

LEAVING SPACE

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an alternative for the chawl redevelopment
in Nala Sopara

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LEAVING SPACE

an alternative for the chawl redevelopment of Nala Sopara

The economy and the population of Mumbai are growing; which results in an on-going process of urbanization. The current population of Mumbai is 21 million. An expected growth of 30 per cent in the coming 15 years will increase this to almost 28 million. This will put an extreme pressure on the housing stock.

The process of growth is already long going. The growth of the city of Mumbai started to accelerate in the 1870s with the opening of the Suez Canal. Two major train lines were constructed with the intention to make Mumbai the 'gateway to India'.

The city of Mumbai is situated on a geographically restricting narrow peninsula. This makes the land in the centre extremely valuable; resulting in high densities and extremely high rental prices. The train stations along the train lines have ever since their construction in 1869 provided new opportunities for the city to grow. Due to the affordability of the public transport and the need of affordable housing the city keeps expanding along the train track going up north; now even as far as the Vasai Virar area. With rent prices that are 1/10 of the prices of Mumbai South and population densities seven times less, at least for now, Vasai-Virar offers possibilities.

In Mumbai the chawl typology was introduced to house the masses. The chawl is a very common building type in Mumbai; Chawls house nearly 20 percent of Mumbai's population. It gained popularity in the 19th and 20th centuries, as the textile industry was booming and there was a high demand for affordable working class housing. The chawl has a strong resemblance to barrack style units. Single room tenements with kitchenette are situated along a corridor. In some cases toilet facilities are shared. The baithi chawl is one of the oldest forms of chawls. The baithi chawl is a ground storey building accessible through small alleys and leaving small 'shaft like' back alleys on the backsides. As demands increased this type of housing was transformed; the same layout was kept, but the height has increased to four or five stories. Now, in the city centre, the most common chawl typology is this 4 to 5 story type. Due to the value of the ground here the chawls are already up for a second round of development, with a strong focus on the high end housing market.

The developments in the south of Mumbai illustrate what might be the future of housing in the Vasai-Virar area.

In the Vasai-Virar area, and specifically in Nala Sopara, we can still find many 'baithi chawls'. Due to the increasing demand for housing in this area the developers have shifted their focus to building the four to five story chawls. Here we can distinguish two forms of chawl development; the redevelopment and the new constructions. In the case of the redevelopment the original baithi chawl is demolished and replaced by a four or five story chawl using the exact same footprint; increasing the density four times. New built chawls are developed on vacant lots using about the same urban layout as the redeveloped baithi chawls; creating a density of about 1300 units per hectare.

Both developments contribute significantly to the provision of housing for the economical weaker sector (EWS) and the lower income group (LIG).

However, these developments create an urban fabric of chawls that is extremely cramped. Whereas the chawls in south Mumbai can be called compact, they still leave space for communal activities in the alleys and courtyard. In the chawl area's in Nala Sopara the open space has been reduced to an absolute minimum. The buildings get placed closer and closer together to create the highest possible density, but leaving hardly any 'open-to sky space'. As advocated by Correa this open-to-sky spaces are a crucial aspect of housing in warm climates: "they become inhabitable, in fact a crucial part of everyday life. Successful housing is a seamless continuum of spaces that goes all the way from the most private, to the semi-private, to the public. This is why it creates communities" This form of densifying not only compromises the communal life but also compromises primary needs such as daylight access. In these areas buildings that are less than 10 centimetres apart are more rule than an exception; creating numerous dwellings without natural daylight access.

As the original layout of front alleys and back alleys of the baithi chawls is kept in the chawl scheme; creating a lot of neglected spaces. Spaces where no one ever comes and are therefore turned into garbage disposals. The aim of the urban layout of the chawls is purely focused on efficiency. Developers want to increase the density, and thereby their profit, as much as possible.

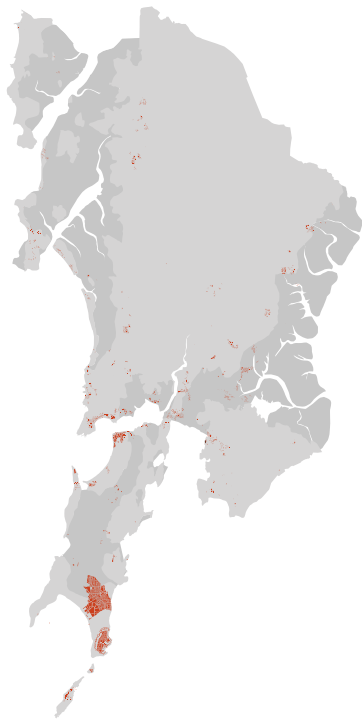
Another side effect of this densifying scheme is the enormous amount of similar dwelling units that is created. These single room tenements are not flexible in any way to the demands of people.

If the development of extremely high-density chawl area continues, a significant part of Nala Sopara will be transformed into housing that provides merely for shelter; Insufficient in terms of providing for open-to-sky spaces and access of daylight. Especially in the east of Nala Sopara we can find enormous areas with baithi chawls; all of them potential targets for the developers to be turned into chawls of 4 to 5 stories. If all of these will be transformed a large part of the area will turn into a monotonous stacking of units; leading to even more segregation in Nala Sopara.

By providing a feasible alternative a change in development can be facilitated. Instead of creating exclusive living conditions for the EWS and LIG chawl areas can be transformed over time into more inclusive communities.

RESEARCH

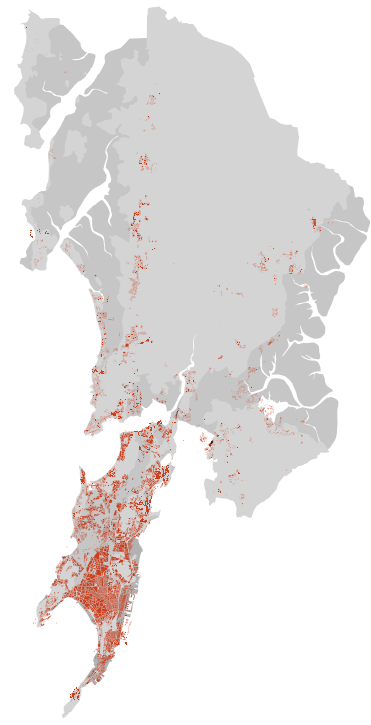
Nala Sopara
and the Mumbai Metropolitan Region



1812



235.000

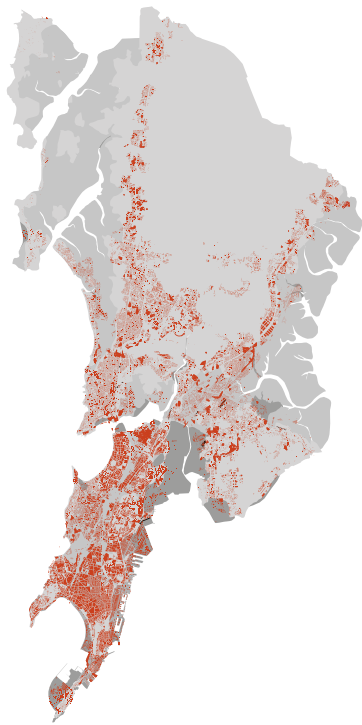


1909



1.018.388

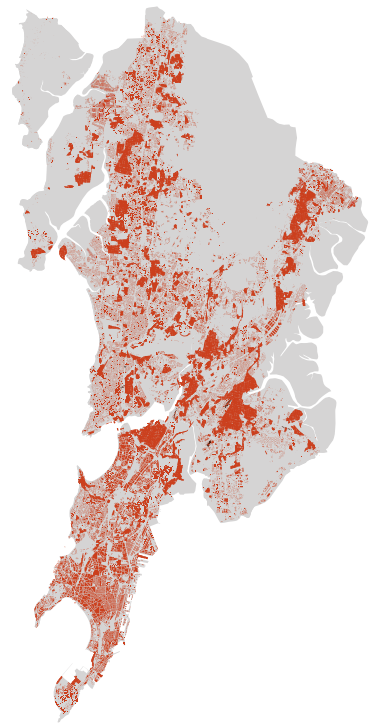
maps of Mumbai: Rohan Varma
<https://www.census2011.co.in/census/city/365-mumbai.html>
 D'Cunha, Jose Gerson (1900). "VI The Later British Period". The Origins of
 Bombay (3 ed.). Asian Educational Services. p. 348.



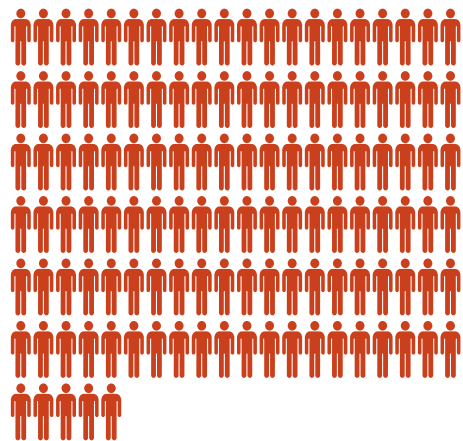
1964



4.152.056

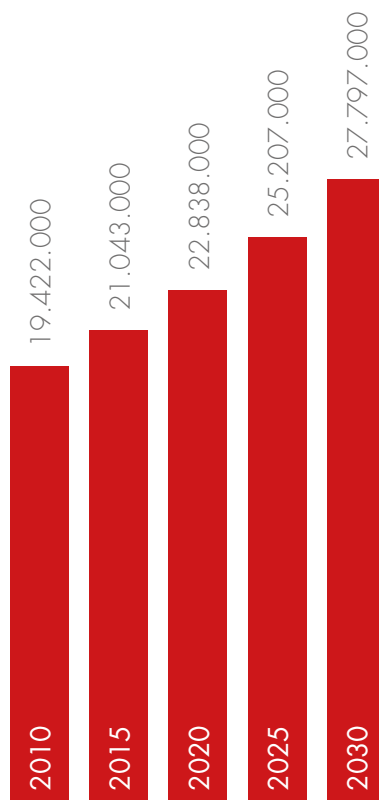


2012



12.442.373

URBAN GROWTH
Mumbai



population MMR



Mumbai Metropolitan Region



Vasai-Virar

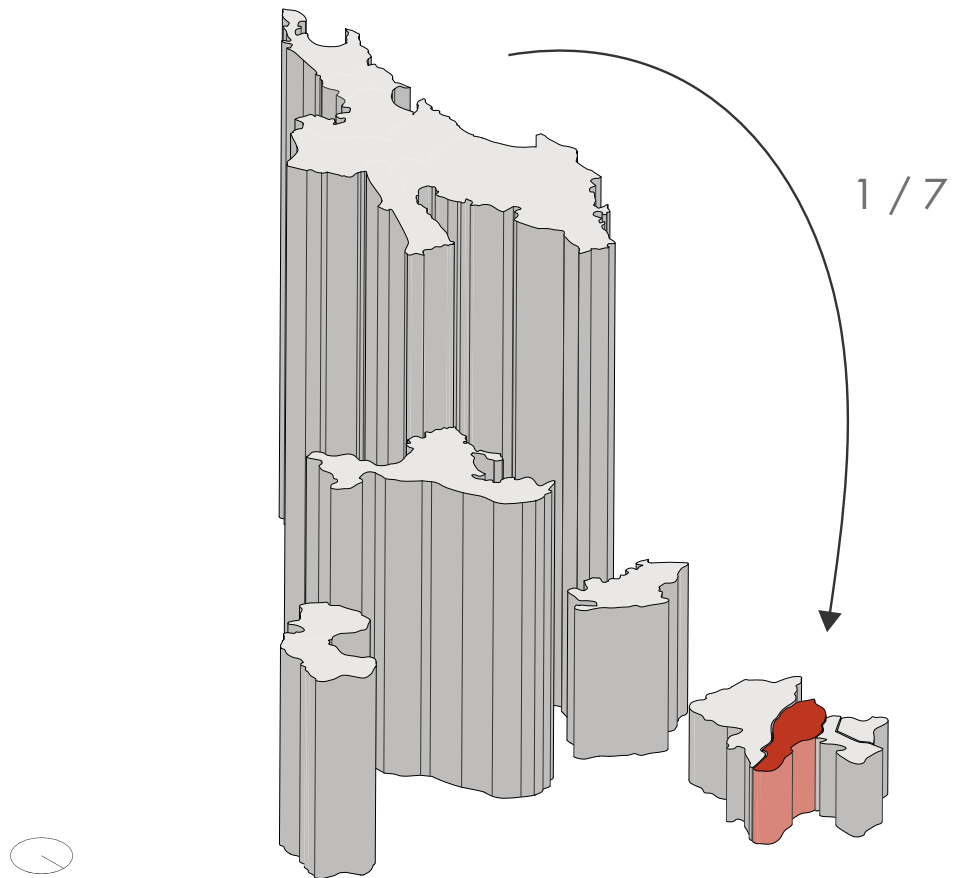


NalaSopara

POPULATION GROWTH and the MMR

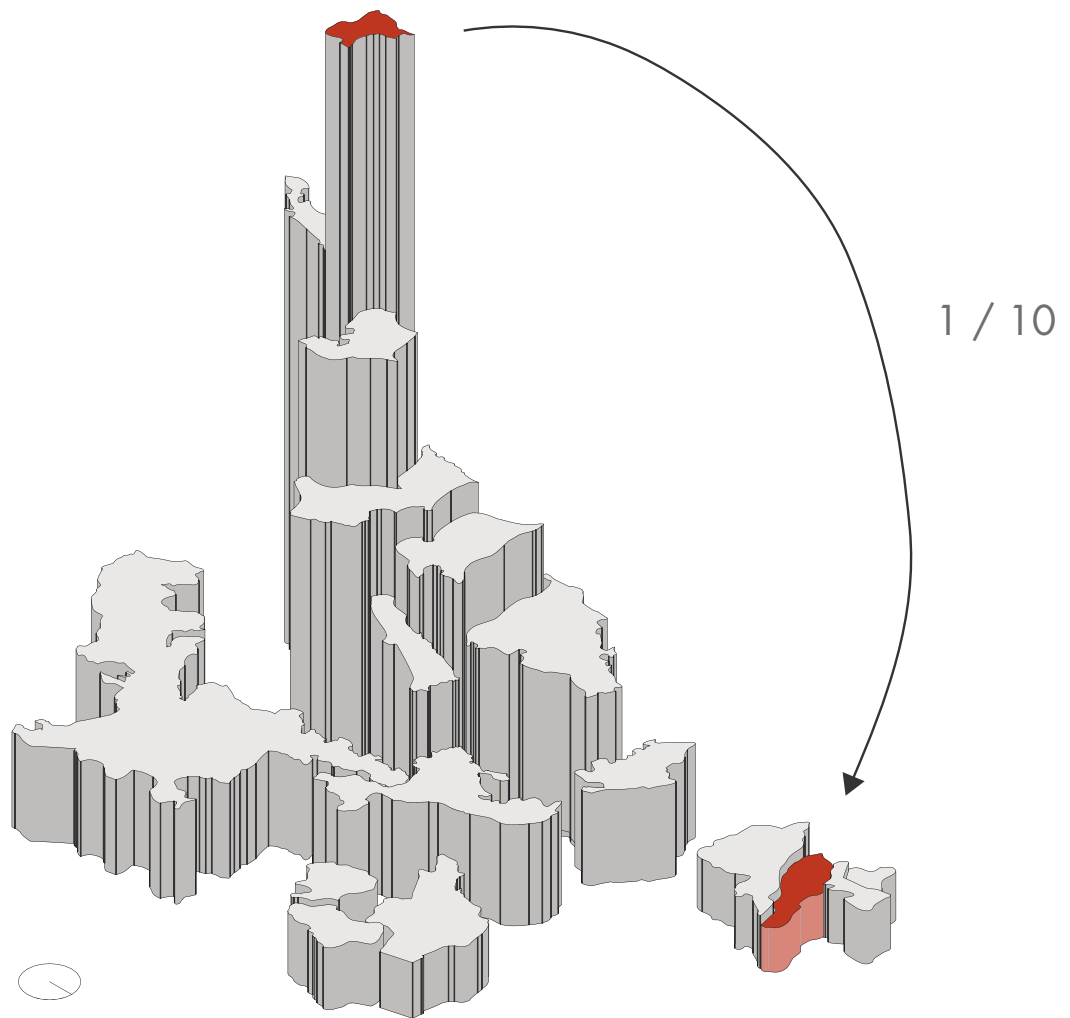


THE TRAIN TRACKS OF MUMBAI
The city of Mumbai



LSE Cities, Urban Age Cities Compared, <https://lsecities.net/media/objects/articles/urban-age-cities-compared/en-gb/>

POPULATION in the Metropolitan Region of Mumbai



Parekh , D. (2008) Report of the High Level Task Force Affordable Housing for All. India:GOI.

RENT PRICES in the Metropolitan Region of Mumbai



URBAN GROWTH
of Nala Sopara

2002



URBAN GROWTH
of Nala Sopara

2005



URBAN GROWTH
of Nala Sopara

2009



URBAN GROWTH
of Nala Sopara

2013



URBAN GROWTH
of Nala Sopara

2017





URBAN FABRIC
of Nala Sopara



mhada development



apartment buildings



the old village



chawls and baithi



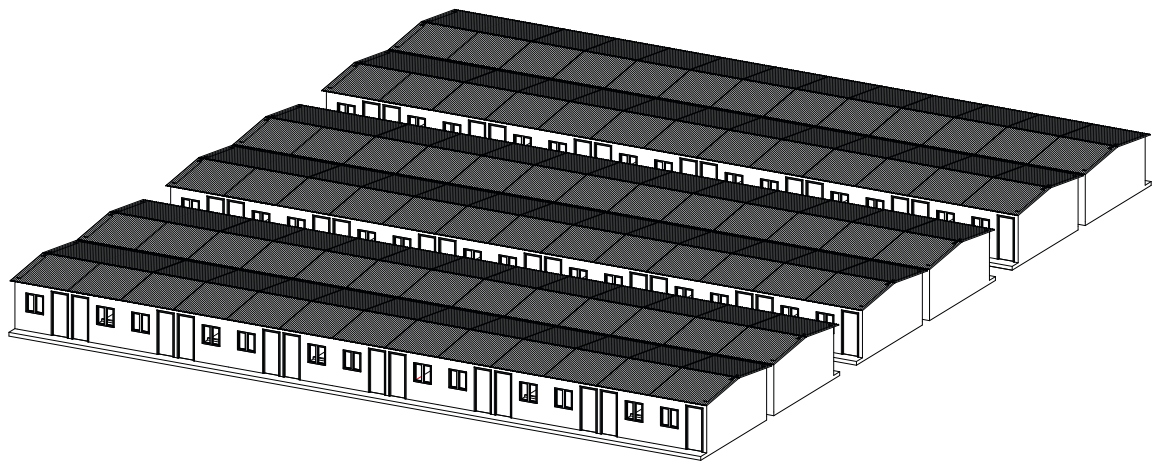
chawls and baithi



chawls

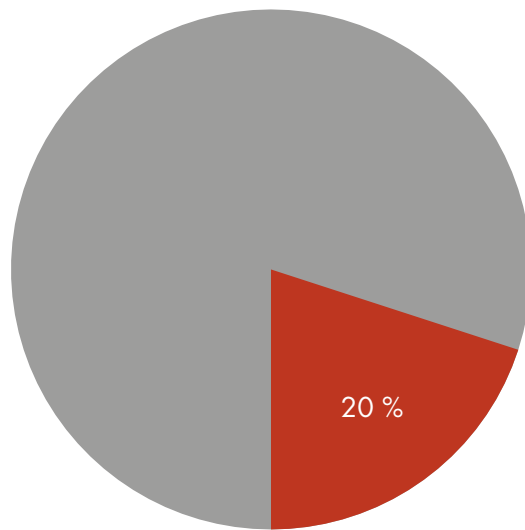
URBAN FABRIC of Nala Sopara

The train track defines a clear separation in the urban fabric.
West of the train track the we can find bigger apparent
buildings and the old village of Nala Sopara. in the Eas the
most common building types are the baithi chawls and the
chawls.



THE CHAWL

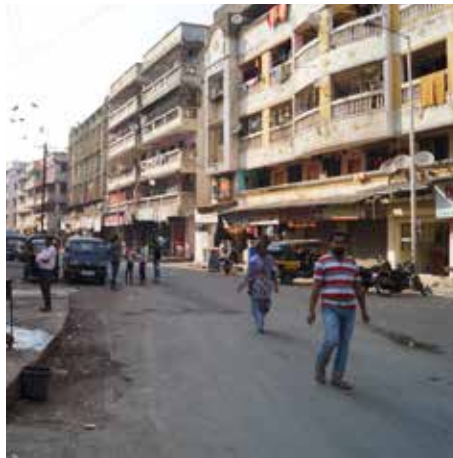
type and redevelopment approach



part of population of Mumbai housed in chawls



BDD chawl // Mumbai South

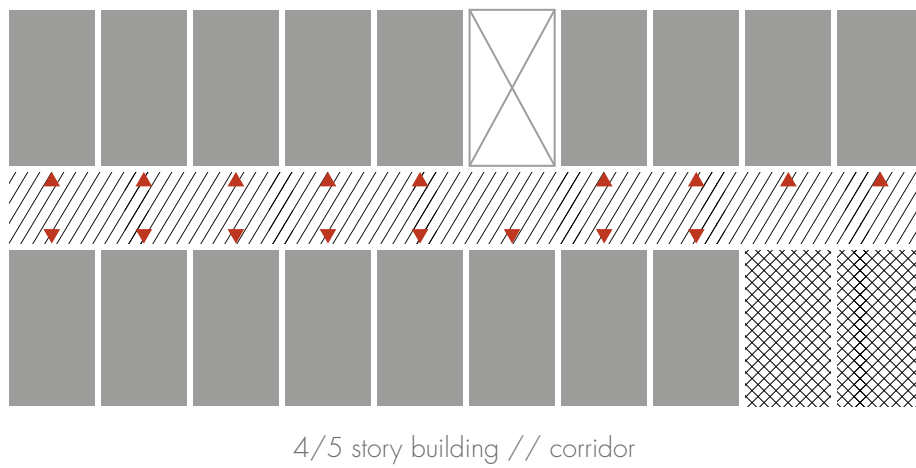
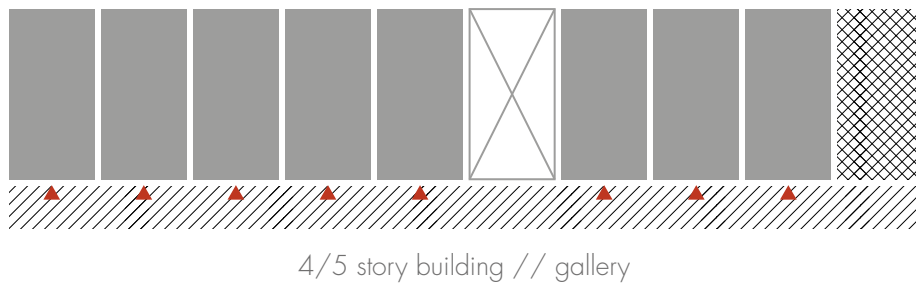
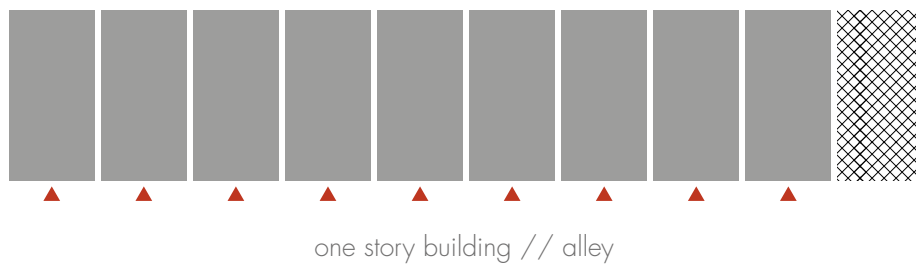


chawls // Nala Sopara

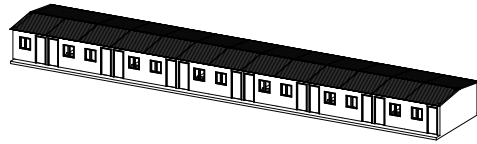


Swadesi Market// Mumbai

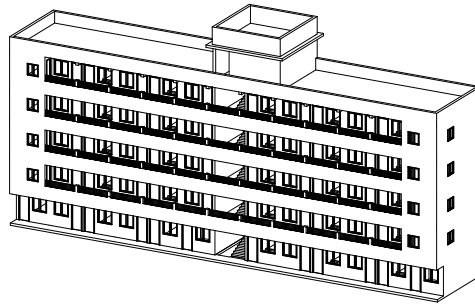
THE CHAWL TYPOLOGY



THE CHAWL TYPOLOGY

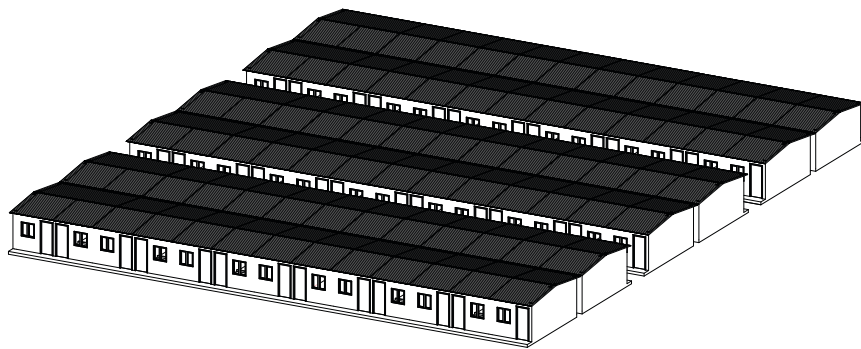


THE BAITHI CHAWLS
chawl typologisch in Nala Sopara

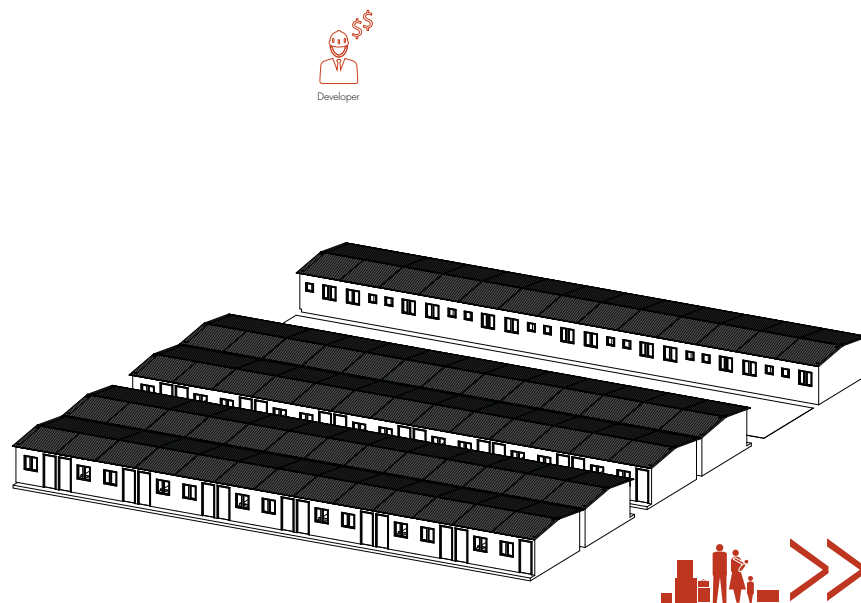
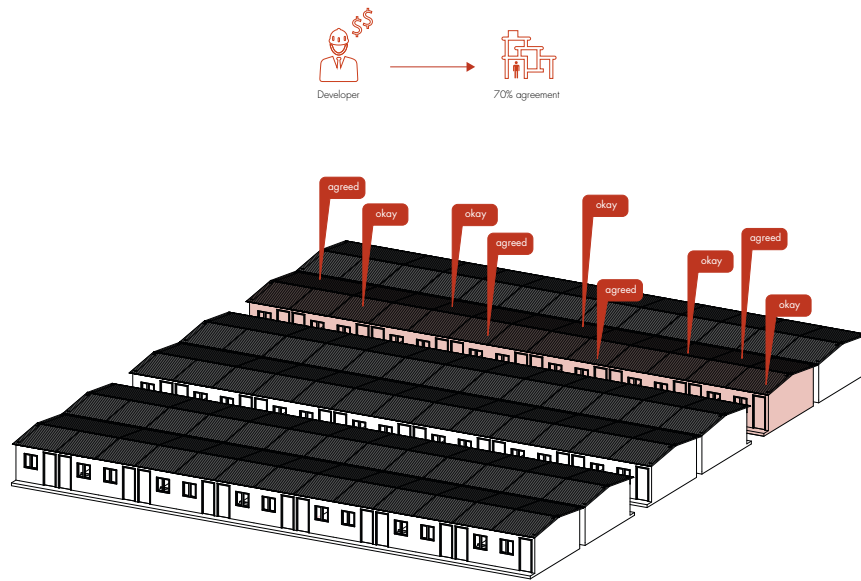


THE CHAWL chawl typologisch in Nala Sopara

the four to five story chawl building with a gallery acces



DEVELOPMENT PROCES
baiti chawl to chawl

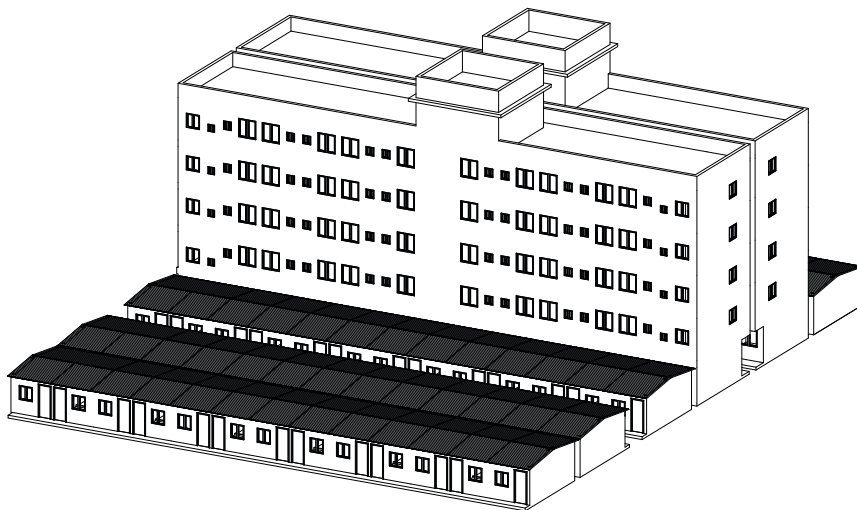
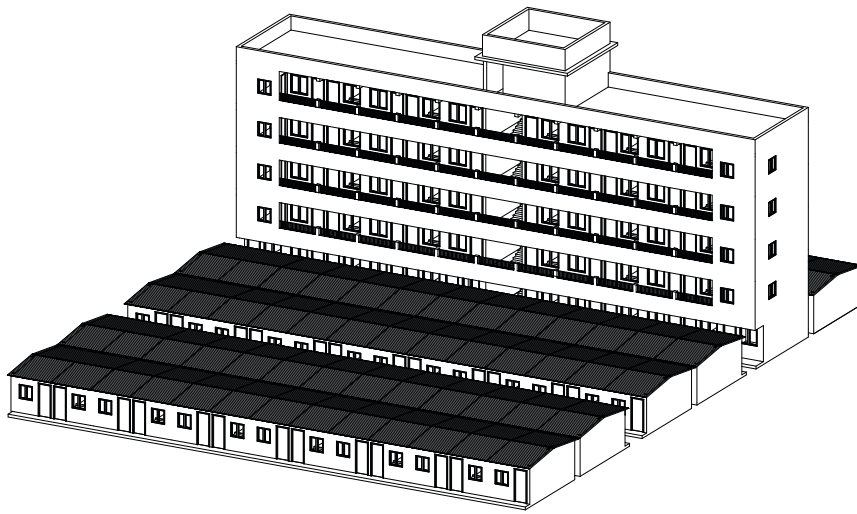


DEVELOPMENT PROCES

baithi chawl to chawl

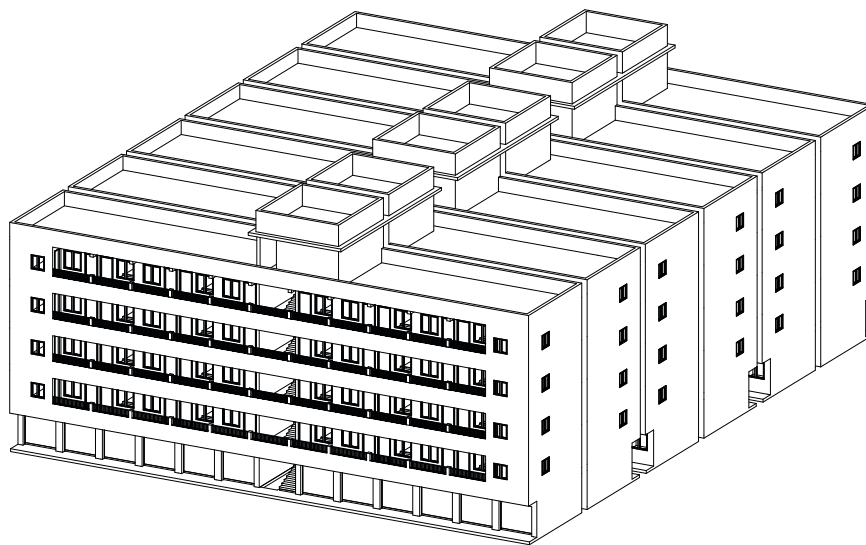
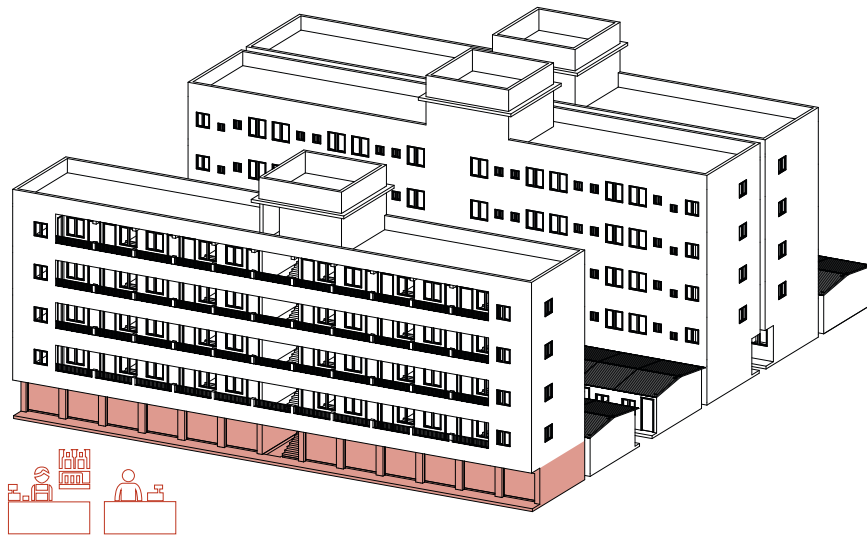
1. before the developer can start his development he needs at least 70% of the current owners to agree with the development plans

2. when the development starts the owners will move to a temporary home elsewhere and the baithi chawl gets demolished



DEVELOPMENT PROCES baithi chawl to chawl

3. a four to five story chawl building will be build on the exact same footprint as the original baithi chawl. increasing the amount of dwellings four times
4. the developer can decide to develop the plot next to it as well. leaving only a very very narrow space in between the two buildings



DEVELOPMENT PROCES

baithi chawl to chawl

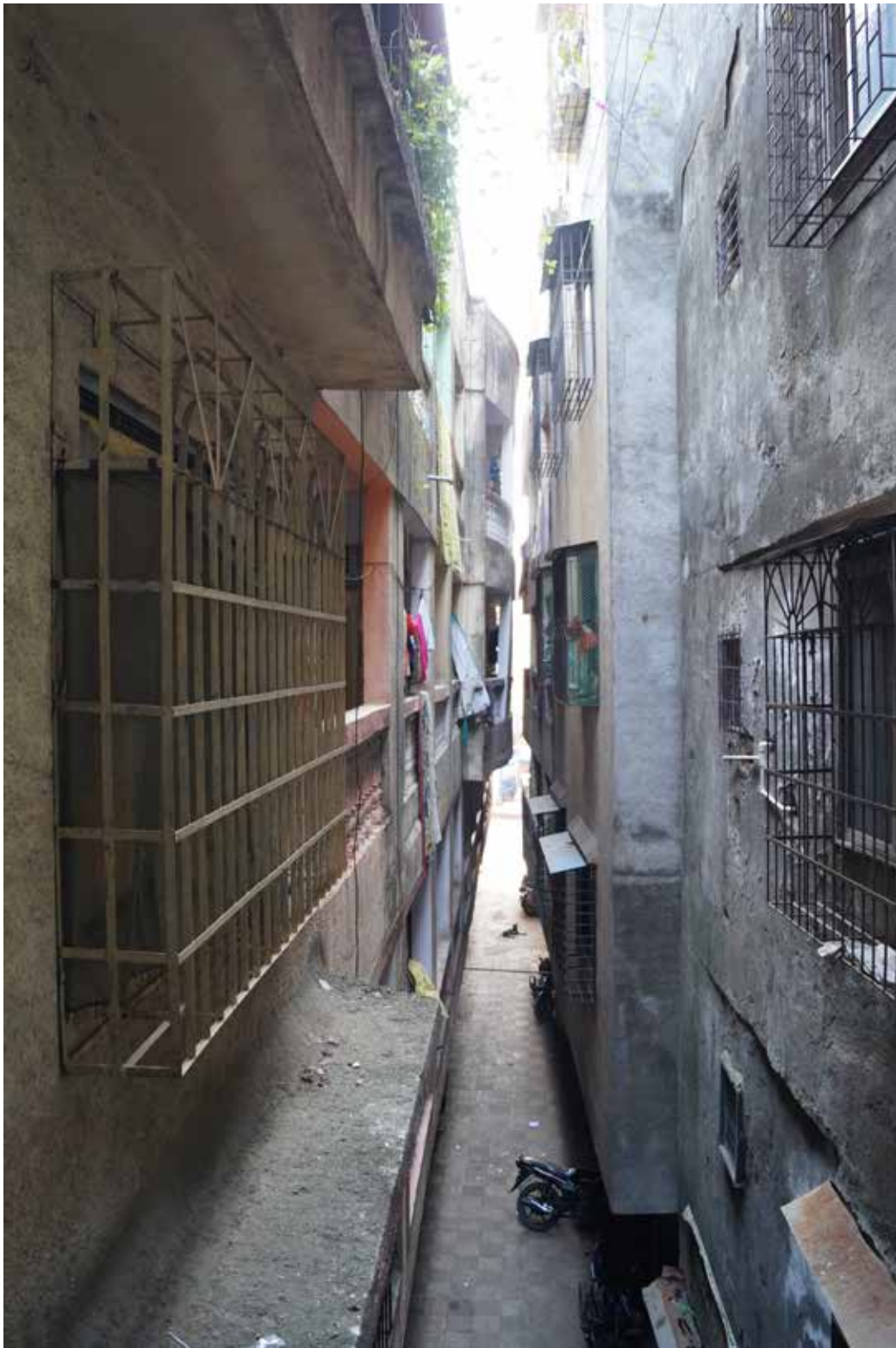
5. in the new build chawl in connected to a bigger street
the ground floor can be developed into shops or workshops;
generating an even bigger profit for the developer

6. If a complete neighborhood is developed into chawls
a scaringly dense cluster of building will arise. the lack of
daylight, ventilation and opens space will form a big problem
for the inhabitants

PROBLEM STATEMENT

current situation and future perspective
of the Rahmat Nagar area





DENSIFICATION
Rahmat Nagar area

as this pictures show the densification in the Rahmat Nagar area takes up extreme forms. In some cases, buildings are not more than 10 cm apart.





