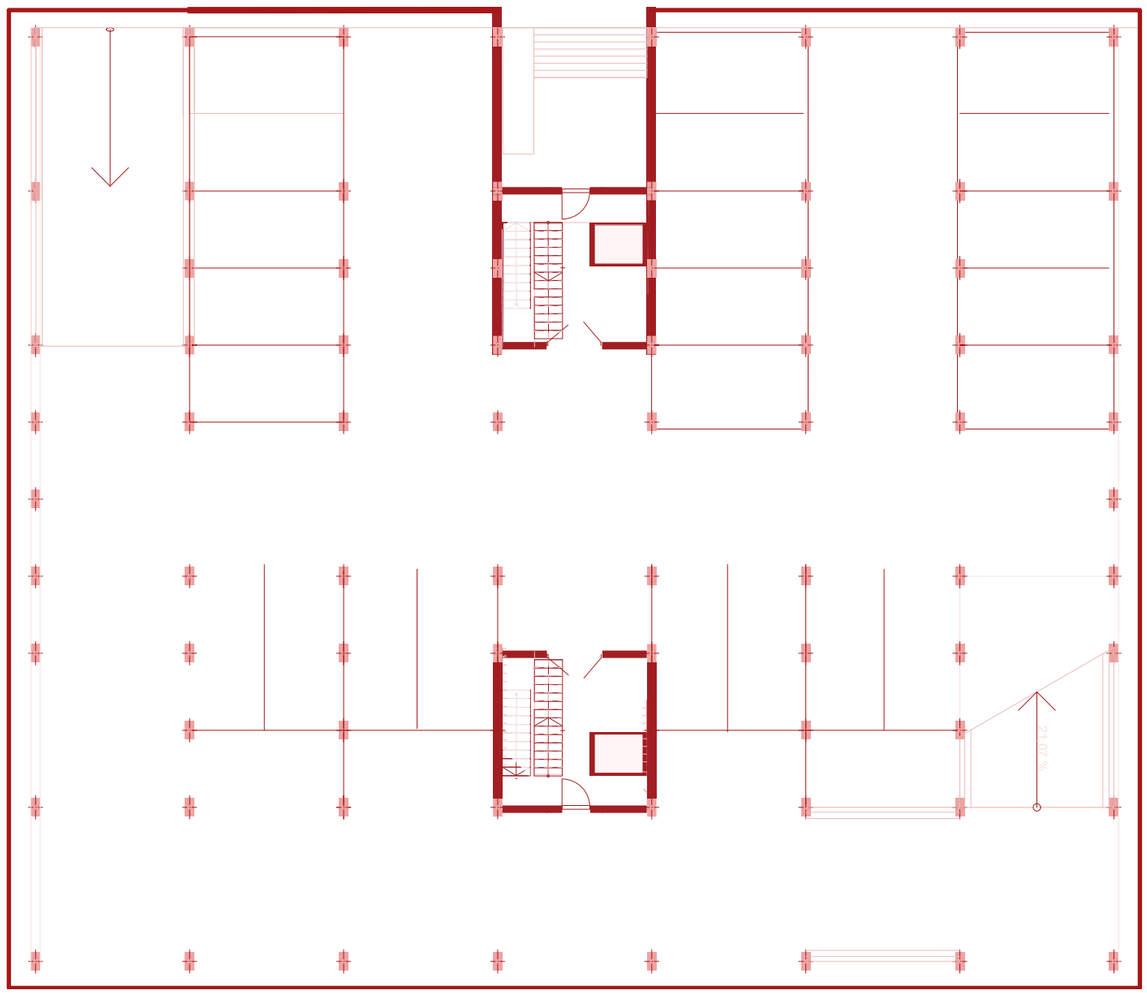
			AMOUNT			
UNIT TYPE	BEDROOMS	INCOME GROUP	1 A	2 B	1 C	
STUDIO	1 BEDROOM	LOW	4	6	4	
SMALL MAISONETTE	1 BEDROOM	LOW	4	4	4	
LOFT	2 BEDROOM	LOW - MID	12	2	7	
MEDIUM MAISONETTE	3 BEDROOM	MID	4	12	4	
LARGE MAISONETTE	3 BEDROOM	MID	14	10	11	
		TOTAL	38	34	30	

AMENITIES	A	B	
PARKING SPACES	605.7 m²	622 m²	

PARKING CLUSTER
Ground Floor

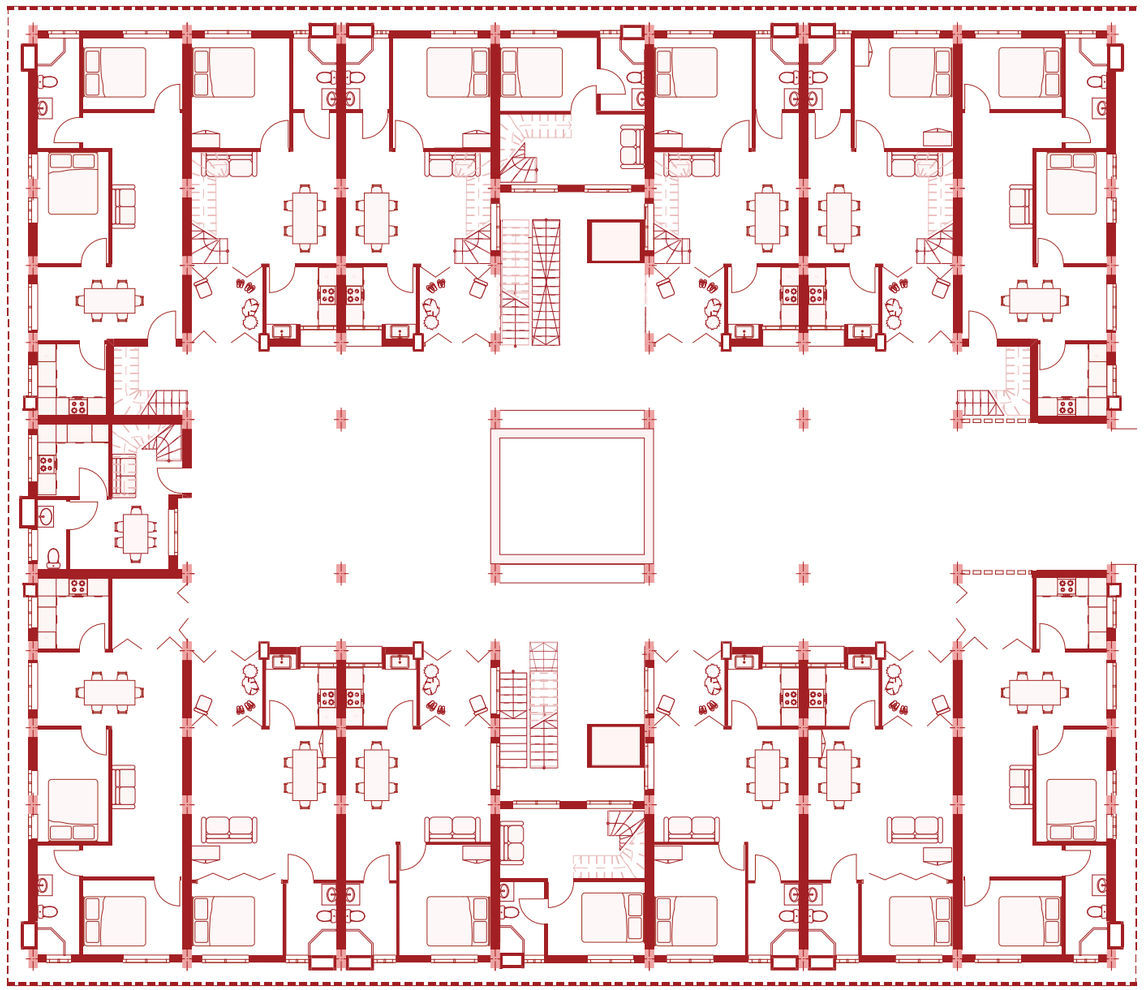


-1 Ground Floor

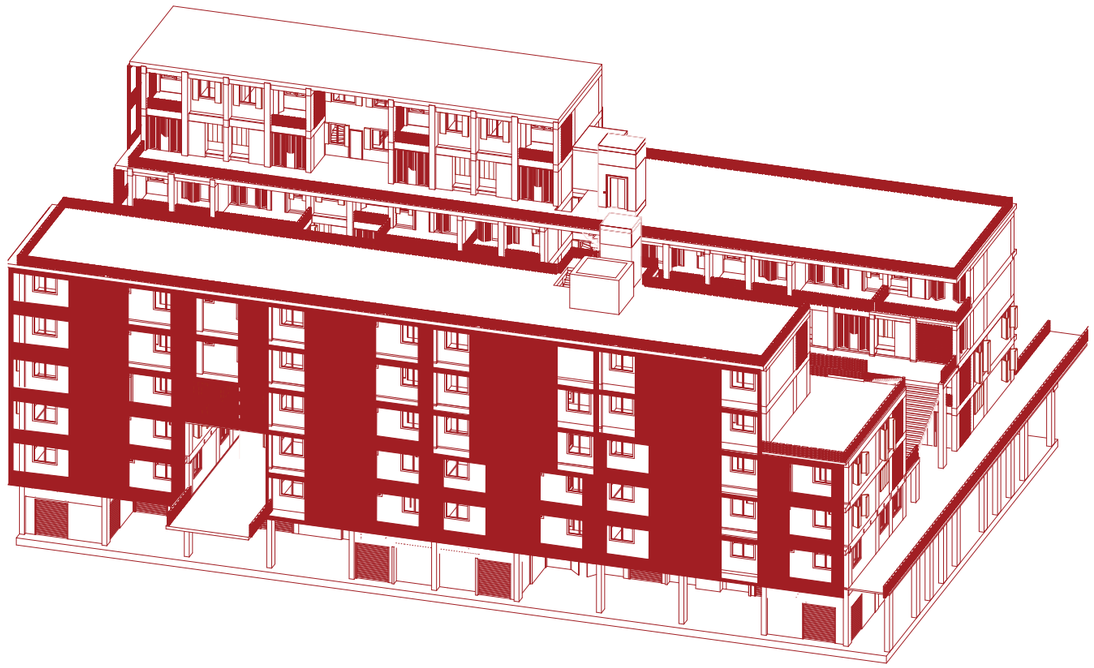


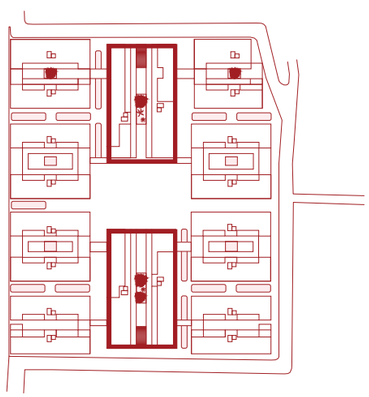
+1 Ground floor

PARKING CLUSTER
First Floor



MID CLUSTER

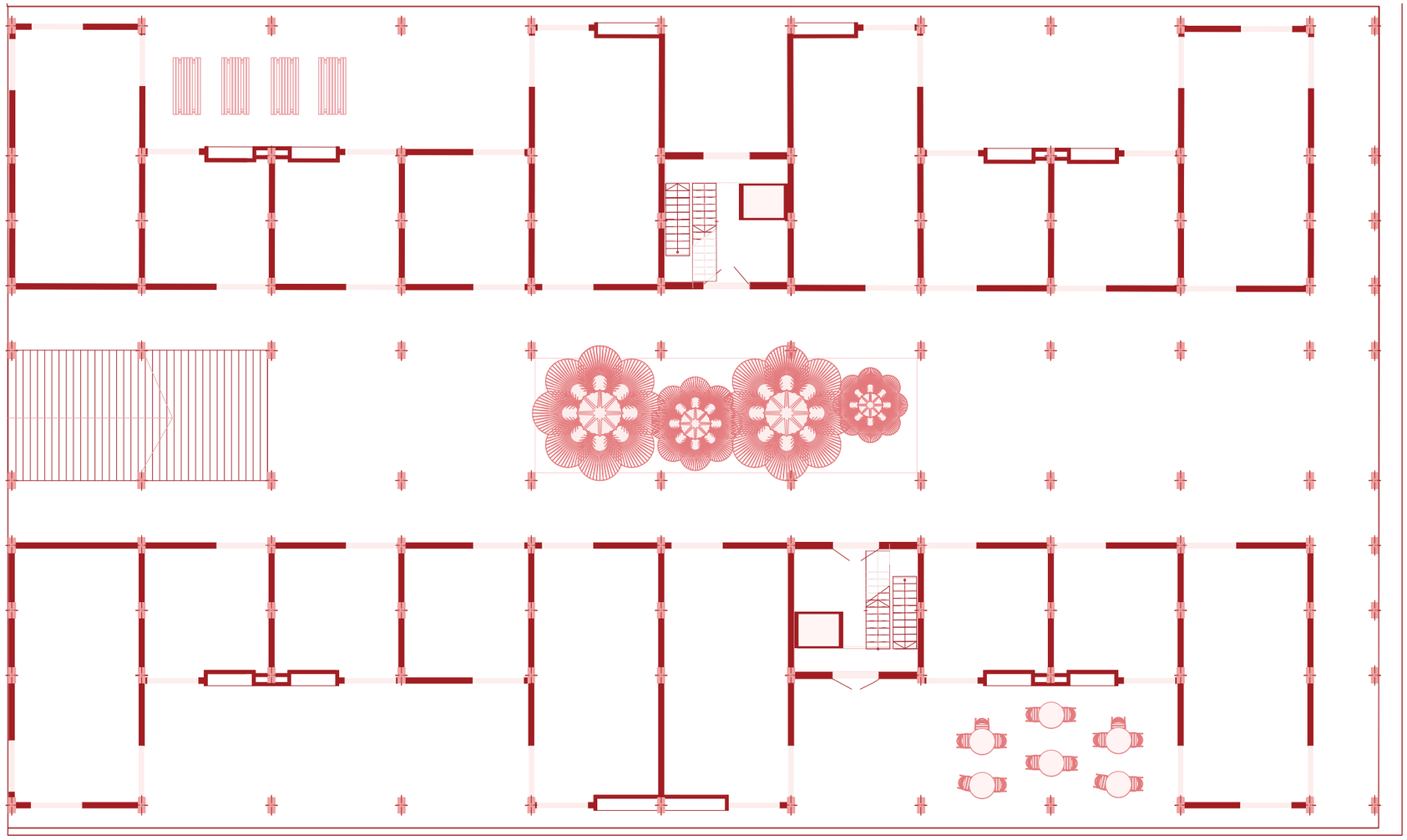




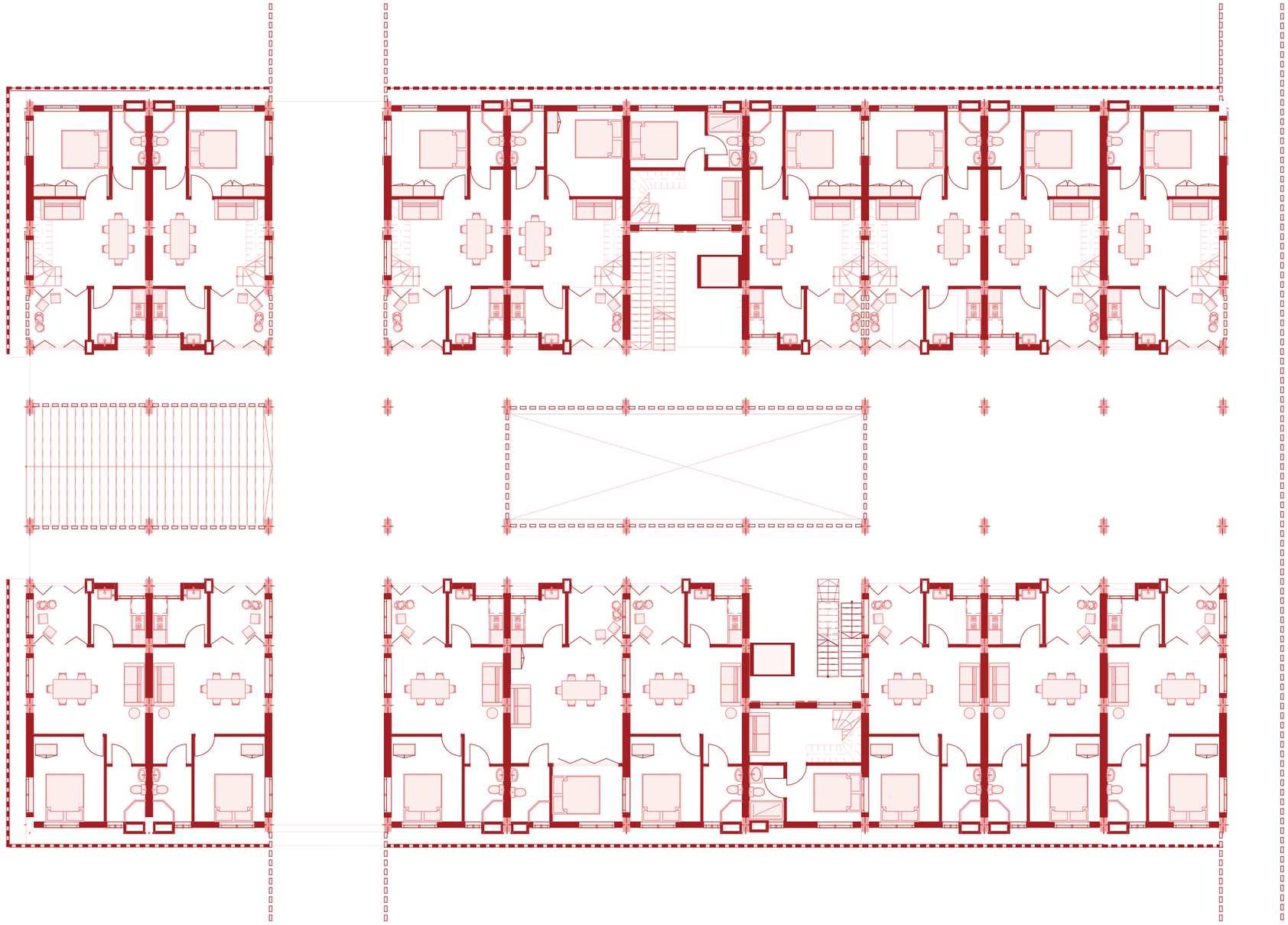
			AMOUNT		
UNIT TYPE	BEDROOMS	INCOME GROUP	A	B	
STUDIO	1 BEDROOM	LOW	8	8	14
SMALL MAISONETTE	1 BEDROOM	LOW	6	6	
LOFT	2 BEDROOM	LOW - MID	0	0	0
MEDIUM MAISONETTE	3 BEDROOM	MID	11	12	35 - 36
LARGE MAISONETTE	3 BEDROOM	MID	24	24	
		TOTAL	49	50	