LACK OF DAYLIGHT ACCESS AND VENTILATION Rahmat Nagar area

As a result of this extreme densification numerous of dwellings have a lack of daylight access and on the lower levels, the ventilation is bad. this results in bad living conditions in terms of hygiene





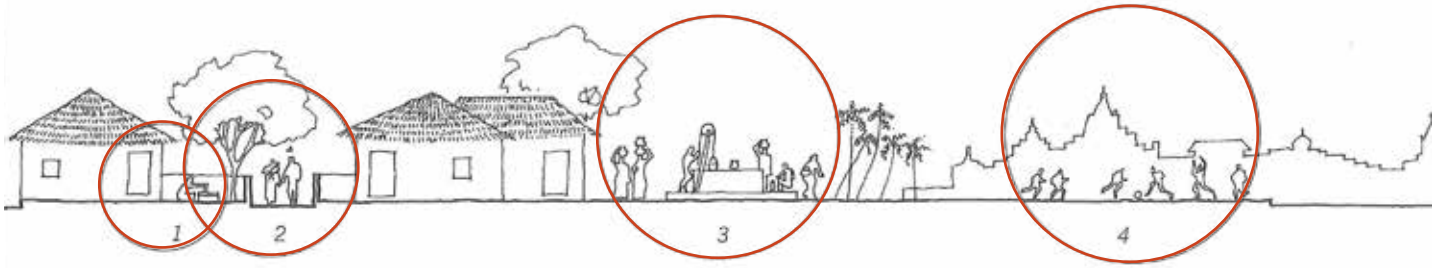
NEGLACTED SPACES
rahmat nagar area

The urban layout of the chawls, with its front alleys and back alleys, creates a lot of 'backsides'. these neglected spaces turn into garbage disposals and therefore have a negative effect on the hygienic condition and the overall feel of the area

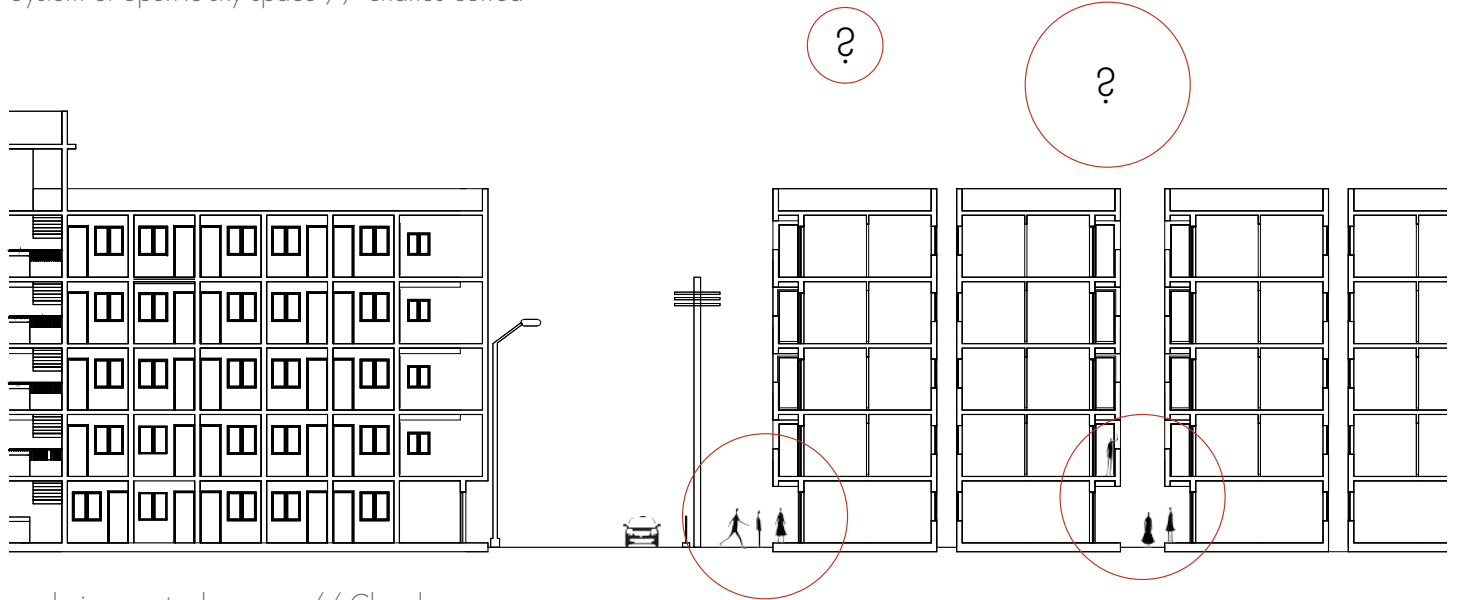
“Successful housing is a seamless continuum of spaces that go all the way from the most private, to the semi-private to the public. in this way it create communities”

Charles Correa
(DASH #12-13, 96)

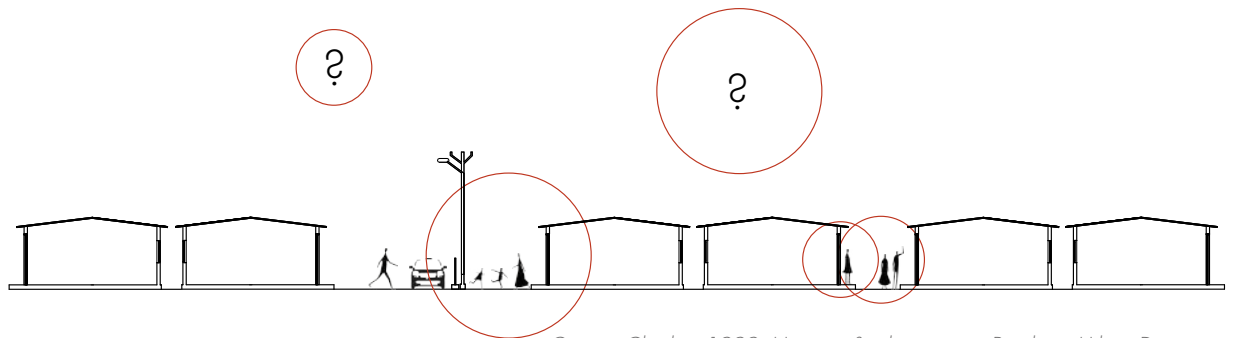
Kuitenbrouwer, Paul, and Dick Van Gameren. 2015. *DASH Global housing: affordable dwellings for growing cities*. Rotterdam. Vol. 12-13. Rotterdam: AiO10 Uitgevers/Publishers, 96



System of open-to-sky space // charles correa



analysis open-to-sky space // Chawls

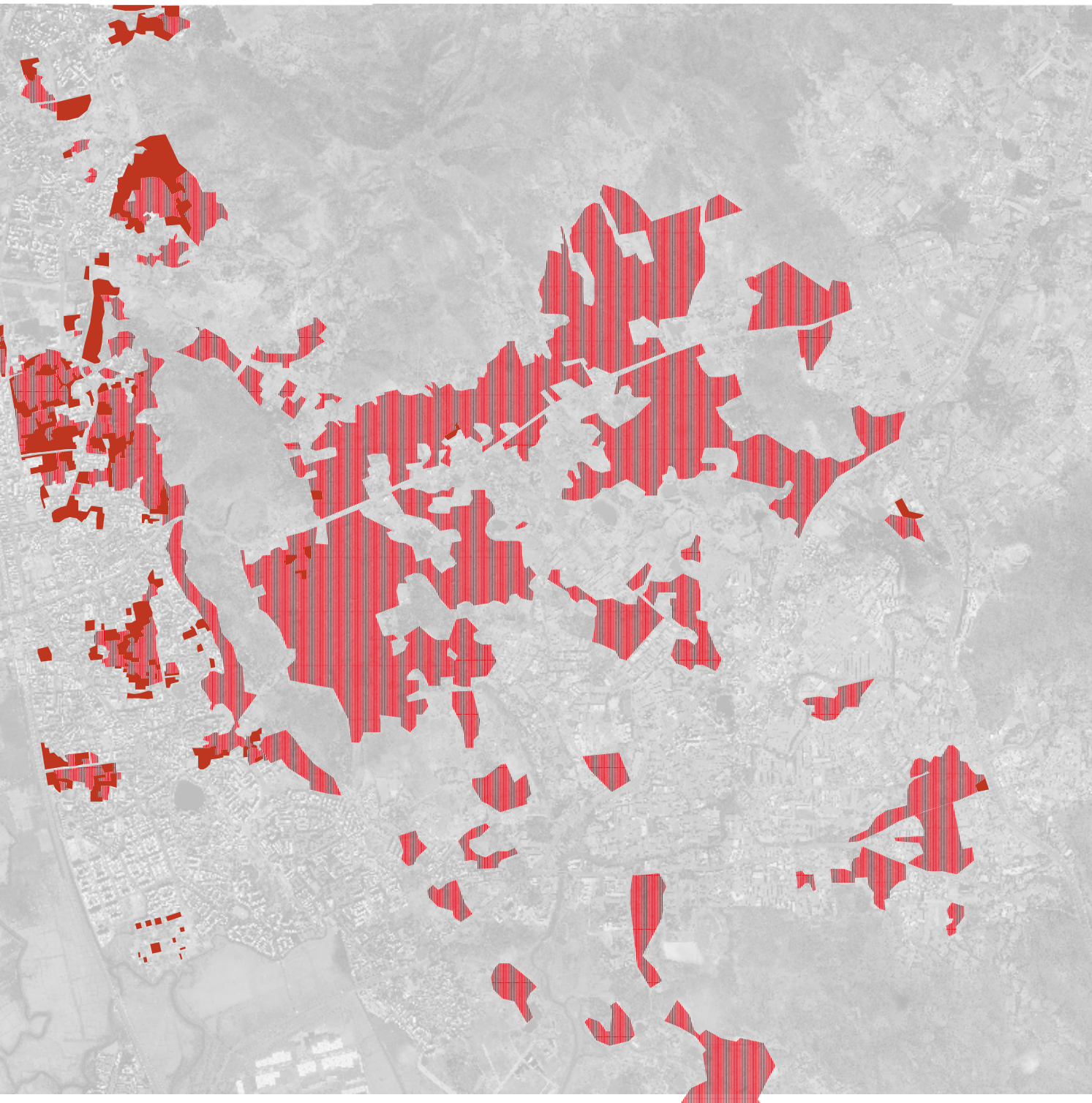


analysis open-to-sky space // Baithi Chawls

Correa, Charles. 1999. Housing & urbanisation. Bombay: Urban Design Research Institute

1. Terraces 2. front doorstep 3. water tap 4. open space for the community





THE SCALE OF THE PROBLEM

monotonous living areas

if the development of extremely high-density chawl area continues, a significant part of Nala Sopara will be transformed in to housing that provides merely for shelter; Insufficient in terms of providing for open-to-sky spaces and access of daylight. Especially in the east of Nala Sopara we can find enormous areas with baithi chawls; all of them potential targets for the developers to be turned into chawls of 4 to 5 stories. If all of these will be transformed a large part of the area will turn into a monotonous stacking of units; leading to even more segregation in Nala Sopara.

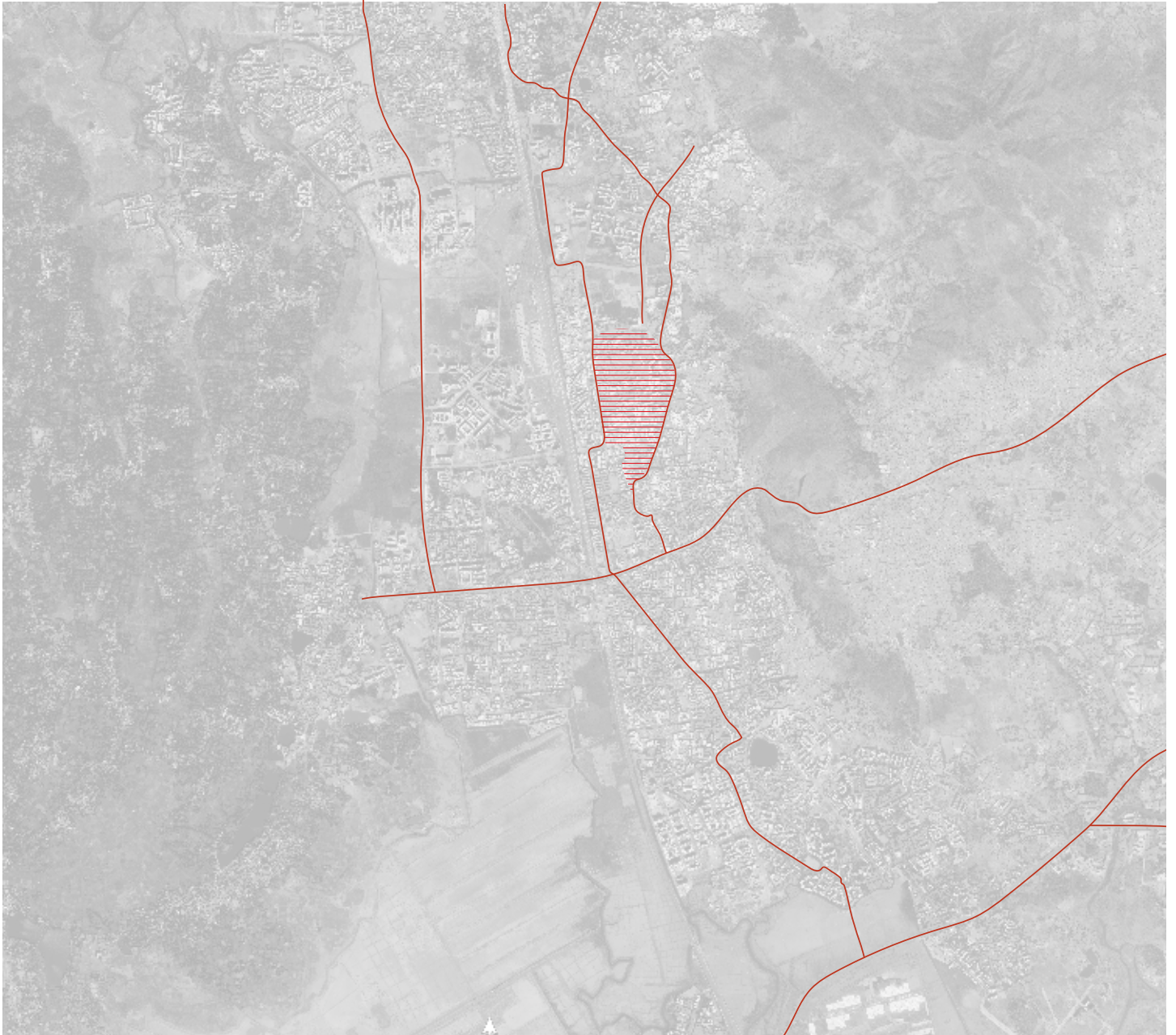
problem statements

RESEARCH QUESTION

How can the cramped (baithi)chawls, of the Rahmat Nagar area, be re-interpreted into a mixed-use area that leaves space for inclusive communities, able to set a feasible alternative for the current chawl redevelopment?

SITE ANALYSIS

Rahmat Nagar area in Nala Sopara



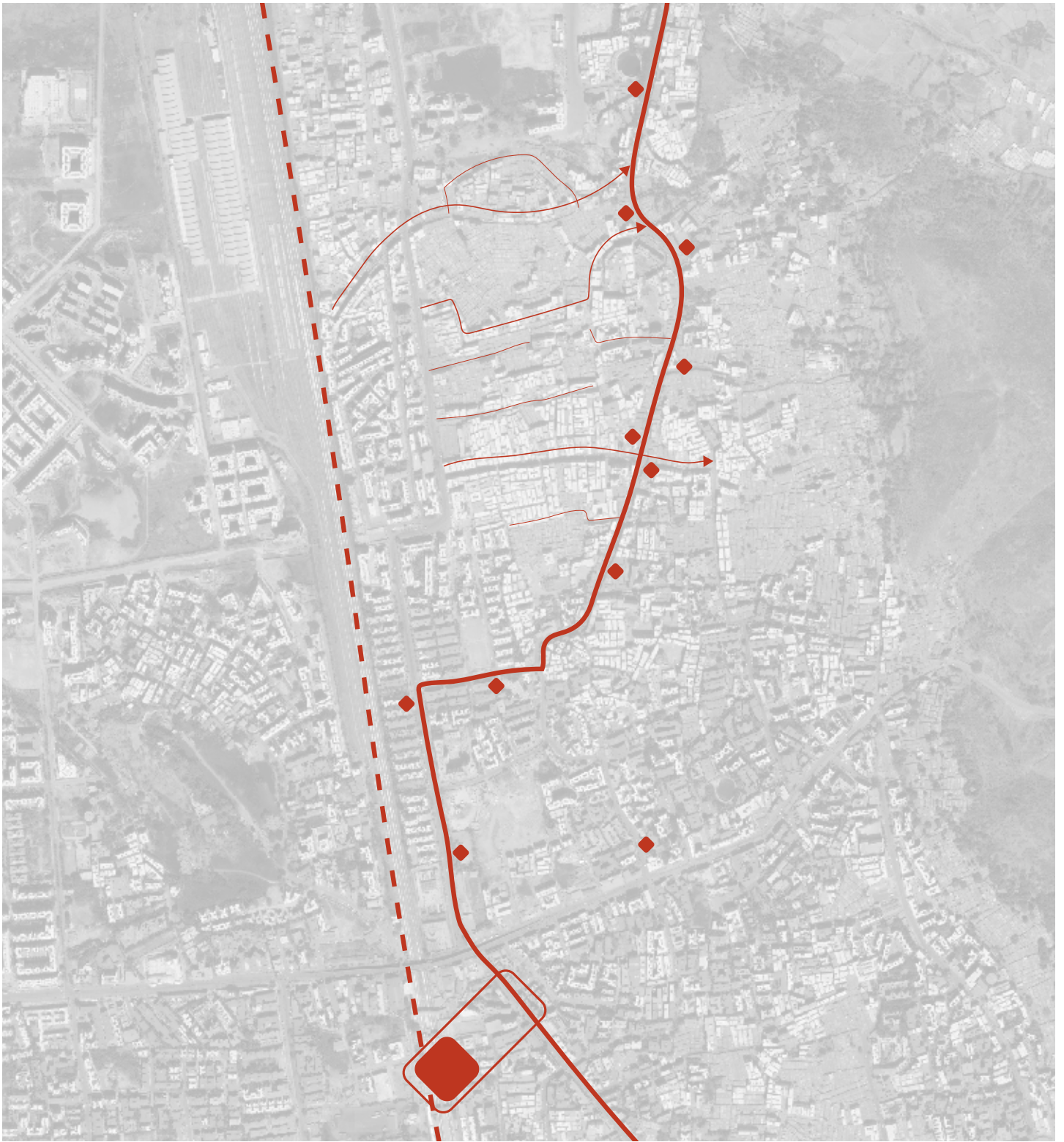
ROAD NETWORK
of Nala Sopara



PRIMARY AND SECONDARY ROADS
Nala Sopara East



PUBLIC TRANSPORT
Nala Sopara



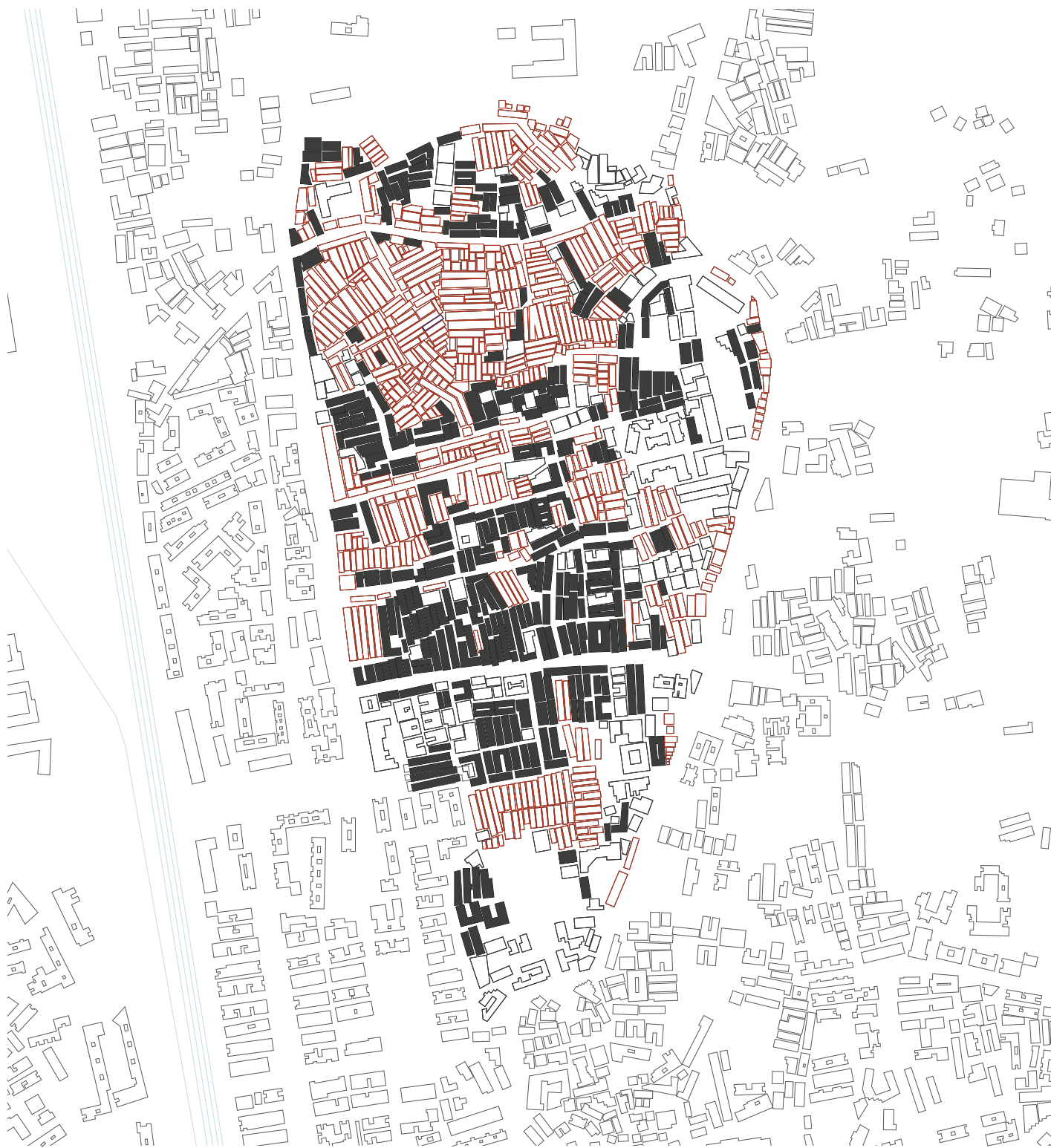
PUBLIC TRANSPORT
Rahmat Nagar area



MORPHOLOGY
built

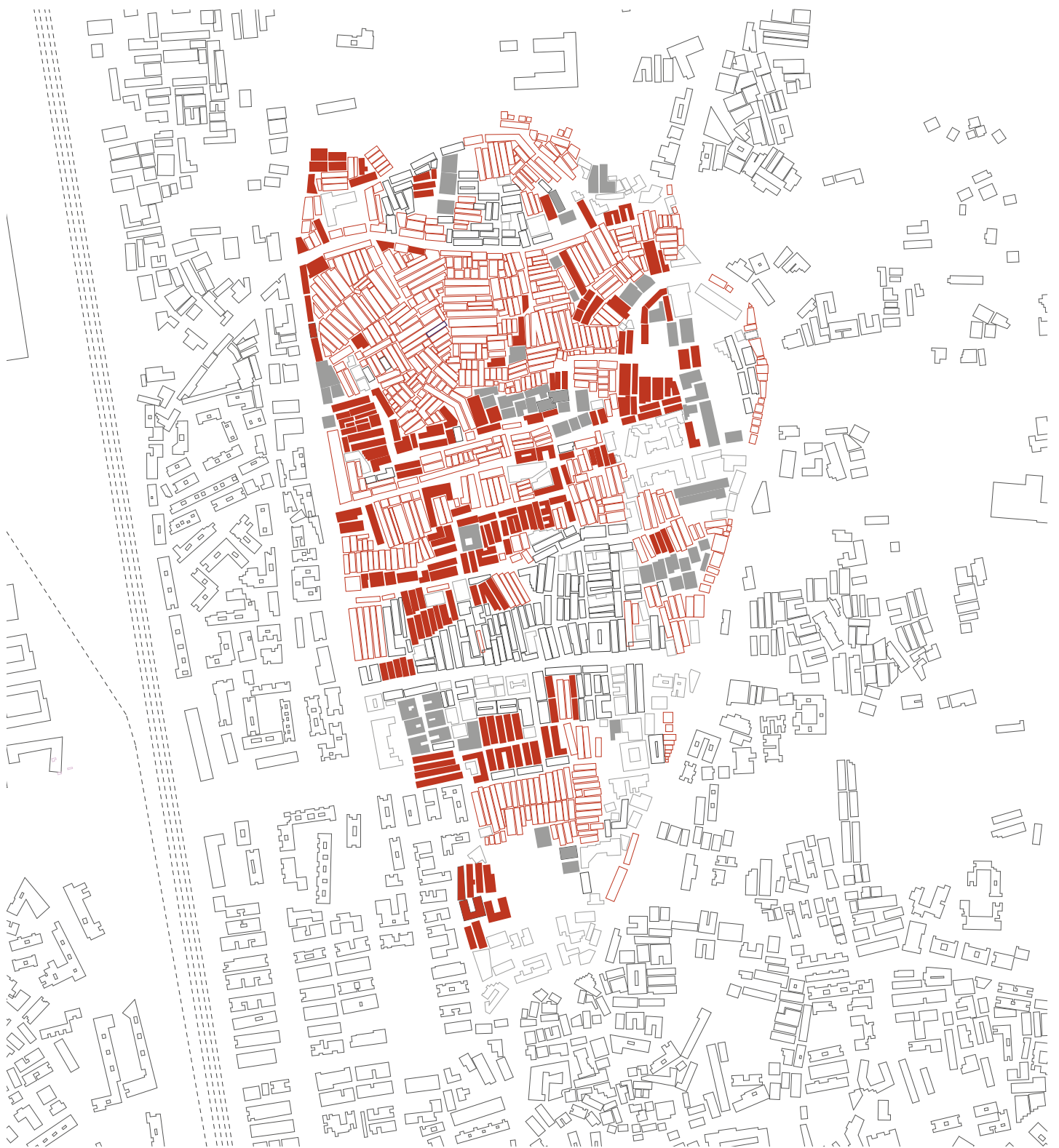


MORPHOLOGY
unbuilt

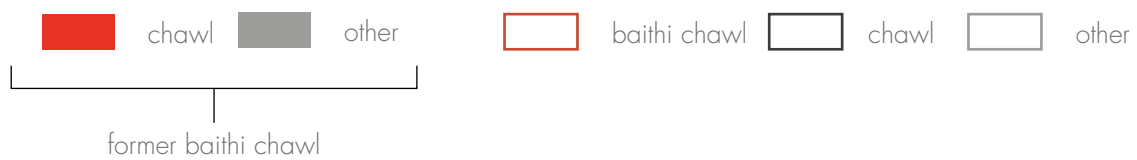


TYPOLOGY
chawls and baithi chawls





ORIGIN OF BUILDINGS
chawls and baithi chawls





AMENITIES
Rahmat Nagar area

school

hospital

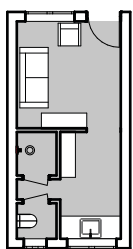
park

religious place



0019

typical floorplan



15,8 m²

residents
per dwelling



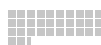
4

m² dwelling
per person



3,95 m²

units
per hectare



325

people
per hectare

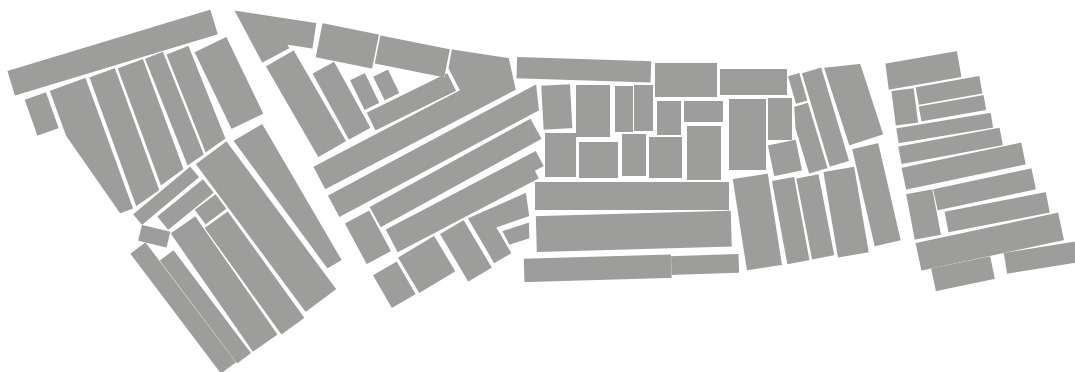


1300

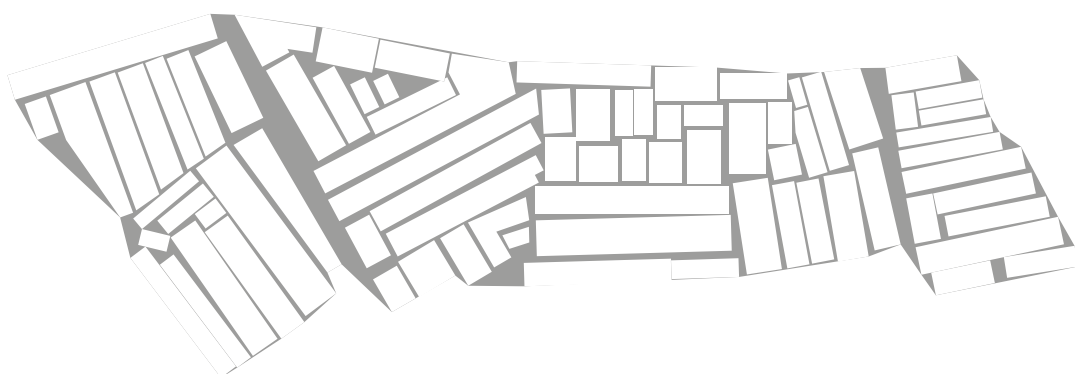
m² open space
per person



3,0 m²



FSI = 0,75

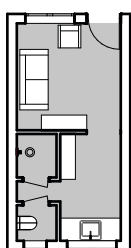


open space index = 0,2

DENSITY
of the baithi chawls



typical floorplan



15,8 m²

residents
per dwelling



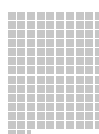
4

m² dwelling
per person



3,95 m²

units
per hectare



1325

people
per hectare



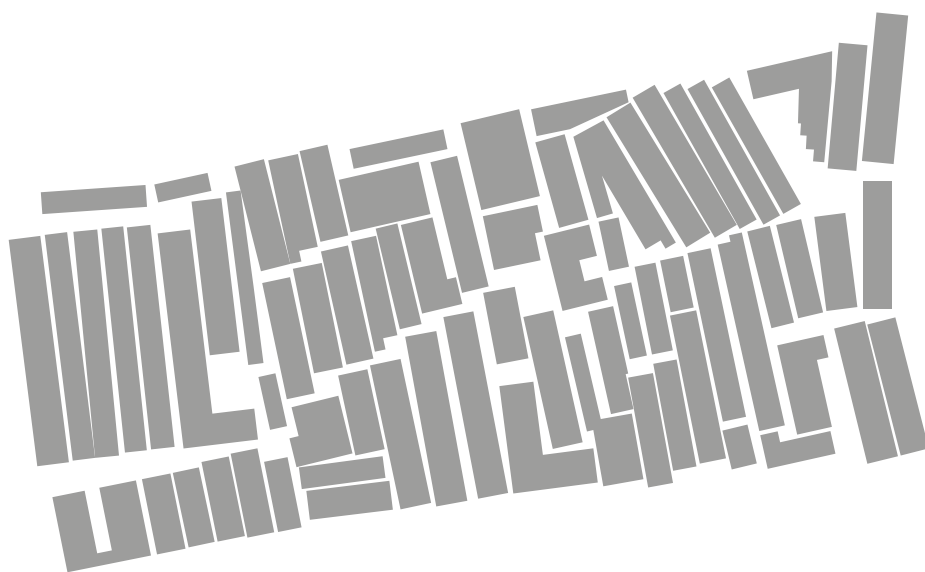
5300

m² open space
per person

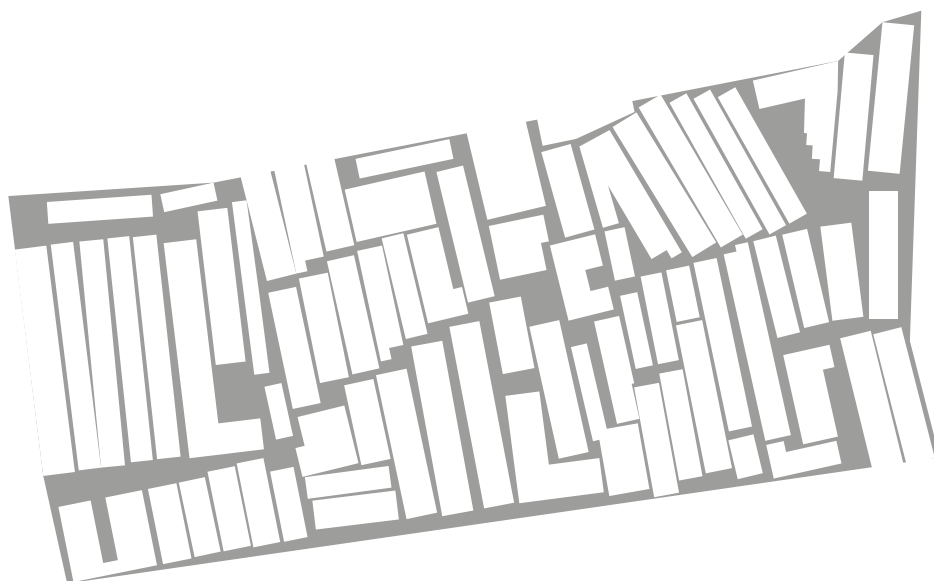


0,57 m²

site analysis
64



FSI = 3

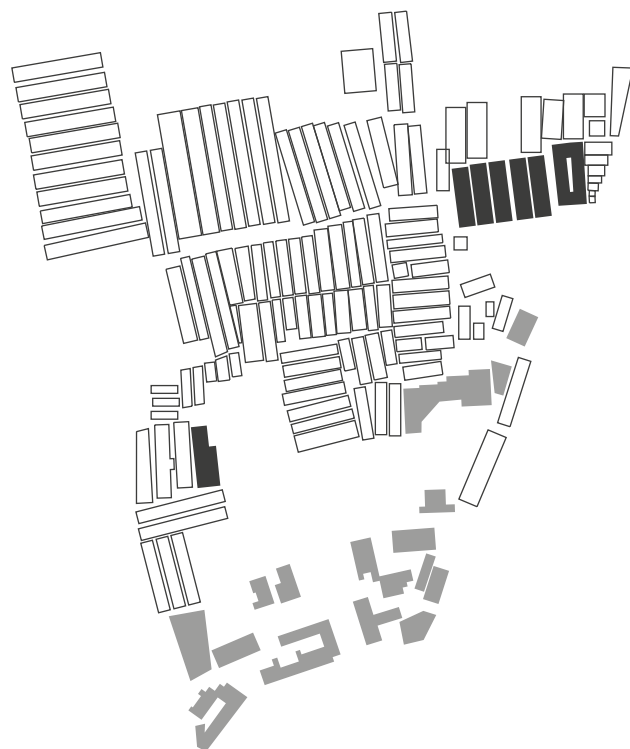


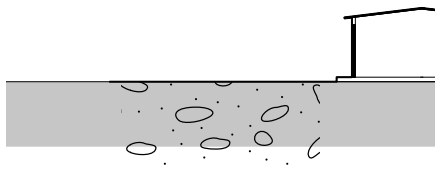
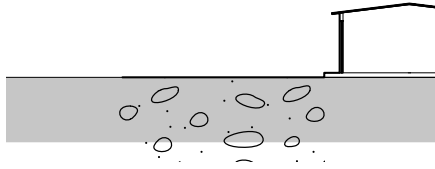
open space index = 0,3

DENSITY
of the chawls

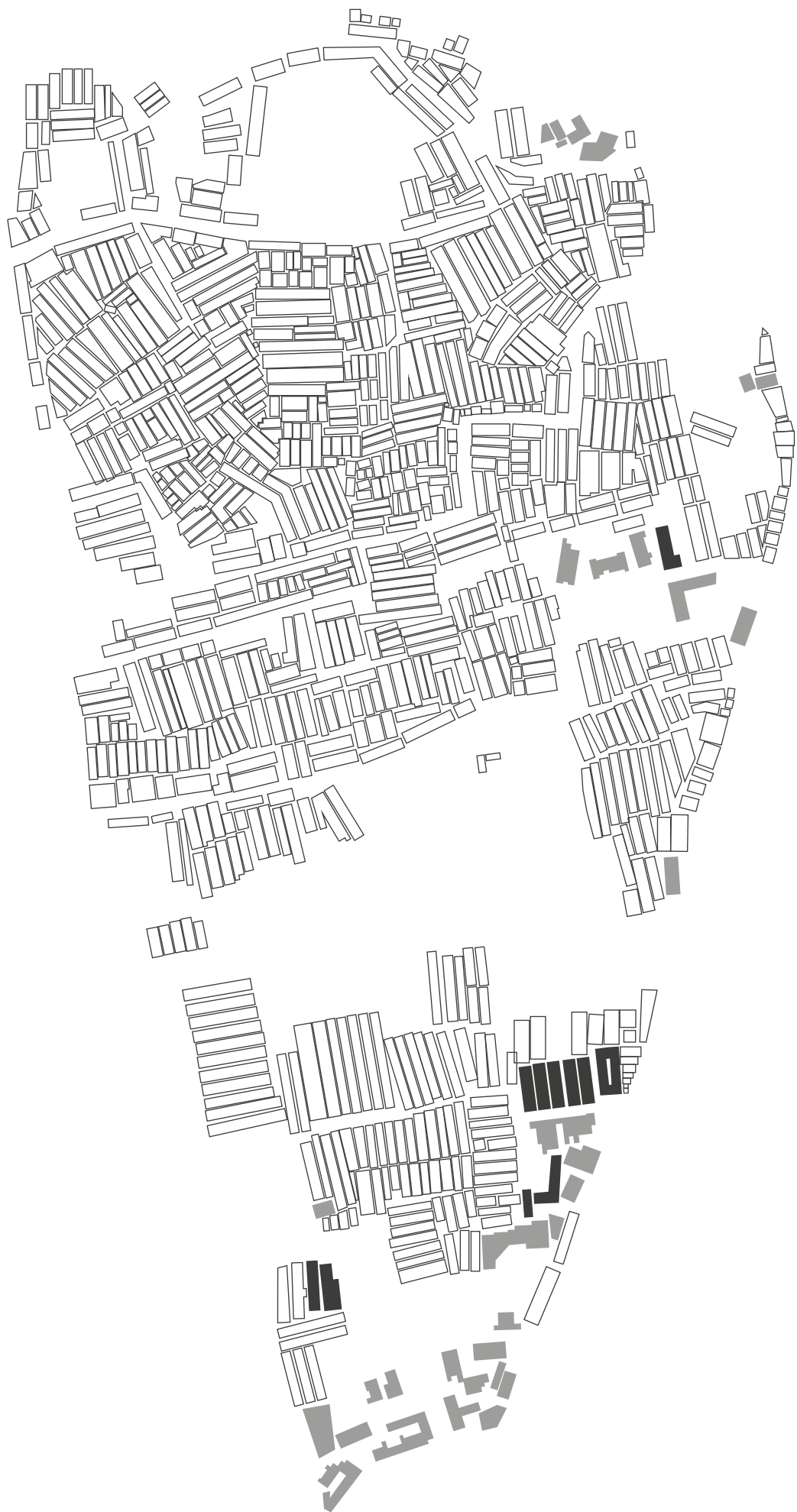
HISTORY

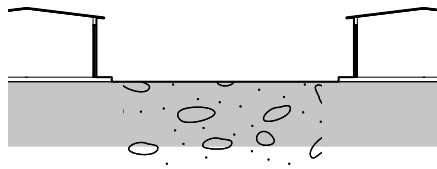
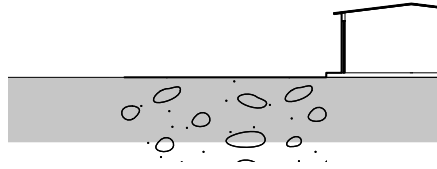
of the built environment of Rahmat Nagar





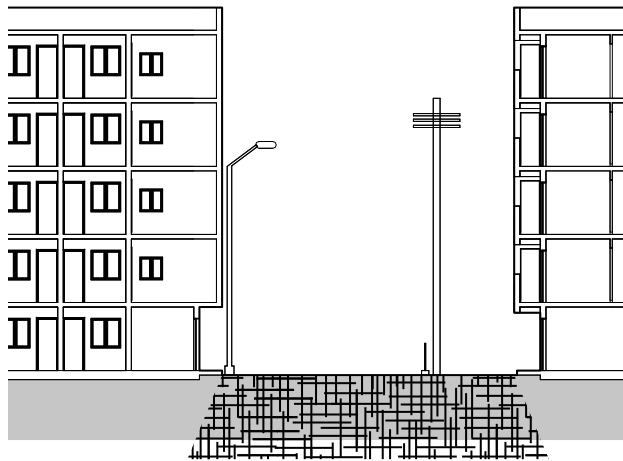
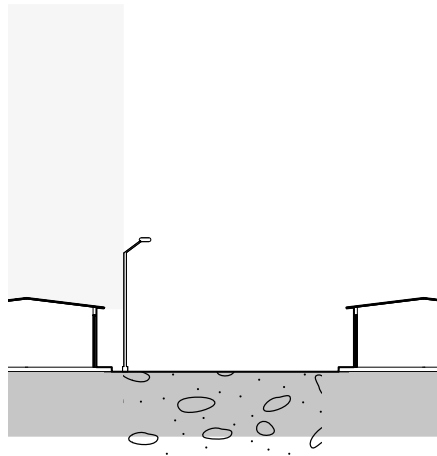
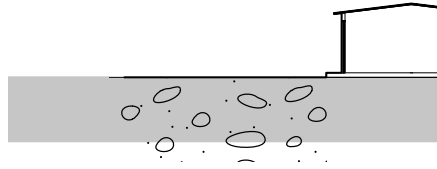
2002
Rahmat Nagar





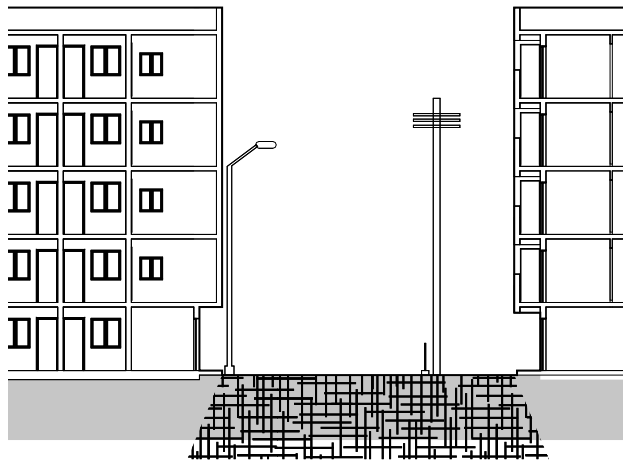
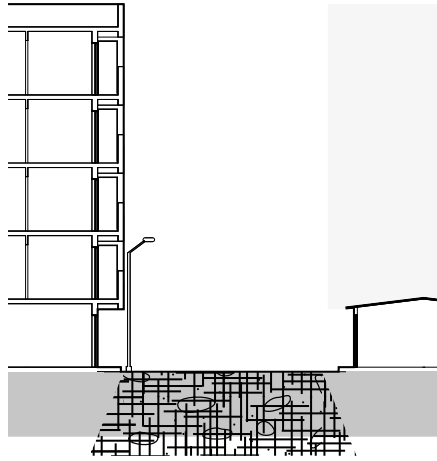
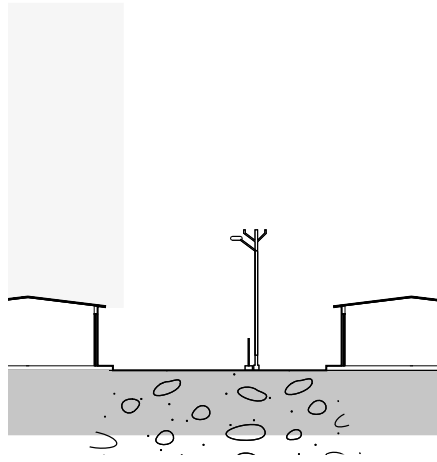
2006
Rahmant Nagar





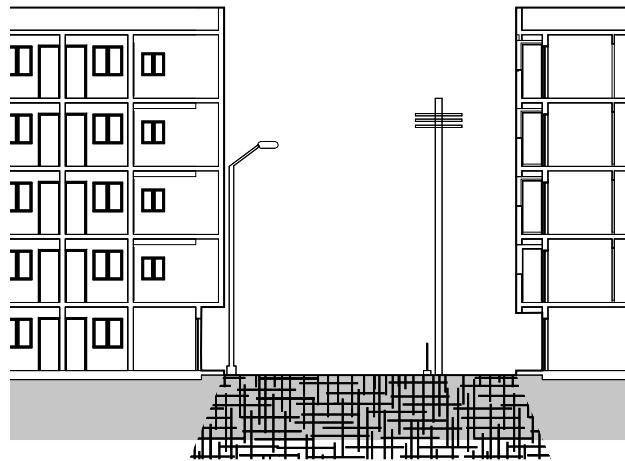
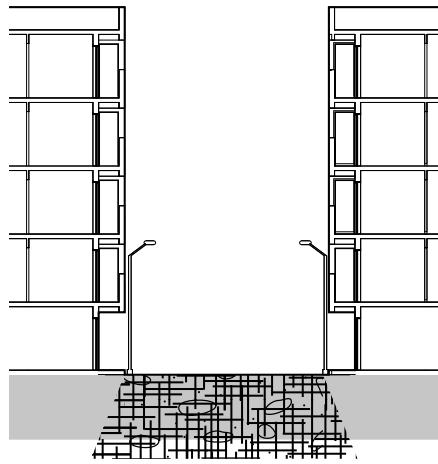
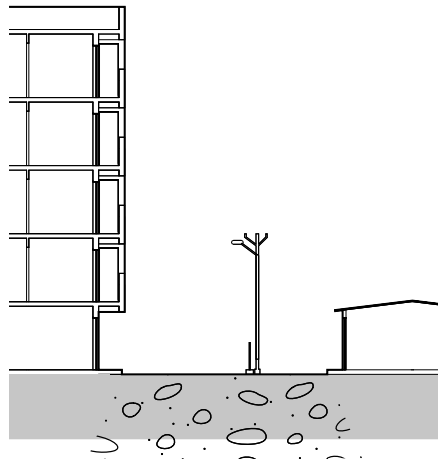
2009
Rahmat Nagar