AMENITIES	A	B	
MARKET/TEA & FOOD SHOPS	605.7 m²	622 m²	

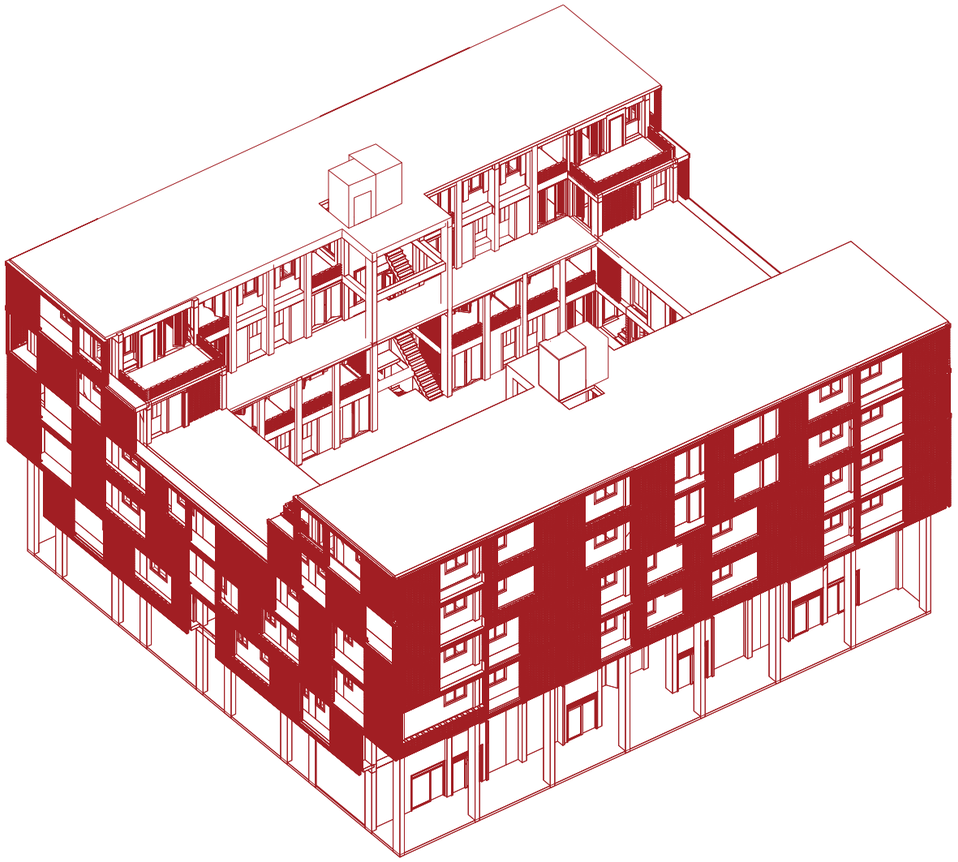
MID CLUSTER
Ground Floor

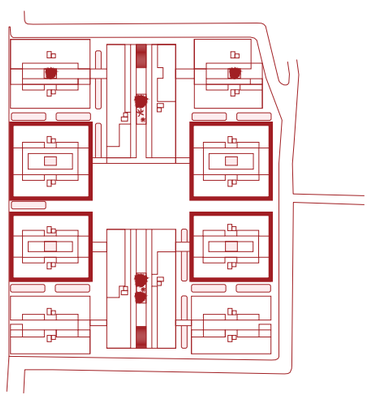


MID CLUSTER
First Floor



MARKET CLUSTER

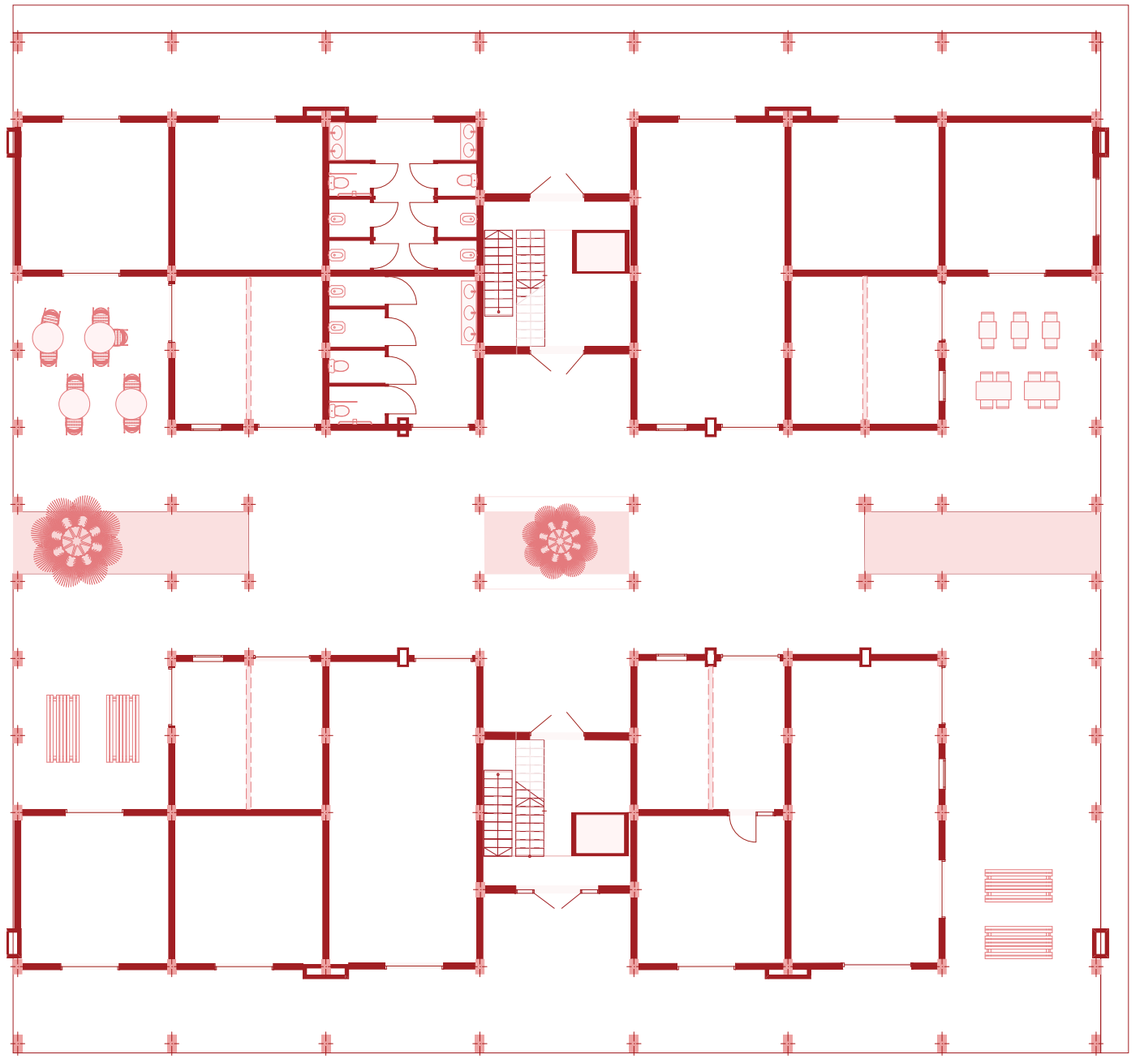




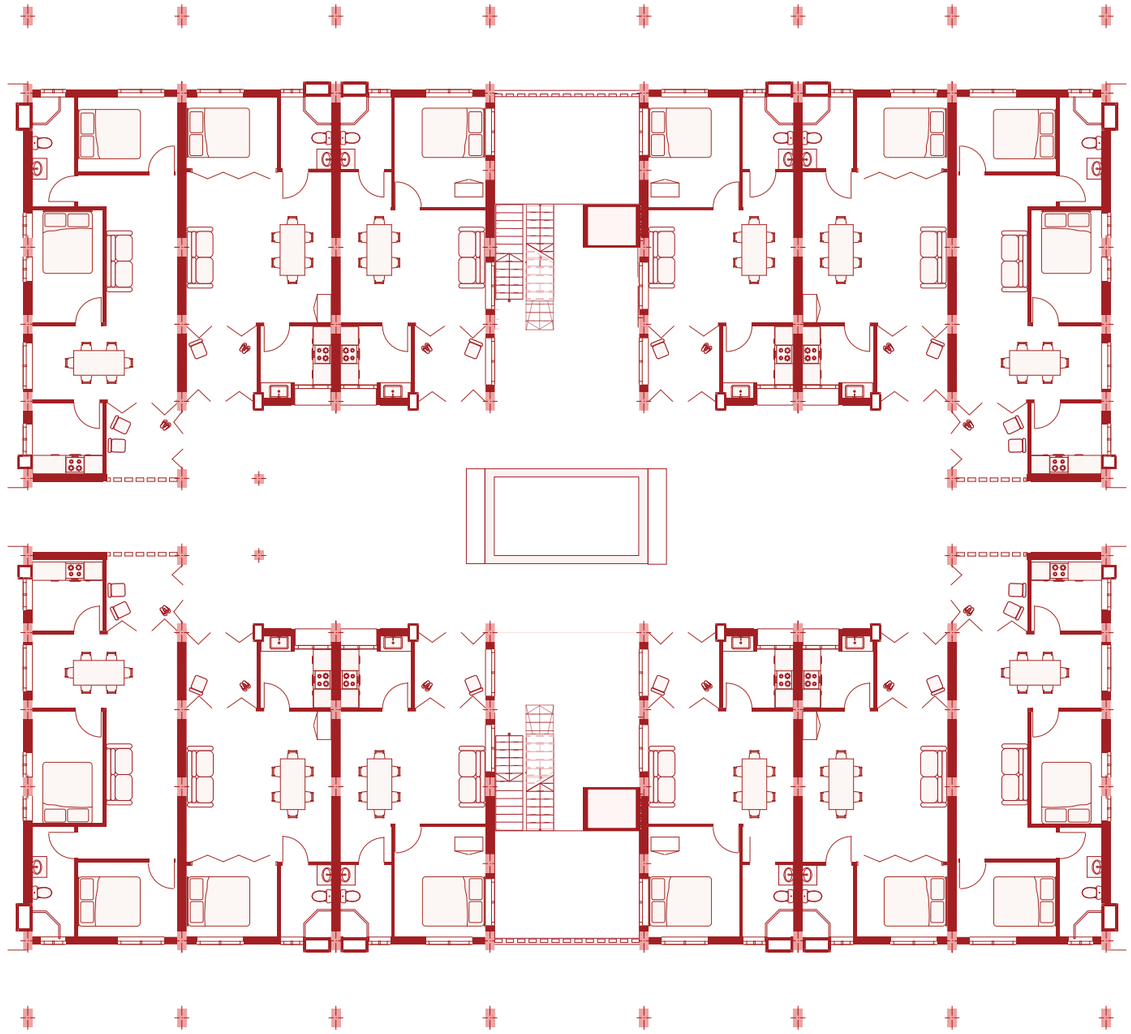
UNIT TYPE	BEDROOMS	INCOME GROUP	AMOUNT	
STUDIO	1 BEDROOM	LOW	8	12
SMALL MAISONETTE	1 BEDROOM	LOW	6	
LOFT	2 BEDROOM	LOW - MID	12	12
MEDIUM MAISONETTE	3 BEDROOM	MID	8	18
LARGE MAISONETTE	3 BEDROOM	MID	10	
			TOTAL	36

AMENITIES	A	B	
MARKET/TEA & FOOD SHOPS	419.9 m²	422 m²	

MARKET CLUSTER
Ground floor



MARKET CLUSTER
First floor







OUTER FACADE MARKET CLUSTER

1:100



MARKET
Phase 1





Phase 1 for the market on the ground floor is to cater to immediate needs which looks a lot like the markets that currently exist. The market structure is easily adaptable as it is a grid of 5 by 5 with columns meaning it can adapt to future needs.

Market Facade - Phase 2

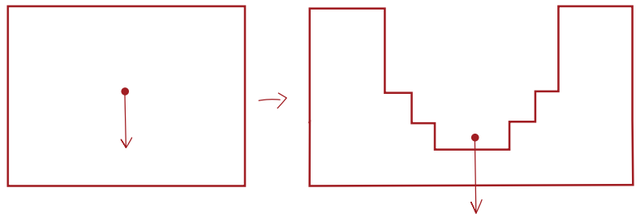



ফ্রেমের দোকান
বিরিয়ানি রেস্তোরাঁ

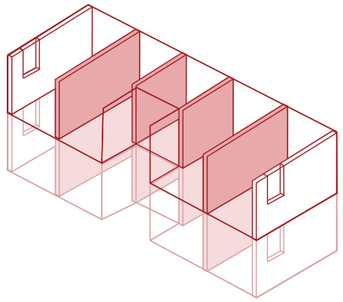
05 BUILDING TECHNOLOGY

CLIMATE RESISTANCE

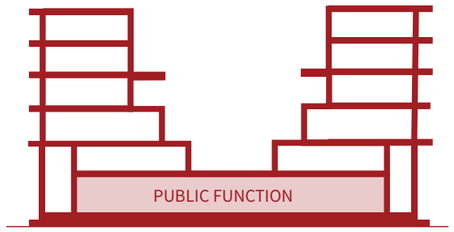
LOWERING CENTRE OF GRAVITY



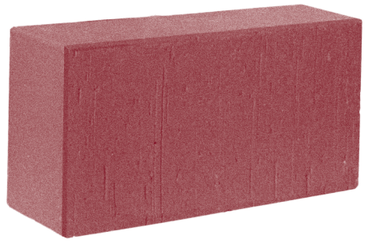
SOLID INFILL OF CERAMIC BRICKS AS SEPARATING WALLS



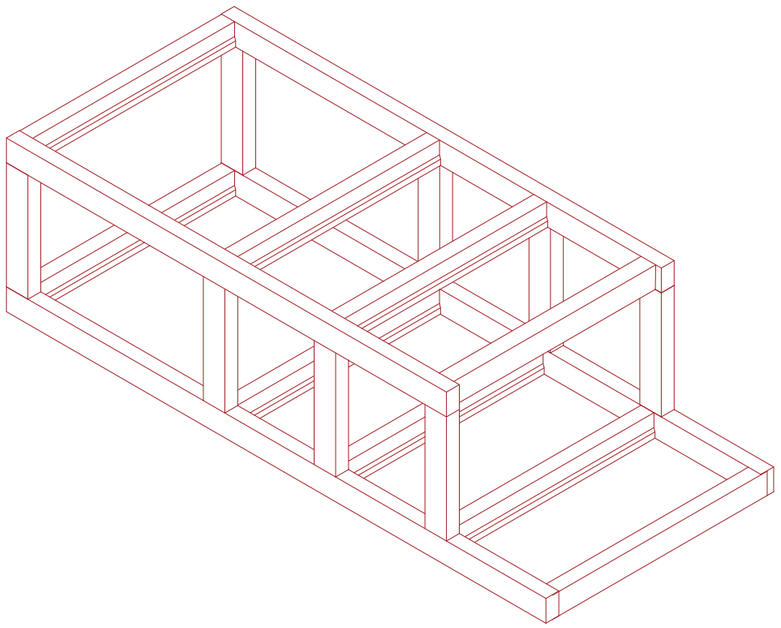
GROUND FLOOR ALL PUBLIC FUNCTION & PLINTH OF 500mm