2012
Rahmat Nagar

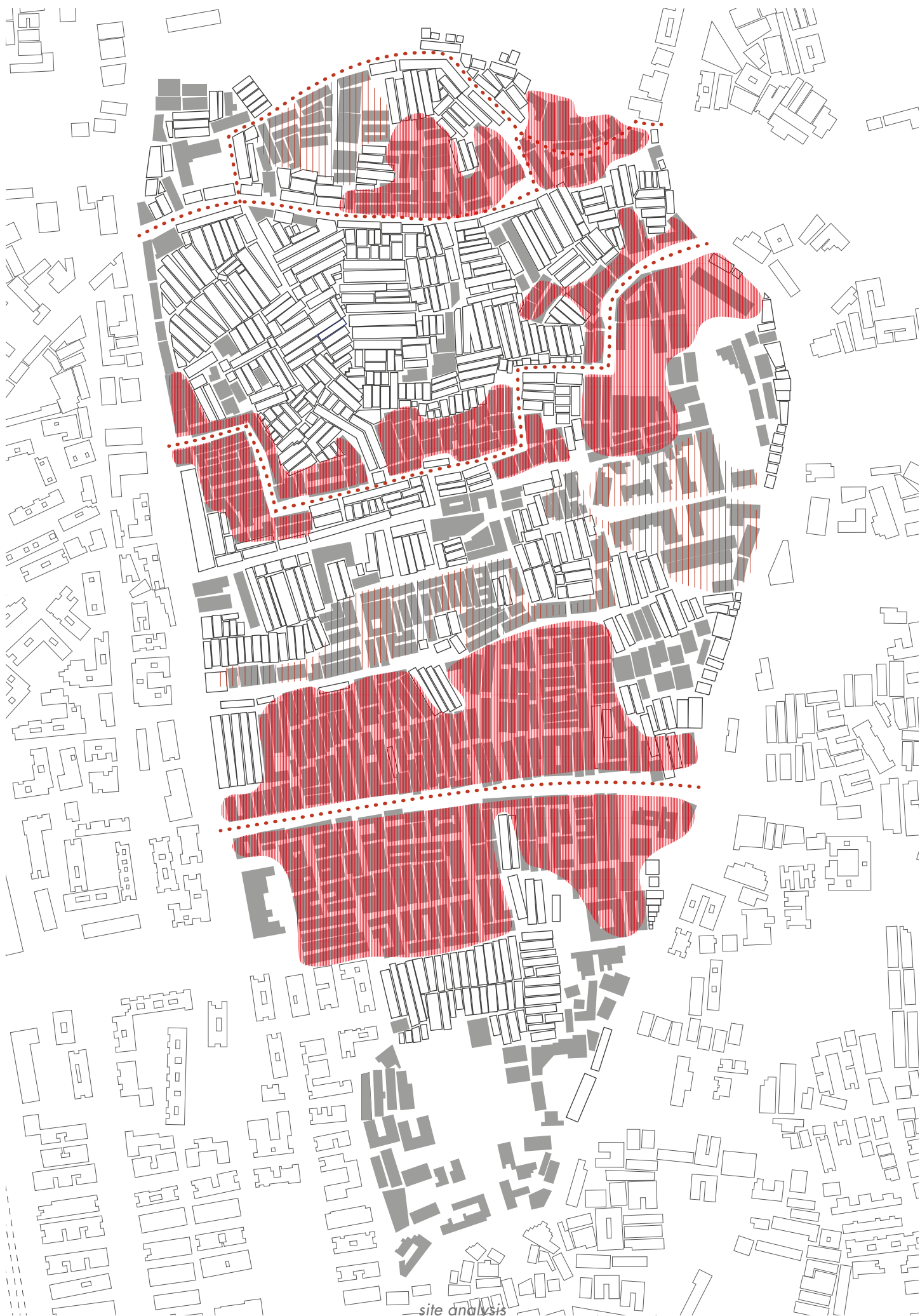




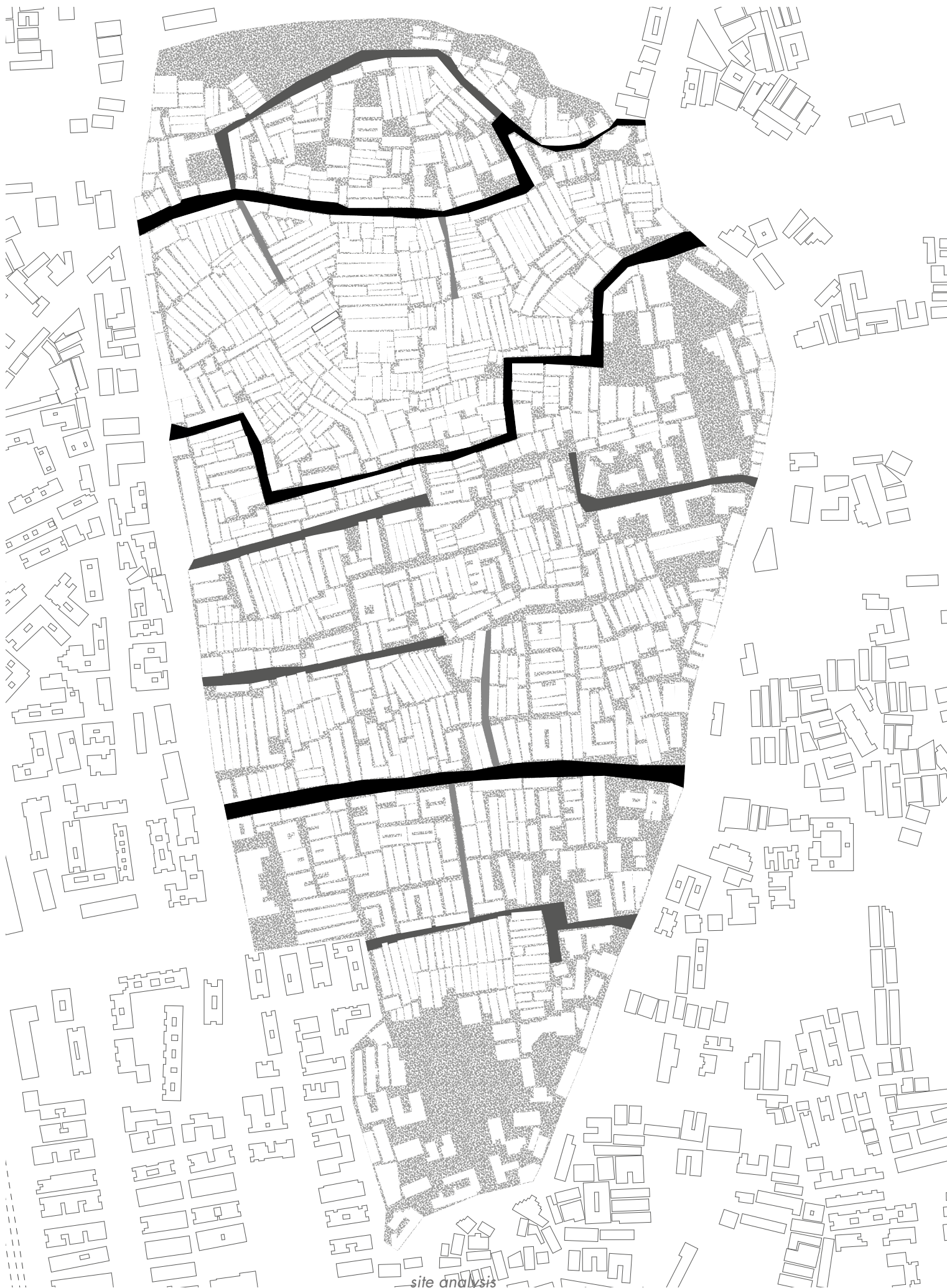
2017
Rahmat Nagar

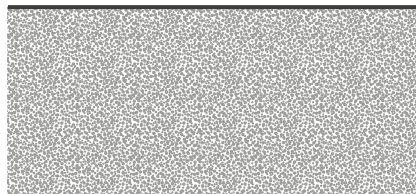
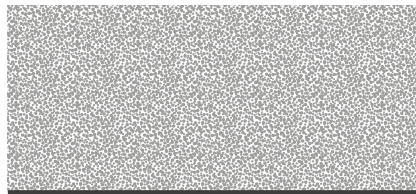
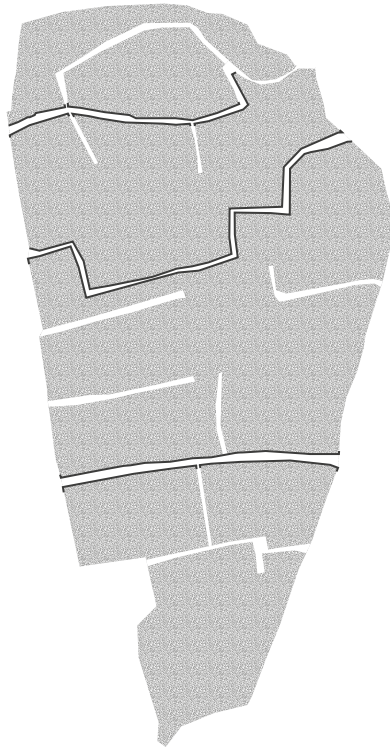


HIGH RISE
Rahmat Nagar



DENSITY CLUSTERS
Rahmat Nagar

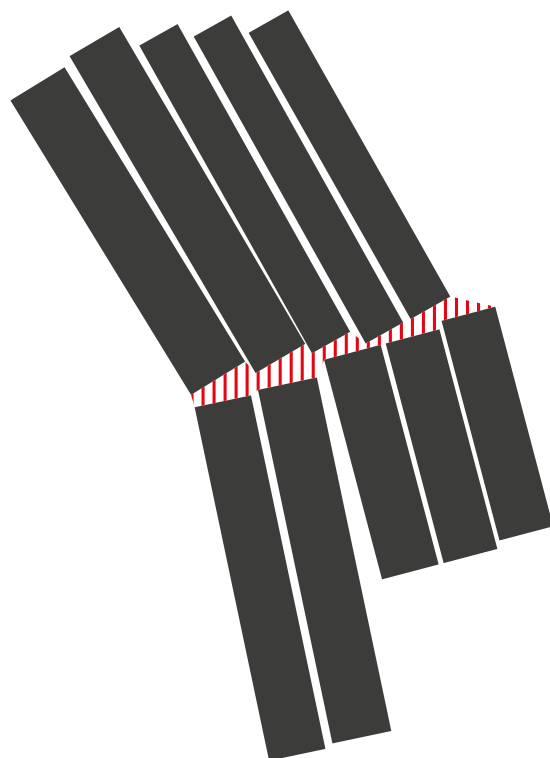


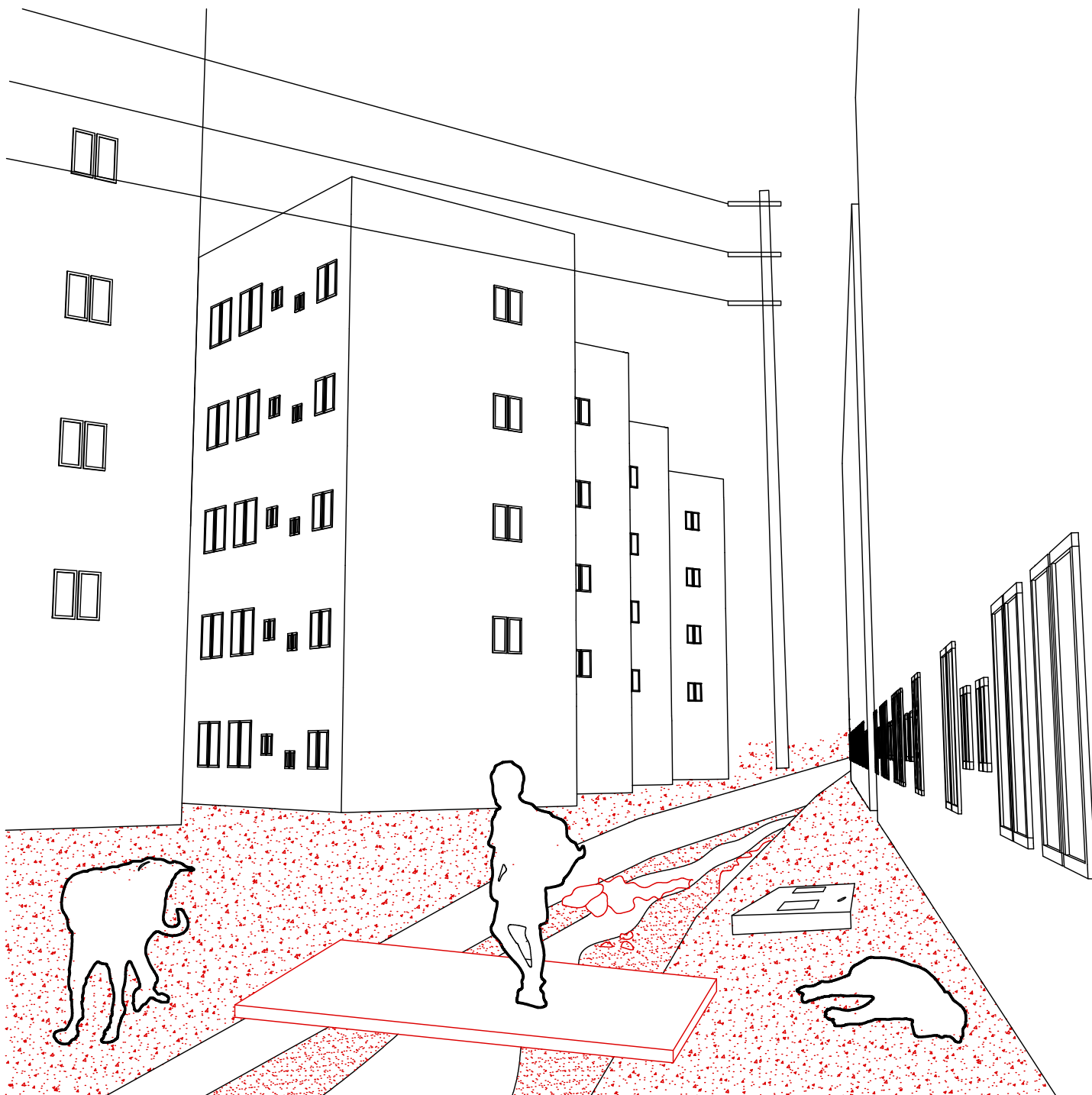


ANALYSIS OF THE URBAN FABRIC

Rahmat Nagar area

the urban fabric of the Rahmat Nagar area has very little connecting roads; only 3. apart from that the fabric in between is like a maze. there are hardly any secondary connections.



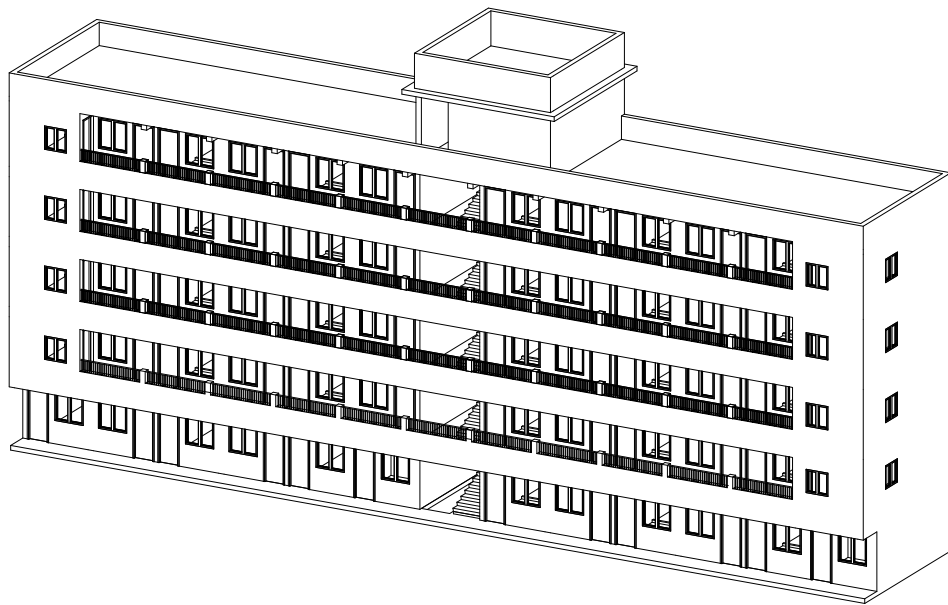


THE INBETWEEN

when the patterns of (baithi) chawls shifts, an open space appears. something that is scarce in the Rahmat Nagar area. But these open spaces are often neglected spaces, instead of appreciated and valued spaces.

BOOK OF PATTERNS

social and spatial practices in the
baithi chawls and chawl
of Nala Sopara



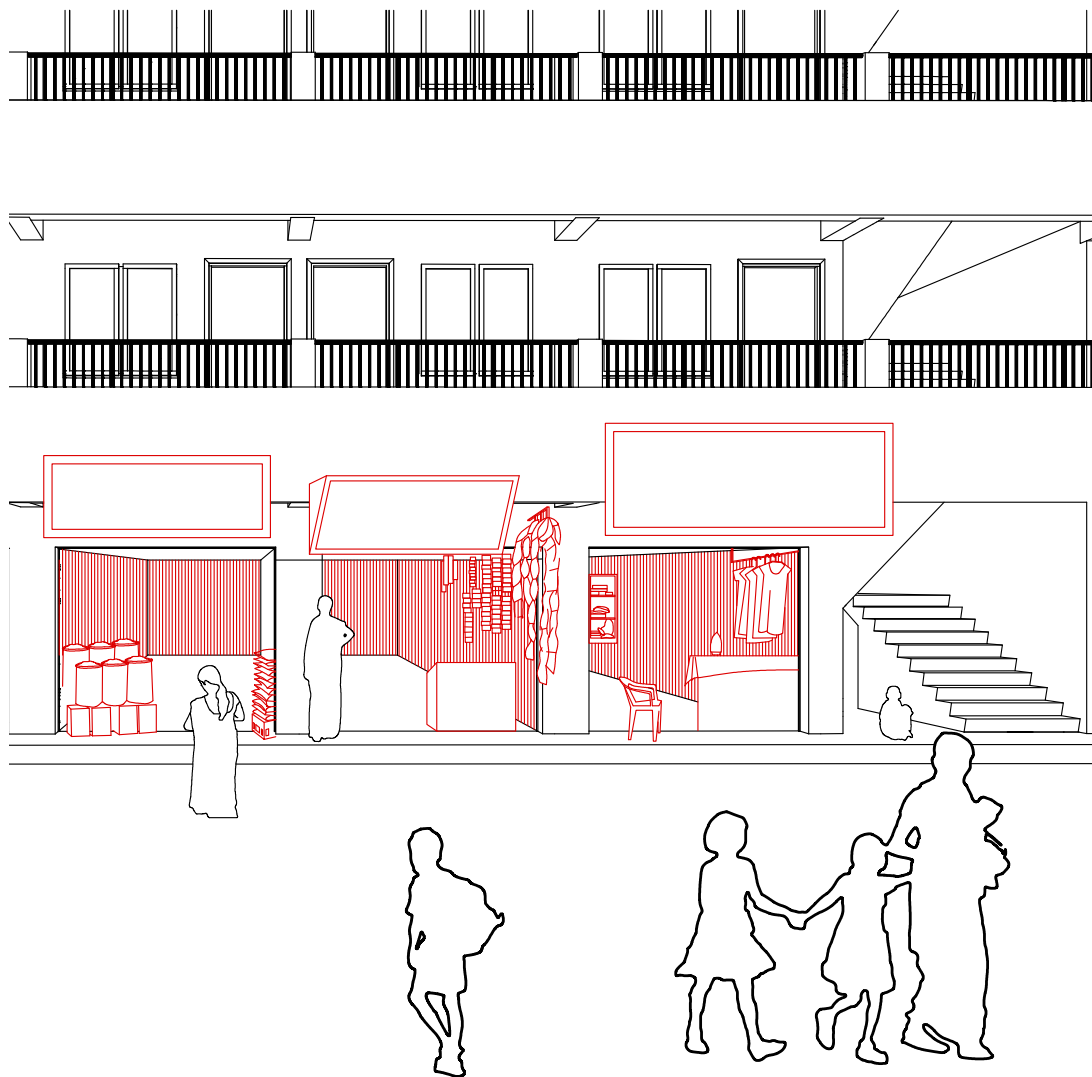
THE CHAWLS

income generation - borders - social spaces - building techniques



STREET VENDOR
income generation

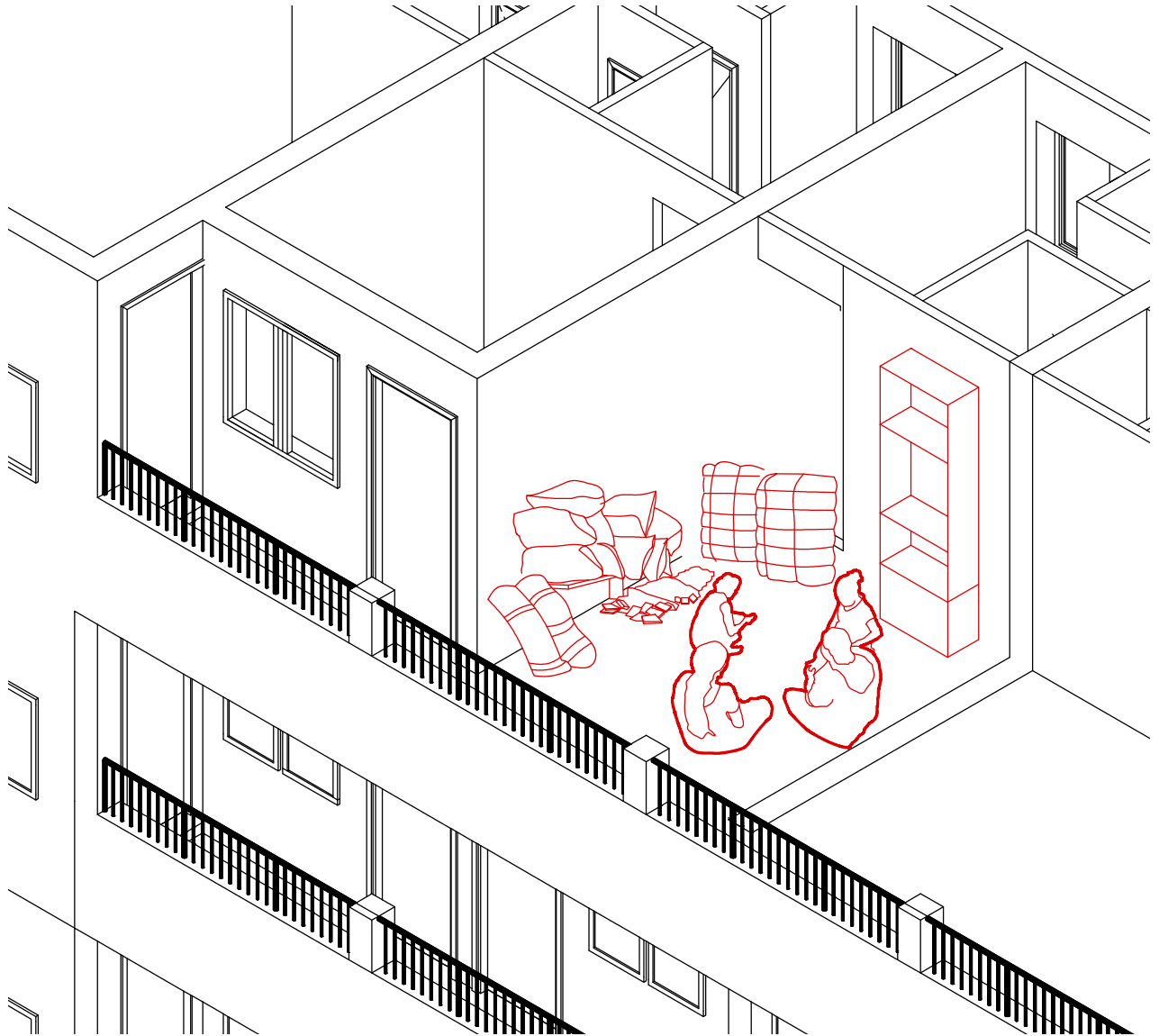
the flexibility of the Street vendors allows them to locate themselves on the busiest streets and corners. They complement the formal shops; creating lively commercial areas



THE COMMERCIAL PLINTH

income generation

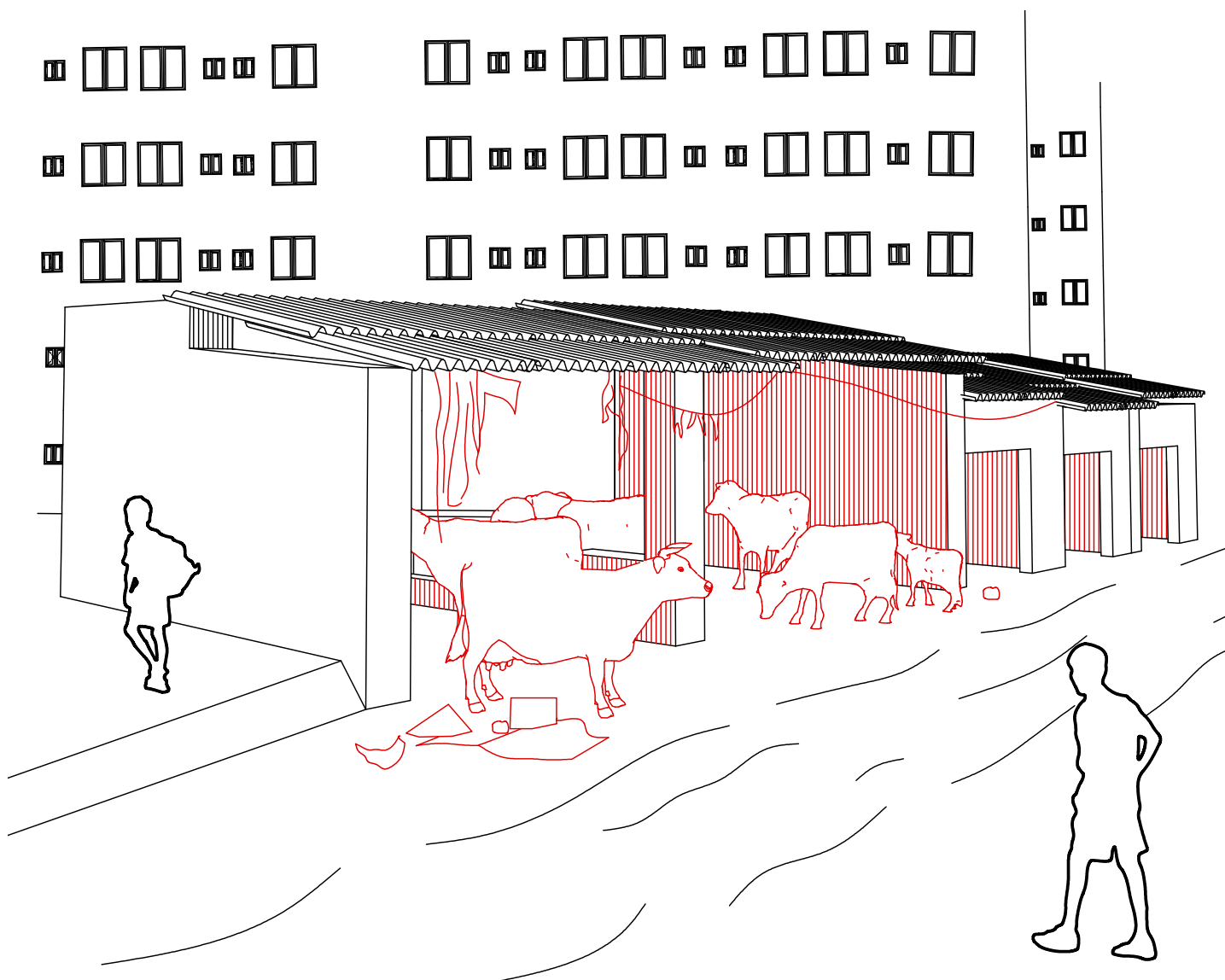
In the main streets, the ground floor of the chawls are converted into shops. The shops offer services such as carpentry, groceries, laundry, etc. the slightly raised ground floor is often used as an extension of the shop.



HOME BASED BUSINESS

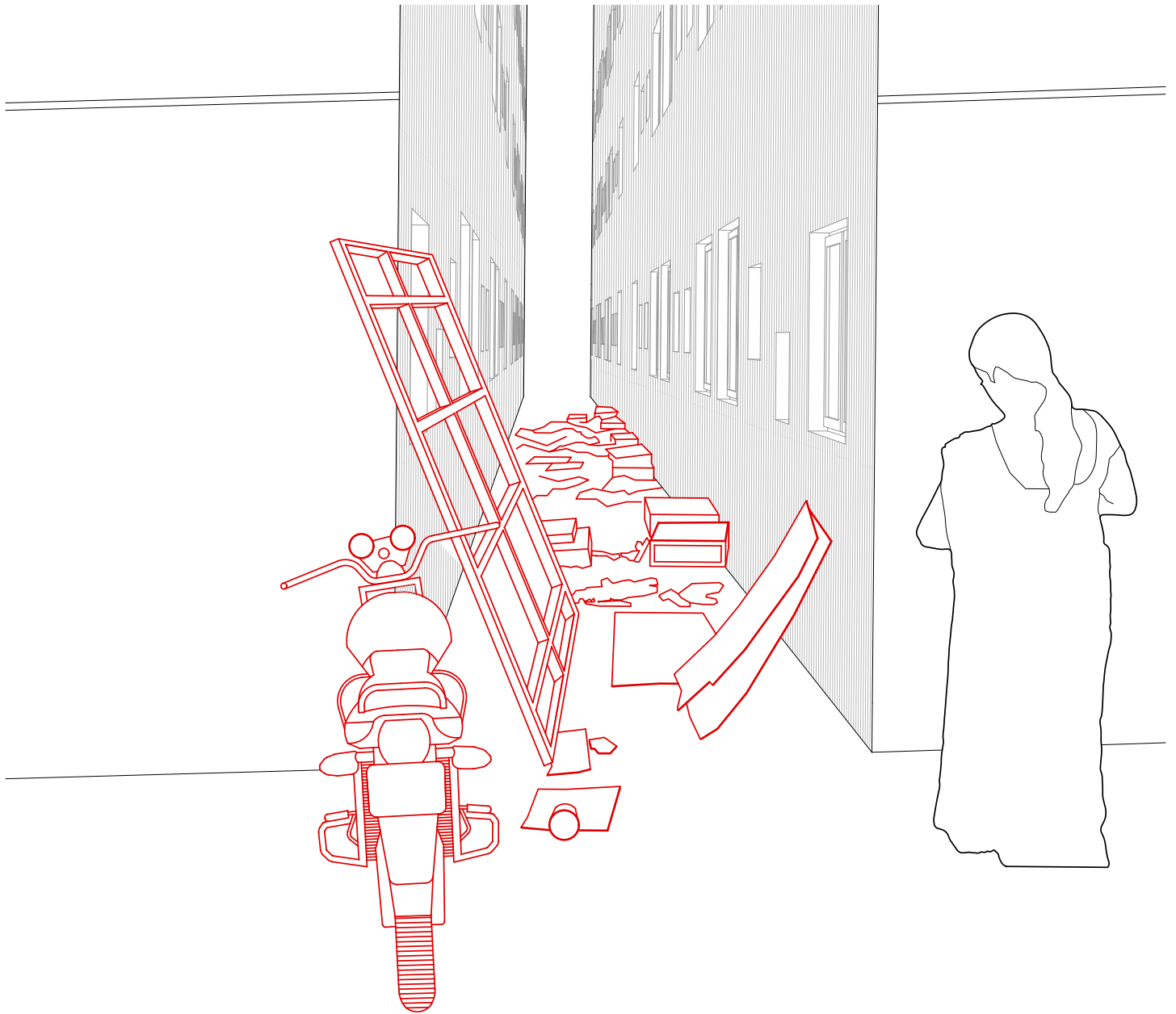
income generation

Some commercial activities such as jewellery making happen inside the dwelling units as well as some services like teaching.



THE COW SHED
income generation

One of the sources of income come from small productive activity which supply products such as milk.

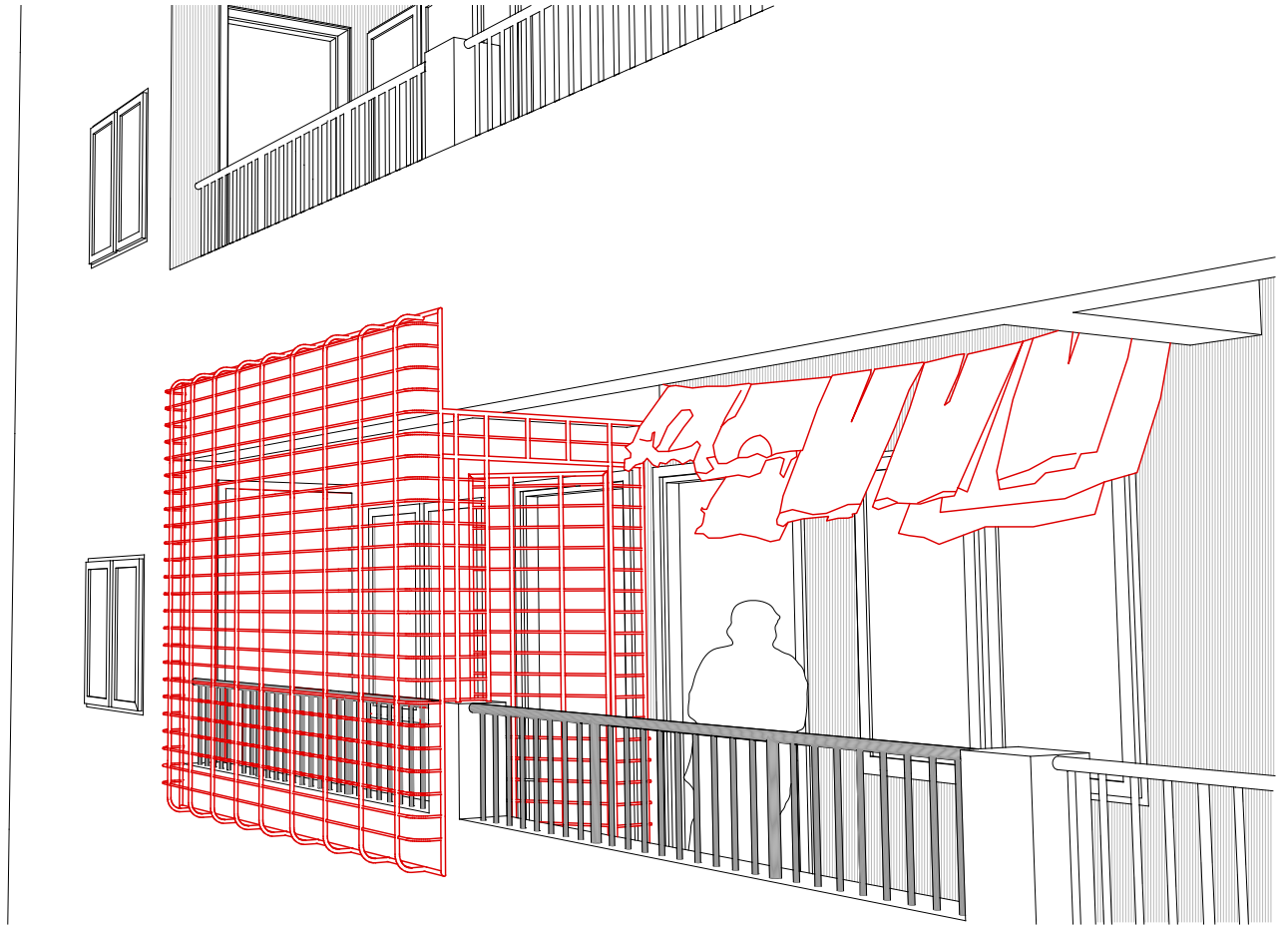


THE BACK ALLEY borders

The clustering of chawls creates an in between space at the back of each block. These extremely narrow back alleys are neglected spaces, often used for garbaged disposal. In some cases, this area gets fenced, creating a physical border.

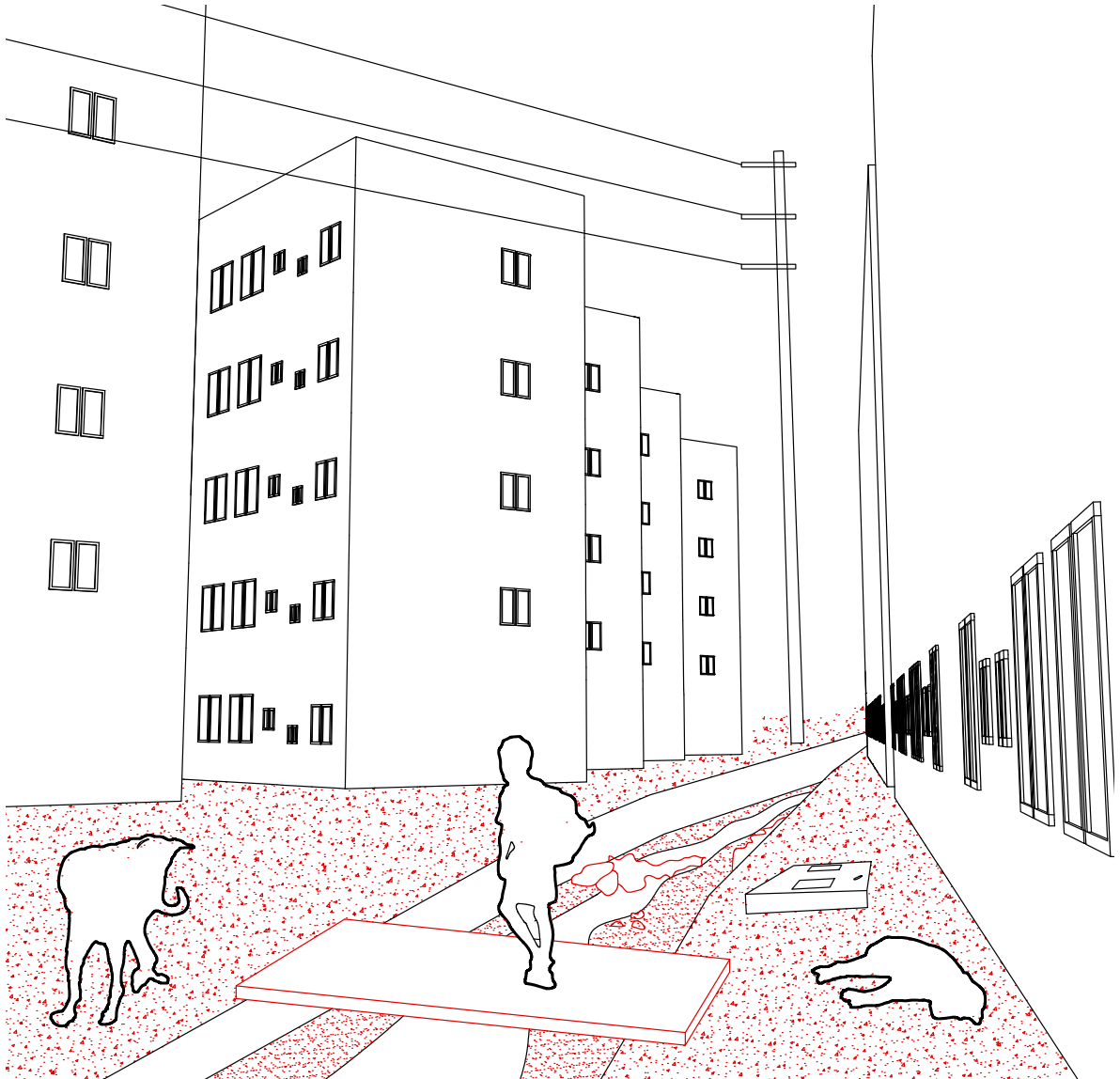


In some areas, the ground floor is raised creating a physical border with the street. It allows the residents to use it as a (semi)-private area.



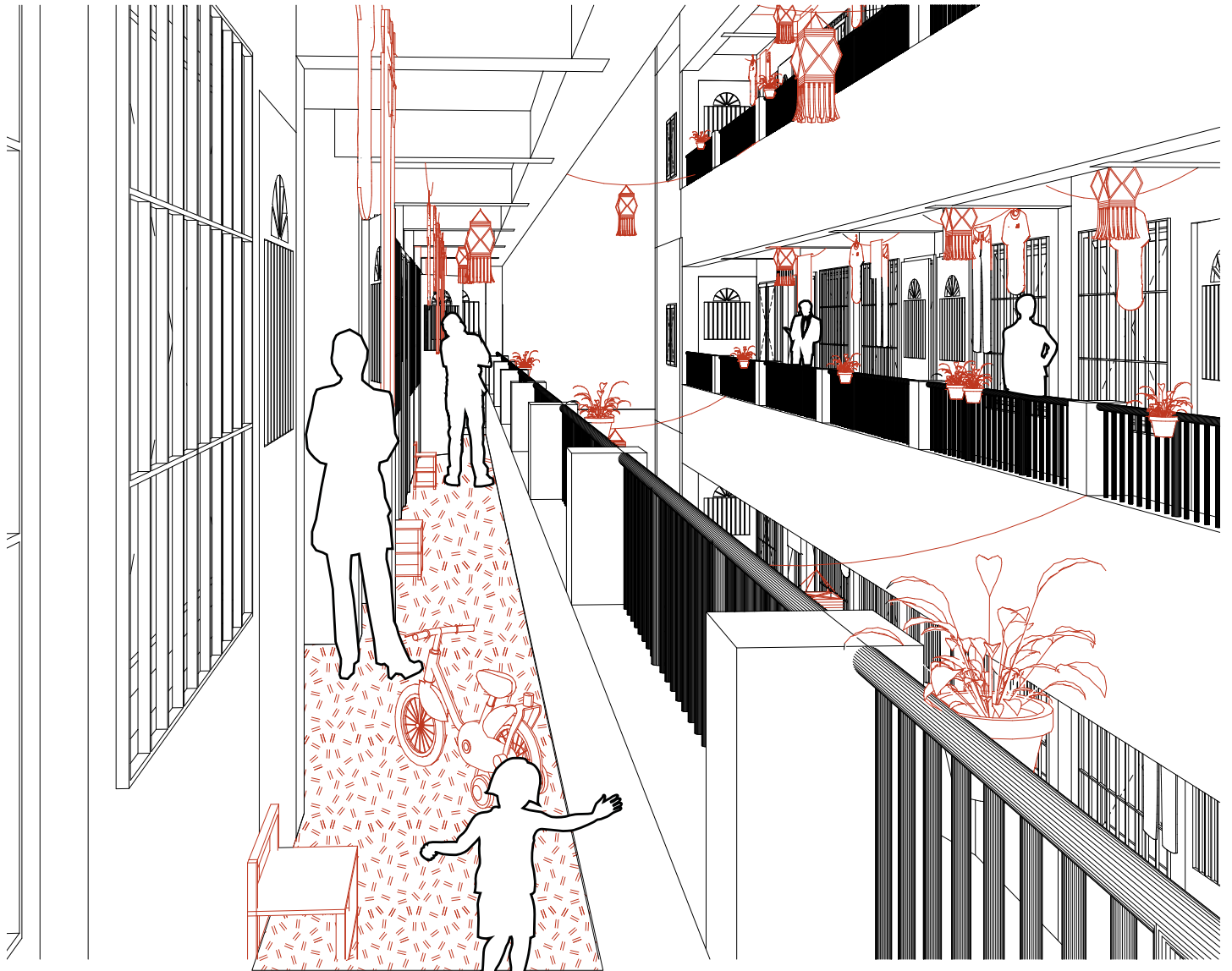
APPROPRIATED GALLERY borders

In the chawls the galleries are used as an extension of the domestic space . The dwelling units at the end of the gallery close of the gallery with cages to create a private zone. This create a limit inside the collective space.