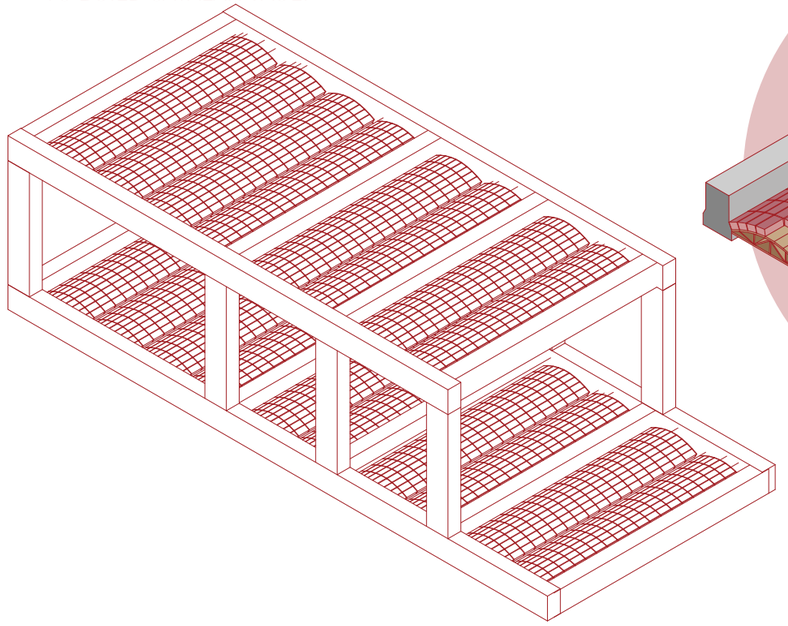
CHOOSING SPECIFIC BRICKS FOR SPECIFIC FUNCTIONS

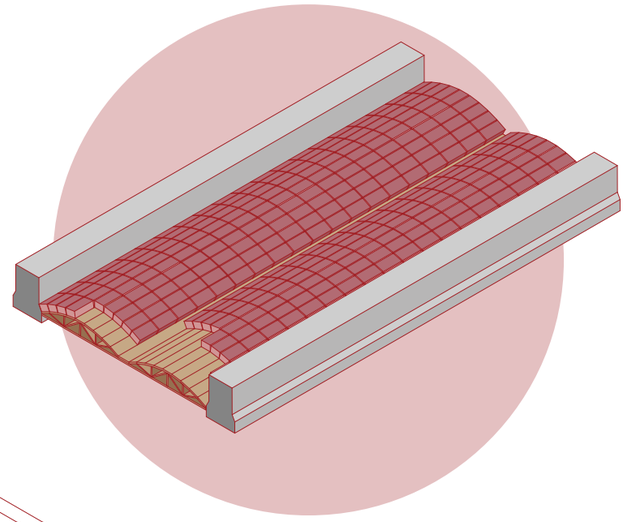


1. IN SITU CAST CONCRETE WITH REBAR

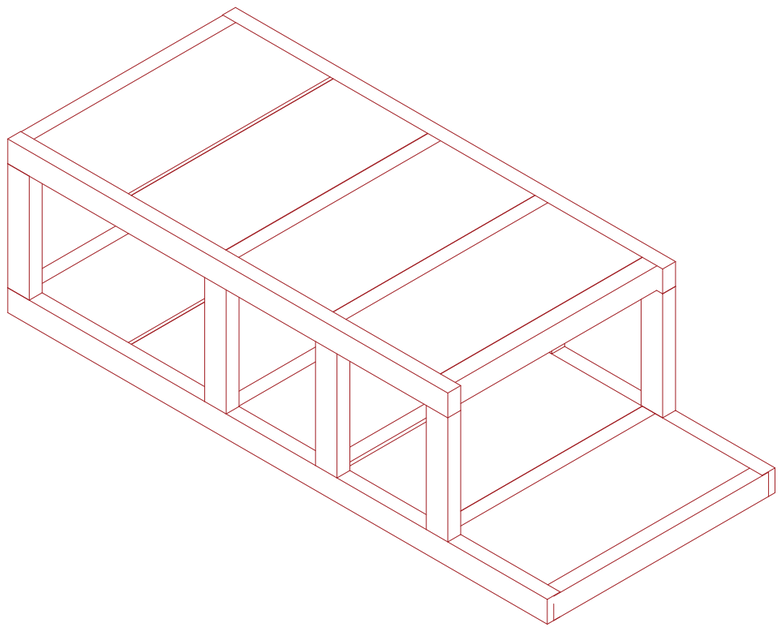


2. CATALAN VAULT - WOODEN FRAMING
TO BUILD CATALAN VAULT

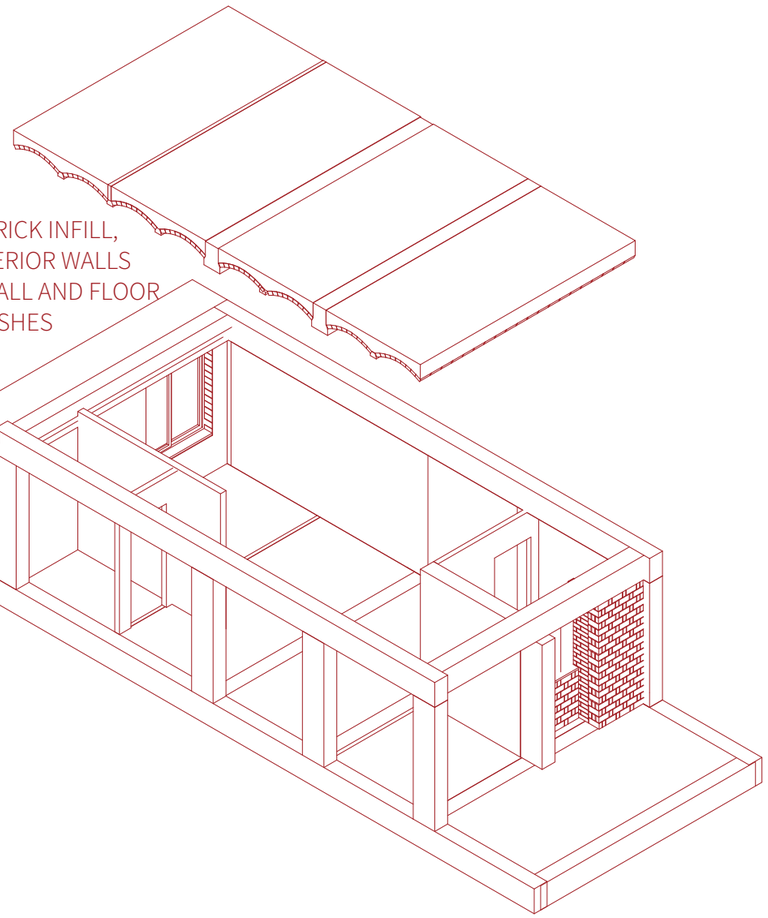




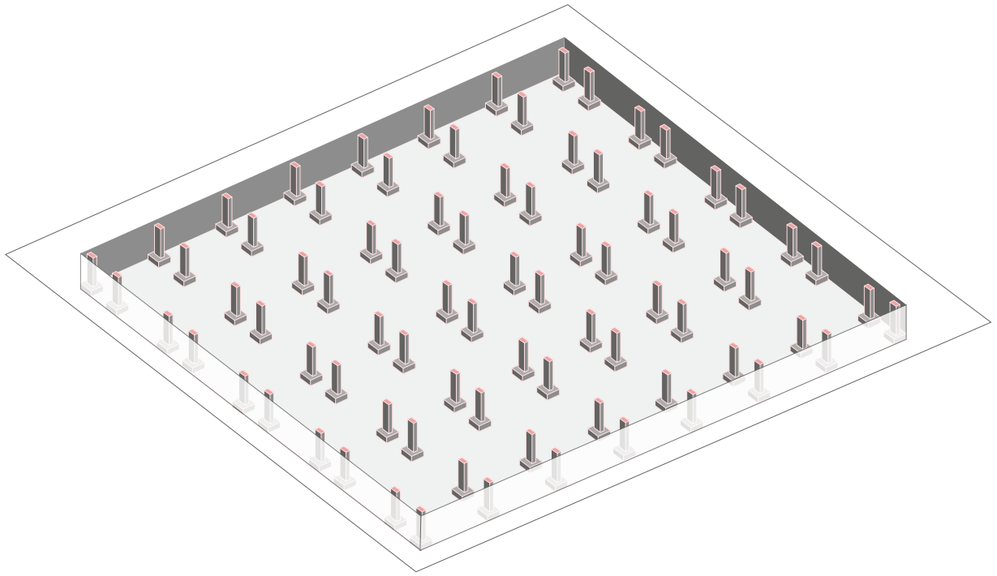
3. IN SITU IN BETWEEN BEAMS ,
& POURING EARTH SCREED



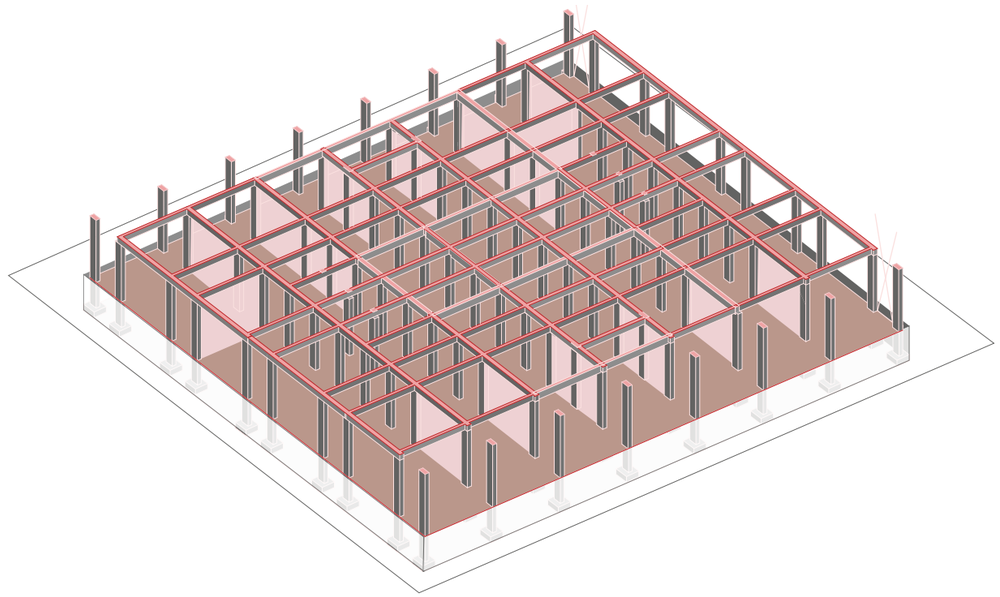
4. BRICK INFILL,
INTERIOR WALLS
& WALL AND FLOOR
FINISHES



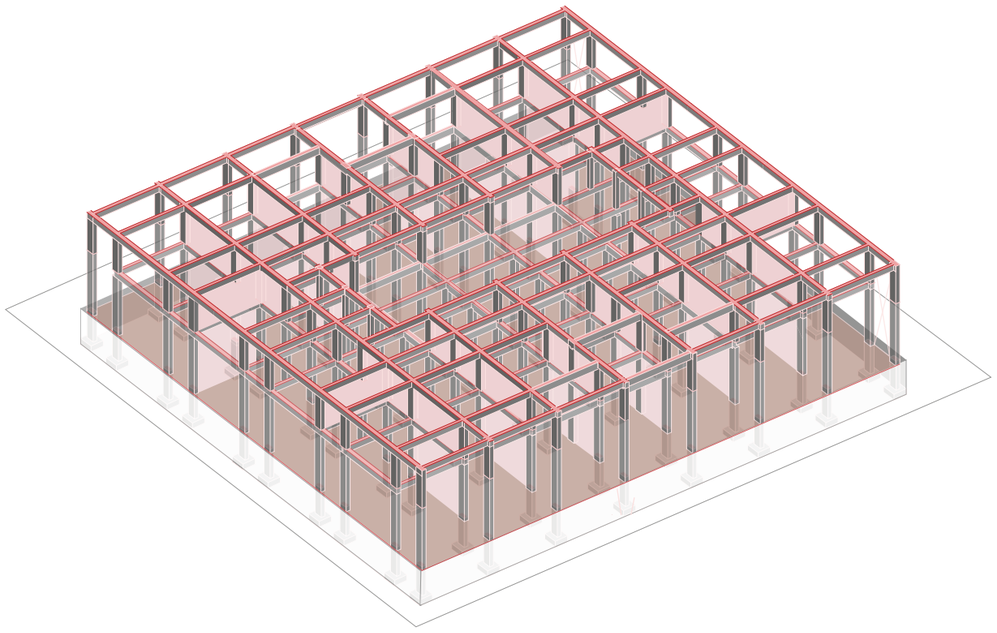
CONSTRUCTION SEQUENCE
Pile Foundation



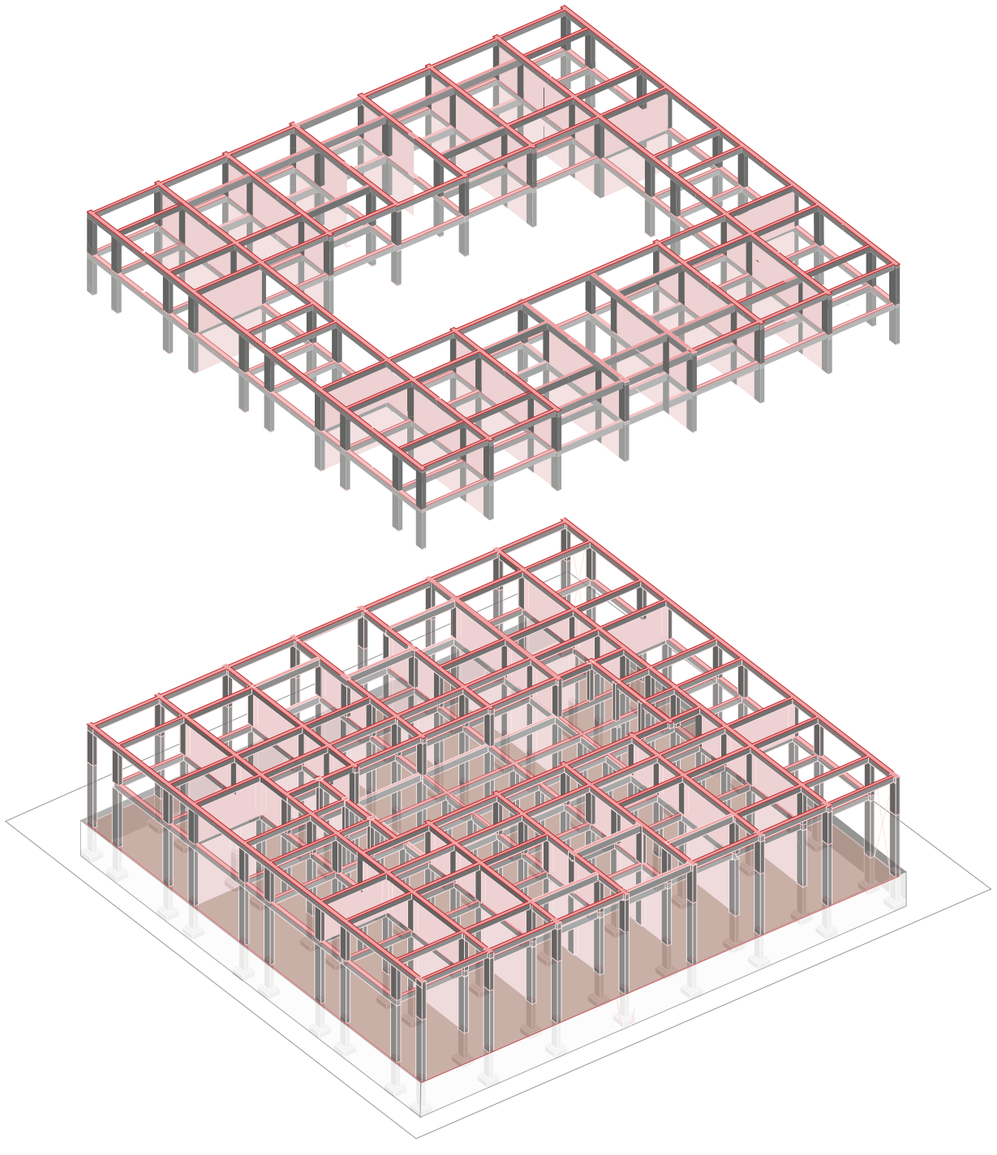
CONSTRUCTION SEQUENCE
Reinforced Concrete Beams and Columns



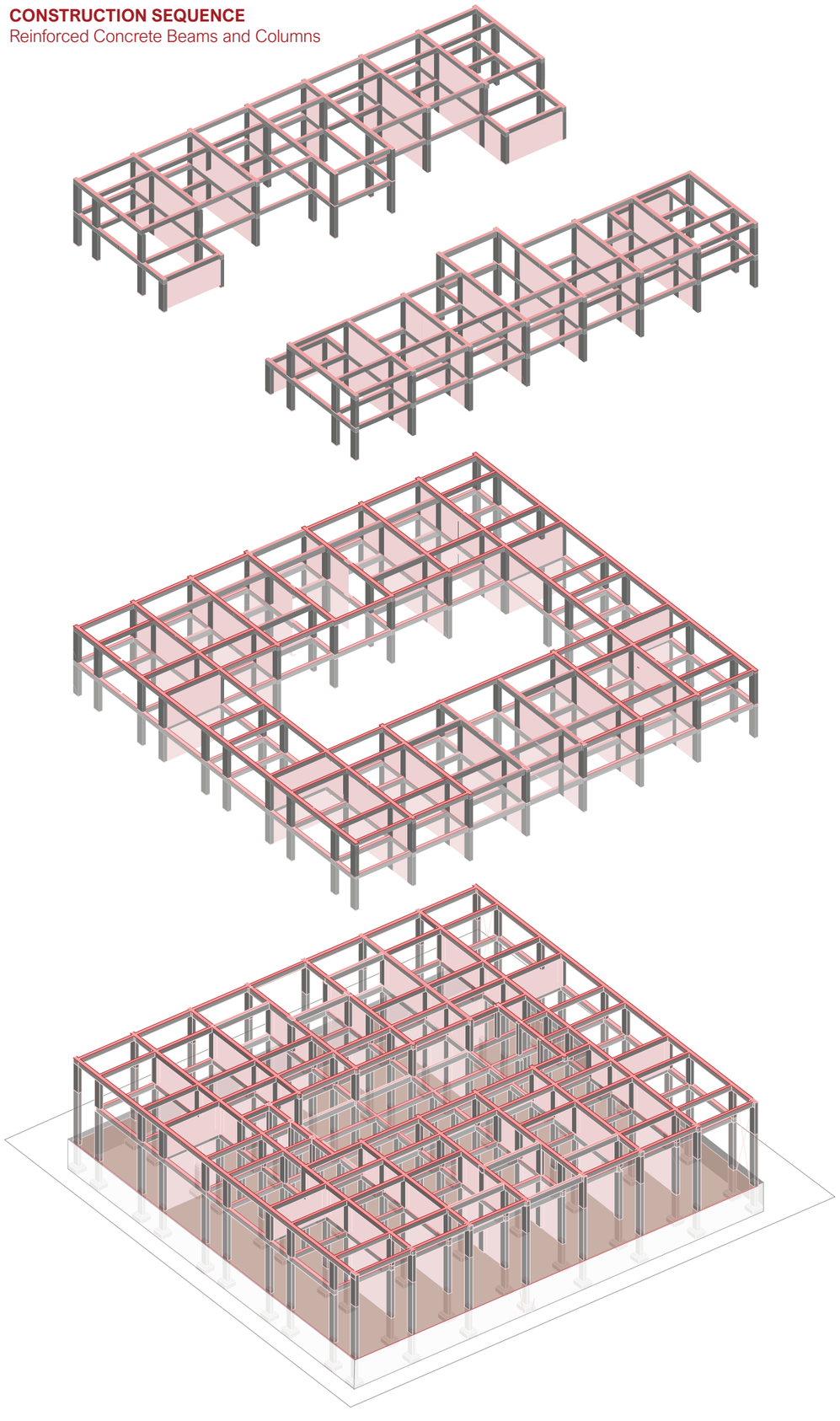
CONSTRUCTION SEQUENCE
Reinforced Concrete Beams and Columns



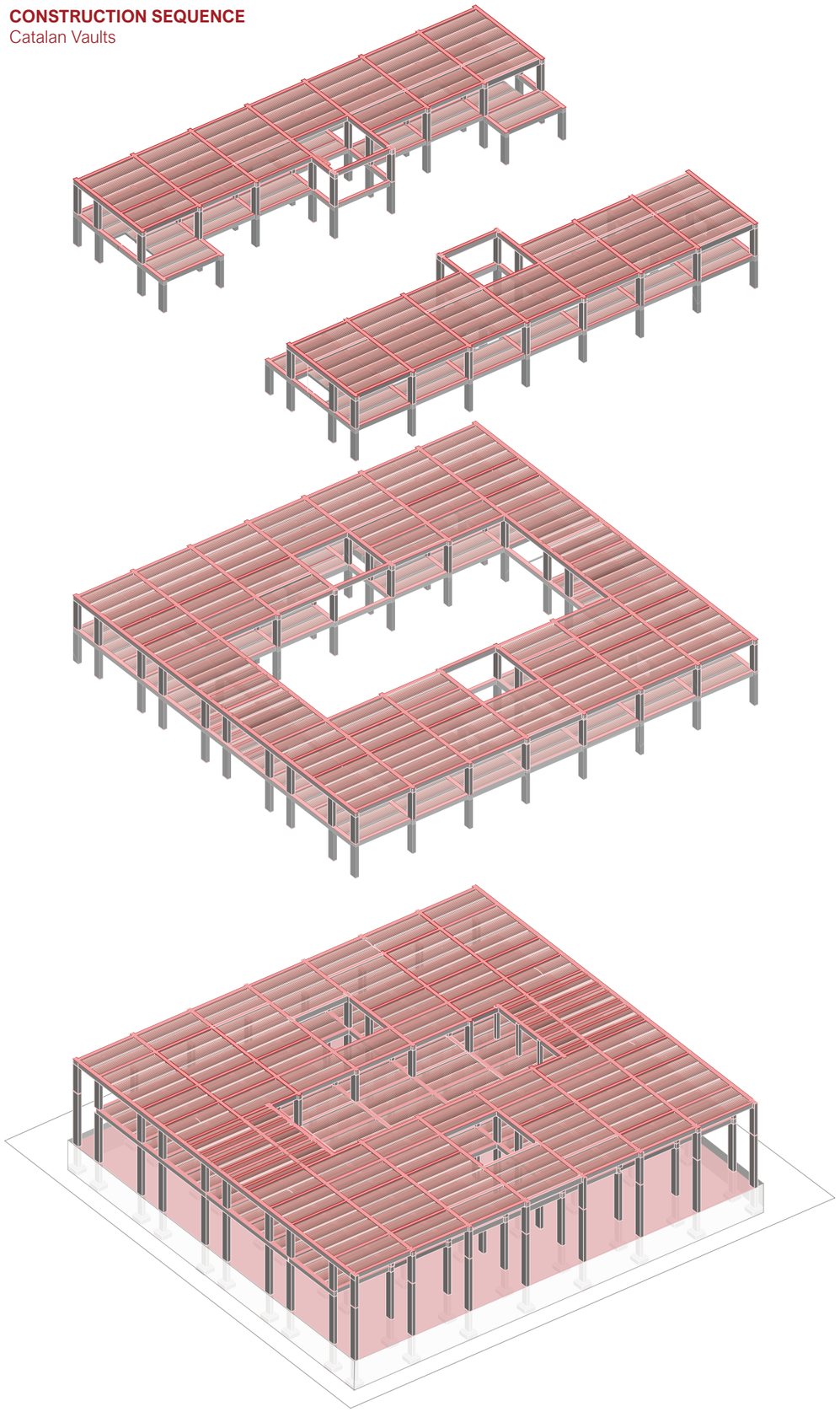
CONSTRUCTION SEQUENCE
Reinforced Concrete Beams and Columns



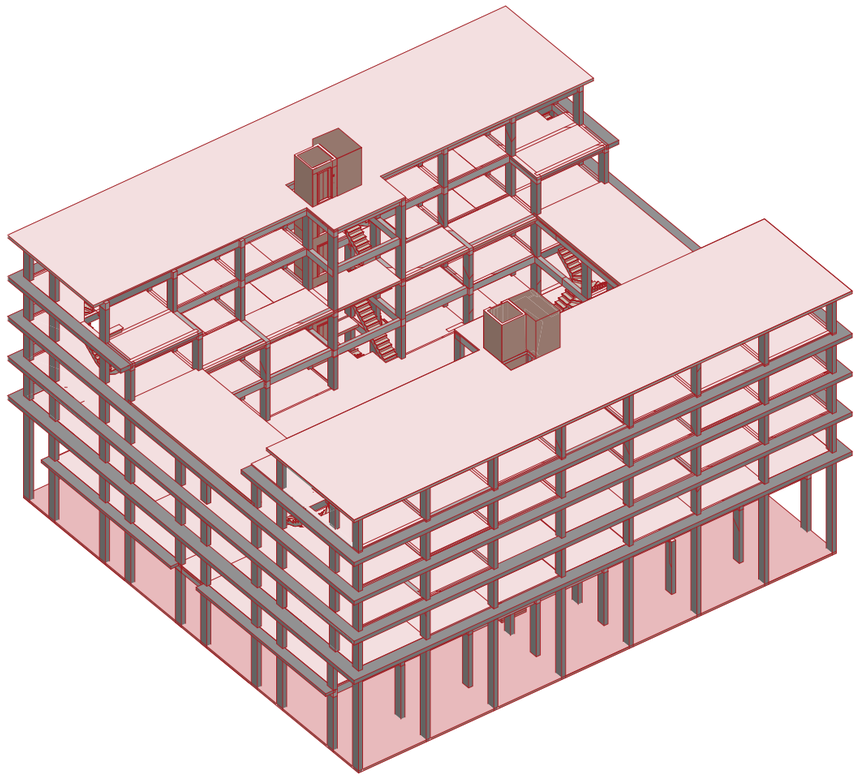
CONSTRUCTION SEQUENCE
Reinforced Concrete Beams and Columns