THE SEWAGE CANAL
borders

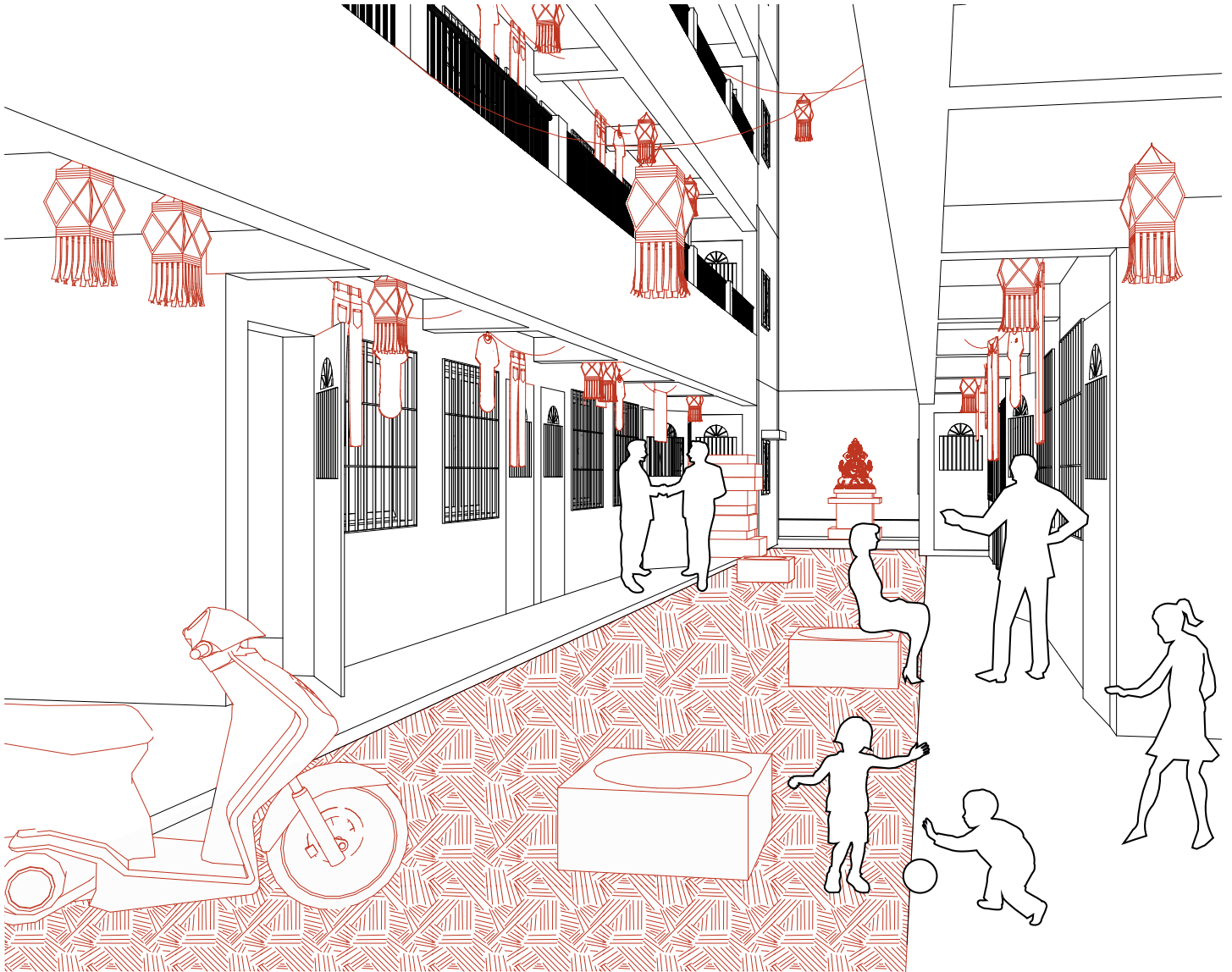
Inbetween clusters of chawls the sewage canal creates a
border in the urban fabric.



THE CIRCULATION GALLERY

social spaces

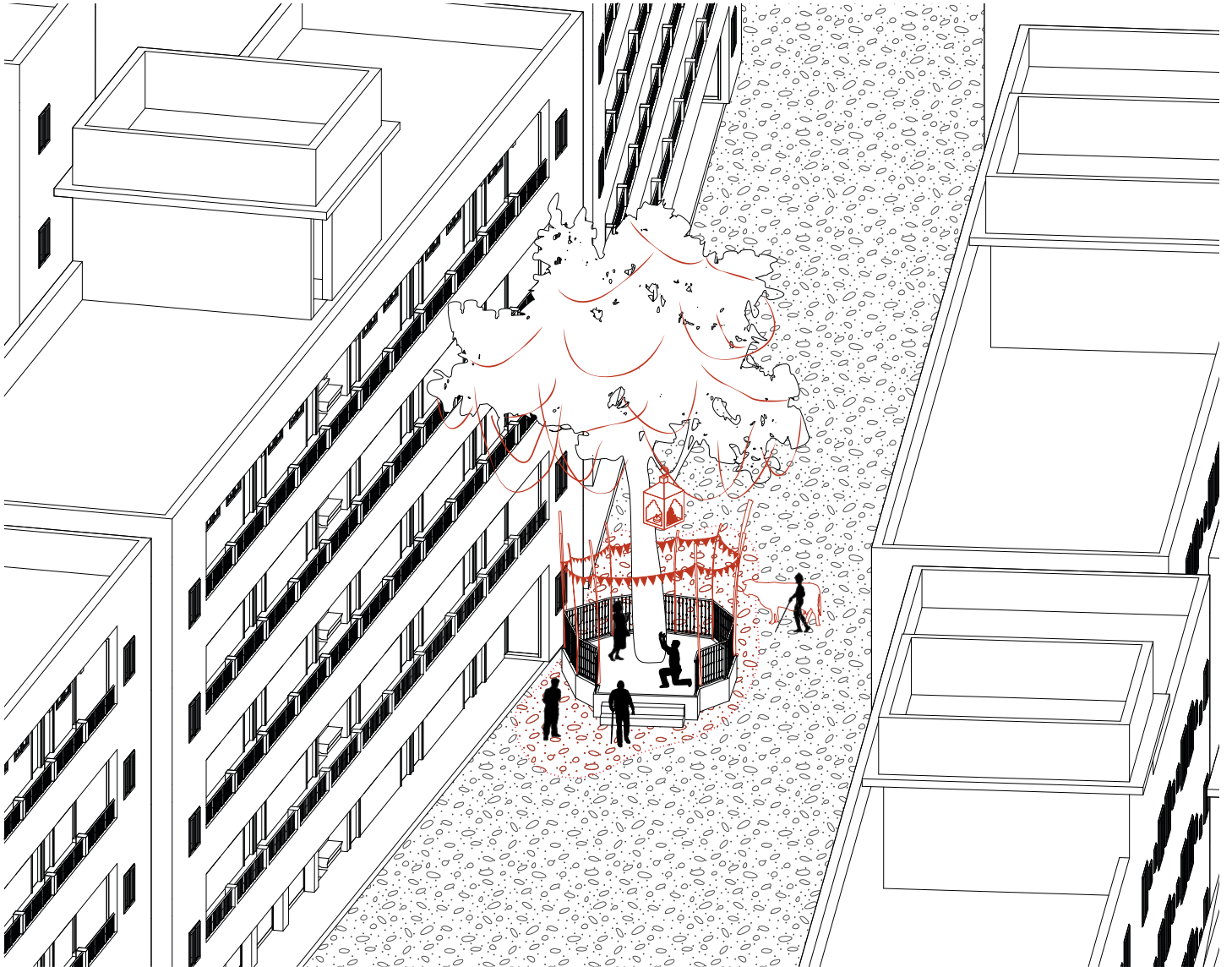
The galleries work as extensions of the homes. a meeting place where women chat while hanging the laundry to dry and where kids run around and play.



THE FRONT ALLEY

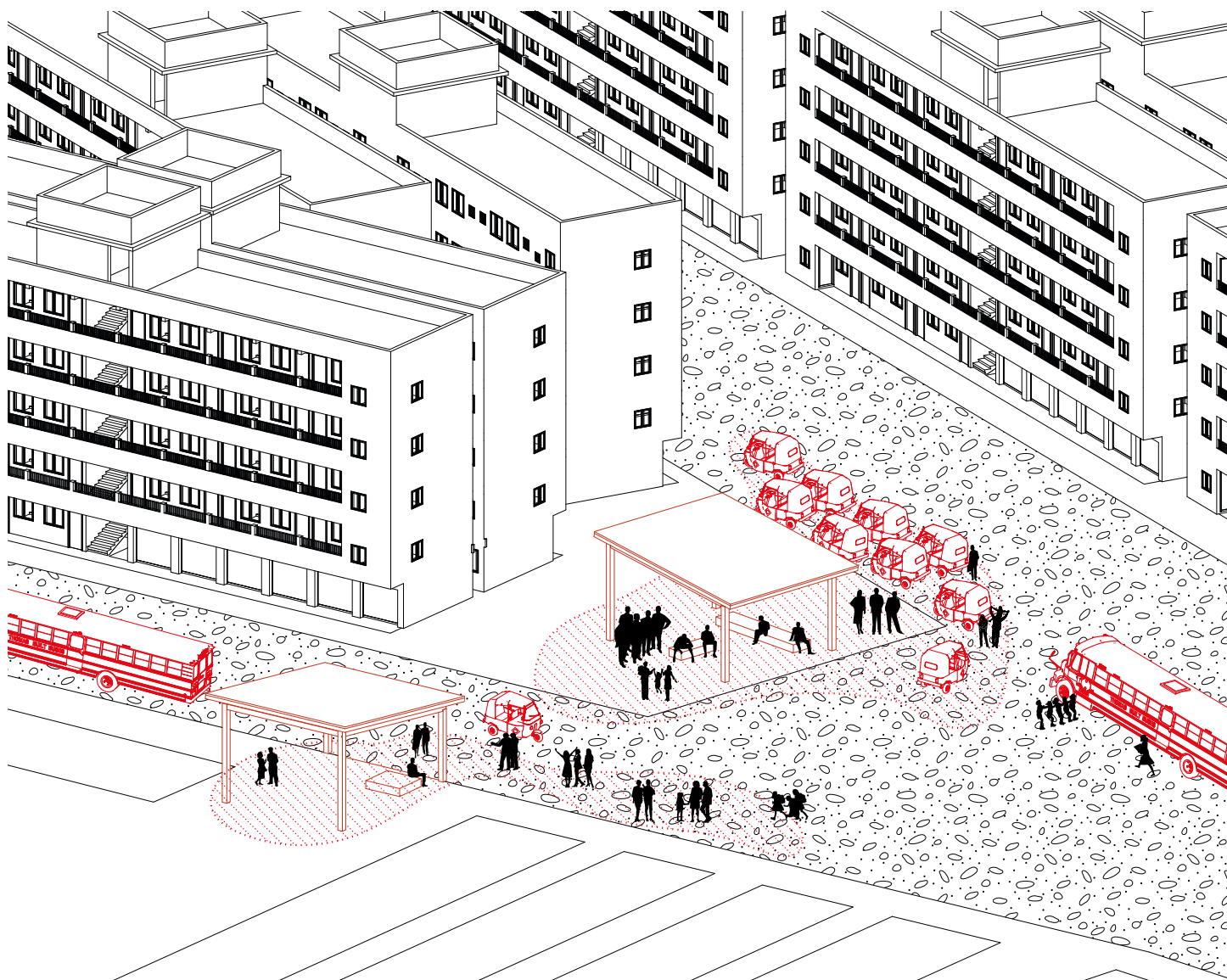
social spaces

The front alleys are a gathering place for all the people from the adjacent buildings. This is where everybody crosses when arriving home; where people stop for a moment to chat.



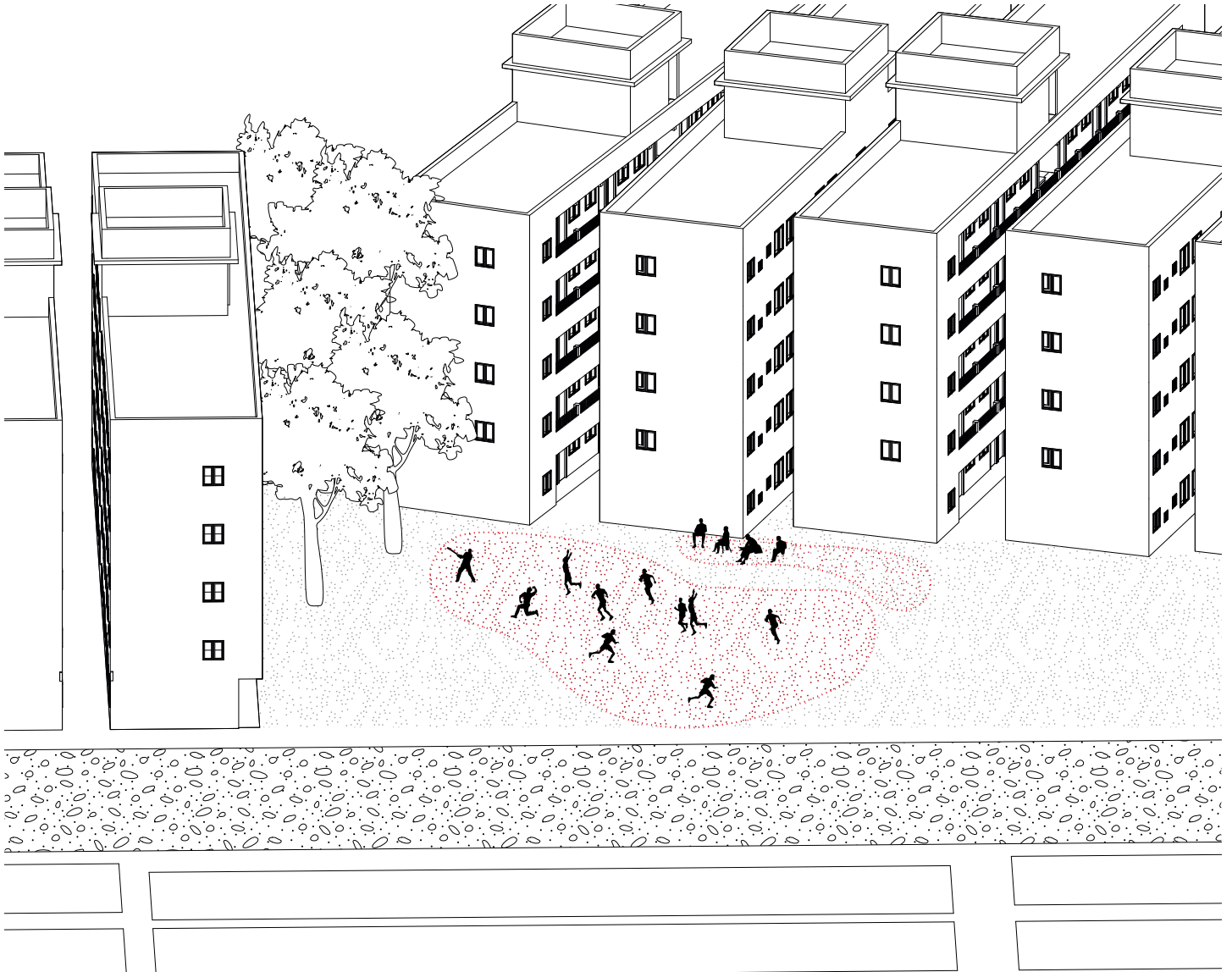
THE HOLY TREE
social spaces

Holy trees function as islands of peace in the hectic everyday life. People stop for a moment of worship before going on with their day.



PUBLIC TRANSPORT HUB
social spaces

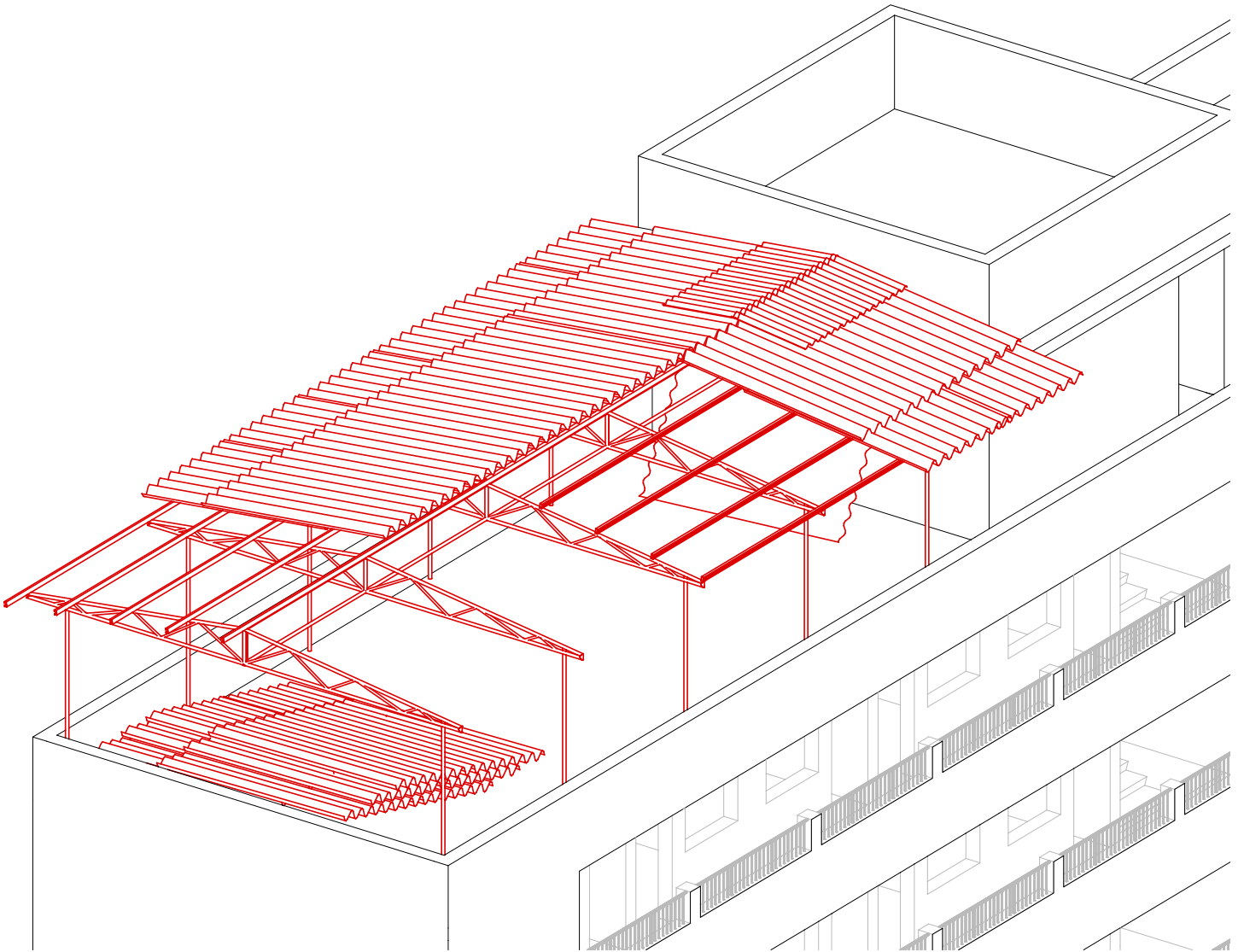
The place that connects the neighborhood to the rest of the area. Women are chatting and kids are playing while waiting for the schoolbus to pick up their kids. Auto rickshaws drivers are waiting for their next customer.



GALLI CRICKET

social spaces

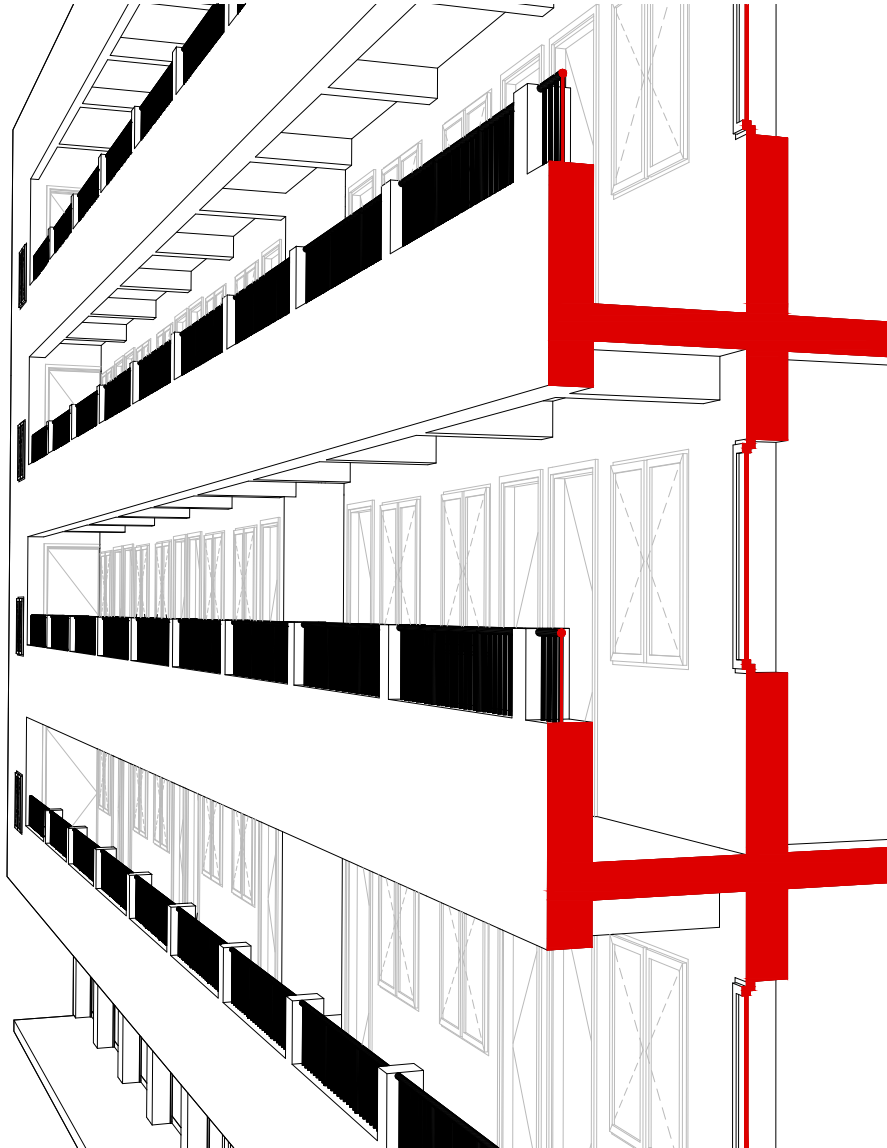
Left over spaces are used to play an informal form of cricket; Galli cricket. Spectators gather around the game to watch and chat.



ROOF EXTENTION

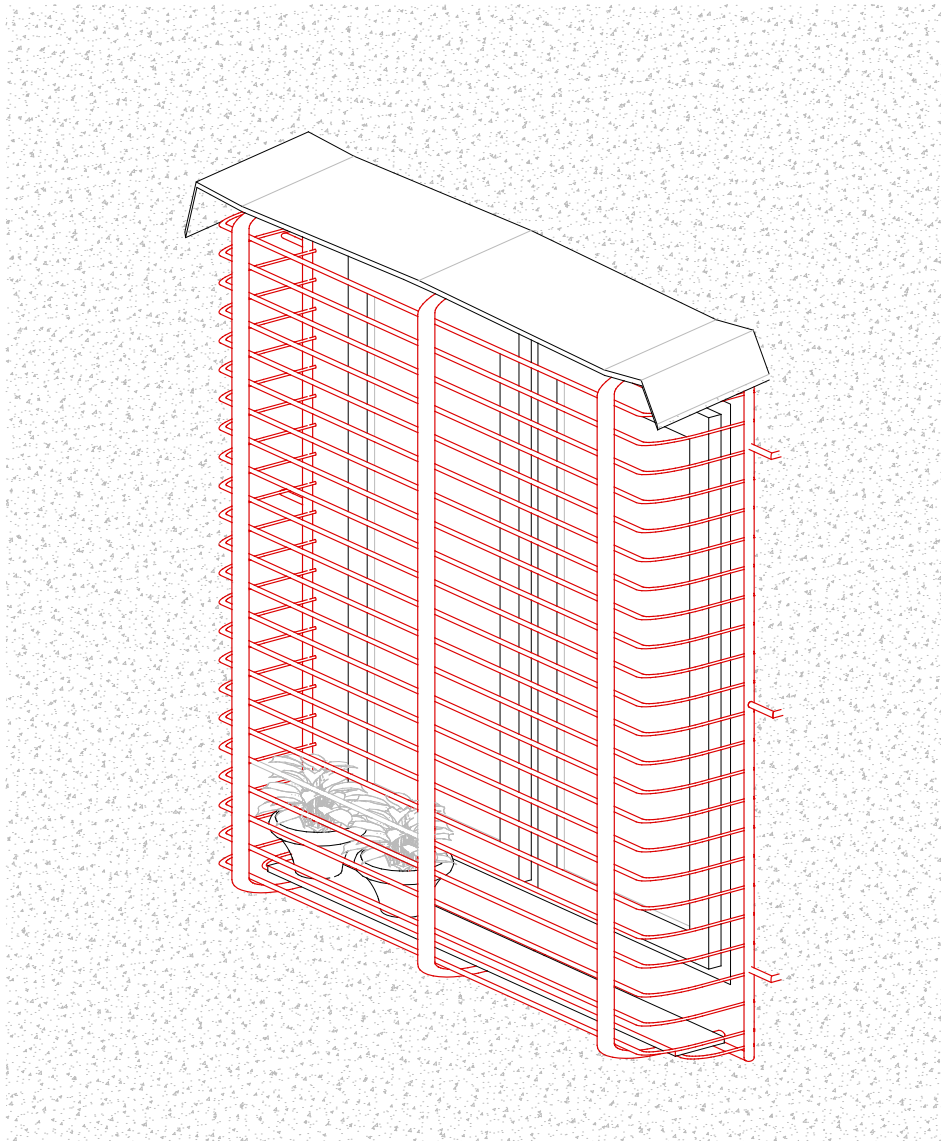
building techniques

As a solution to make the building water proof, corogated steel roof extensions are added. This also provides the possibility to use the roof as an extra space.



CONCRETE CANTILEVER GALLERY building techniques

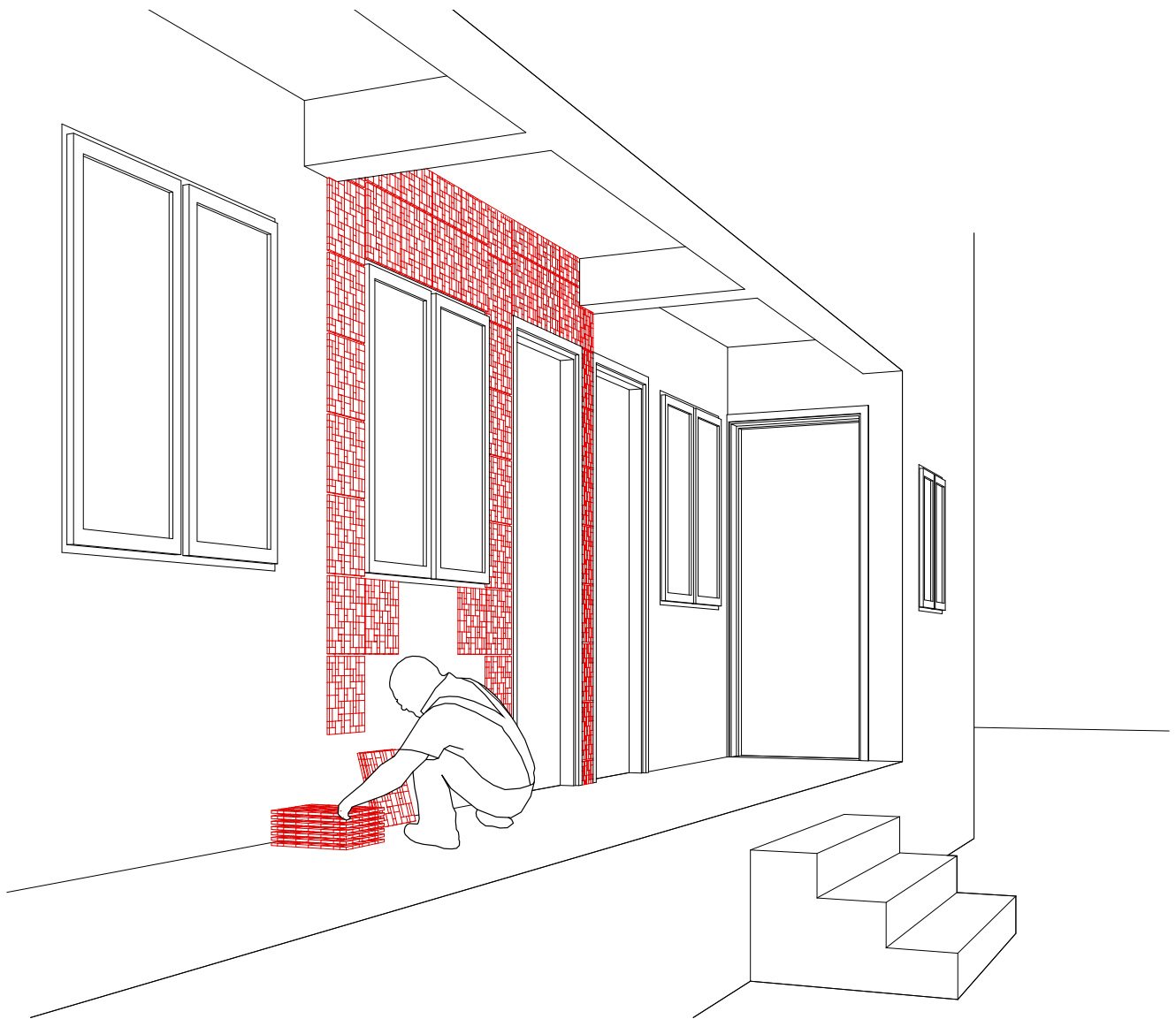
The use of concrete is the most common solution for the chawl's structure. Also, the use of the material allows the existence of the corridor, one of the main characteristic of the chawl.



WINDOW CAGES

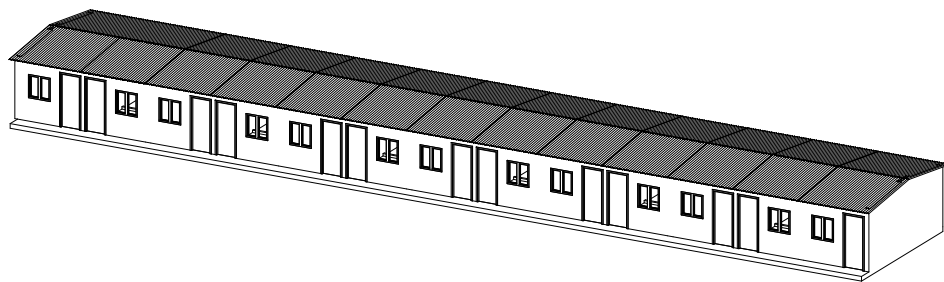
building techniques

With different layers of steel pipes, the cage's components are common to see not only as a security solution, but also as an extension of the dwelling unit. A support is added to put plants inside. a basic roof solution is sometimes added to protect from the sun.



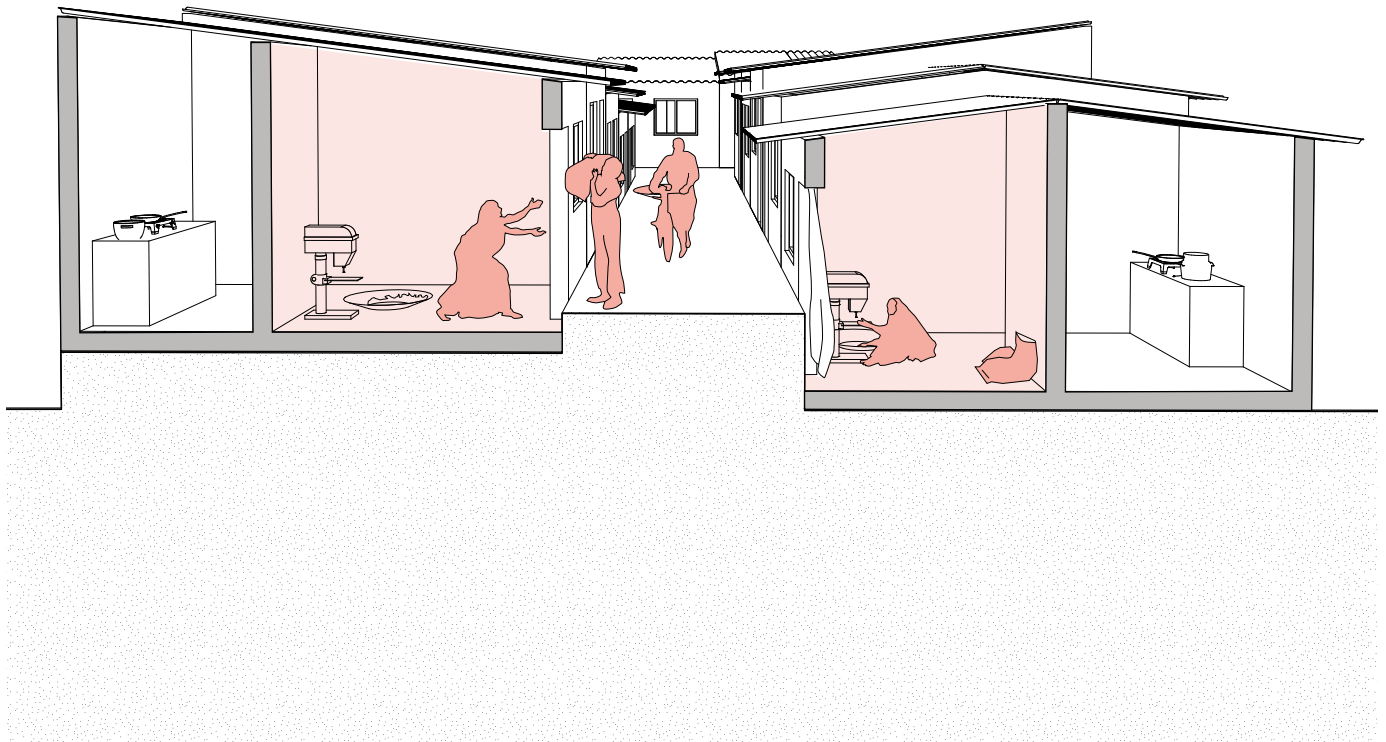
CUSTOMIZED FACADE building techniques

The access of some housing units are customized in order to make a difference in a monotonous facade. The most common material is the tiles, and it is used in the full width of the unit.



THE BAITHI CHAWL

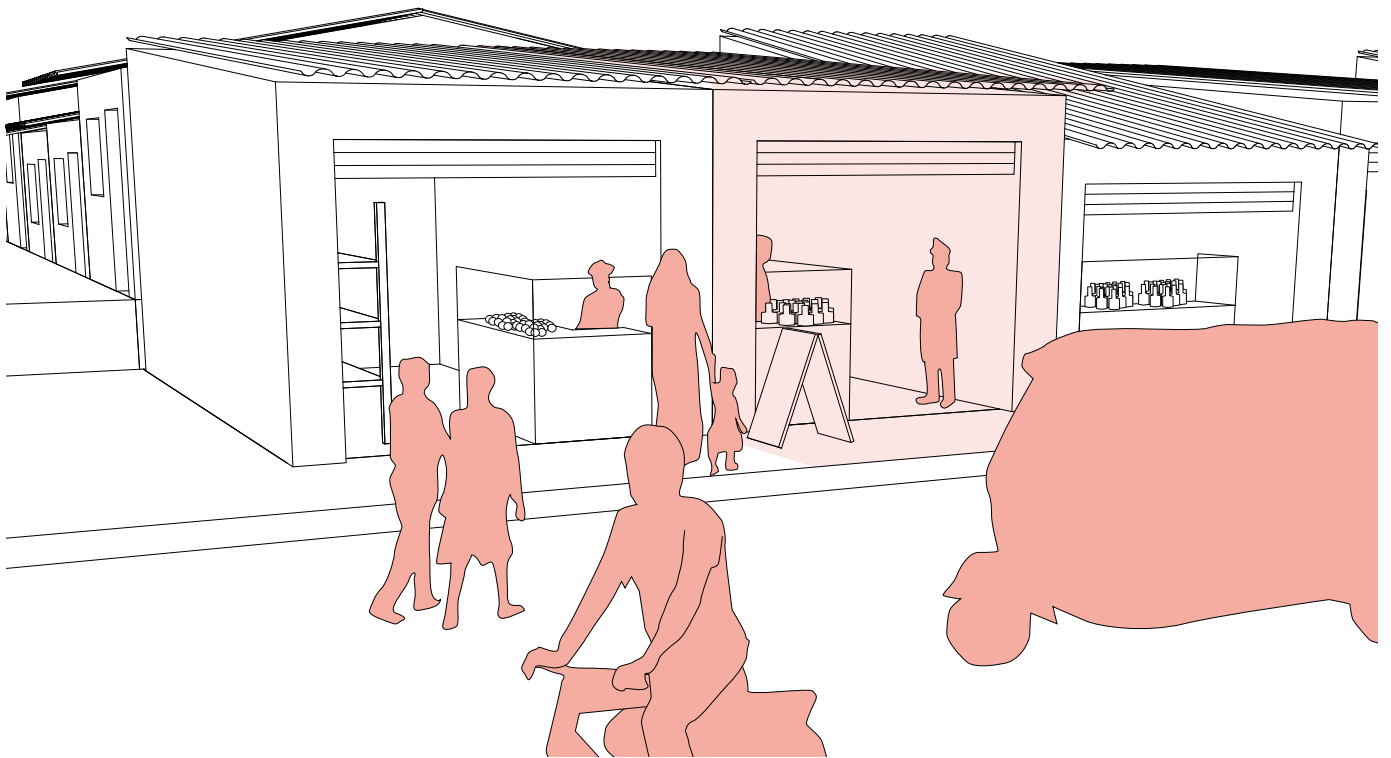
income generation - borders - social spaces - building techniques



DOMESTIC WORKSHOPS I

income generation

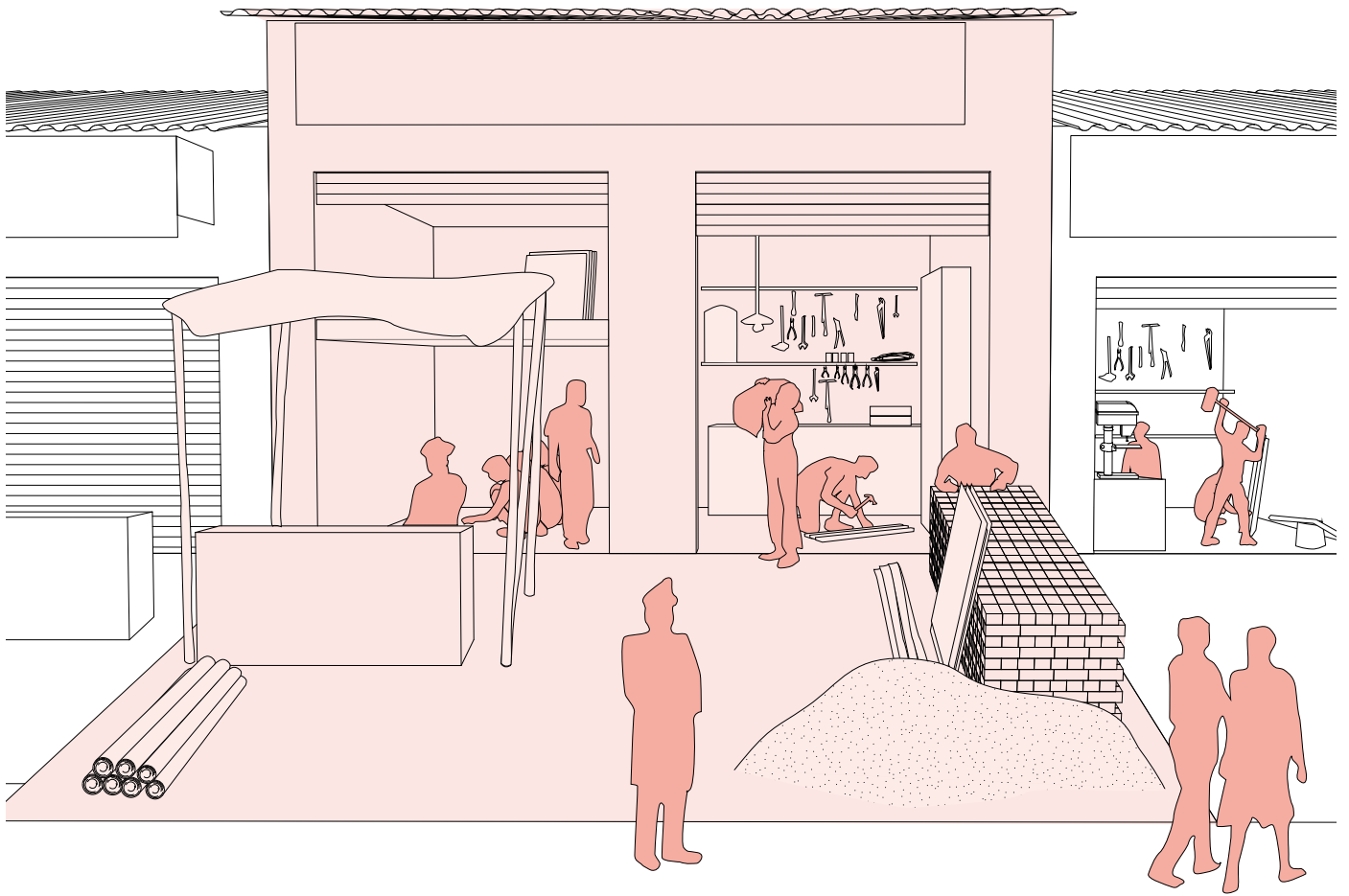
In some of the baithi chawls manufacturing of goods takes place in mixed used residential units. It both occurs that multiple units in one chawl are producing the same goods being part of one company, as are the autonomous operating units working individually. The front room is both used for manufacturing and storing the goods.



LOCAL SHOPS

income generation

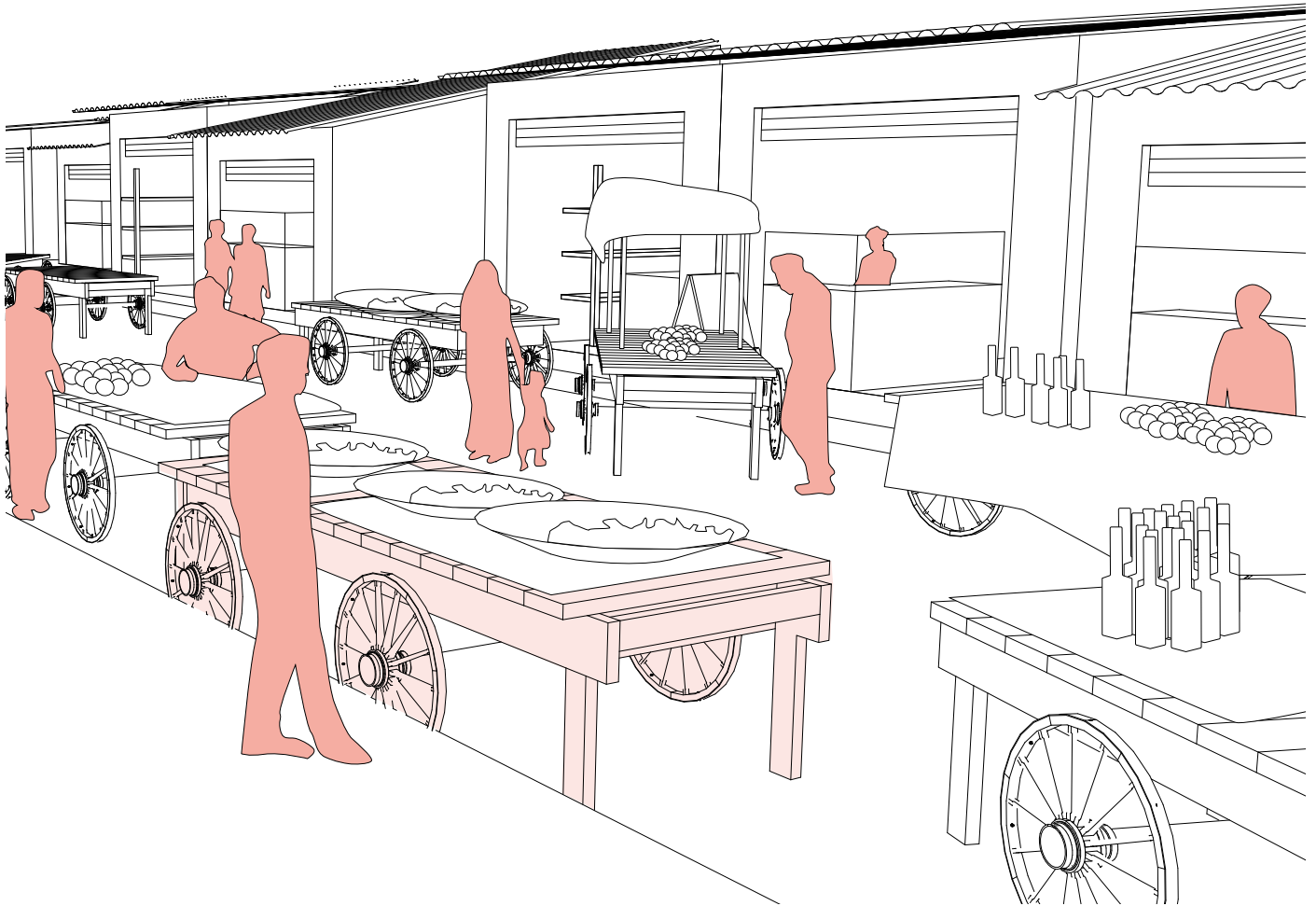
The baithi chawls are perpendicular to secondary roads which are themselves perpendicular to the main road. In this secondary roads local shops are placed along the streets. These shops vary in size, ranging from a couple of square meters to deeper units which sometime have a backroom or second floor to house the owners family. The roads are wider than the baithi chawl paths giving space for other forms of mobility than pedestrians.



INDUSTRIAL GHALAS

income generationi

The highway coming from Mumbai offers a vital artery for various industrial activities taking place in the area of Nala Sopara East. These activities are held in workshops of varying size close to the highway and along the main road crossing the area. These so-called Ghalas are manufacturing and selling various products mostly related to construction such as bricks, cement, steel beams etc. A concrete ramp is built in front of the ghalas on which the finished goods, raw material and a reception desk are placed.



STREET VENDOR STANDS

income generation

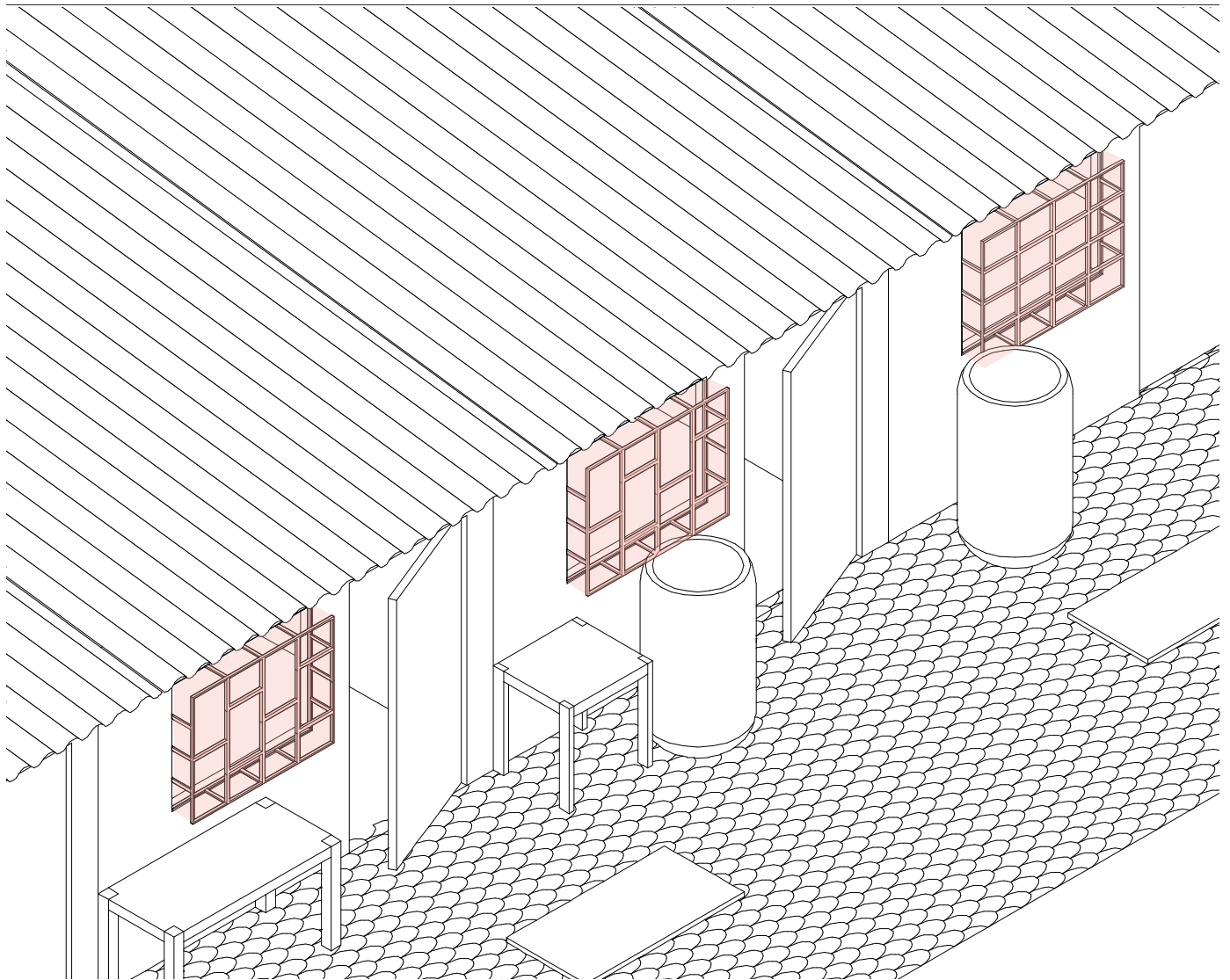
The street vendor stand offers another way of selling goods in the shopping streets. In the busier streets these stalls are clustered in a market but they also appear 'alone'. They are mostly made of wood or metal with plastic sheet covers and often mobile or temporary constructions. The vendors sell mostly products related to daily needs such as food. Sometimes the stall is part from the shop where they stand in front of and serve as an extension to the interior.



SOCIETY GATES

borders

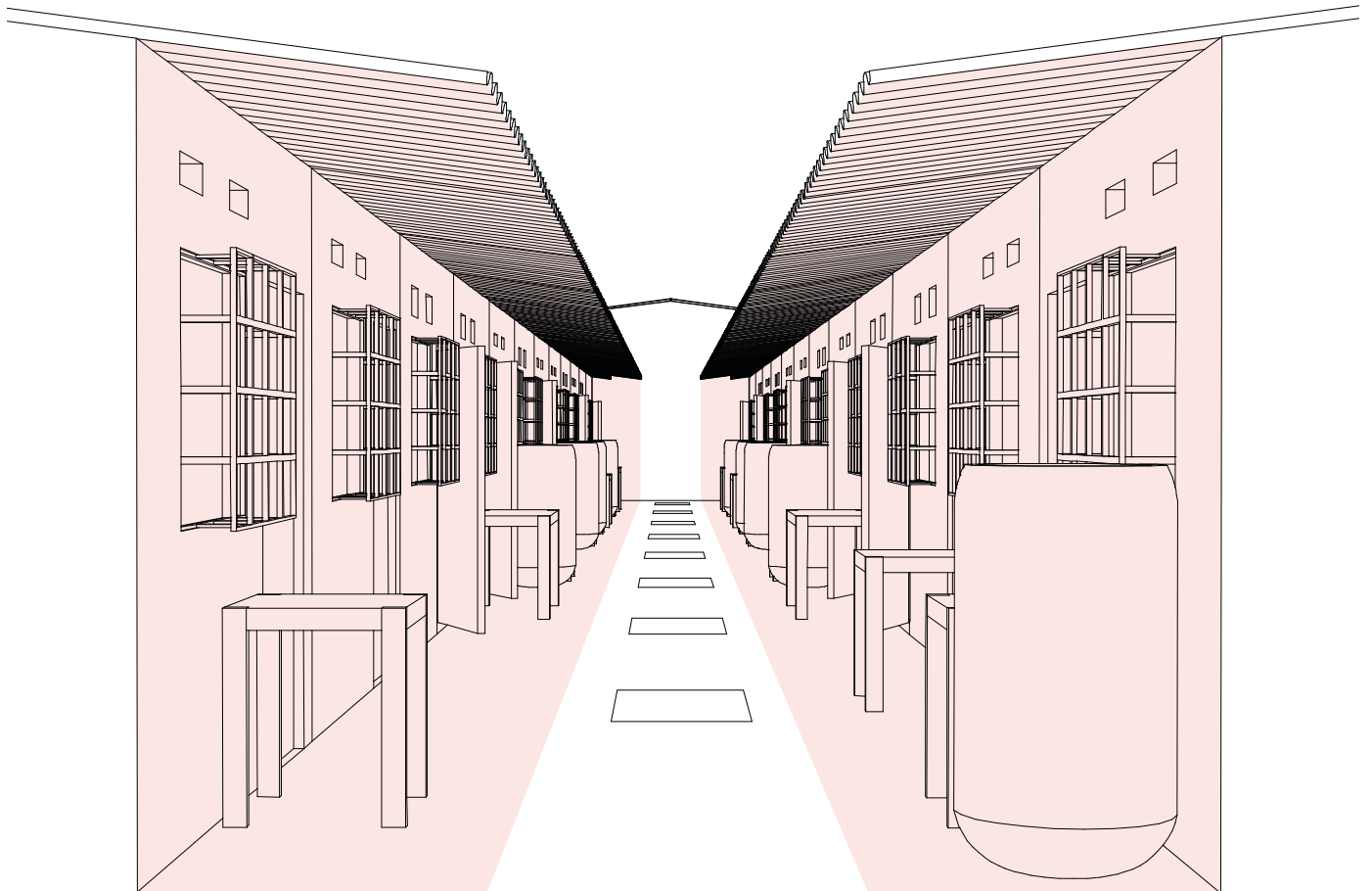
The society gate acts as a transitional border that sets the perimeter of semi-public space: the society area. This measure not only gives information about the society itself but also gives a very clear message to everyone not from the society that they are visitors.



WINDOW CAGES

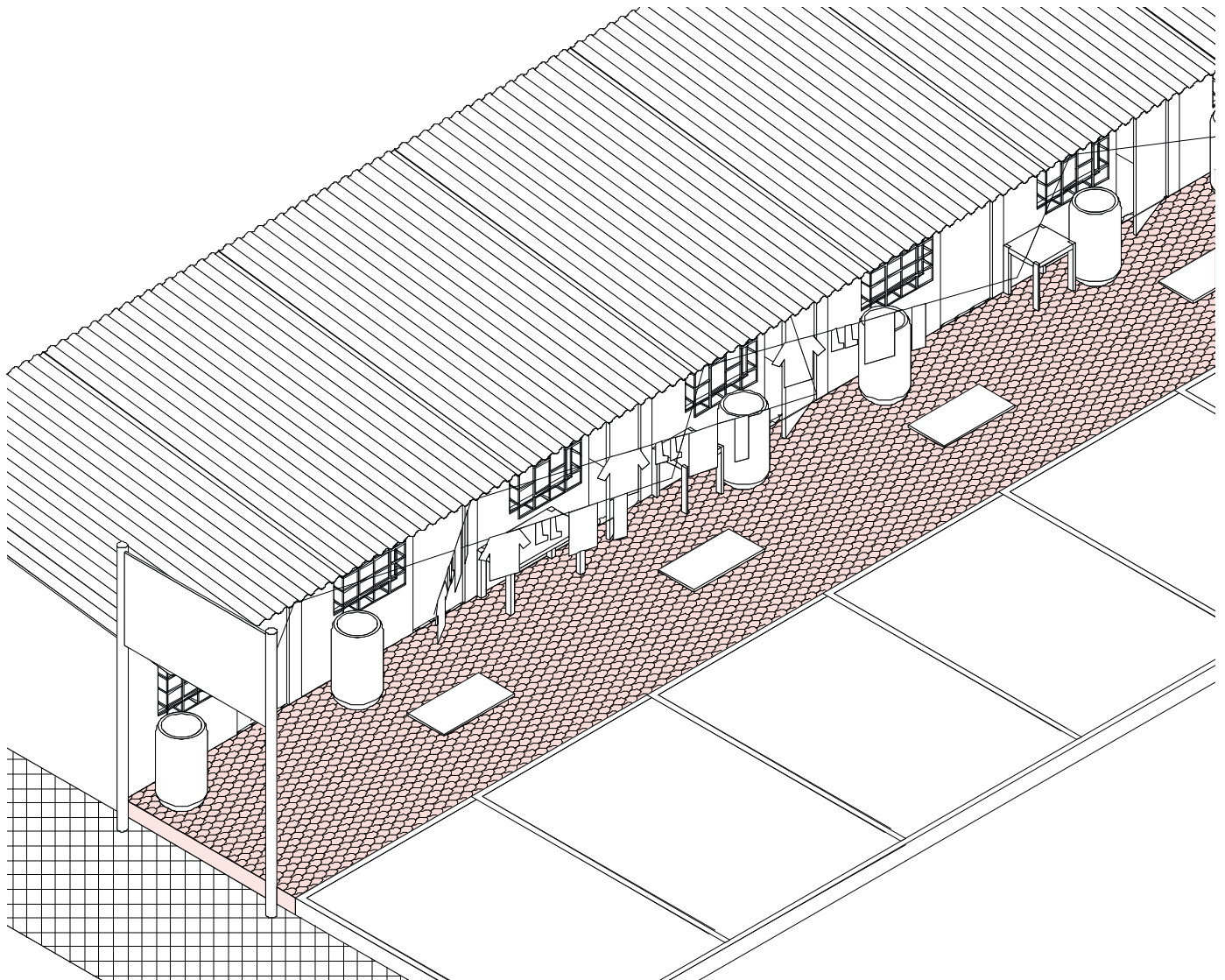
borders

The cages in front of the windows of baithi chawls are for protection but also indicate to the person not living there: "keep out, private property". It's a very hard transitional element that separates semi-public with private space. In other cases, you will find these cages to be used as an extension of the dwelling, but the cages found in baithi chawl dwellings are not deep and are only meant for security purposes.



ROOF CANOPIES borders

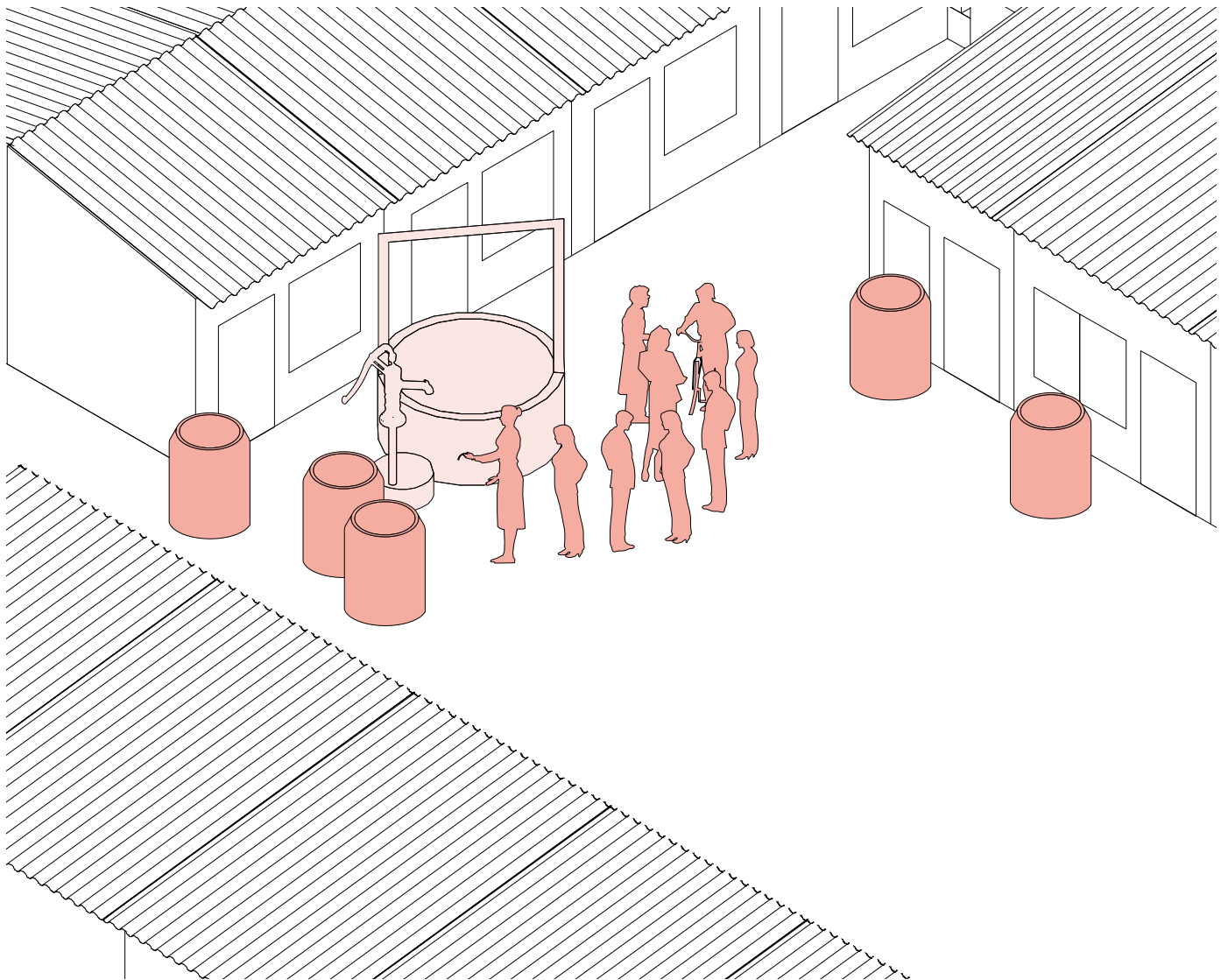
The roof canopies of baithi chawls cover a part of the communal lane. This space is appropriated by the different dwellers and used as an extension of their house, to store water, to dry clothes or to sit outside. This makes this layer a private area although being actually semi-public. This space further softens the transition of public street to private dwelling



COMMUNAL PAVEMENTS

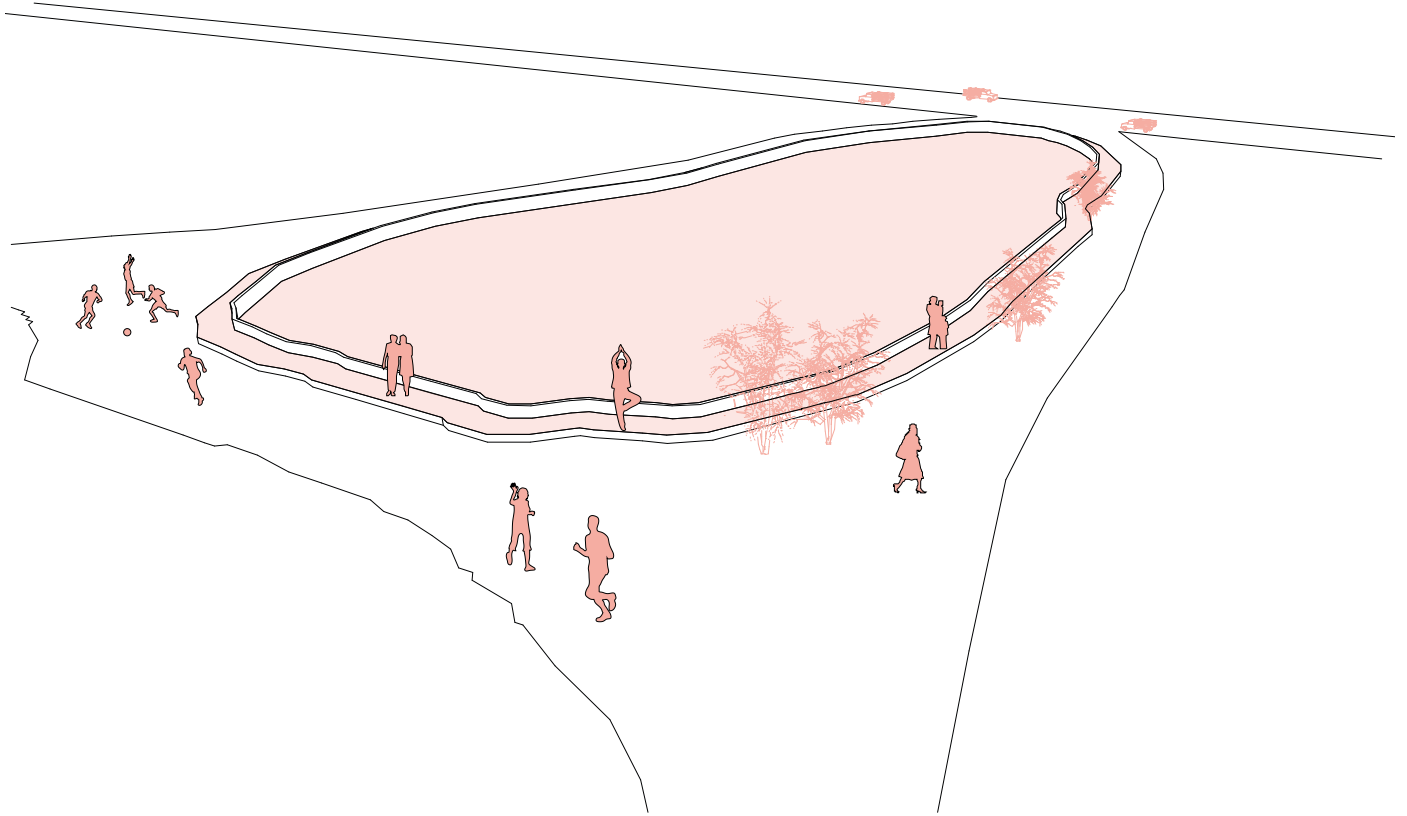
borders

The communal pavement of the alley between baithi chawls is an element that highlights the semi-public character of the communal lane. This pavement is characterised by a little height difference and different type of bricklaying and is often well maintained showing the community's tight interaction.



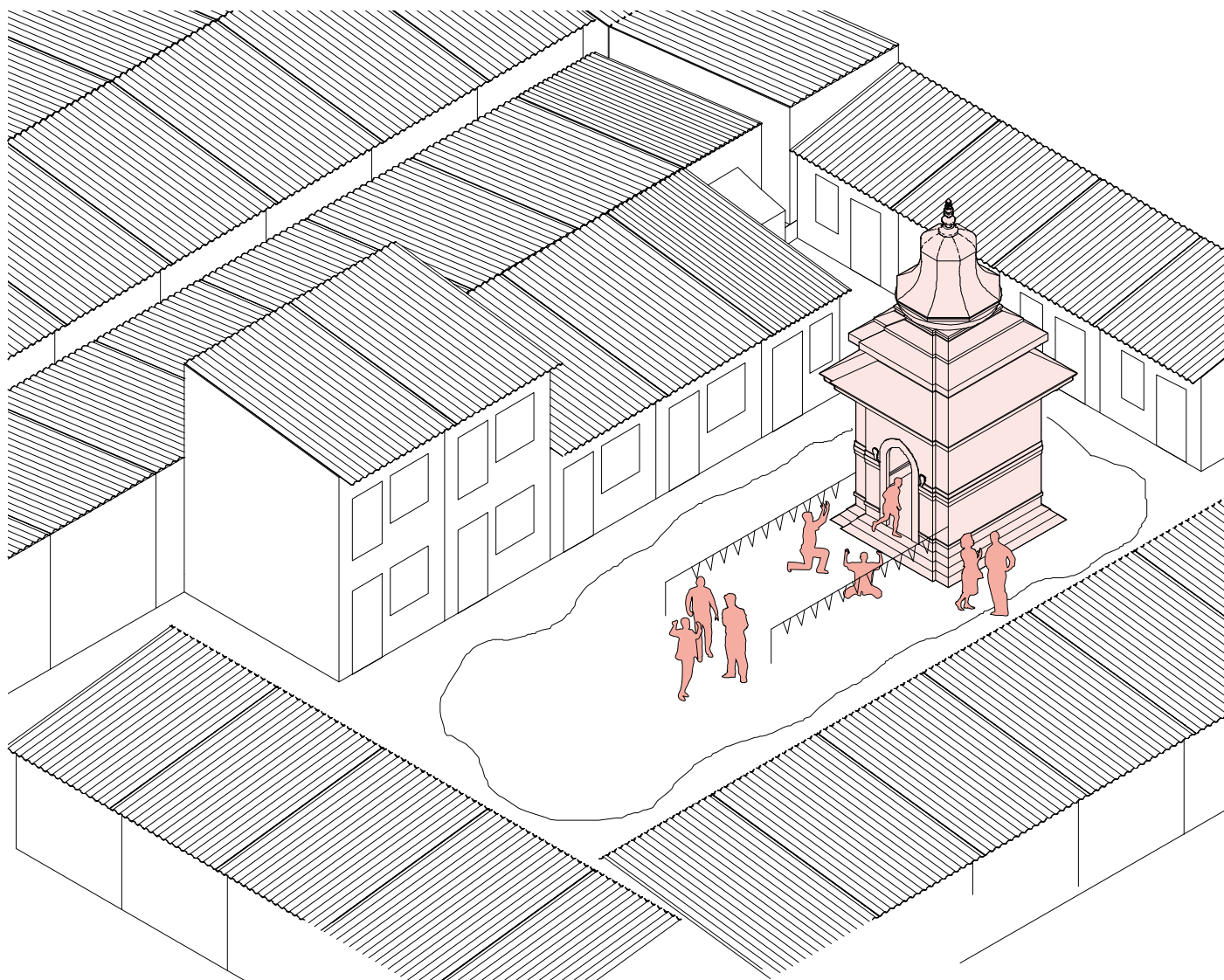
WELLS social spaces

Wells around the rows of baithi chawls act as a place to meet for the women of the baithi chawl area. In a conservative nation such as India, where women of economical lower classes have not always the possibility to move around, the act of getting water as a daily activity act as a way for women to go out of their houses and to meet one another, to gossip or to talk.



LAKES social spaces

Lakes can be found all around the baithi chawl area of Nala Sopara. Some of them are used for industrial purposes but some have been transformed to public spaces for people to enjoy a walk, to sport or to have some privacy away from the communal baithi chawl areas. Not only people from the nearby baithi chawls use these spaces but they also attract visitors from further away resulting in a place where people can be less exposed.



TEMPLES AND SHRINES

social spaces

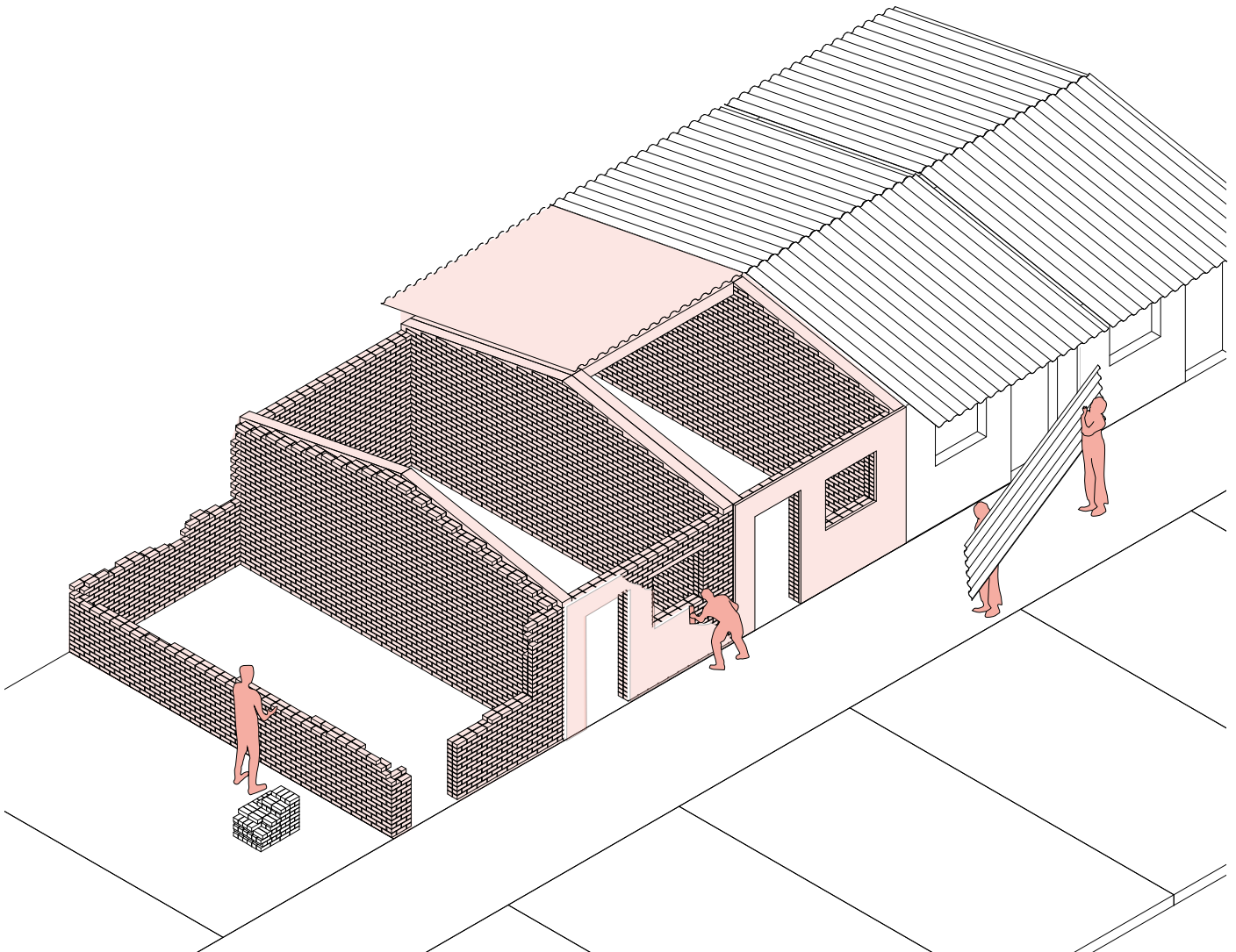
Temples or places of worship are scattered all around the baithi chawl alleys, often situated in open areas. These places are spaces to pay respect to the gods but also to meet the community, to show that you are pious and committed and fitting within the group.



COMMUNAL ALLEYS

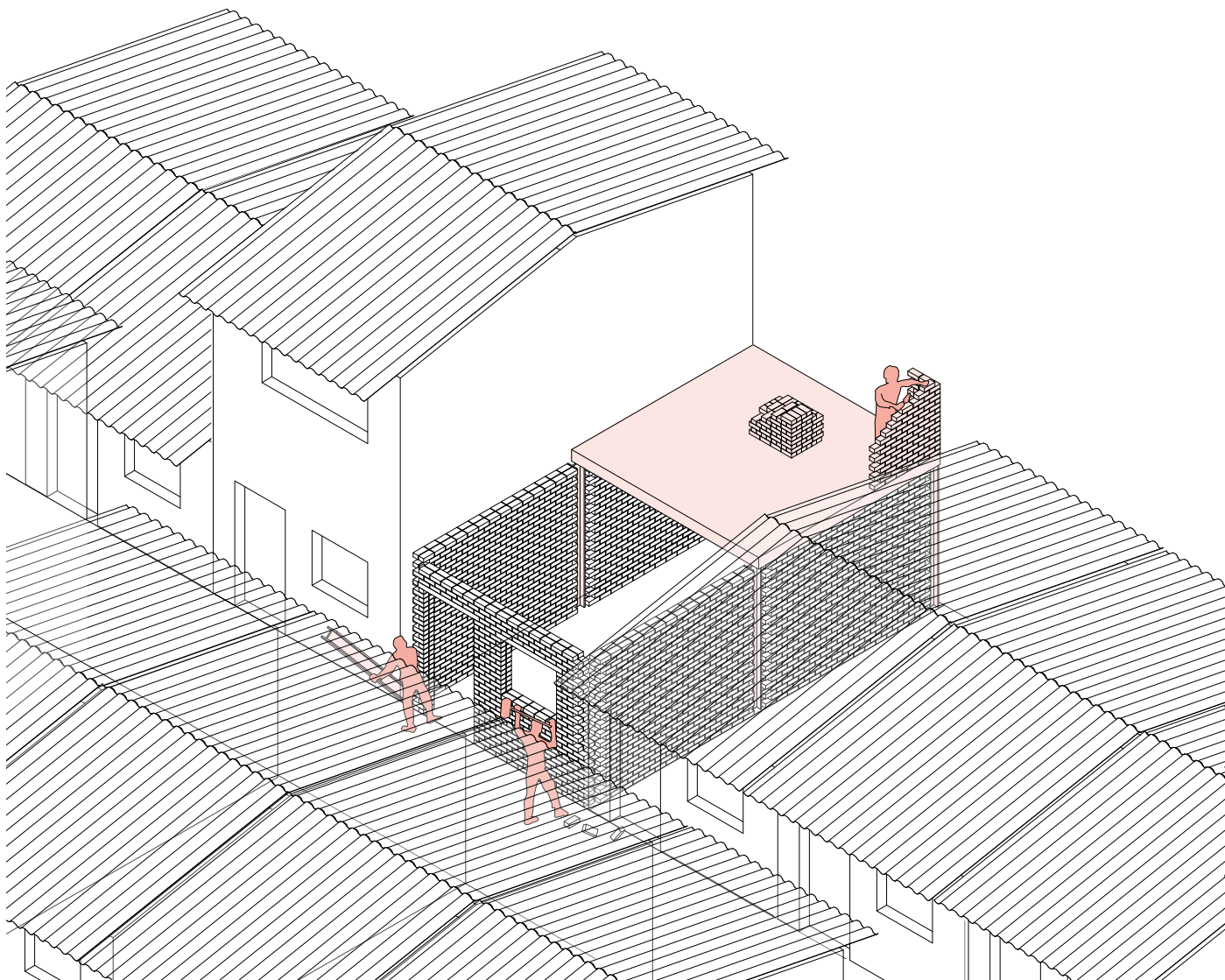
social spaces

The communal alley is, although its a cramped space, a very lively social area. This is where the private lives of the dwellers meets the public sphere and where family, friends and neighbours meet each other. It is a very important space for the community to bond and to discuss important matters. People sit in front of their houses or stand in door openings chatting with oneother.



BAITHI CHAWL CONSTRUCTION PROCESS building techniques

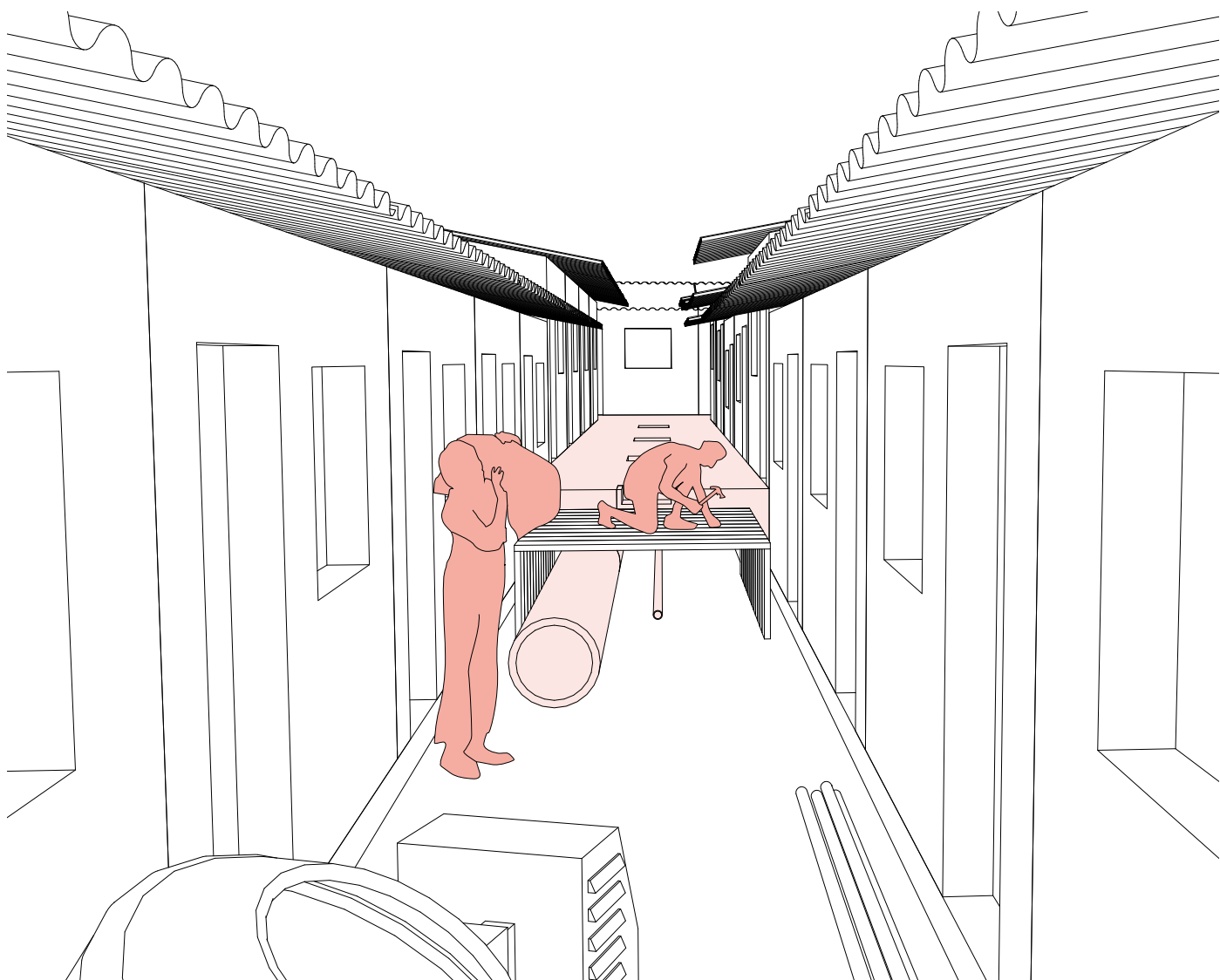
The units of the baithi chawls are constructed by the same contractor or developer and grouped in clusters of approximately twenty parts. The walls are made of brick after which the exposed sides are covered with a layer of cement to protect the bricks from rainwater. After this small steel beams are layed upon the wall to support the roof made of corrugated steel.



VERTICAL UNIT EXTENSIONS

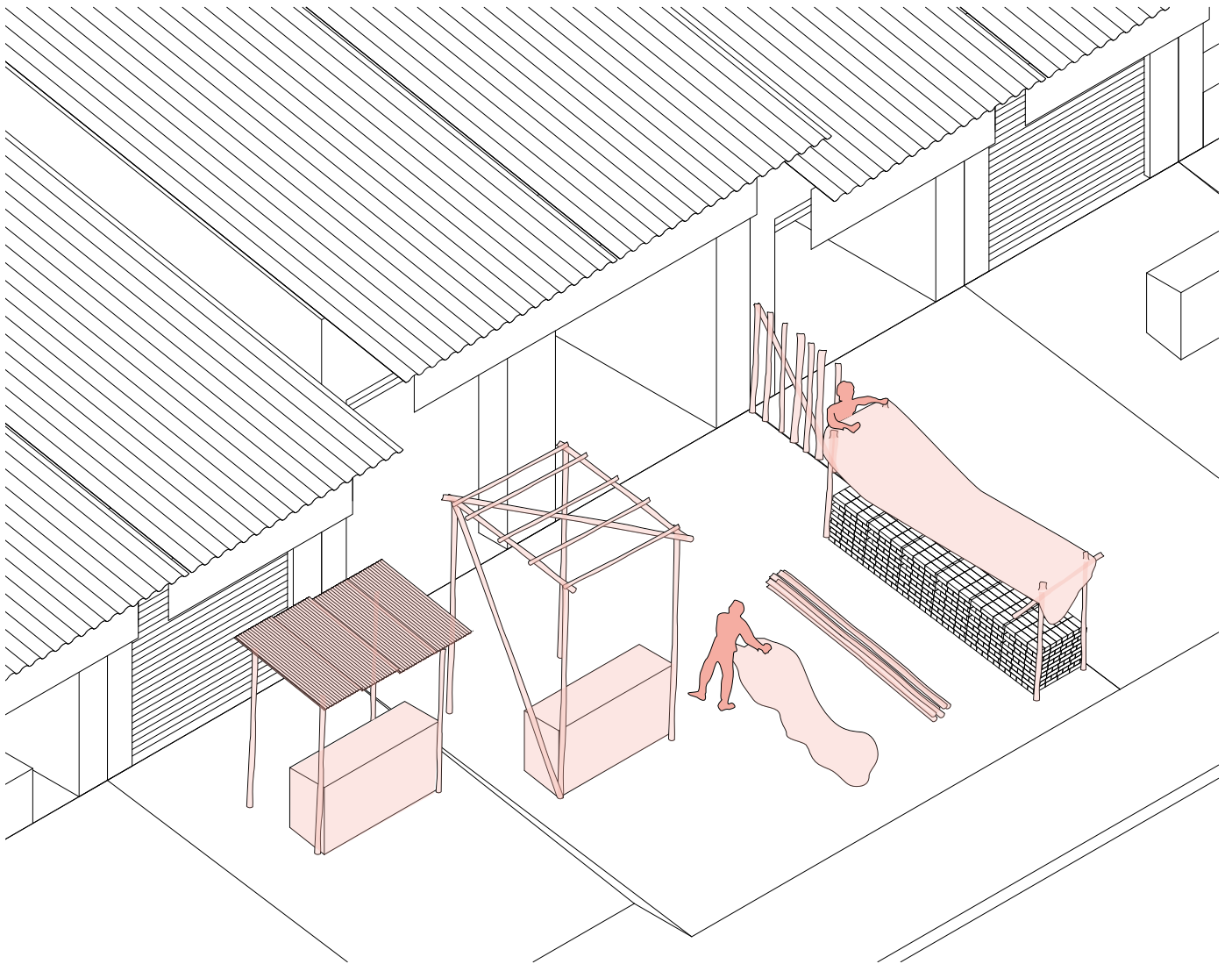
building techniques

In some cases the units can individually be extended with a second floor on top of the existing structure. The load bearing structure exists out of steel beams that are placed in voids that are cut out of the brick. On top of this construction a new concrete slab is cast after which brick walls clad with cement are used for infill.