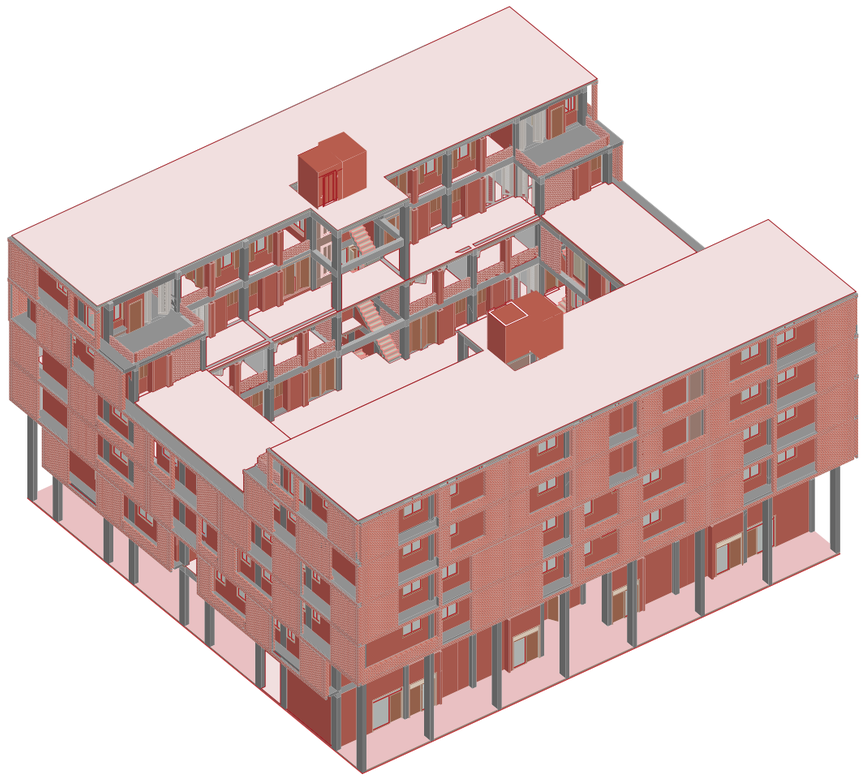
CONSTRUCTION SEQUENCE
Catalan Vaults

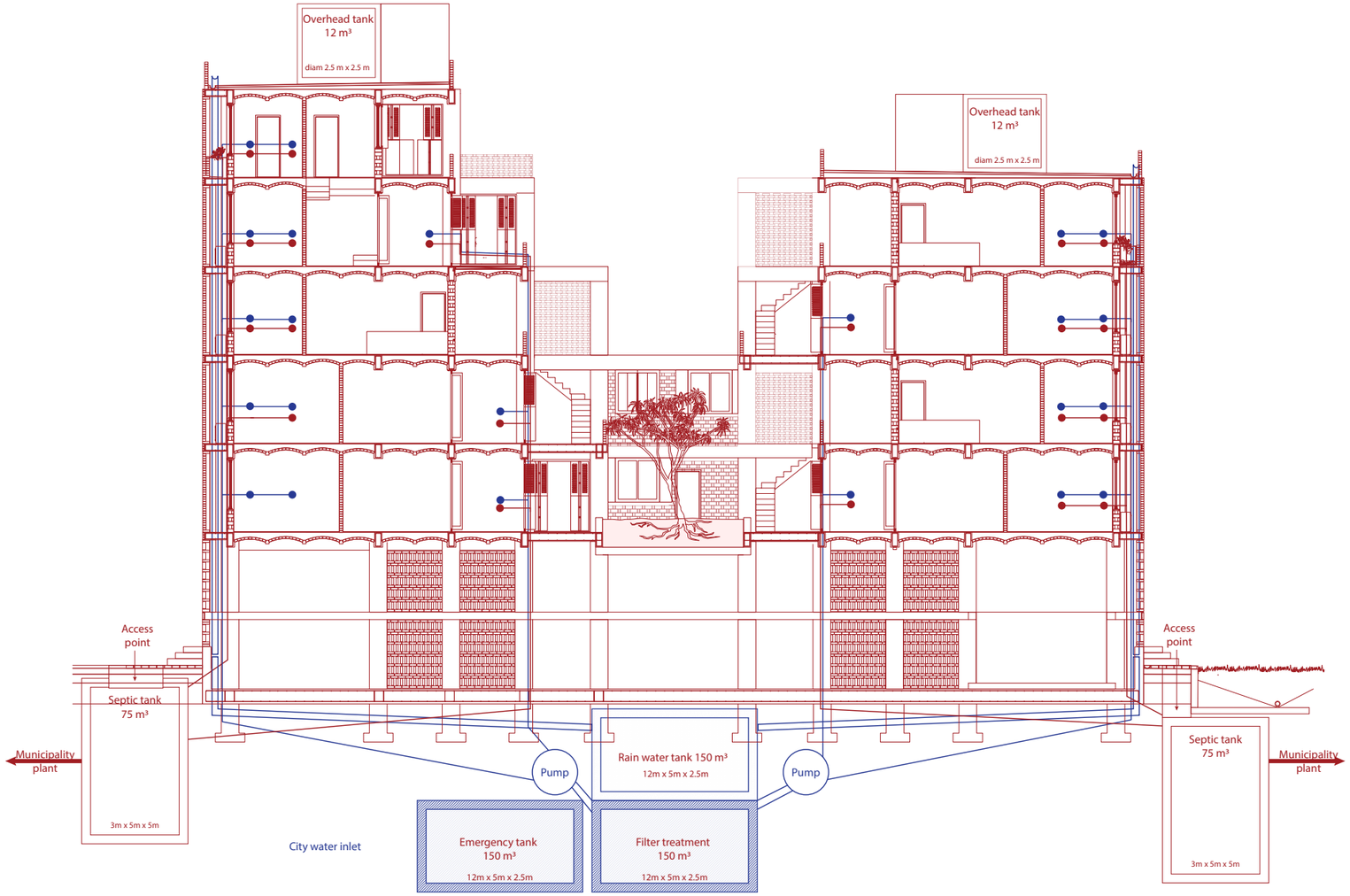


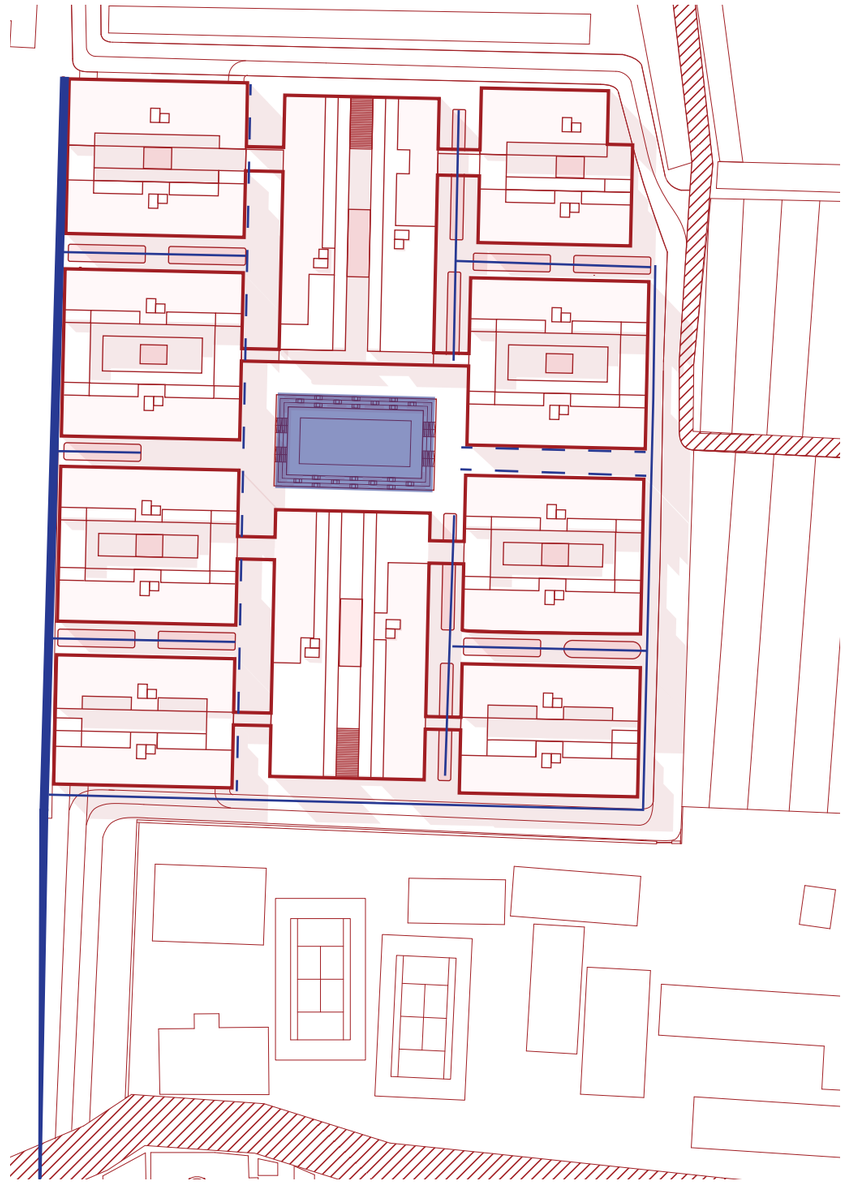
EARTH SCREED



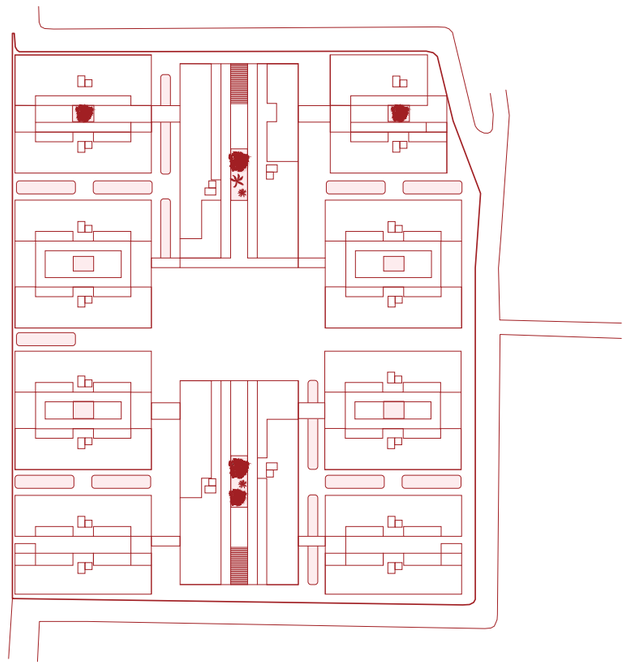
FINISHES




Overhead tank
12 m³
diam 2.5 m x 2.5 m
Overhead tank
12 m³
diam 2.5 m x 2.5 m
Access
point
Septic tank
75 m³
3m x 5m x 5m
Municipality
plant
Pump
Rain water tank 150 m³
12m x 5m x 2.5m
Pump
City water inlet
Emergency tank
150 m³
12m x 5m x 2.5m
Filter treatment
150 m³
12m x 5m x 2.5m
Access
point
Septic tank
75 m³
3m x 5m x 5m
Municipality
plant