ELEVATED FLOOD PREVENTIVE PATHS building techniques

Due to the high water level in the monsoon period some Baithi Chawl societies have elevated their communal path in order to prevent flooding. This concrete construction is next to preventing floodings also supplying a common water and drainage system for the adjoining houses. Some of these houses have been raised afterwards to level again with the path when the owners had enough money.

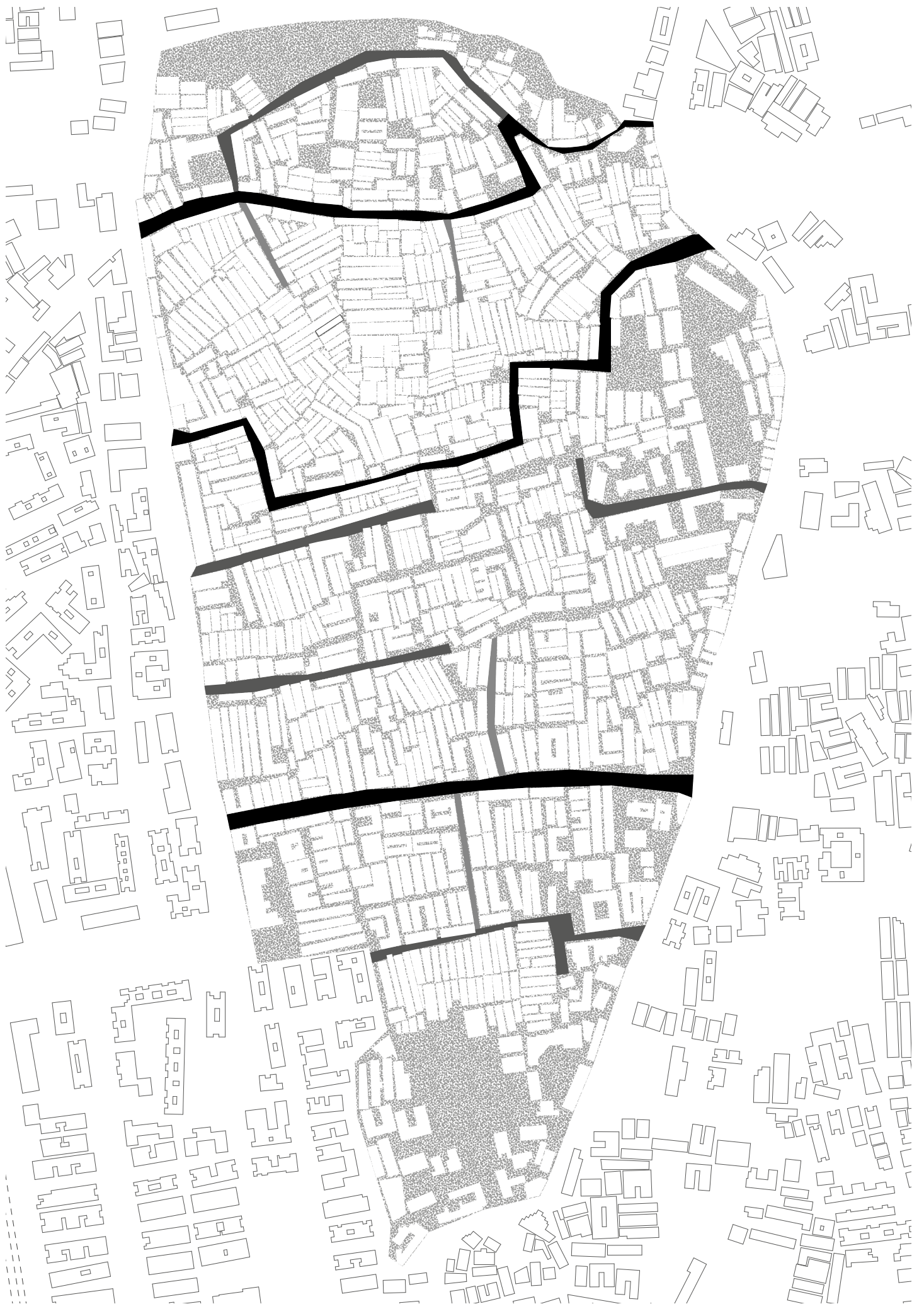


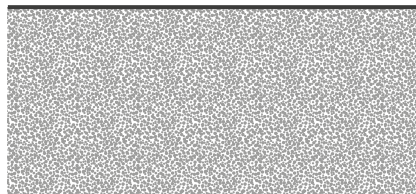
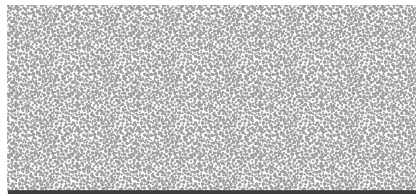
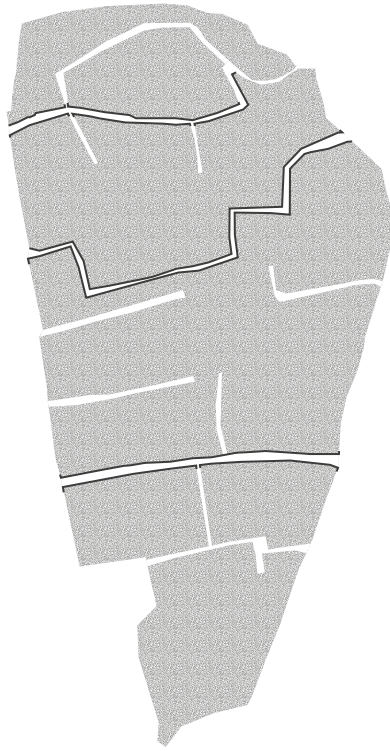
EXTERIOR BUILDOUT building techniques

The local shops and industrial ghalas appropriate some of the exterior space in front of the unit with secondary structures. These structures have different functions: sometimes they serve as a reception desk, as a cover for goods or to mark the border between two units. The used material are wooden or bamboo sticks or small steel beams covered by a plastic canvas or corrugated steel or plastic sheets. The desks are made of wood or sometimes cast in concrete.

URBAN STRATEGY

redevelopment approach and goals

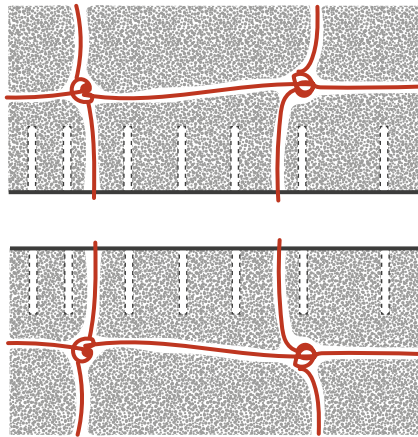
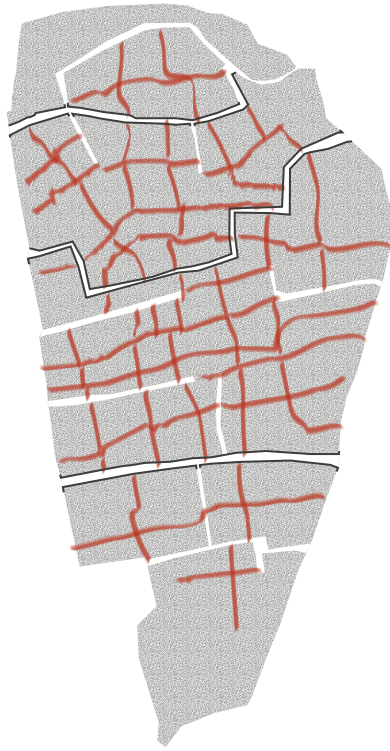




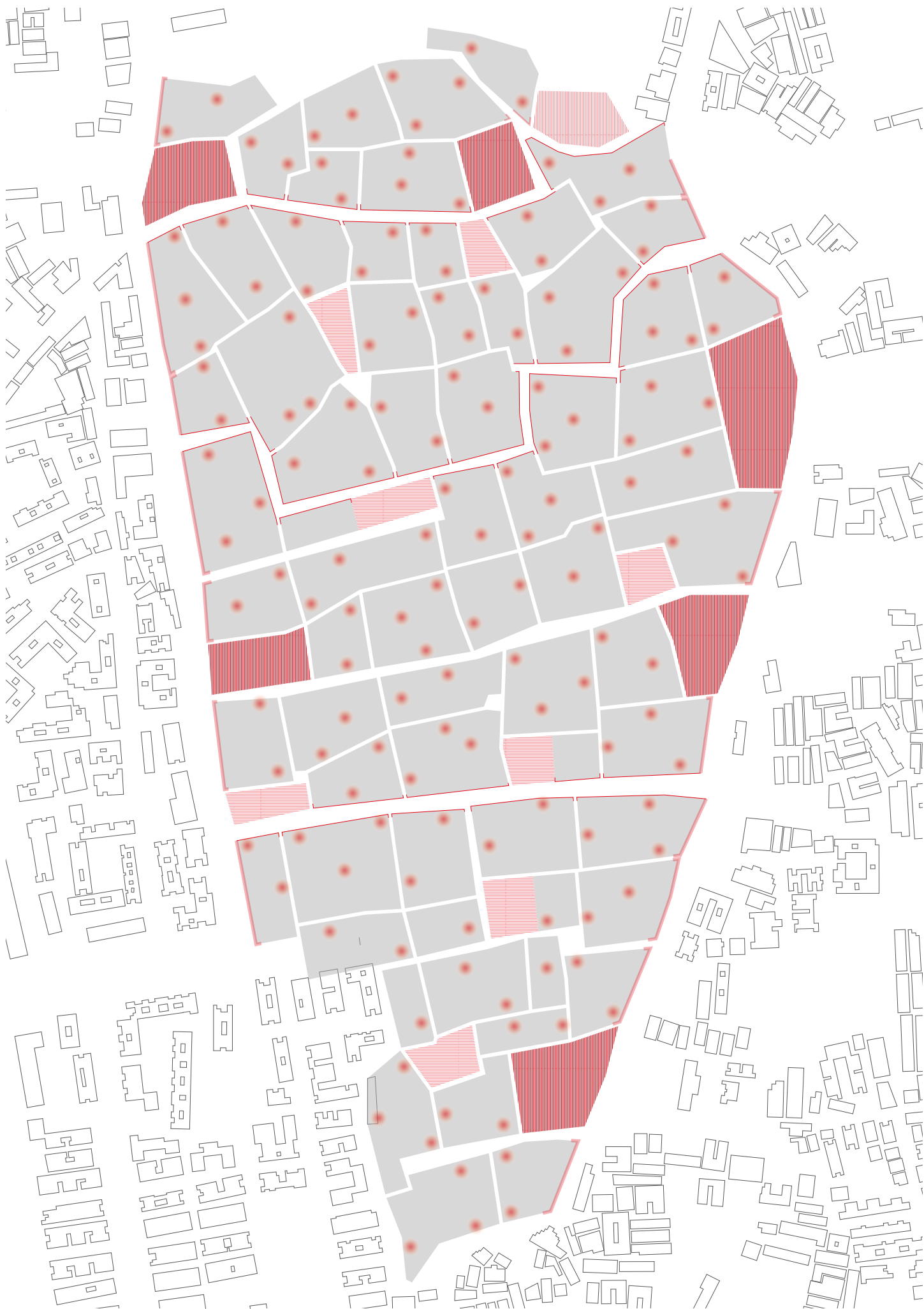
ANALYSIS OF THE EXISTING URBAN FABRIC Rahmat Nagar area

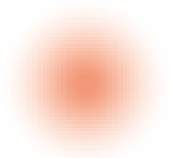
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CREATING CONNECTIONS IN THE URBAN FABRIC
the community spine

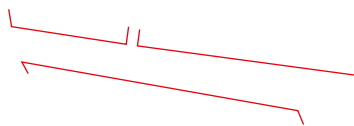




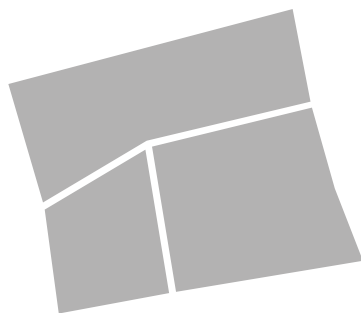
integration of amenities



bigger amenity cluster



preserving of commercial plinth

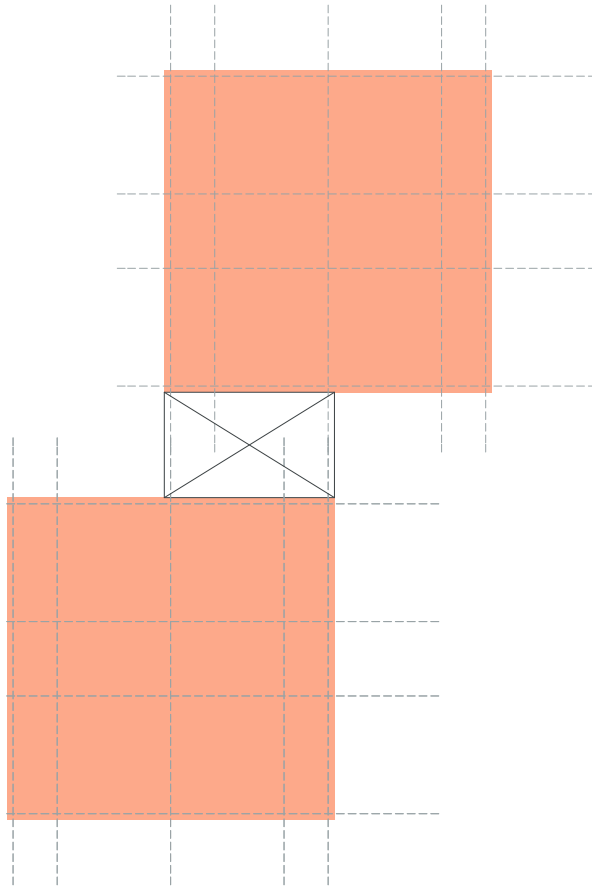


creating secondary connections

URBAN STRATEGY
Rahmat Nagar area

THE DESIGN

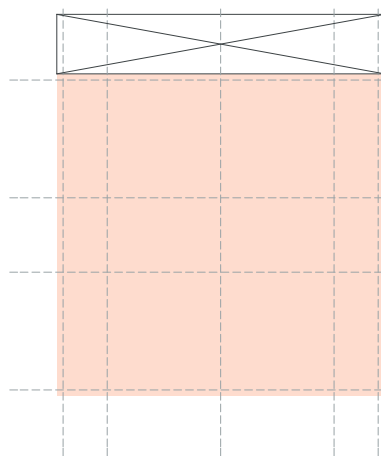
type and redevelopment approach



CLUSTER

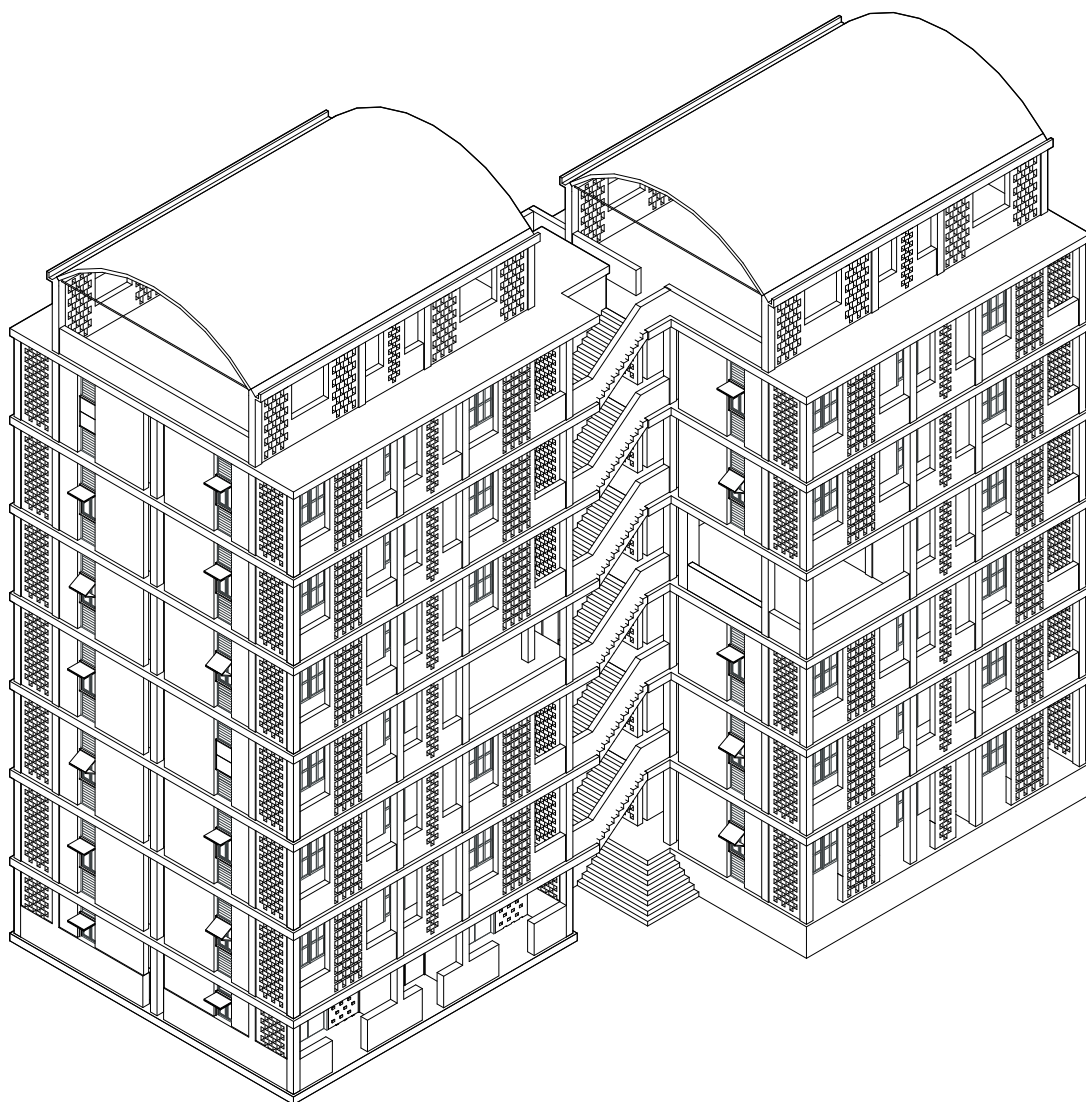
48 units

150m² amenities



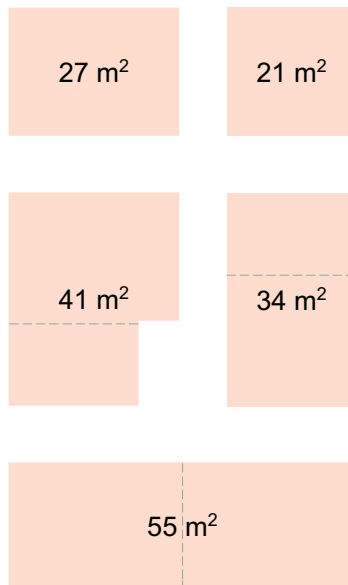
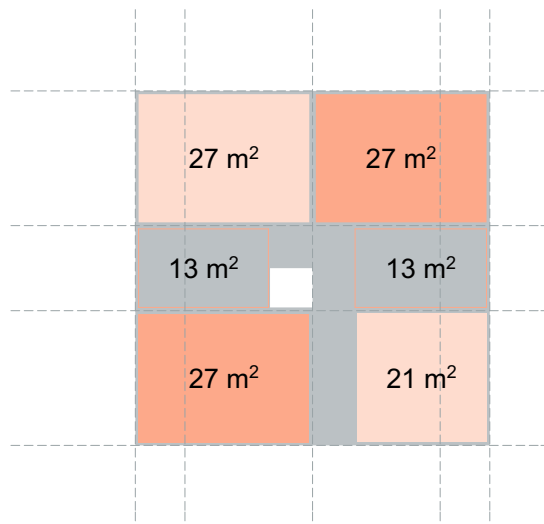
SEPARATE

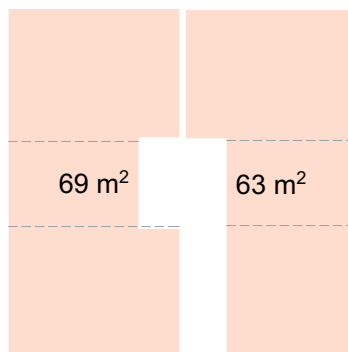
12 maisonette units

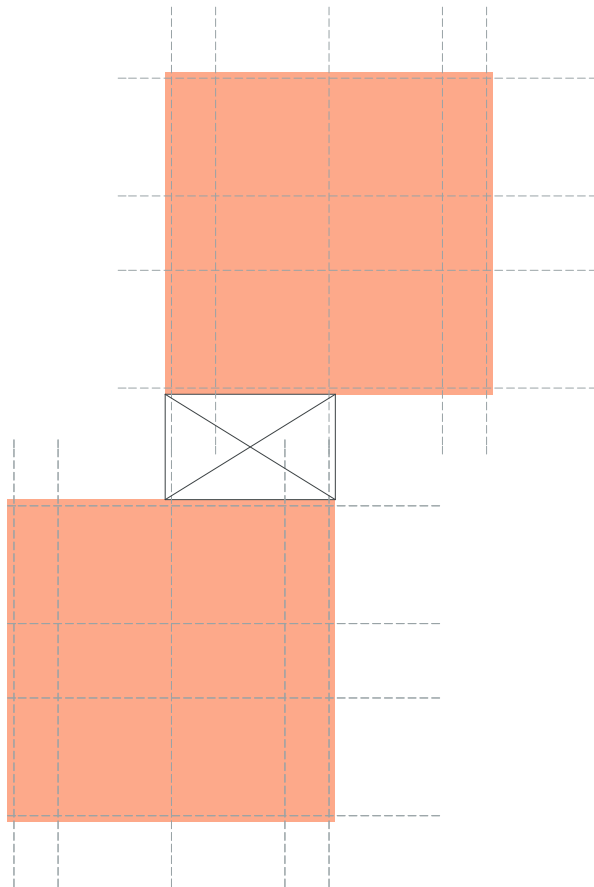


THE CLUSTER

2 towers with a shared circulation system



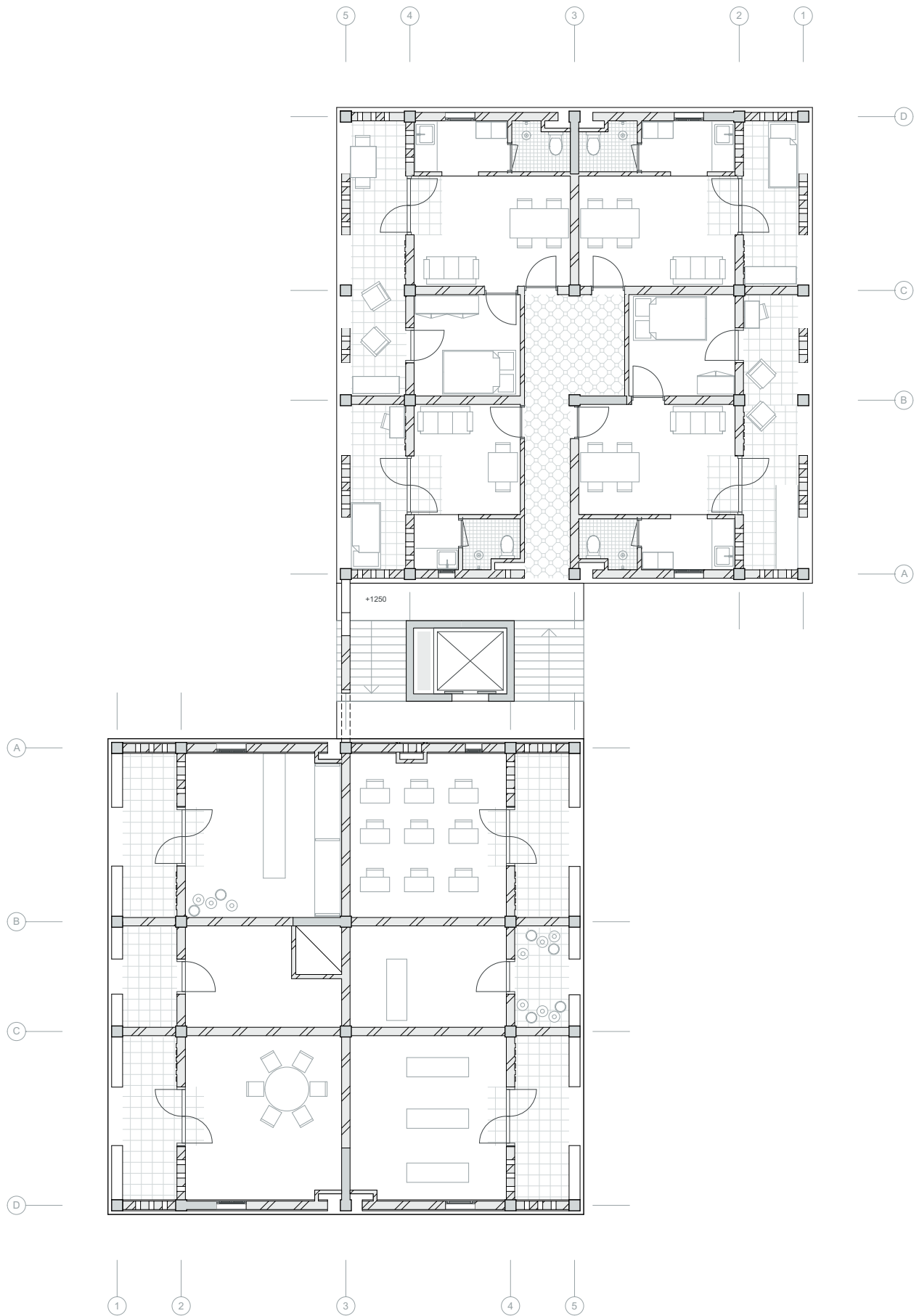




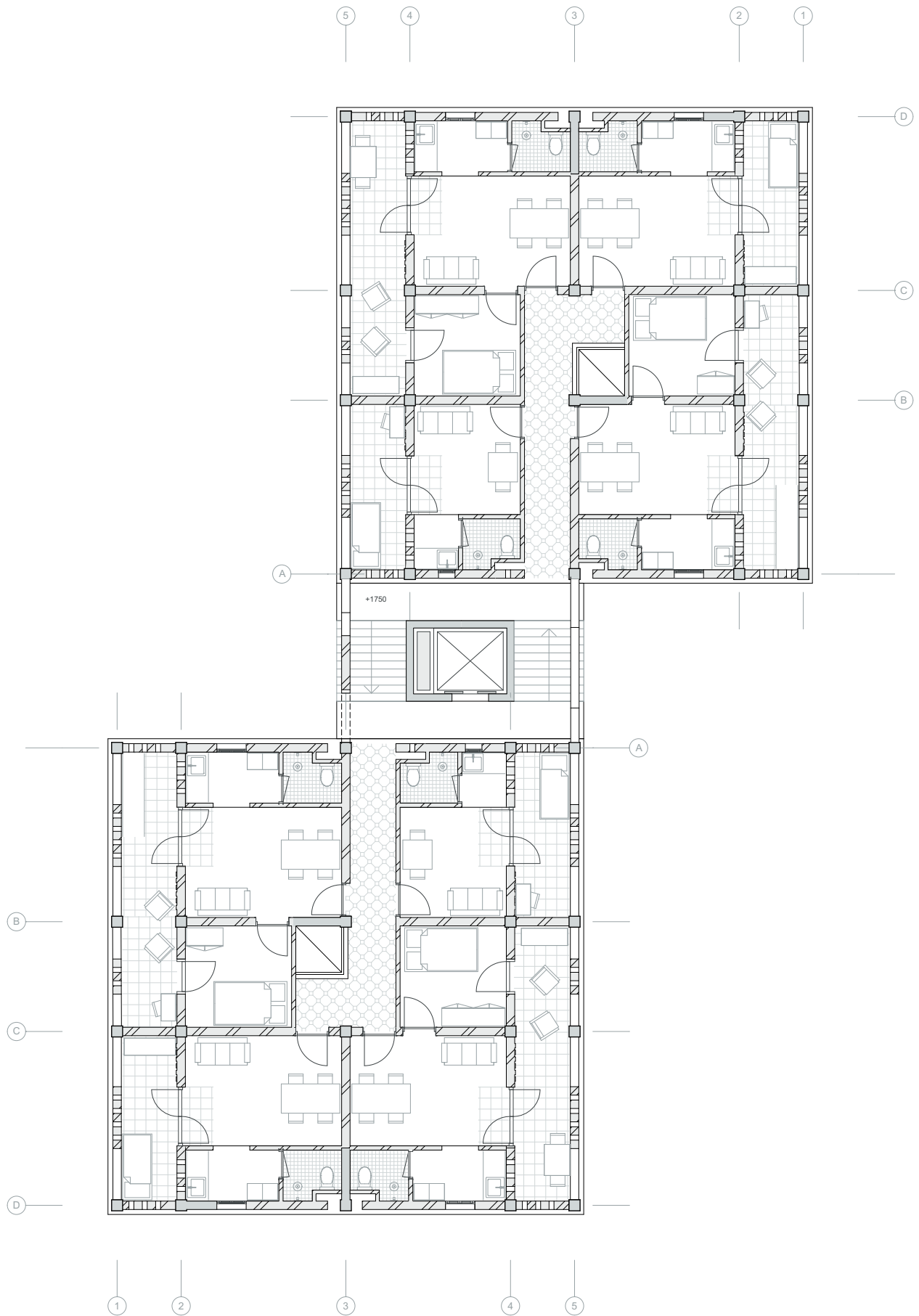
CLUSTER

48 units

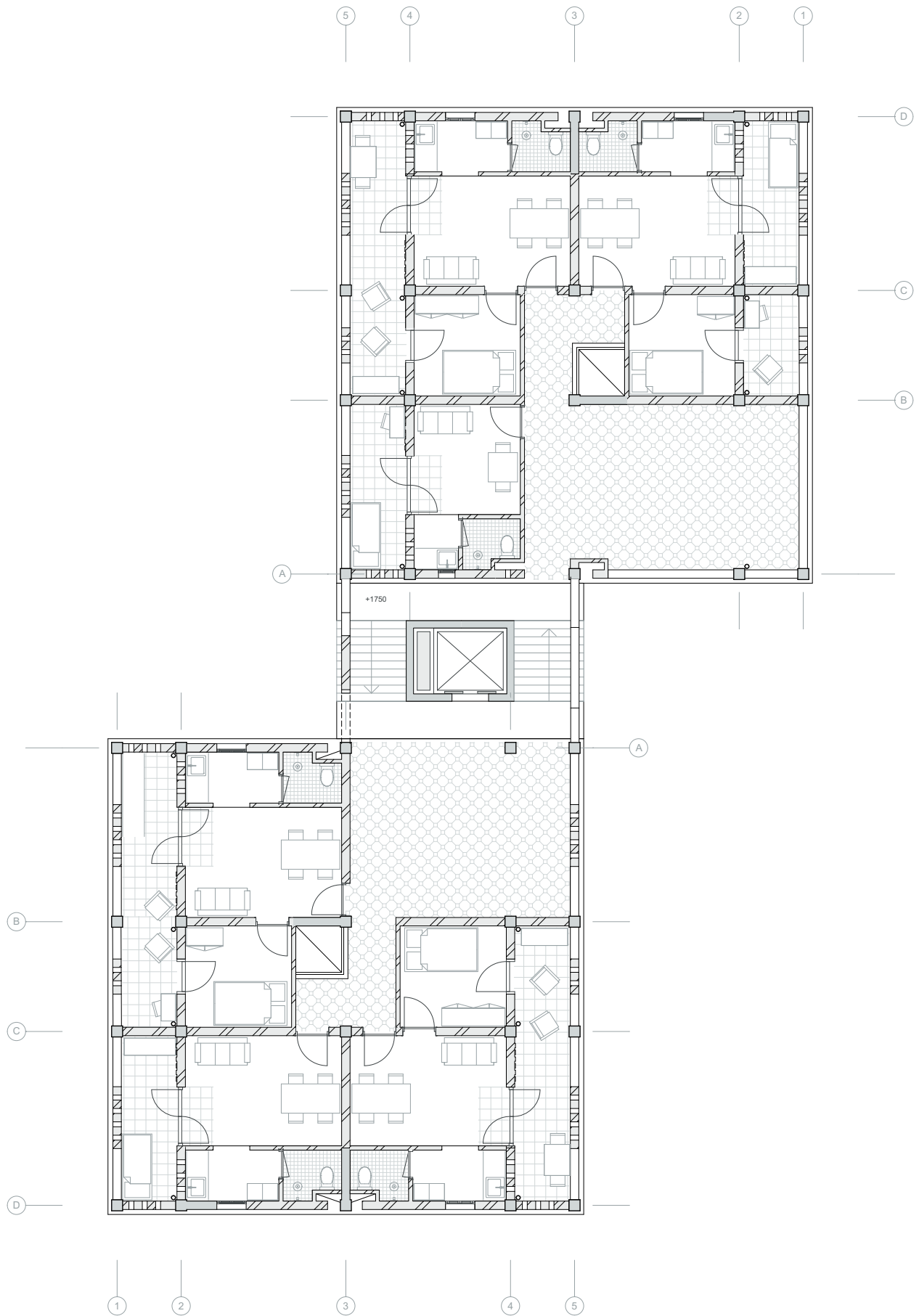
150m² amenities



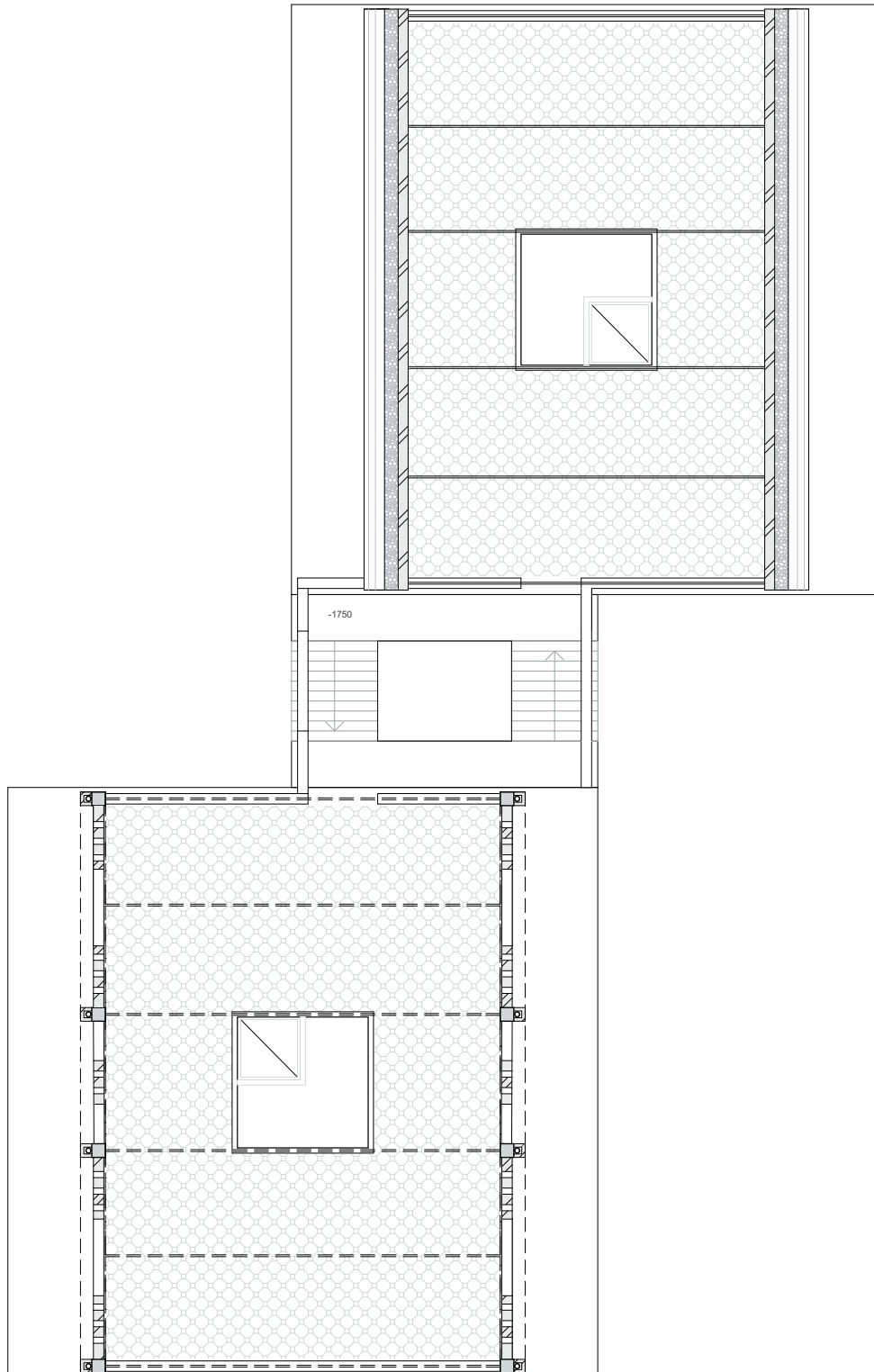
GROUND FLOOR
1:150



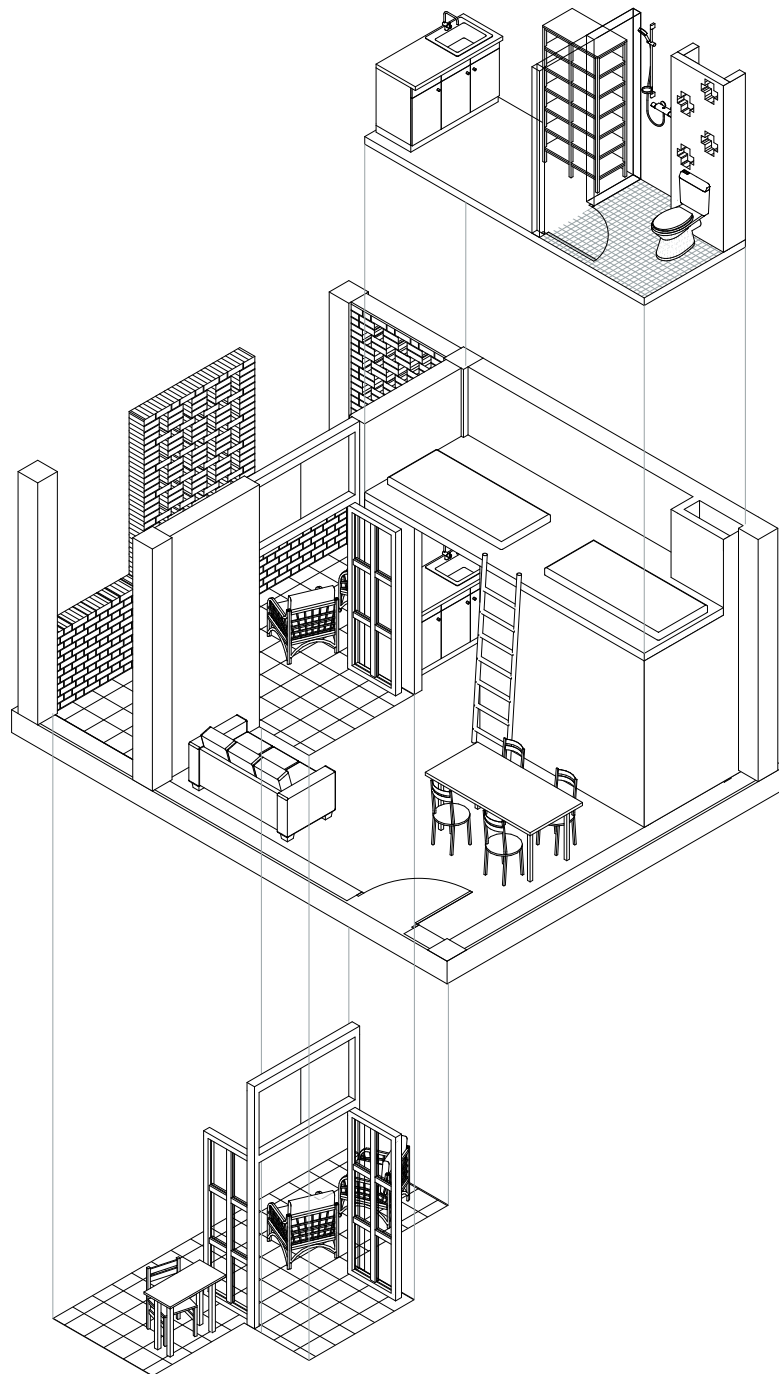
AVERAGE FLOOR
1.150

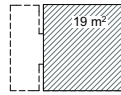
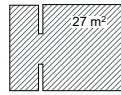