06 NEIGHBORHOOD AND MASTERPLAN SCALE



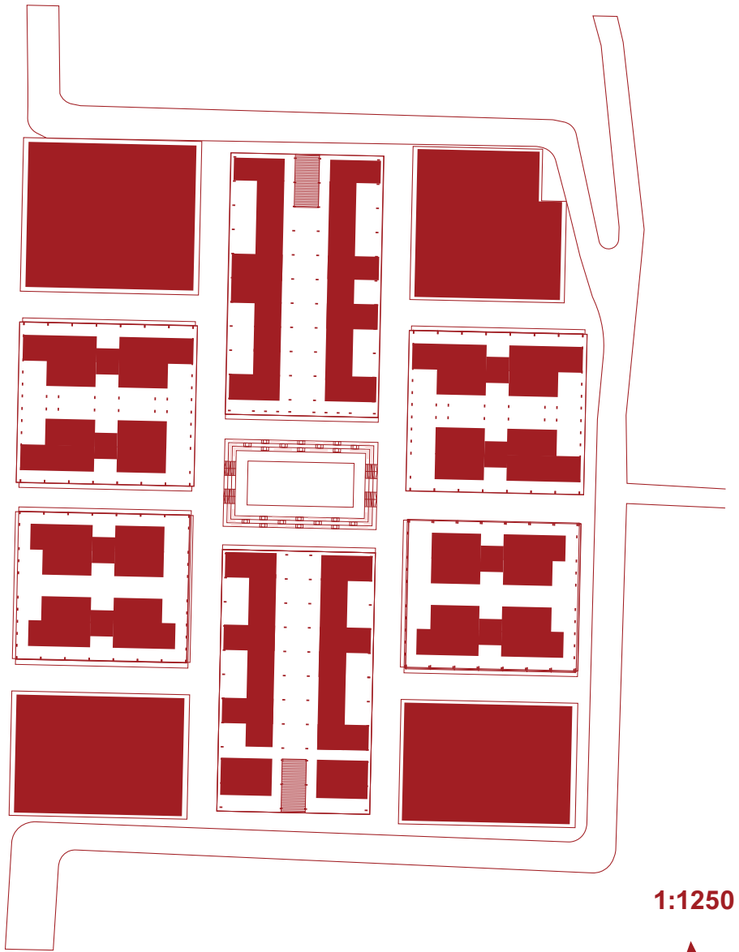
NEIGHBORHOOD SCALE

Ground Floor



1:750

NOLI PLAN



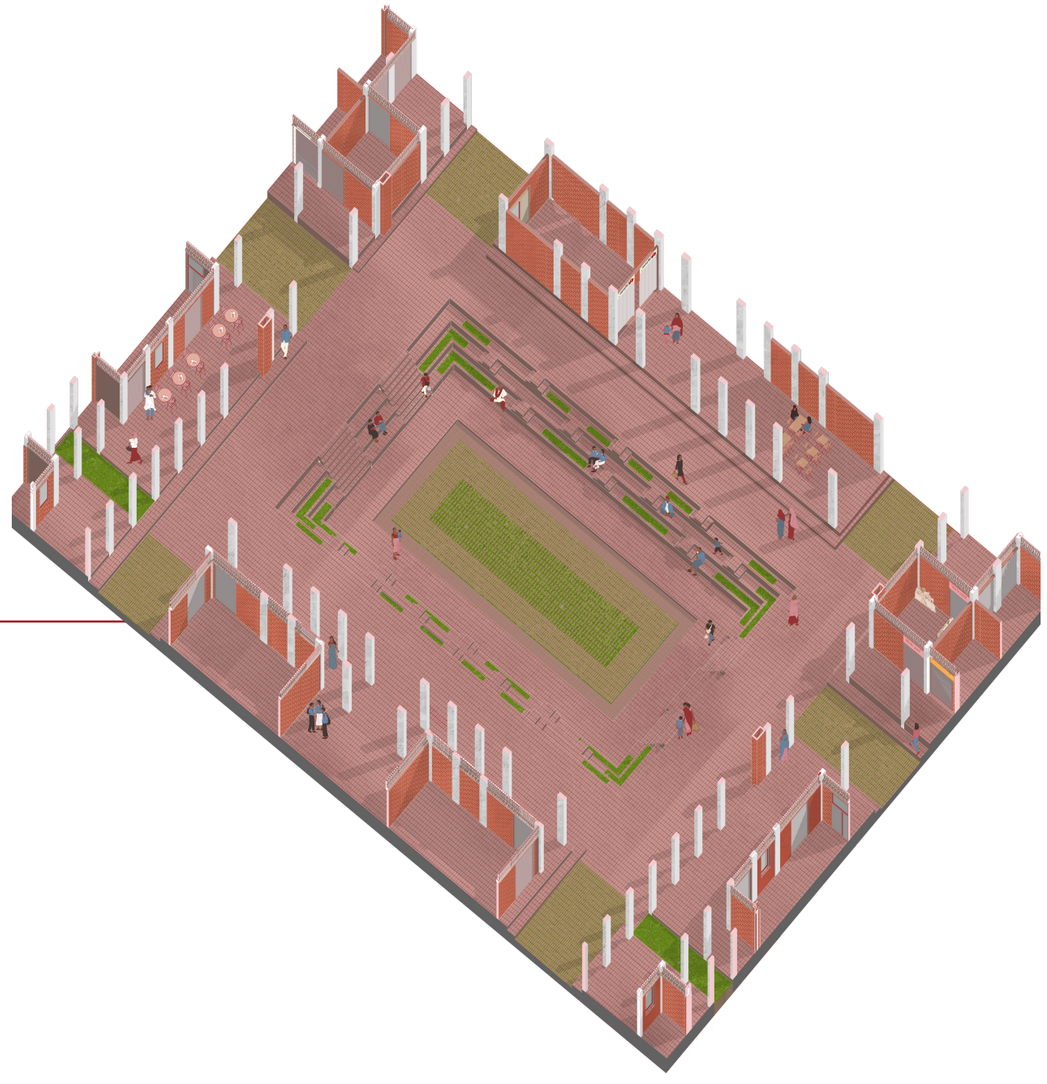
1:1250

NEIGHBORHOOD SCALE

Public Square

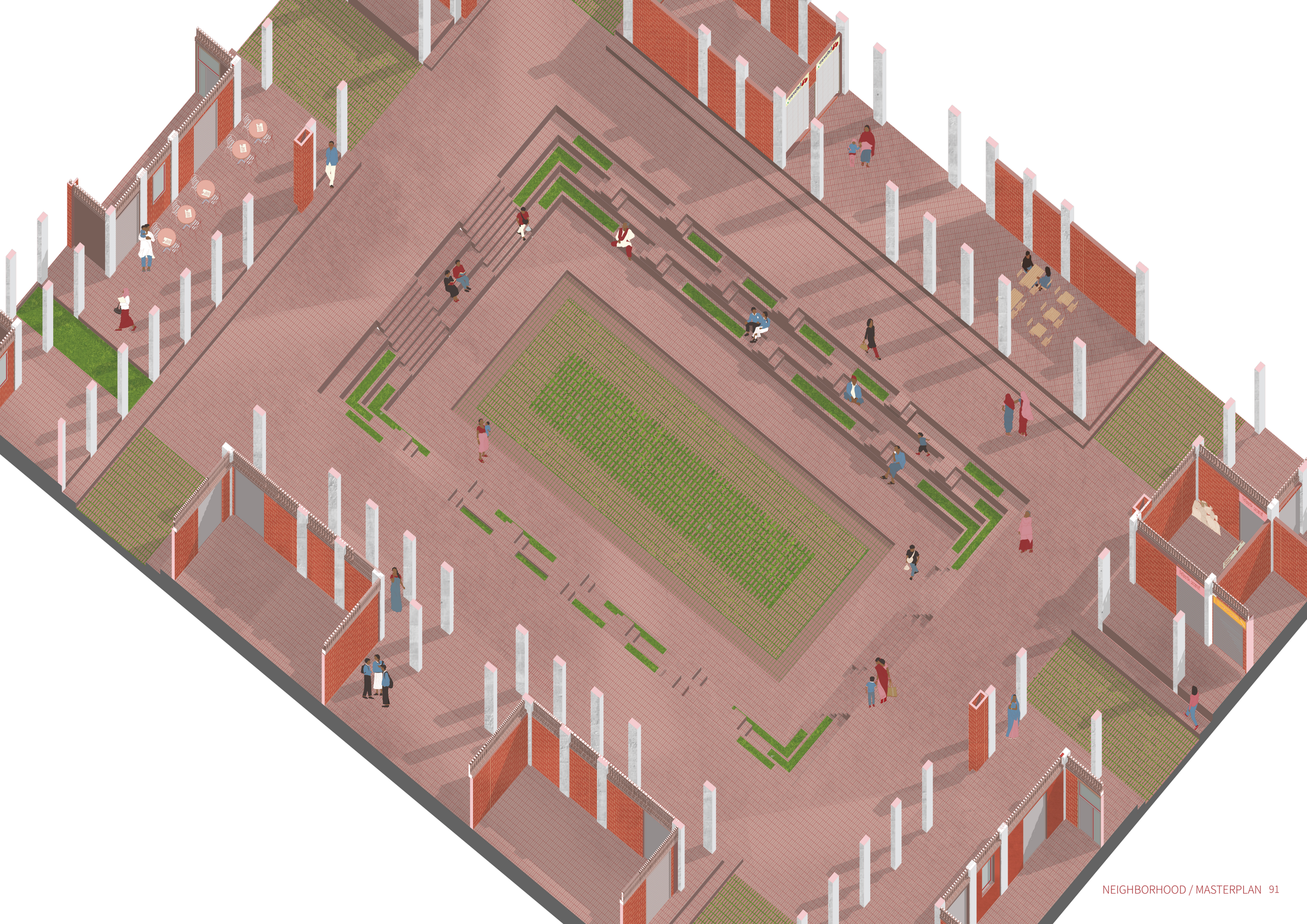


1:750









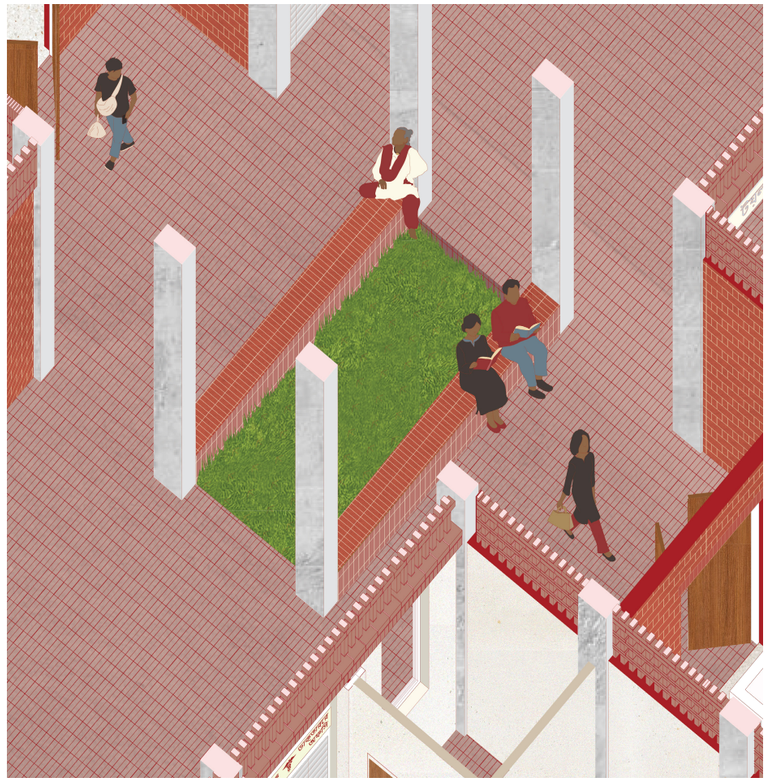
NEIGHBORHOOD SCALE

The Different Levels of Public Space

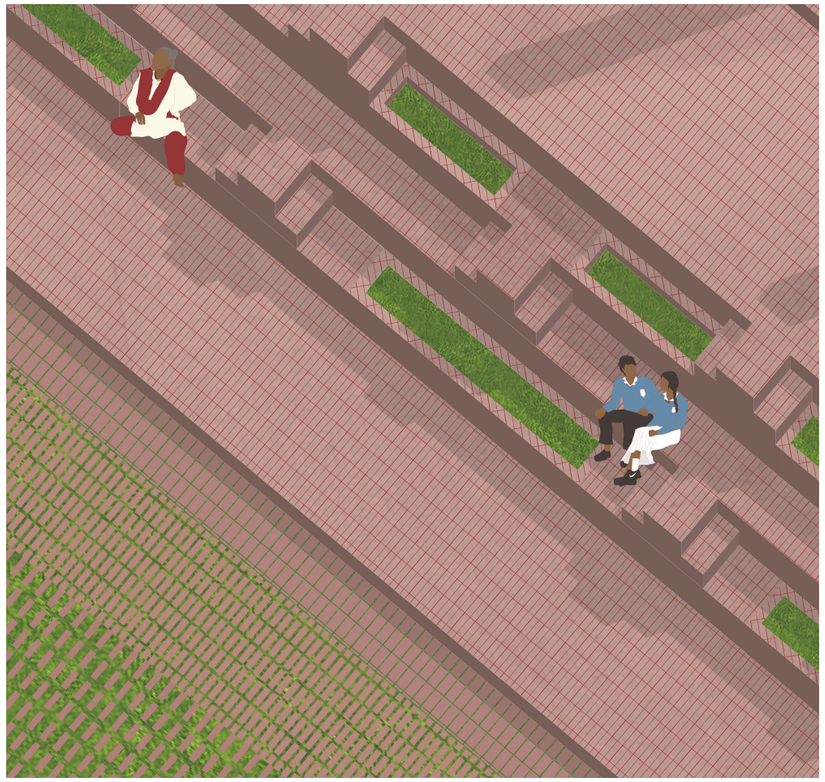
COURTYARD



MARKET CENTRE



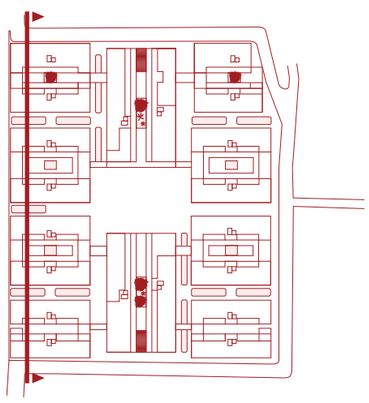
PUBLIC SQUARE





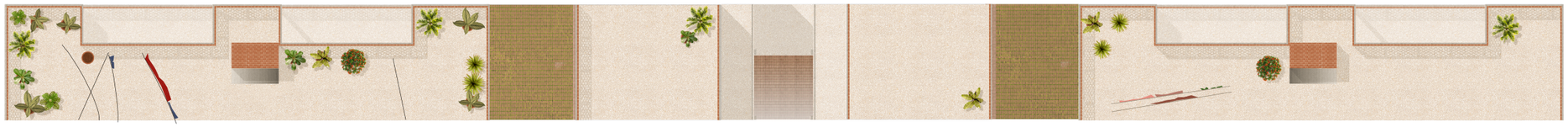

ক্রিকেটের দোকান

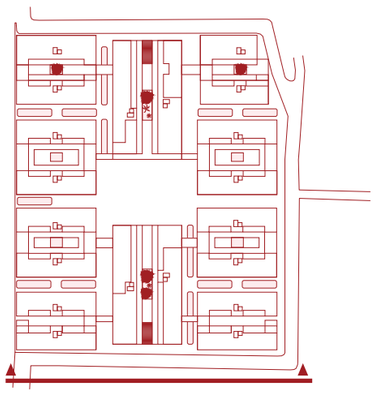




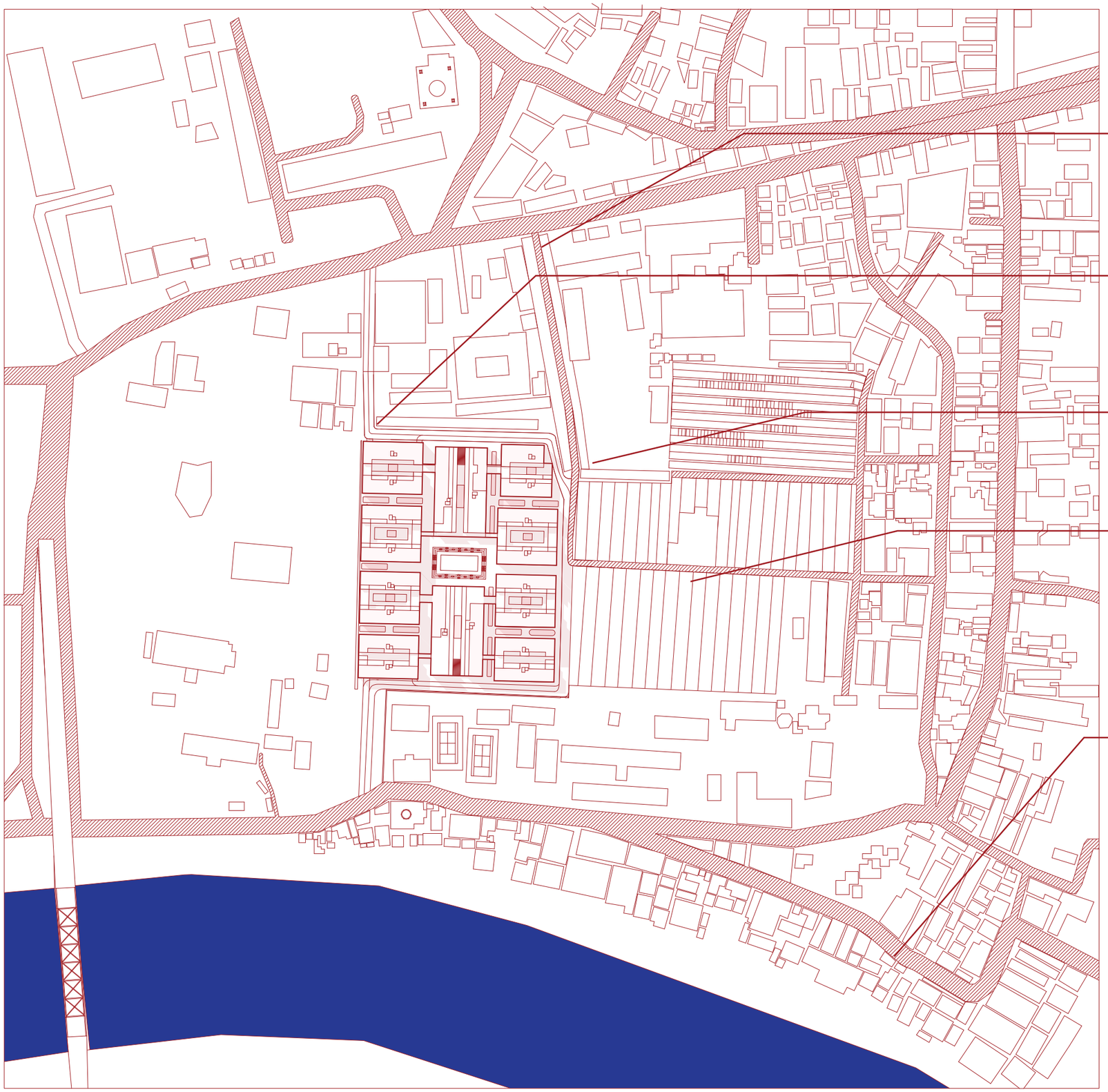


Birds Eye View
1:400









Keeping “City Supermarket” entrance

This street remains narrow, as this will be the entrance for smaller vehicles such as tuc tucs and pedestrians. This road will function better as larger vehicles pass through the new road.

Keep plot closed on 1 side

This will become the most private end of the plot. There is already lots of nature creating a peaceful area for the residents.

Making Plot more accesable

Connecting to the two main roads will increase accesability, one of the reasons the previous market was demolished.

Extending the street

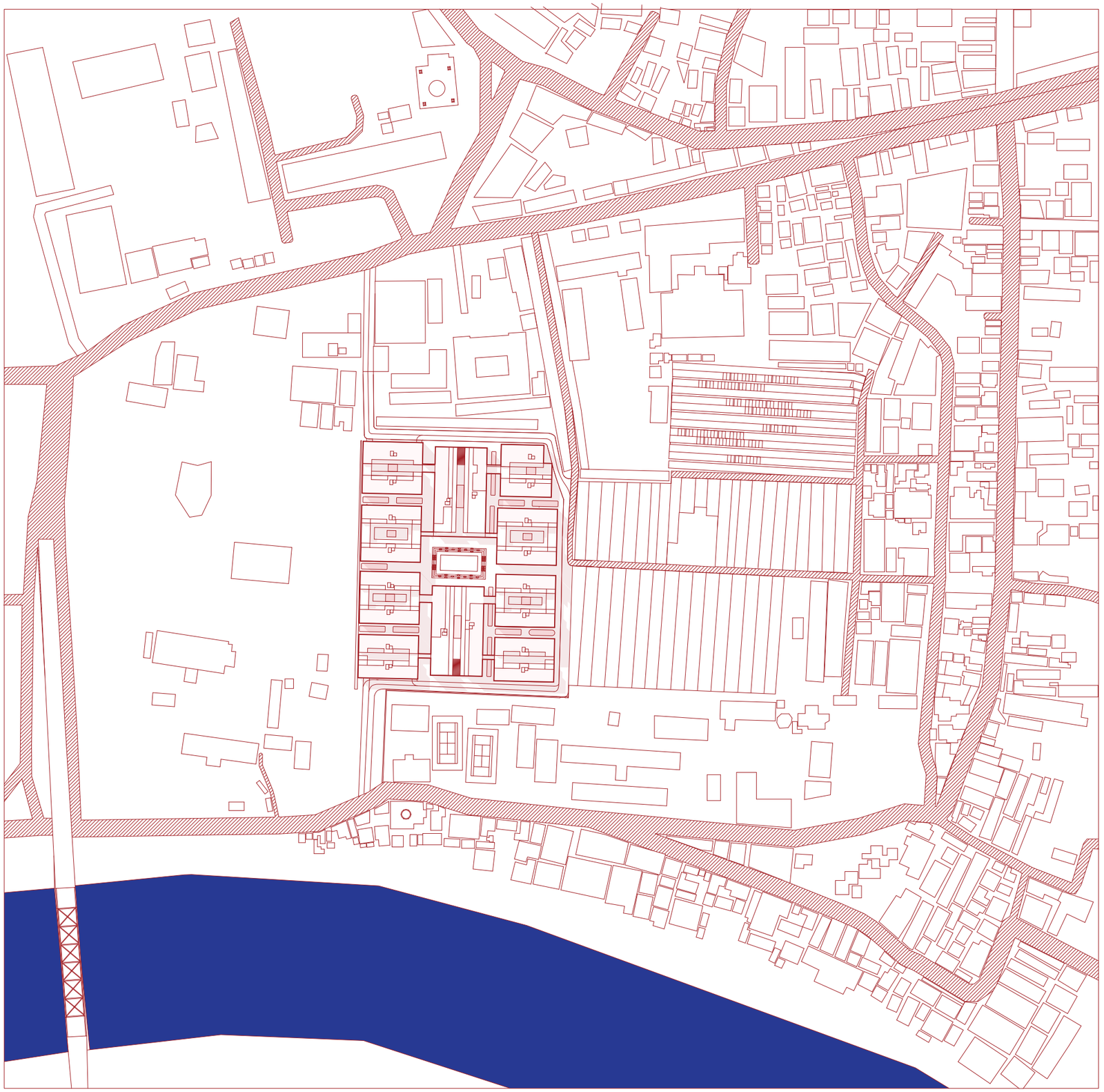
One of my goals was to recreate the lively street life both on the ground floor where the public functions are and the first floor where housing is locating.

A boulevard along the river

First phase would be making openings and only removing few market buildings.

Connecting the river to the main land will optimize the use of the river, both transport, washing etc and making it a hotspot location with a view.

1:2500



HOUSING	AMENITIES	
289 Housing units total	130 parking spots	**FSI = 2.1 (excluding parking)**
82 Low income 1 bedroom	2011 m² market/retail	**GSI = 0.77**
45 Low income 2 bedroom		**Dwellings per ha = 181**
162 mid income 3 bedroom maisonettes		

1:2500

CONSTRUCTION CALCULATION

Item	Unit Cost (৳)	Quantity / Area	Total Cost (৳)	Total Cost (USD)
Mahogany	৳4,000/m²	354.24 m²	৳1,416,960	$11,656
Brick Rattrap	৳800/m² or ৳15/brick	7,410 m²	৳5,928,000	$48,765.33
Concrete	৳7,000–9,000/m³	423.3 m³	৳3,960,843.75	$28,962.64
Foundation		962.5 m²	৳4,285,350	$35,710
Glass with frame	৳4000/m²	231 m²	৳924,000	$7,524
Bamboo	৳500–1,000/m²	74.4 m²	৳37,200	$306
Bricks in Double Façade	৳528/m²	17,424 bricks (≈920.8 m²)	৳1,473,280	$3,999.47
Brick Floors	৳800/m²	3,139.9 m²	৳25,119,200	$20,663.73
Terrazzo Finishing	৳1,200–2,000/m²	3,139.9 m²	৳3,767,880	$30,995.60
Total cost finishes for market cluster			৳ 9,918,720	$85,830
Labour Cost of finishing	25-40% of the total cost		৳ 2,479,680 - 3,967,488	$ 20,241 - 32,386
Price per m2	Market cluster is approx 3,739 m²		৳ 2650/m²	$ 21,58 m²
Total finishing costs over total m²			৳ 79,500,000	$ 647,400
24,000 taka / m² (200.5 USD / m²) for Concrete construction with Brick infill (including labour)*	total m² of entire plot	30,000 m²	৳ 720,000,000	$ 5,877,360*
total costs entire project			**৳ 779,500,000**	**$ 6,524,760**

INCOME GENERATION CALCULATION

Unit Type	Number of Units	Monthly Rent (USD)	Monthly Rent (BDT)	Total Monthly Income per unit (USD)	Total Monthly Income (BDT)
Low Income – 1 Bedroom	82	$65.81	৳8,000	$5,396.42	৳656,000
Low Income – 2 Bedroom	45	$82.26	৳10,000	$3,701.70	৳450,000
Mid Income – 3 Bedroom	59	$123.39	৳15,000	$7,280.01	৳885,000
Mid Income – 3 Bedroom	103	$146.93	৳18,000	$15,133.80	৳1,854,000
Total Units	289			$31,511.93	৳3,845,000
Shop Type	**Number of Shops**	**Area per Shop (m²)**	**Total Area (m²)**	**Total Monthly Rent (BDT)**	**Total Monthly Rent (USD)**
Small Market Shops	57	22.1	1,259.70	৳1,259,700	$10,282.93
Large Market Shops	17	44.2	751.4	৳751,400	$6,133.68
Total (Market)	74		2,011.10	৳2,011,100	$16,416.61
Price for rent is 750-1000 taka per m²**					
Parking	**Parking spots**	**income /month (BDT)**	**income / month (USD)**		
Residentual	76	৳ 228,000	$1,861.16		
Commercial	54	৳ 583,200	$ 4,760.66		
Total	130	৳ 811,200	$ 6,621.82		
৳20–৳50/hour for cars and ৳3000 per month for residents ***					
		total income per month	$54,550.36		
total m² of entire plot	30,000 m²	total cost	**$ 6,524,760**		
Payback time		119.6 months	**9.9 Years payback**		

DESIGN FOR REPETITION