GF + 3
1:150



ROOF TERRAS
1:150

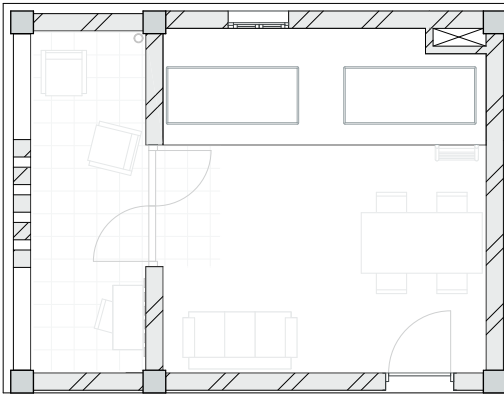




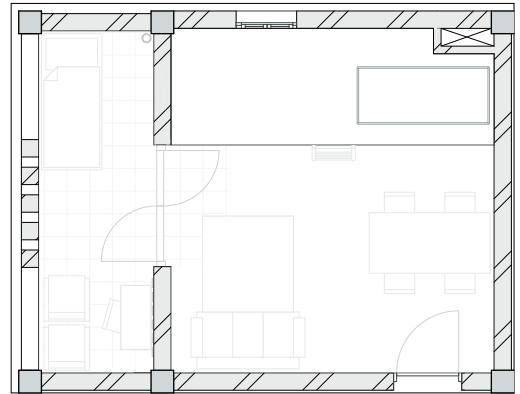
dry season

monsoon season

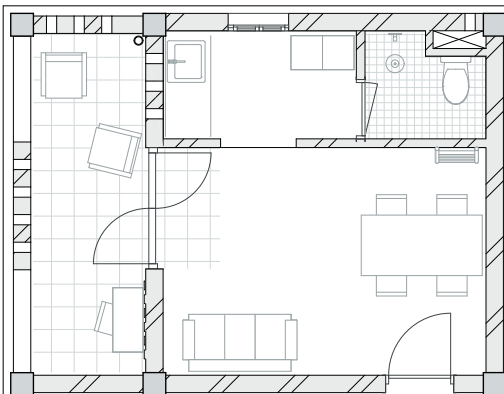
usable space



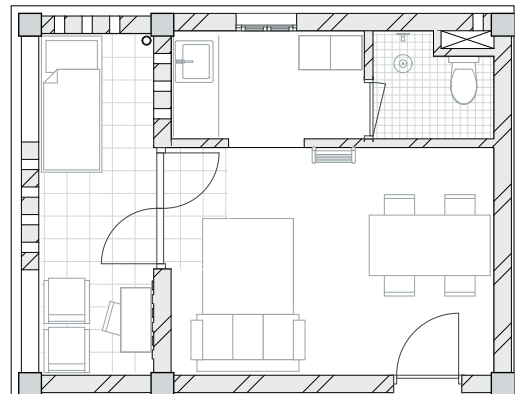
loft



loft



main floor



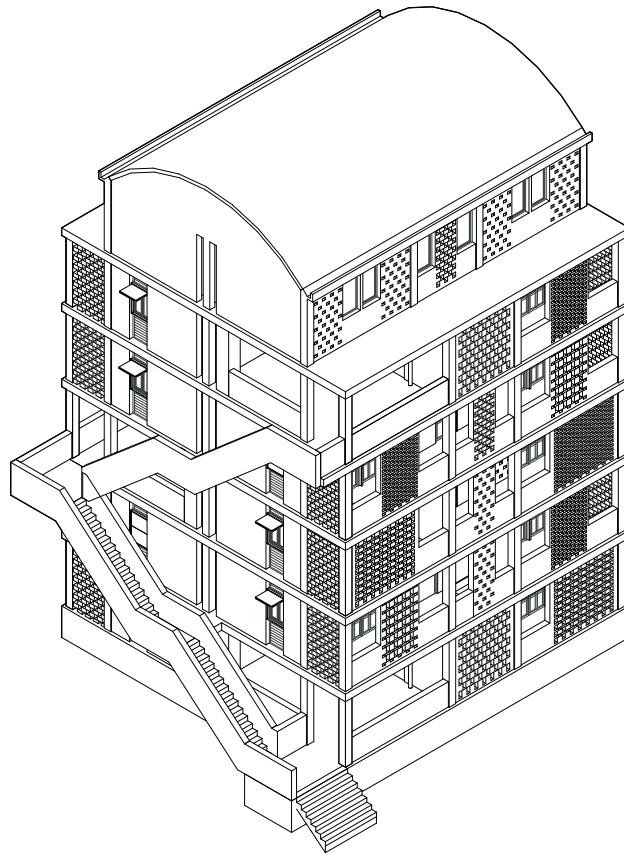
main floor

use of space // daytime

use of space // nighttime

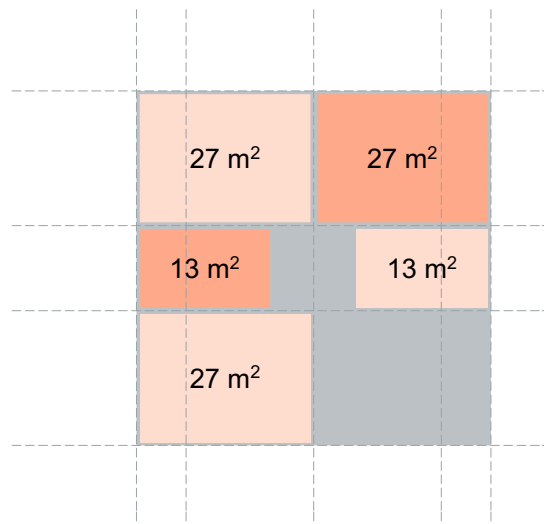
THE UNIT the basic unit

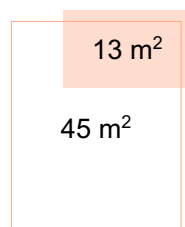
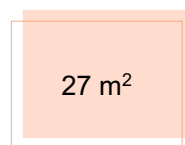
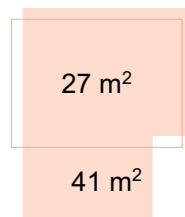
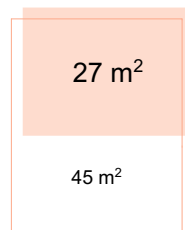
The units of the cluster block are very small. they vary from 20 to 41 m². therefore the use of the space can be multifunctional. shown here is the most basic unit and its use of the space during daytime and during nighttime. this basic unit can be extended with a 13 square meter room, which can serve as an extra bedroom. But even without a family of four can live in comfort in this apartment of 27m²

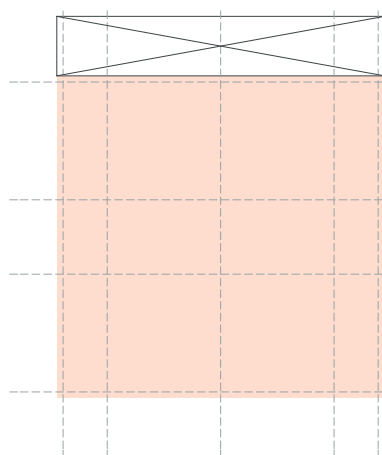


SEPARATE

a stand alone building with maisonette dwellings

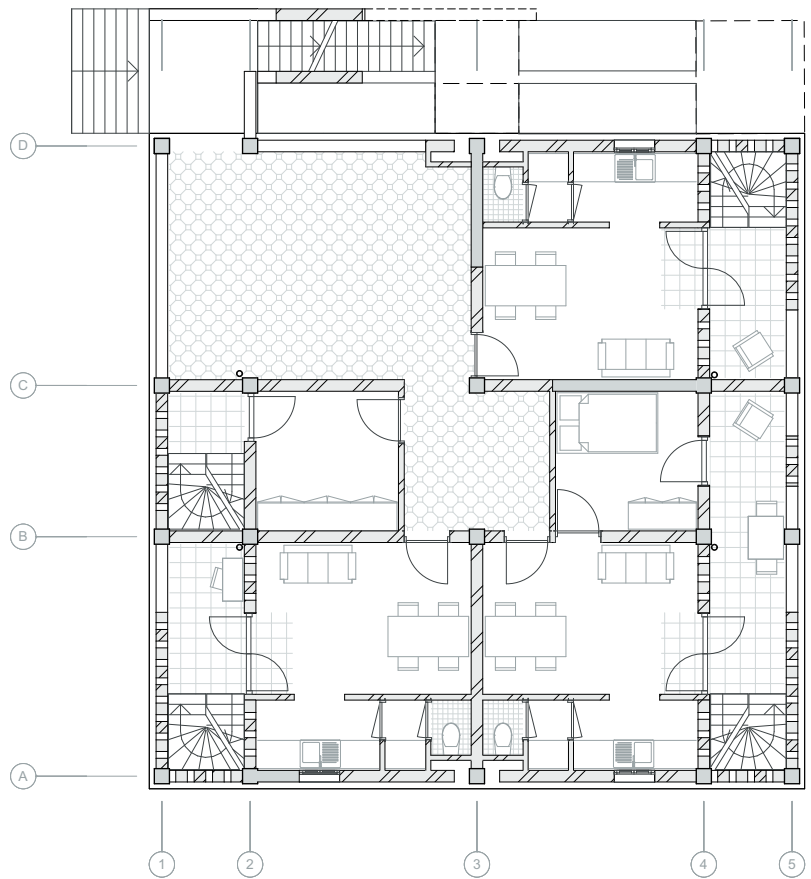






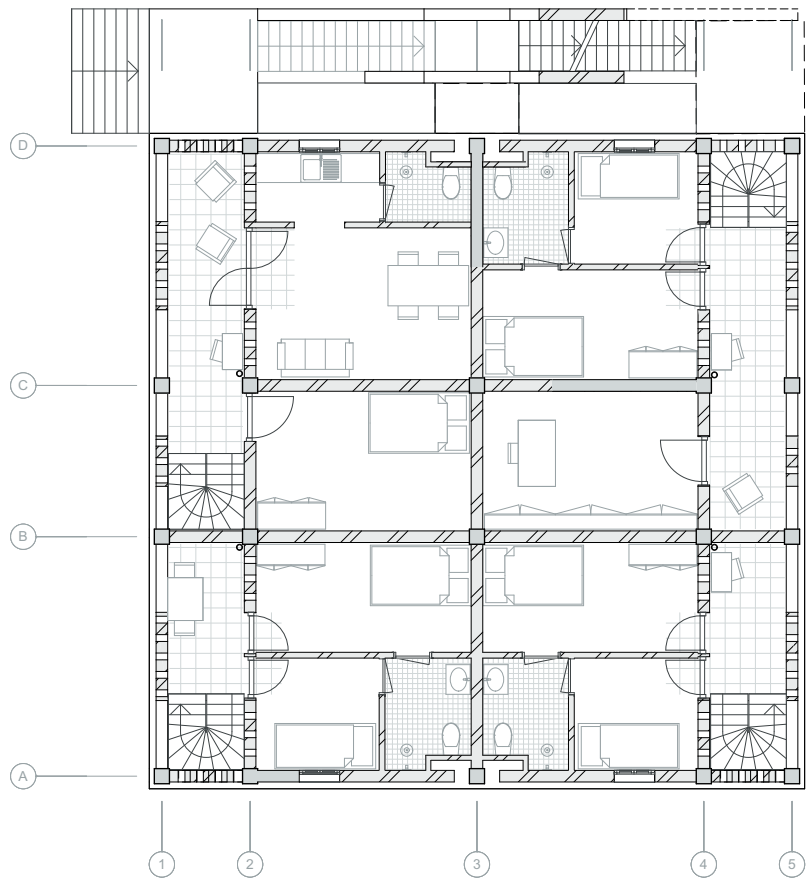
SEPARATE

12 maisonette units



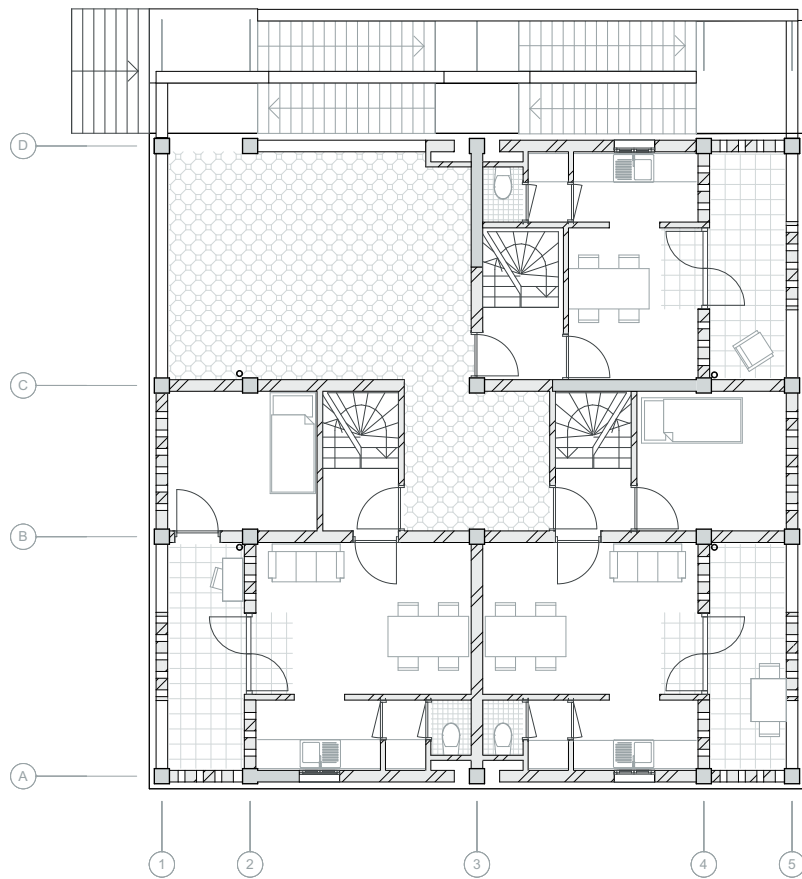
GROUND FLOOR
1:150

GF+2 has same layout, only mirrored

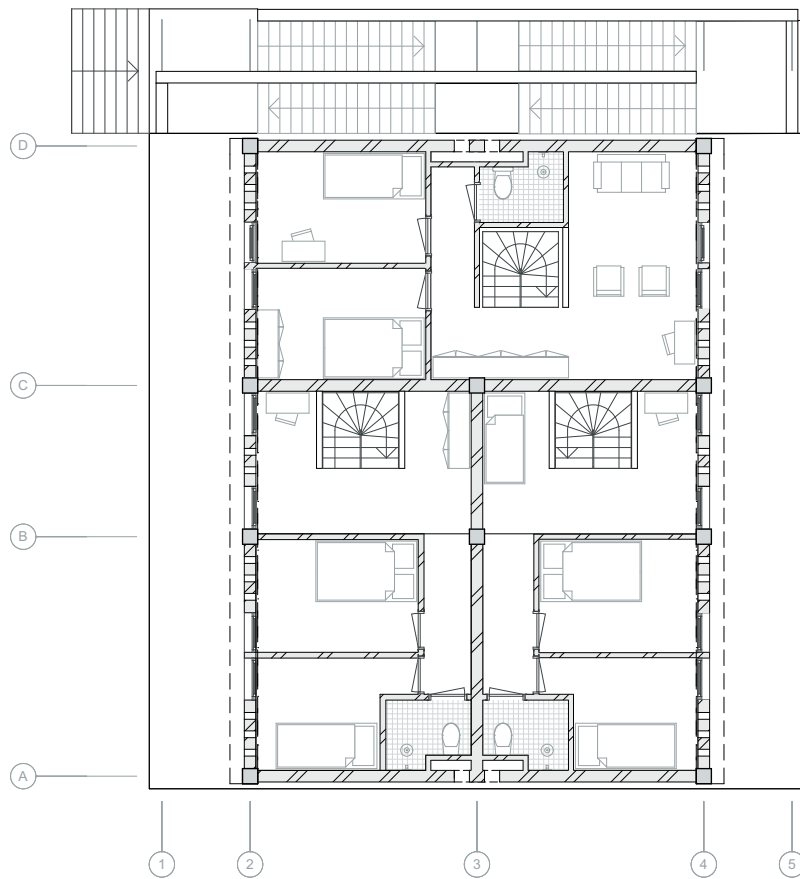


GF + 1
1:150

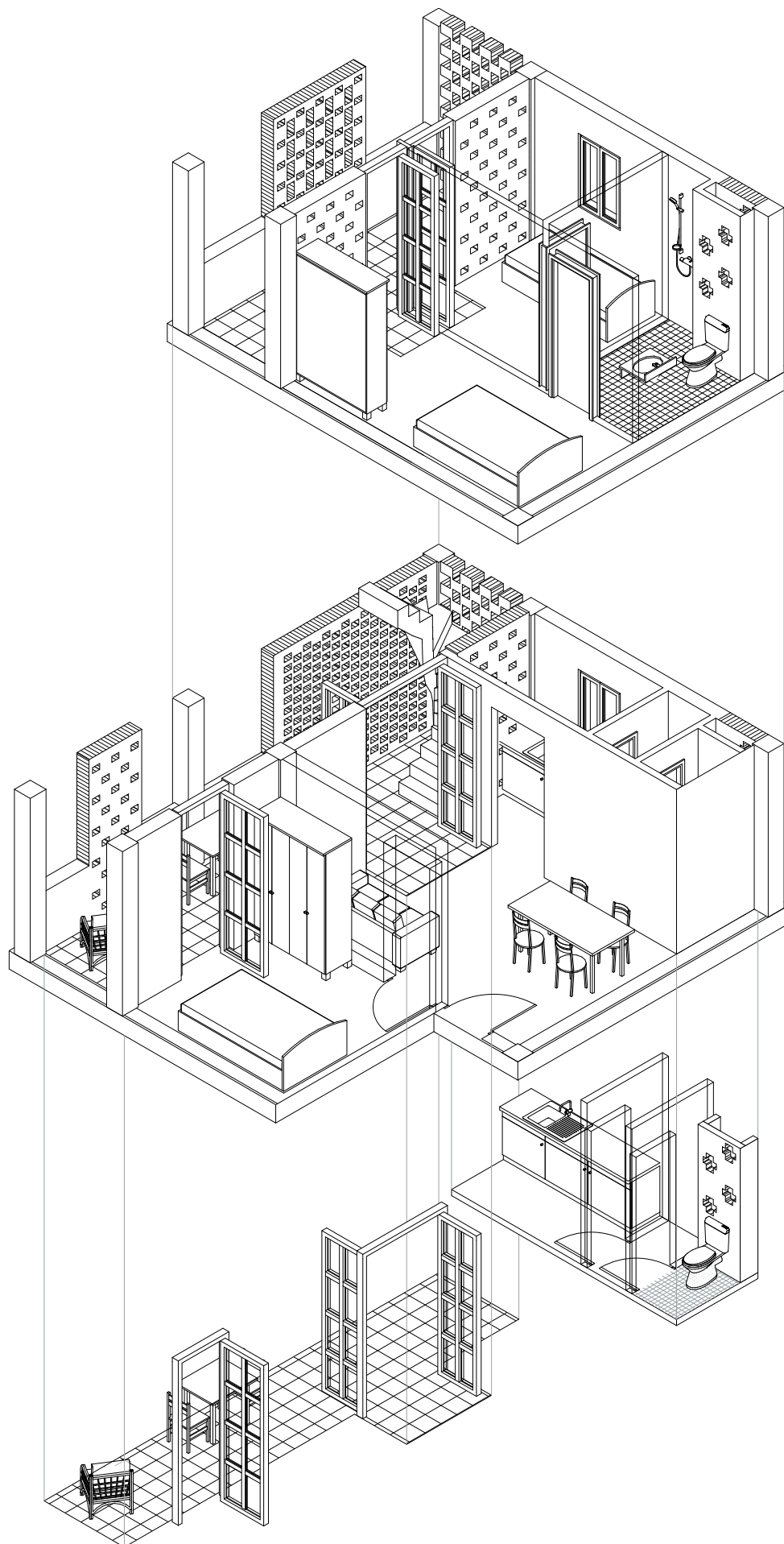
GF + 3 has same layout, only mirrored

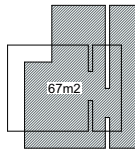


GF + 4
1.150

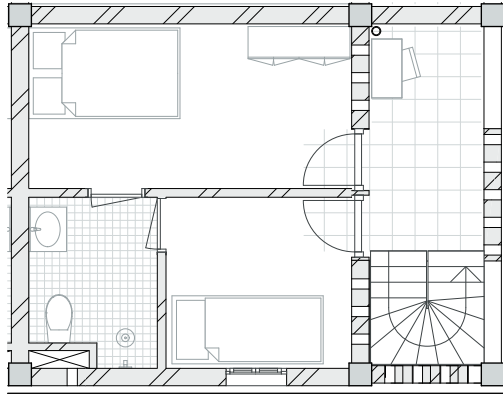


GF +5
1.150

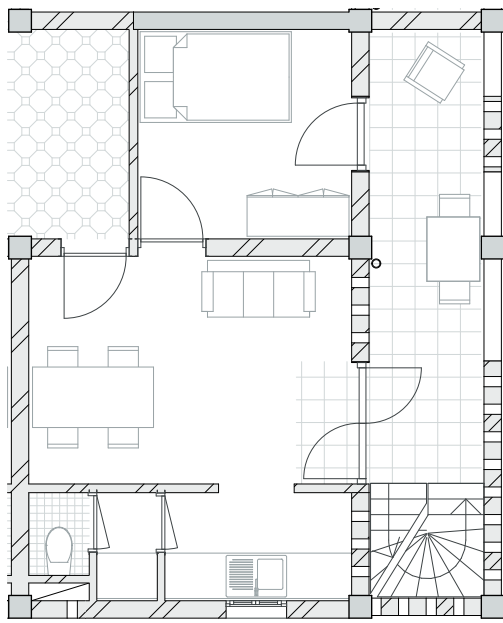




usable space



upper floor



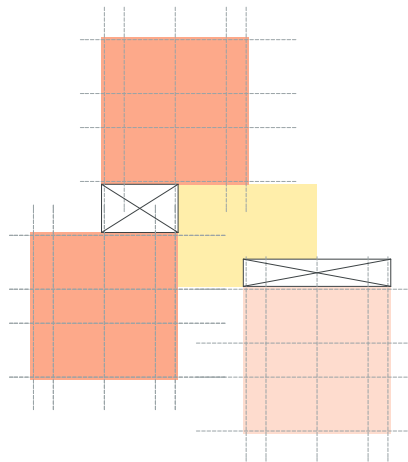
main floor

use of space

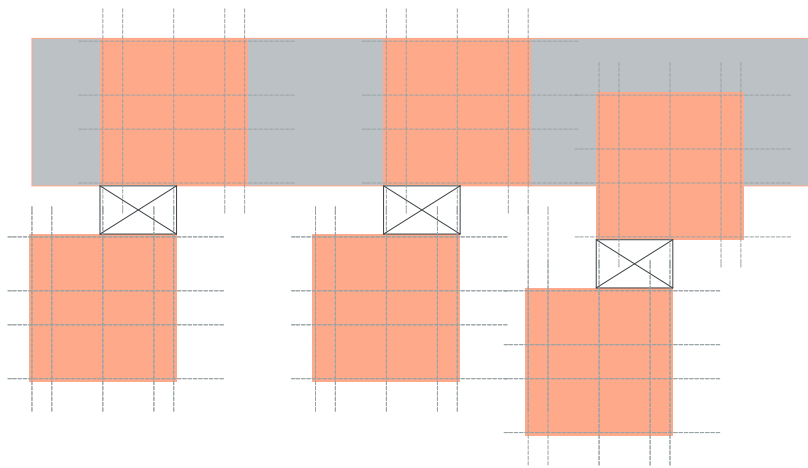
THE UNIT
the maisonette unite

In the separate building, the units are all maisonette units. they vary from 67m² to 73 m². As these units are bigger they all have at least one separate bedroom, and often even two. The verandah functions as a corridor to access these different rooms and to get from the lower level to the upper level.

CLUSTERING PRINCIPLES



THE COMMUNITY CLUSTER
one separte and one cluster

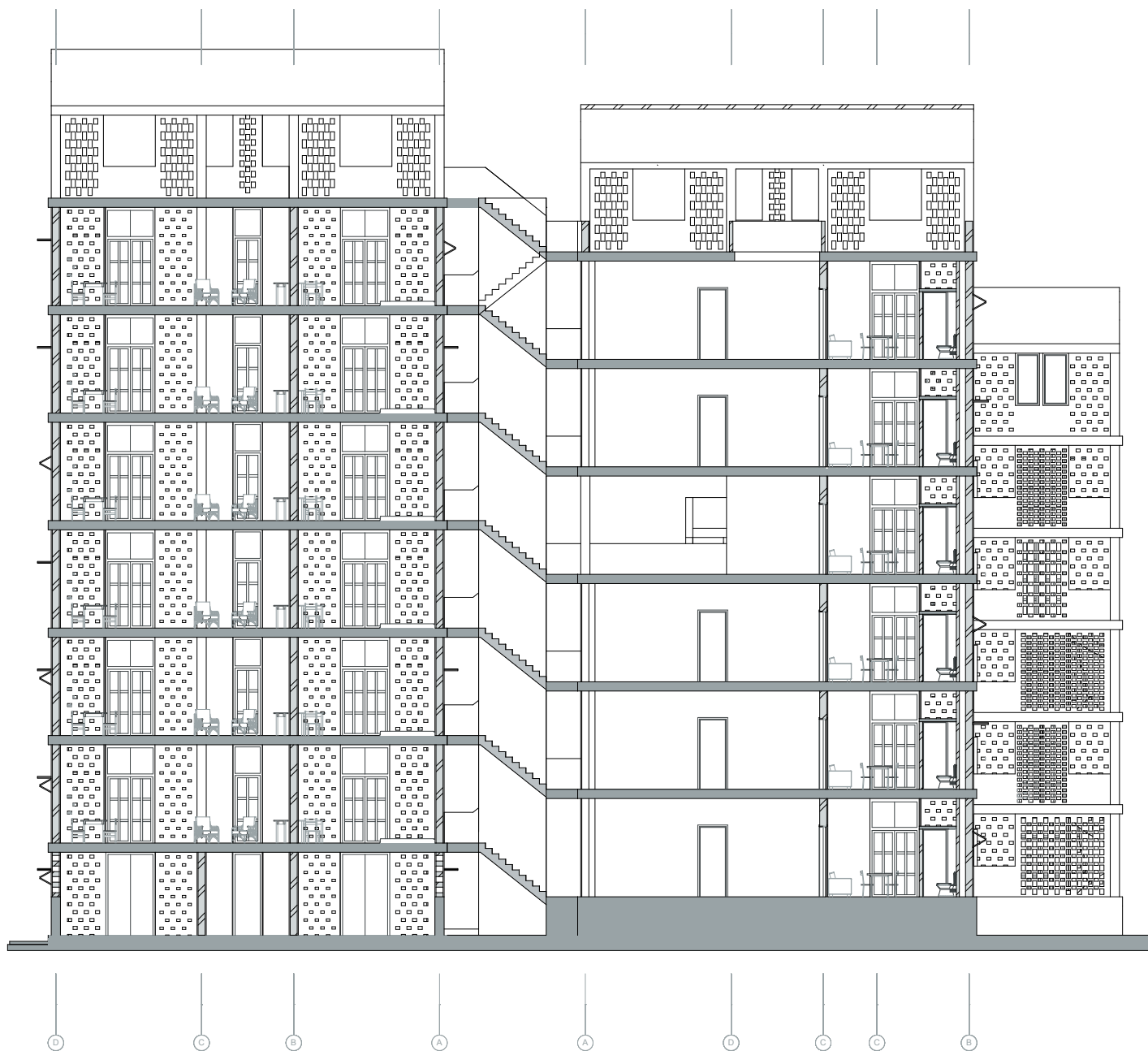


COMMERCIAL PLINTH
one story plint + clusters





SECTION II
1.200



SECTION III
1.200



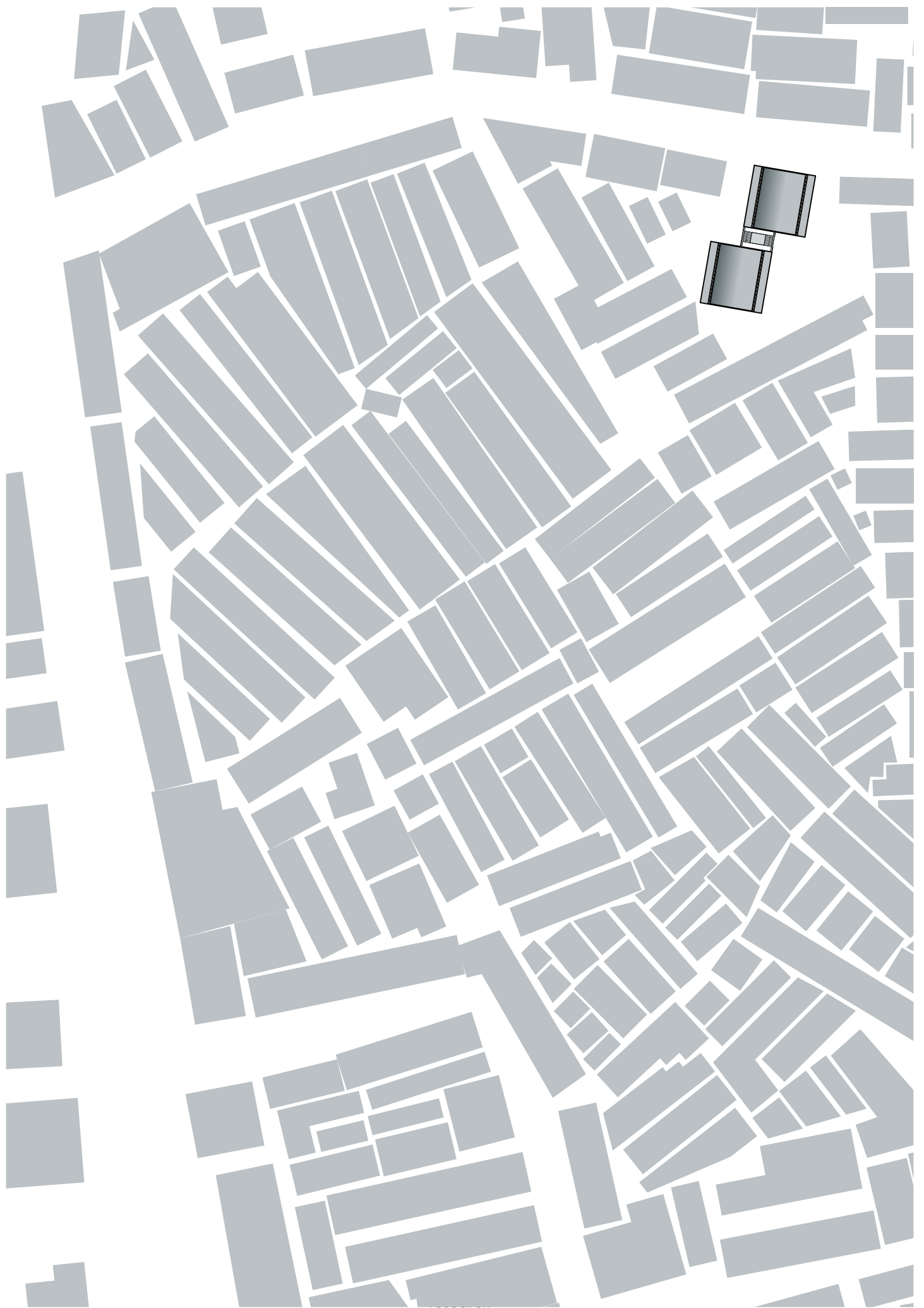
COMMUNITY CLUSTER

axo

URBAN LAYOUT

clustering
and
redevelopment approach





ONE CLUSTER

40 units

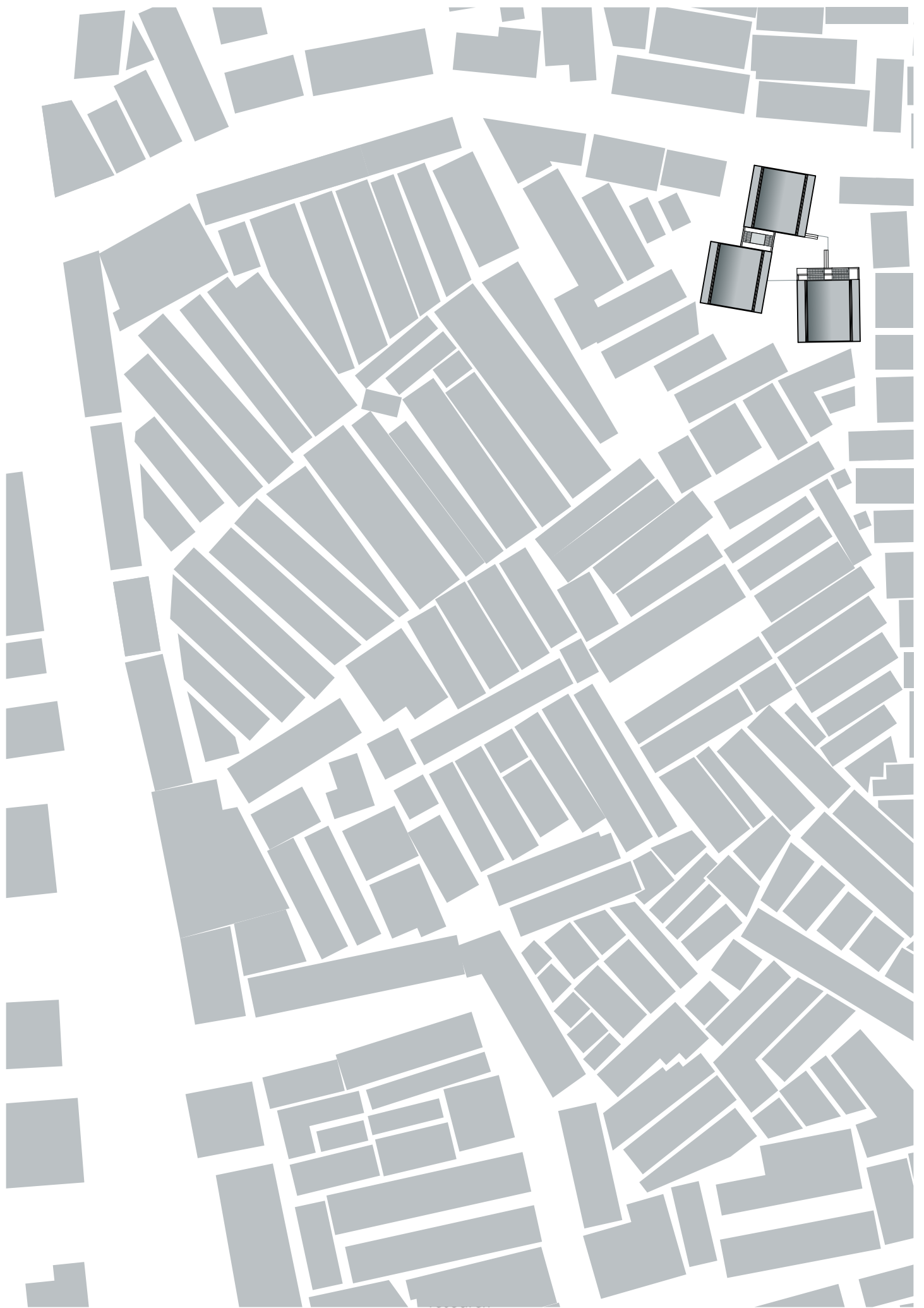
BENEFITS INHABITANTS:

improved living conditions

BENEFITS NEIGHBORHOOD:

-

-



ONE COMMUNITY

52 units

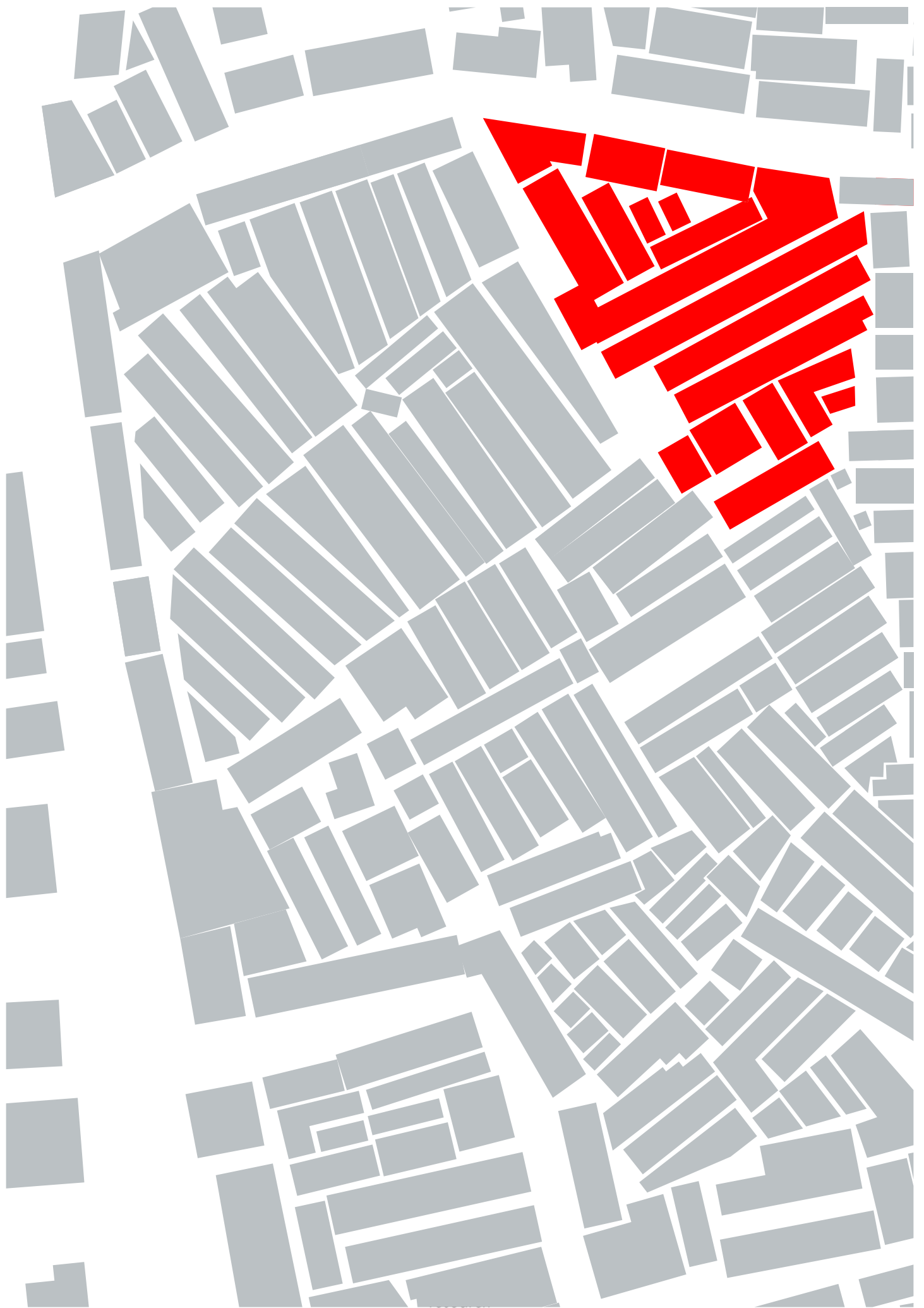
BENEFITS INHABITANTS:

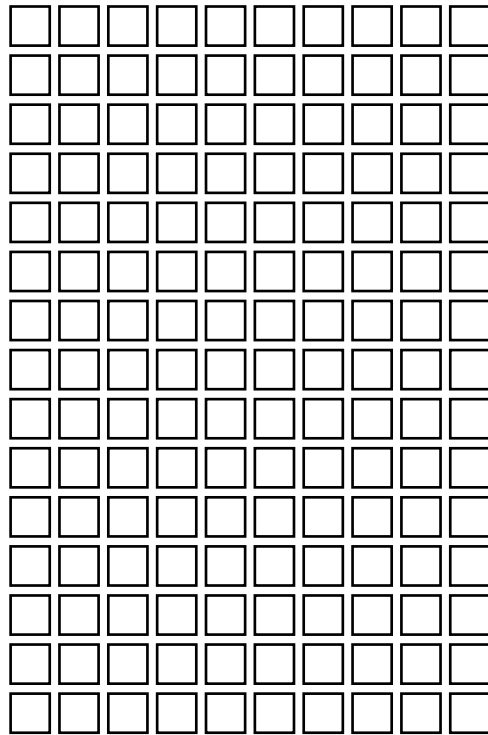
improved living conditions

small public space

BENEFITS NEIGHBORHOOD:

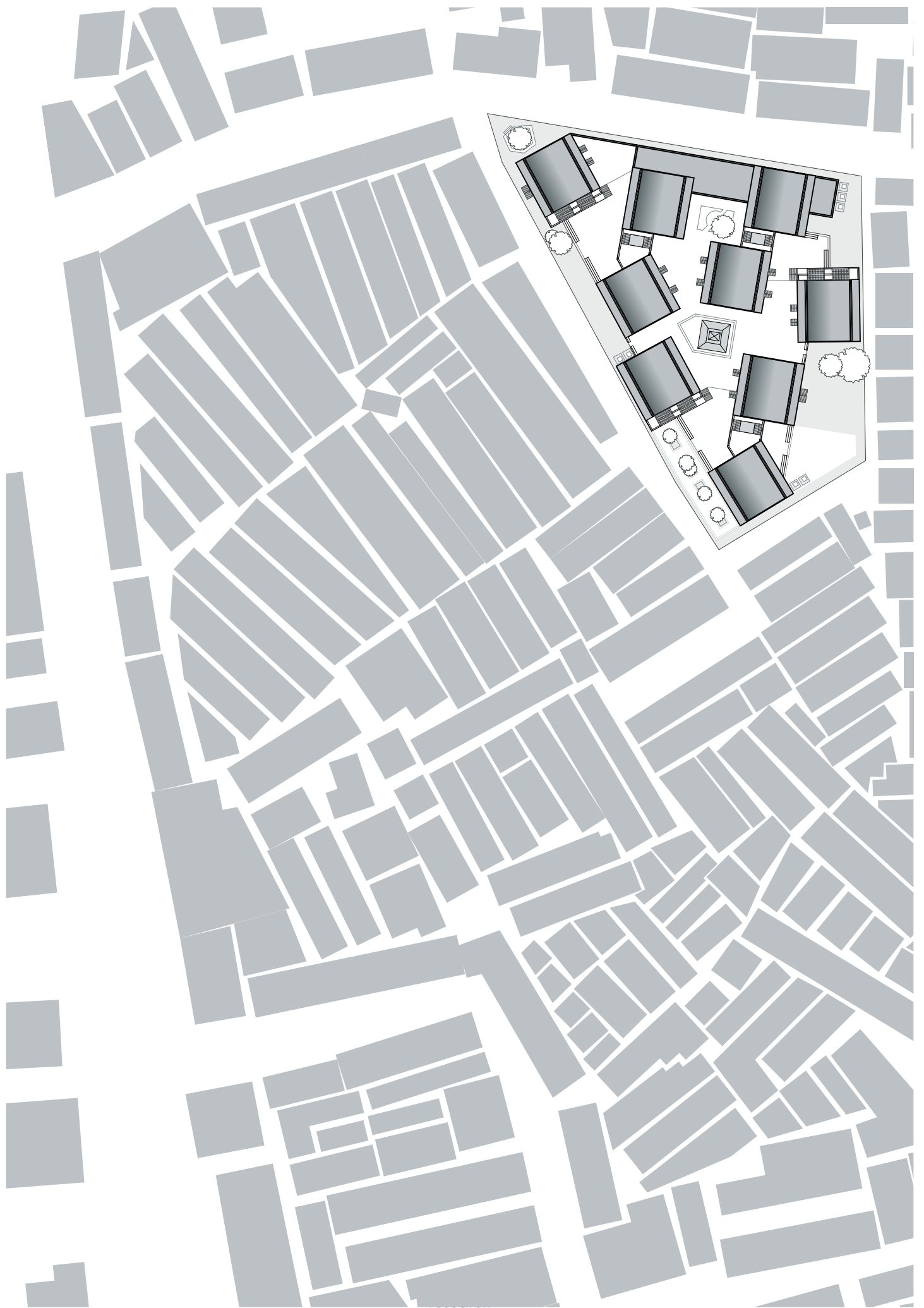
-





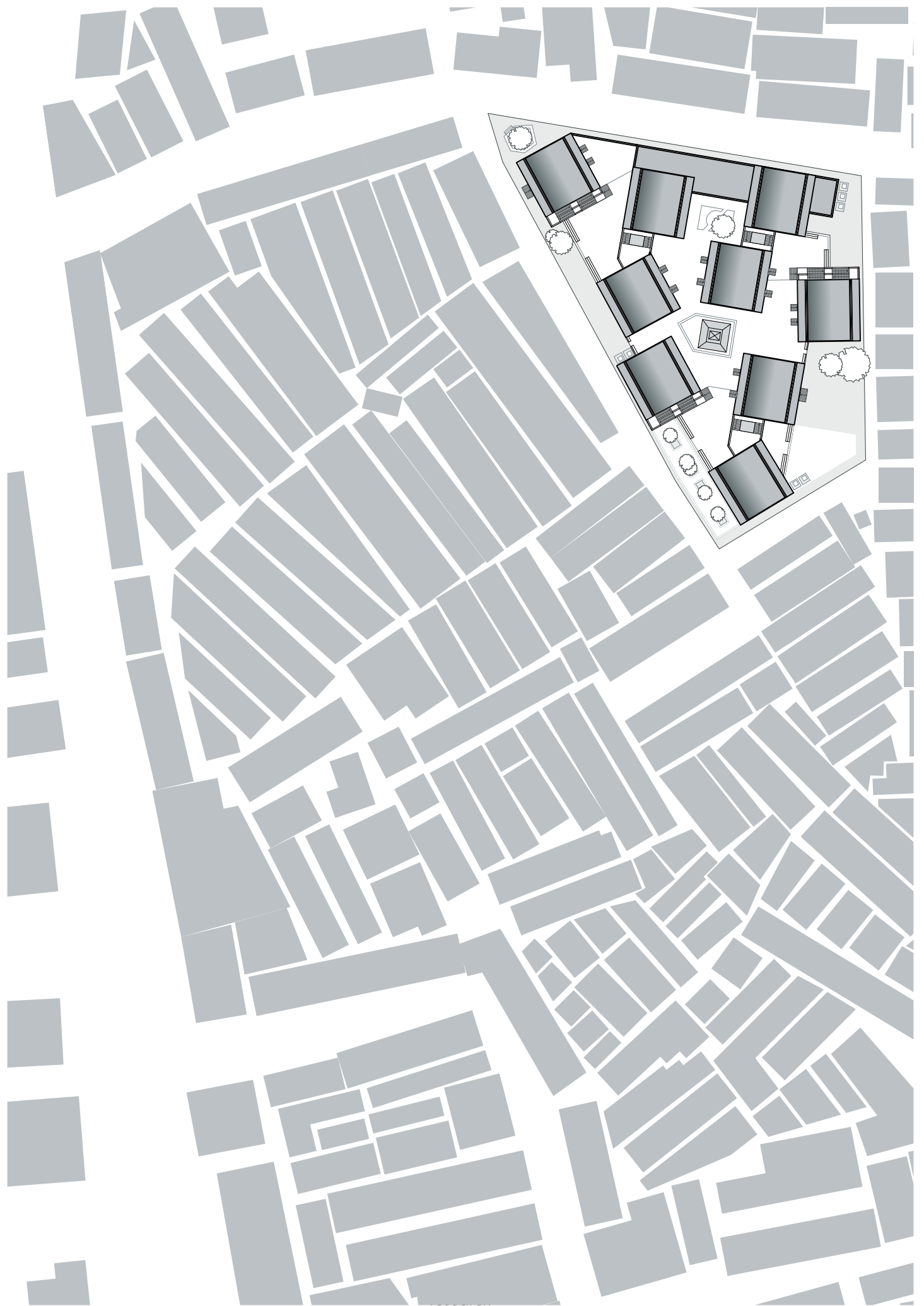
150 baithi chawl units







+ 36 MIG units



THE POCKET

180 units

BENEFITS INHABITANTS:

improved living conditions

system of public space

amenities

BENEFITS NEIGHBORHOOD:

improved infra structure
enables buildings sites more inward the area

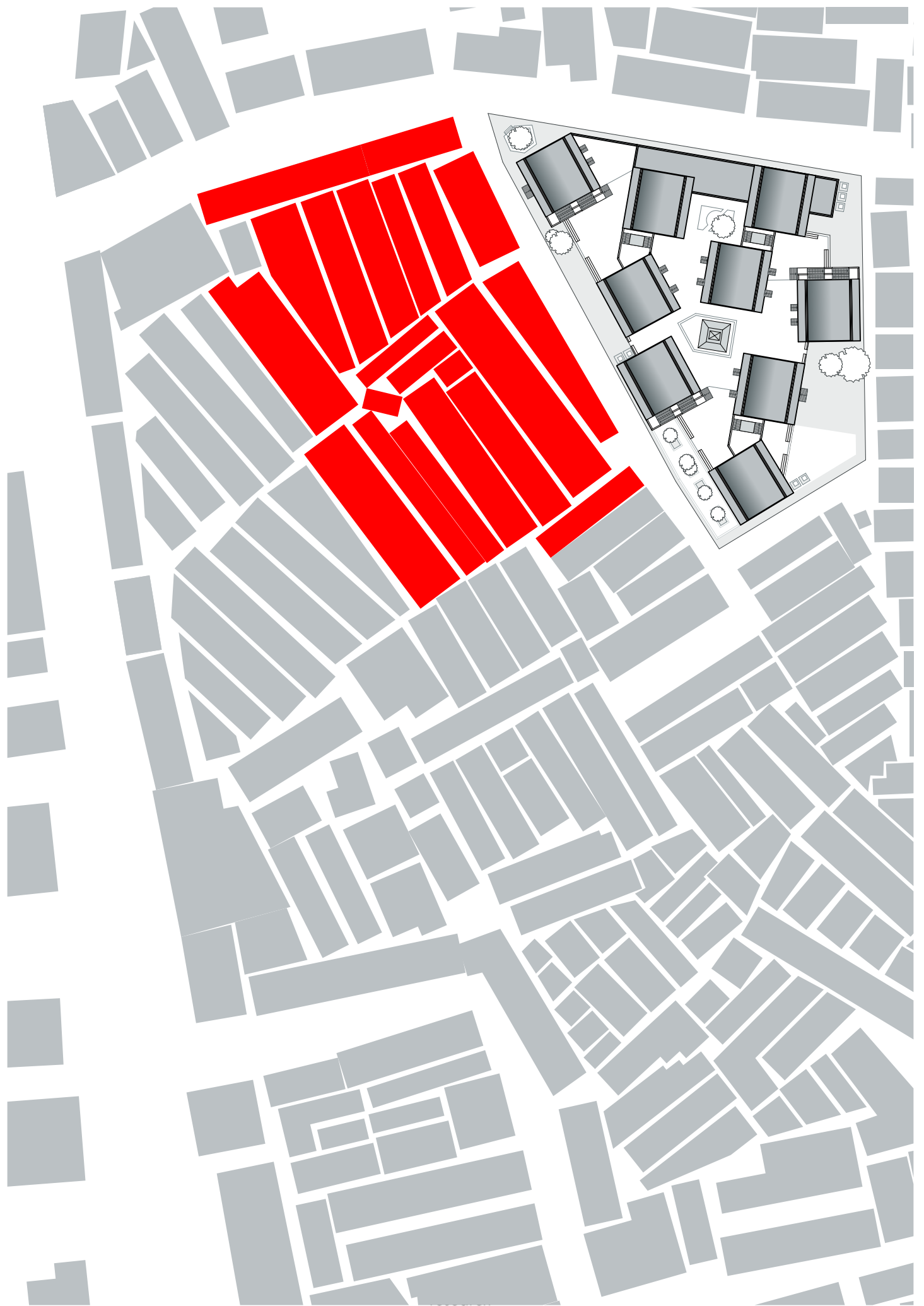
small public square

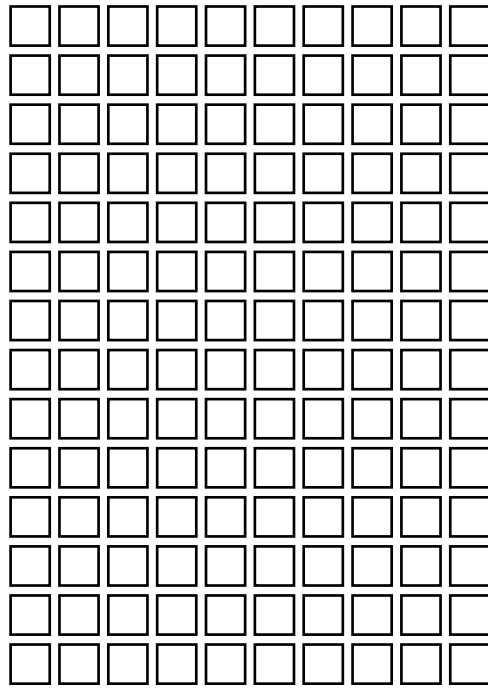
-

THE DESIRED SCALE

the size of the pocket is determined by the existing breaks in the urban fabric of baithi chawls. this size of development is the ideal size: most improvements can be reached by using this scale to develop. the community can be served as a whole by providing a system of public spaces and amenities. more can be achieved then if just one building is developed at the time

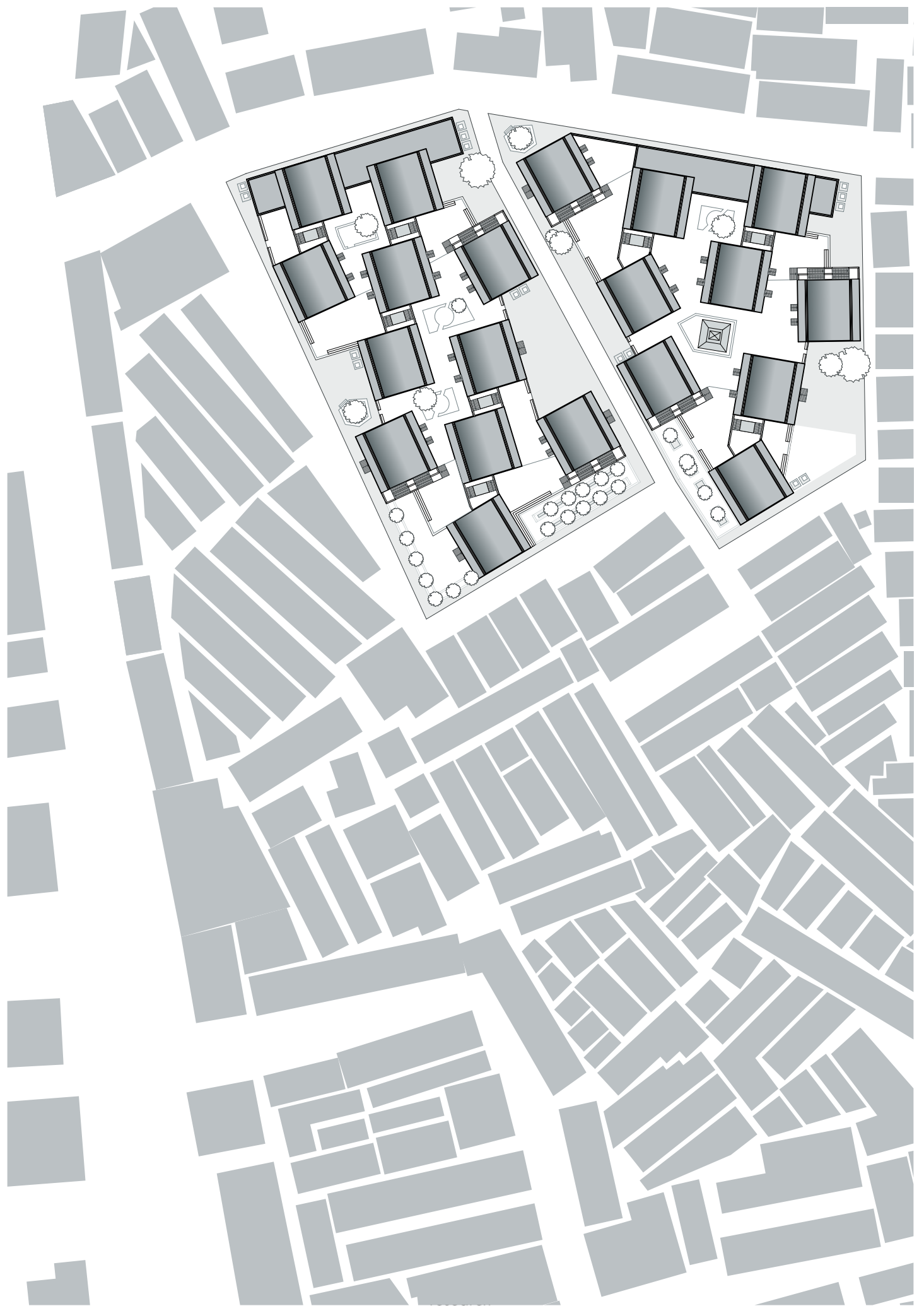
-

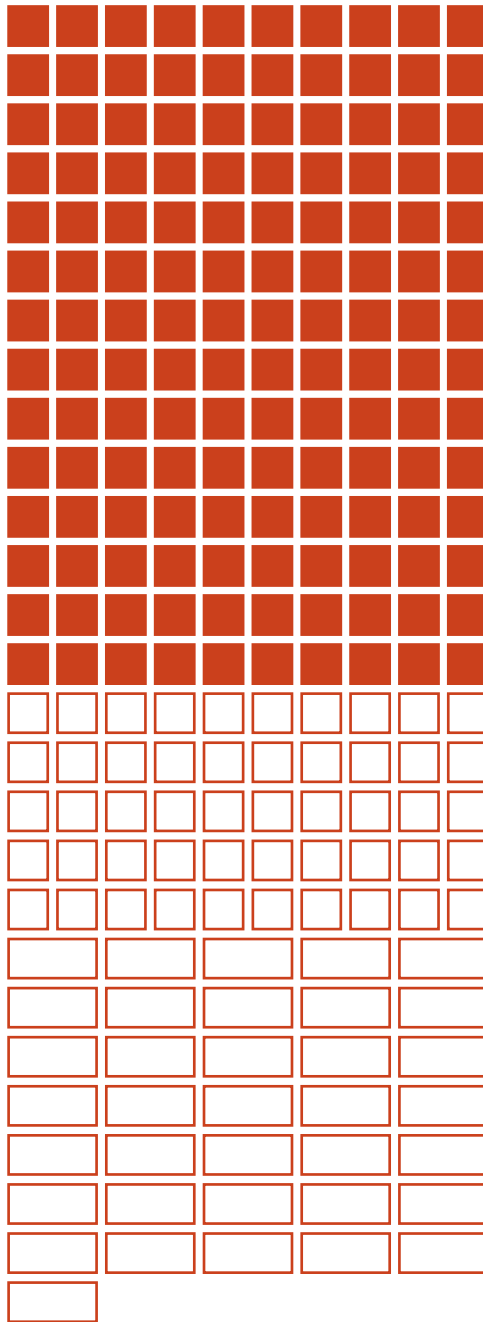




140 baithi chawl units



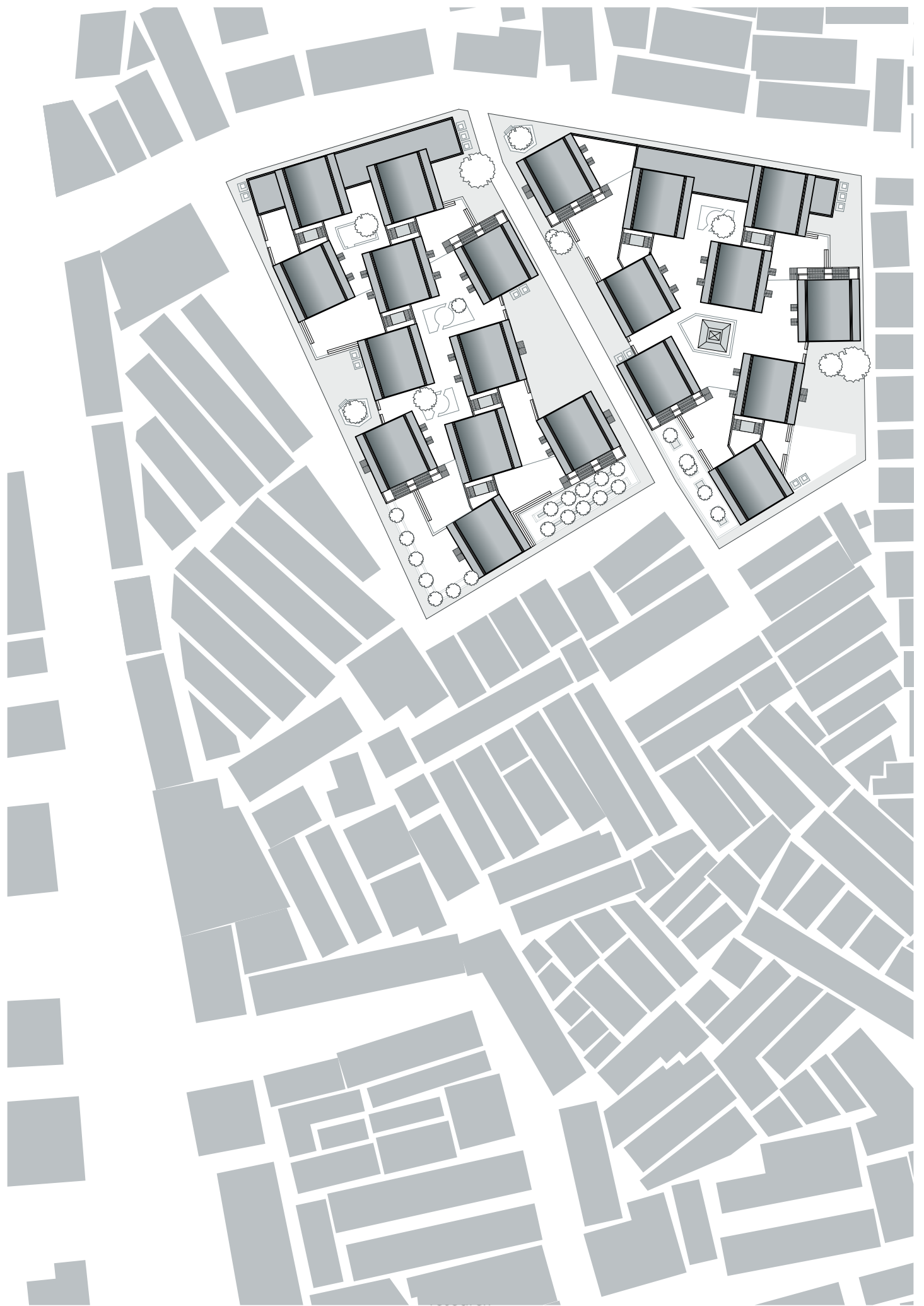




+ 50 EWS/LIG units

+ 36 MIG units





ONE CLUSTER

180 units

BENEFITS INHABITANTS:

improved living conditions

system of public space

amenities

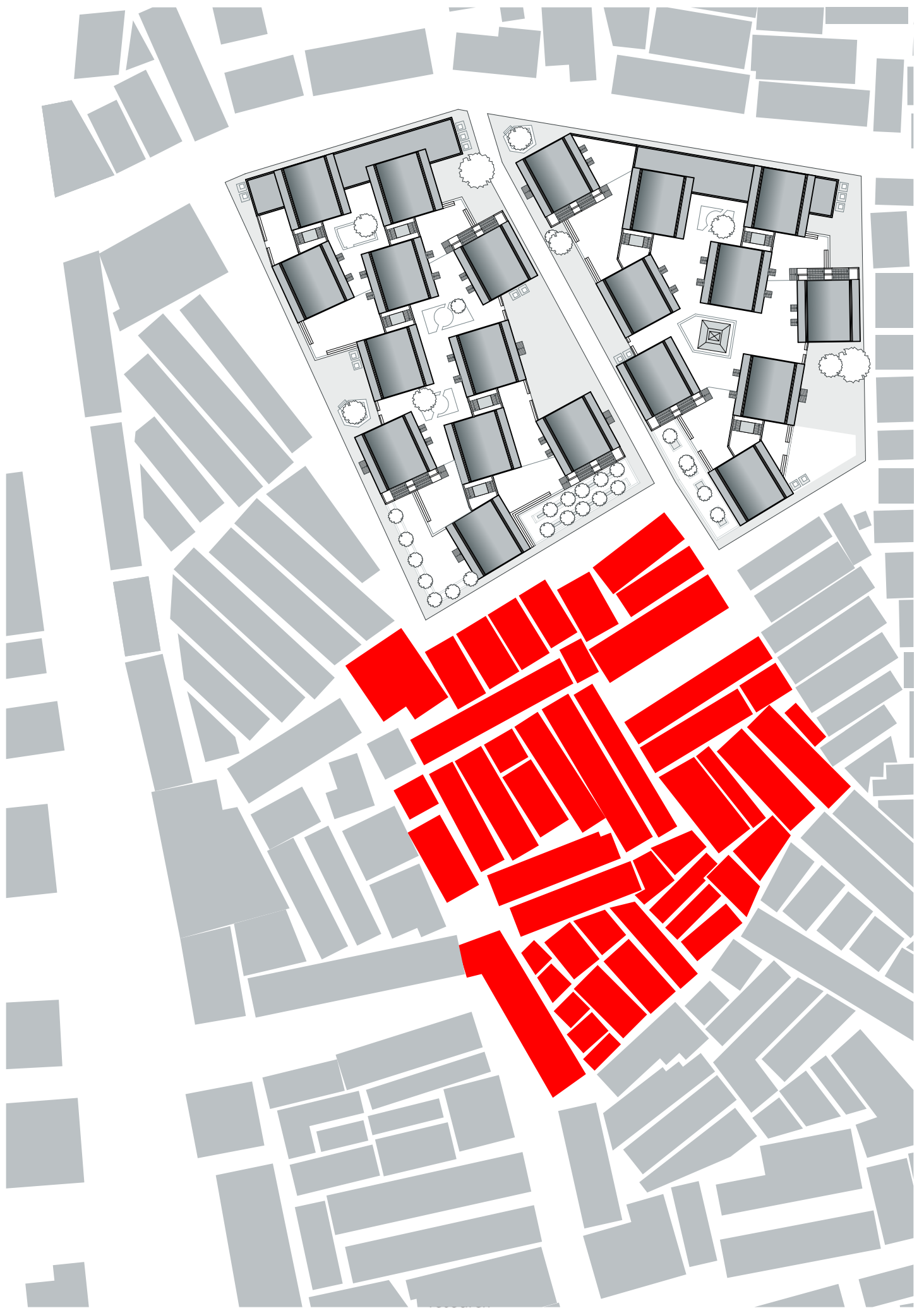
BENEFITS NEIGHBORHOOD:

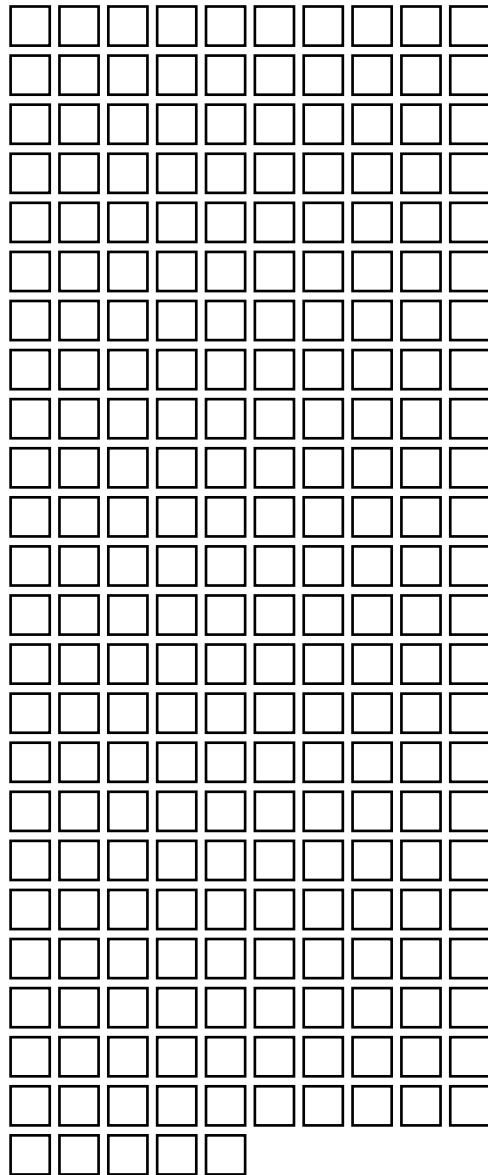
GOOD infra structure
enables buildings sites more inward the area

public square

network of open spaces

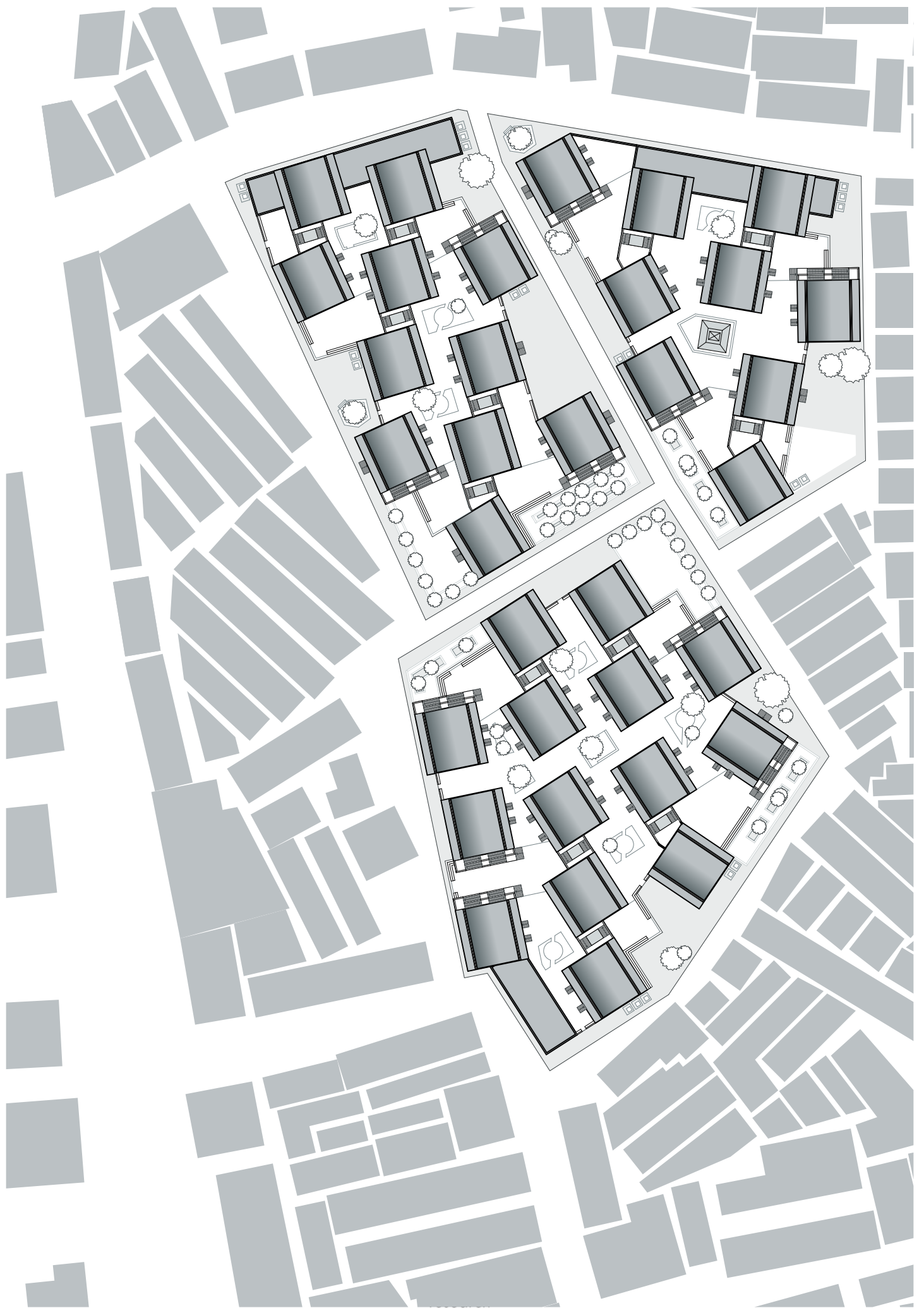
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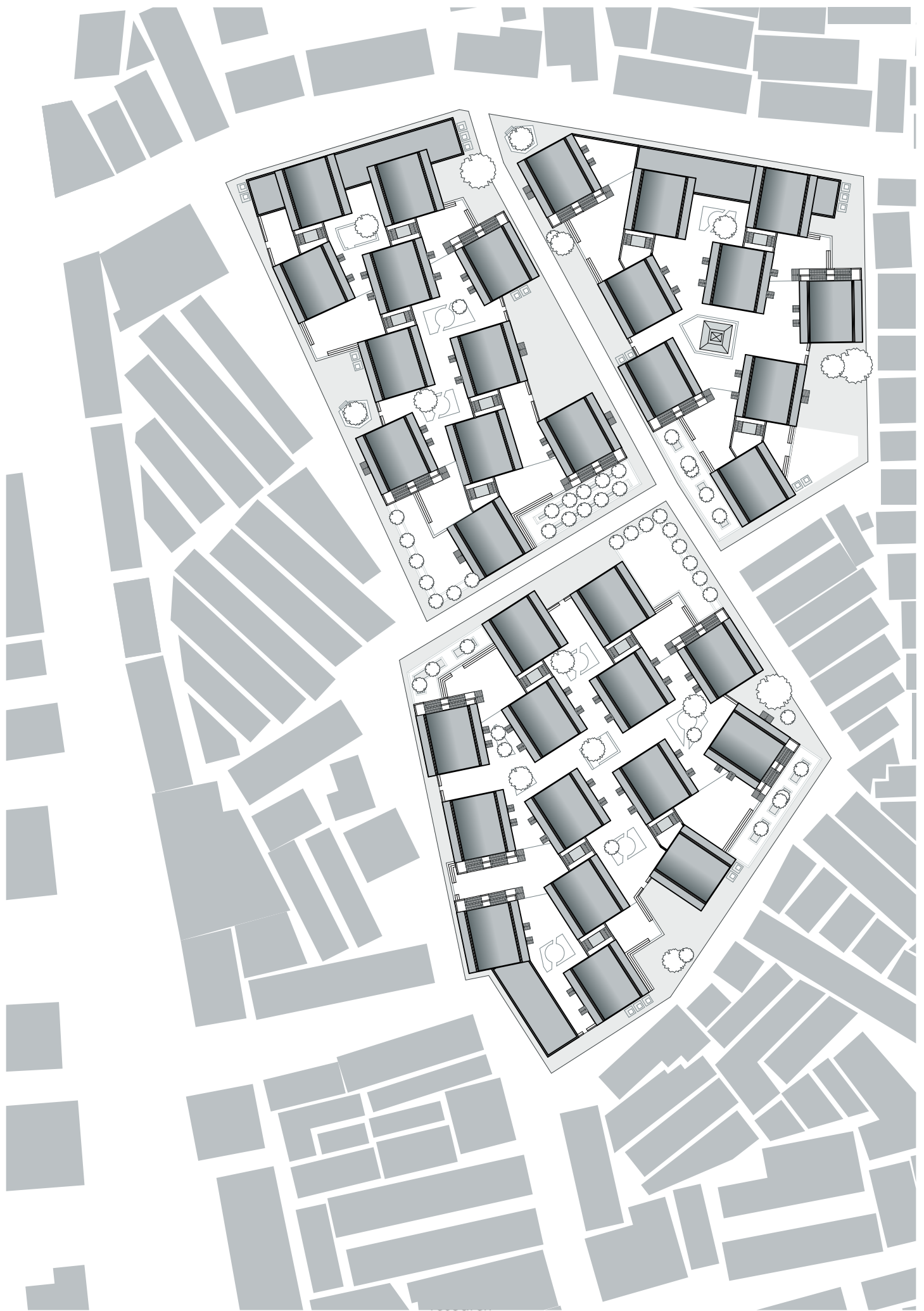
255 baithi chawl units







+ 36 MIG units



ONE CLUSTER

180 units

BENEFITS INHABITANTS:

improved living conditions

system of public space

amenities

BENEFITS NEIGHBORHOOD:

GOOD infra structure
enables buildings sites more inward the area

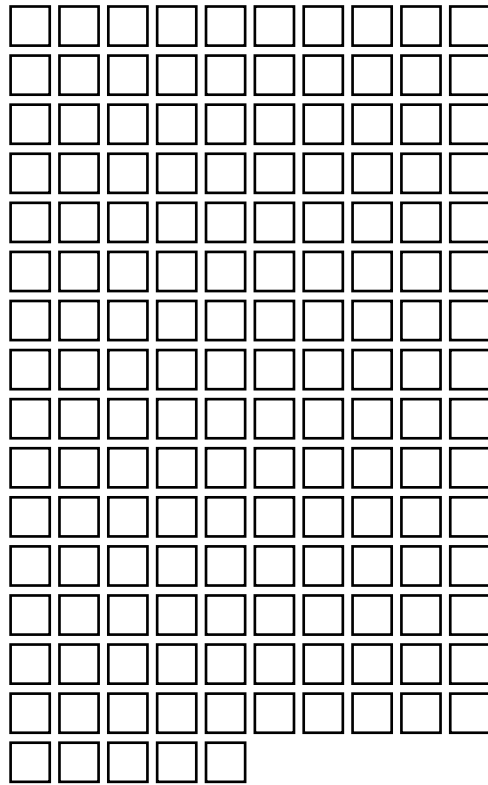
public square

network of open spaces

bigger open spaces at crossings

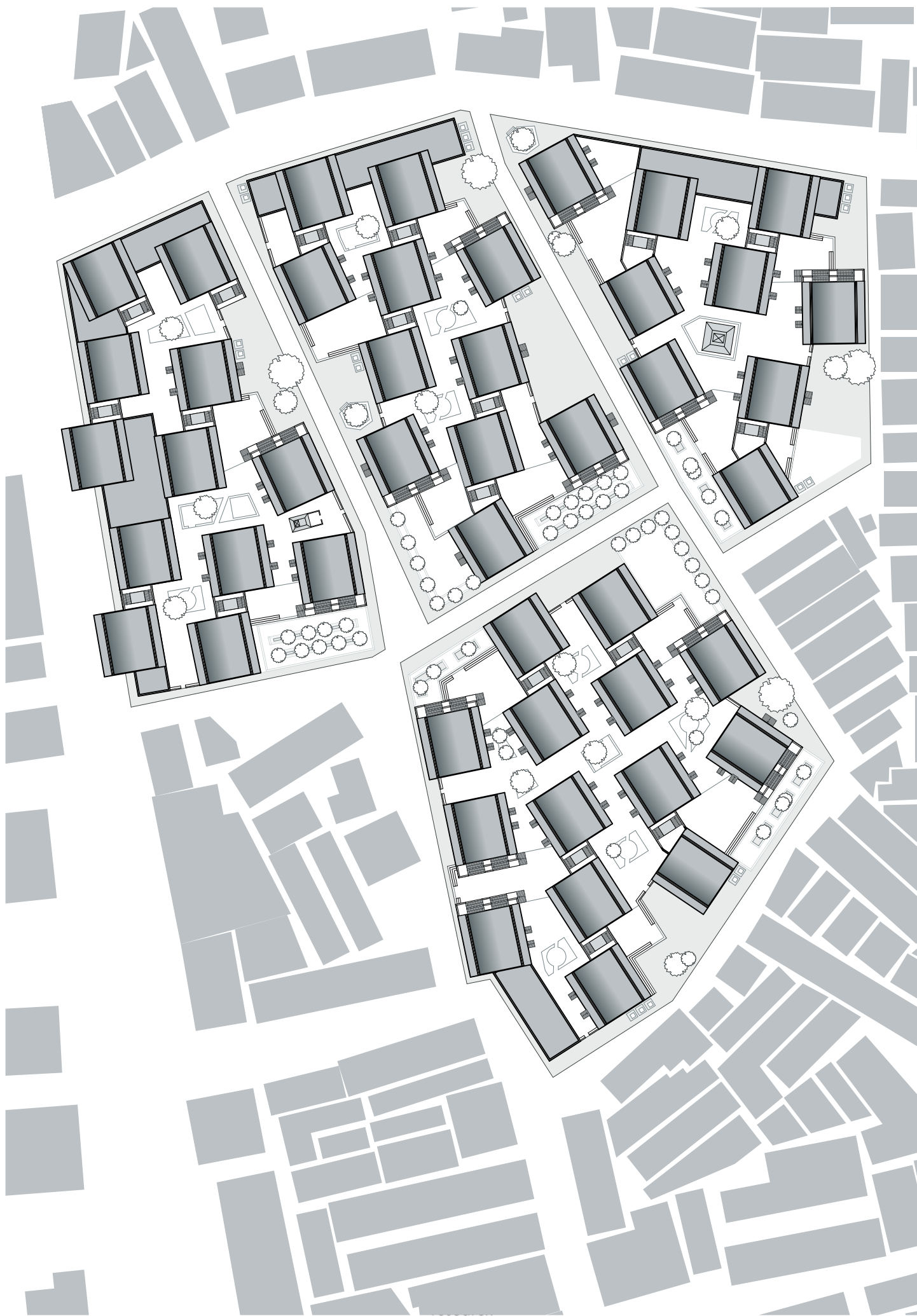
-

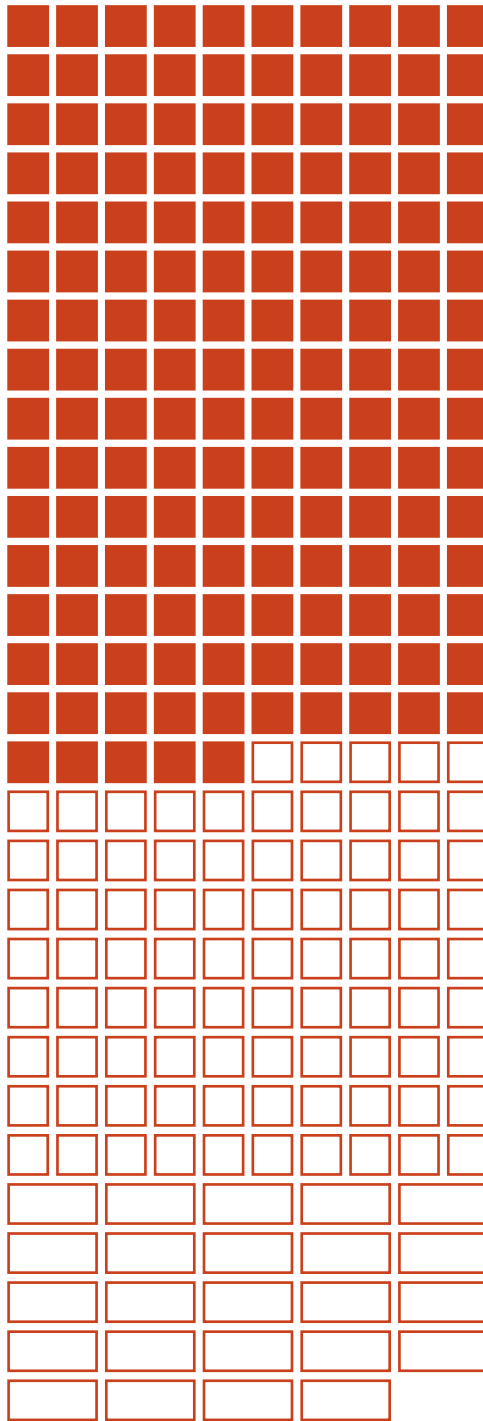




155 baithi chawl units

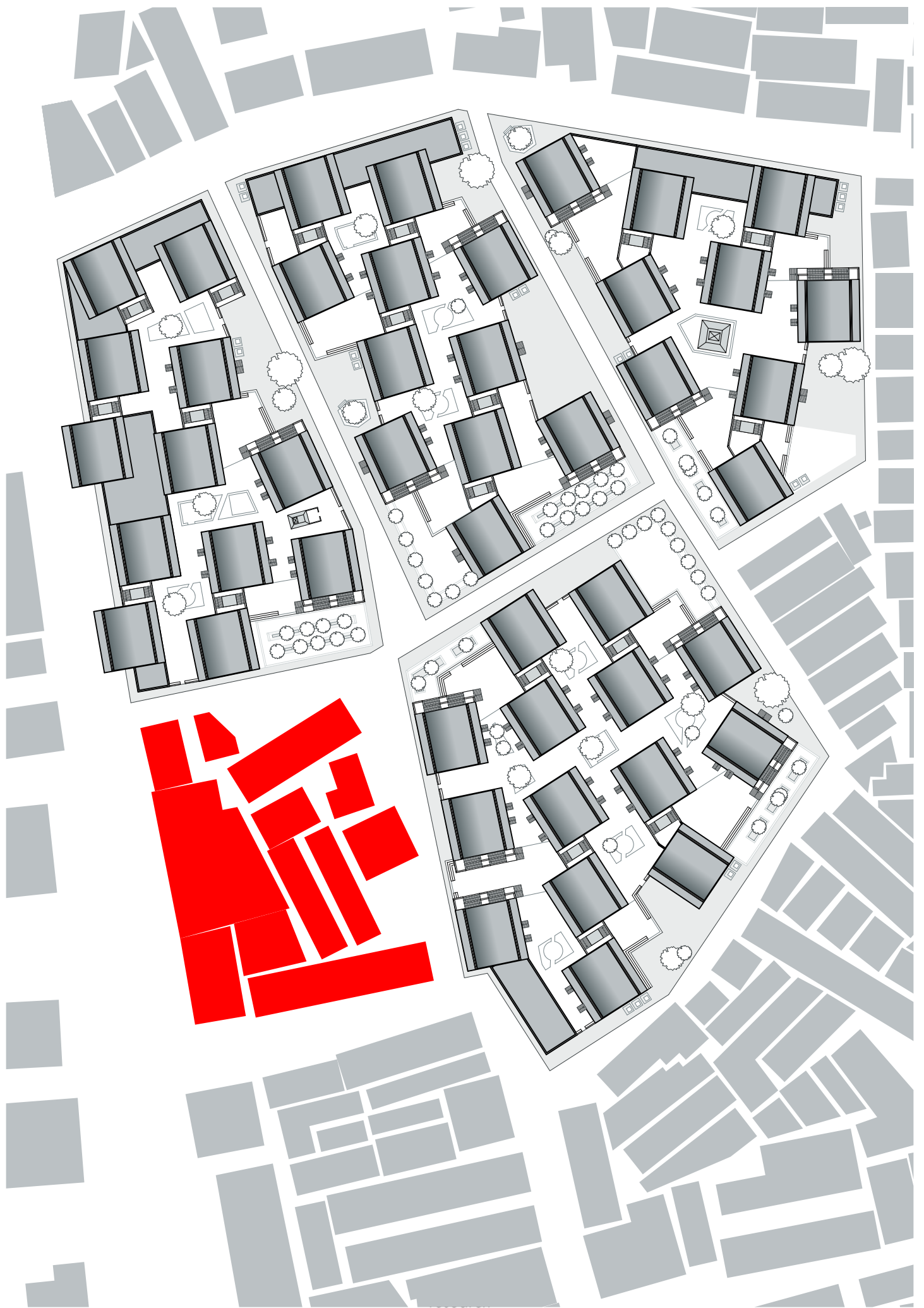


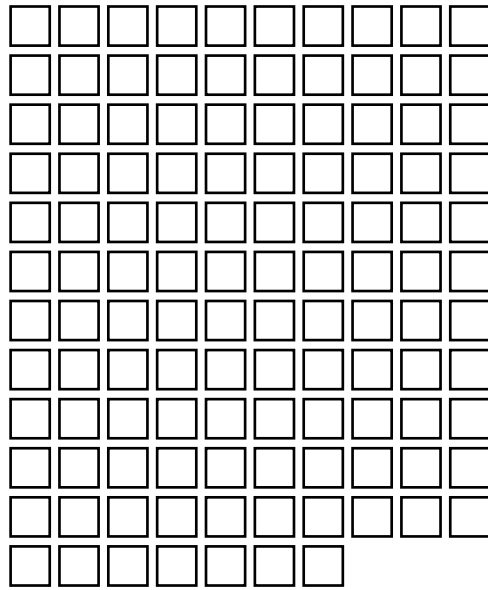




+ 85 EWS/LIG units

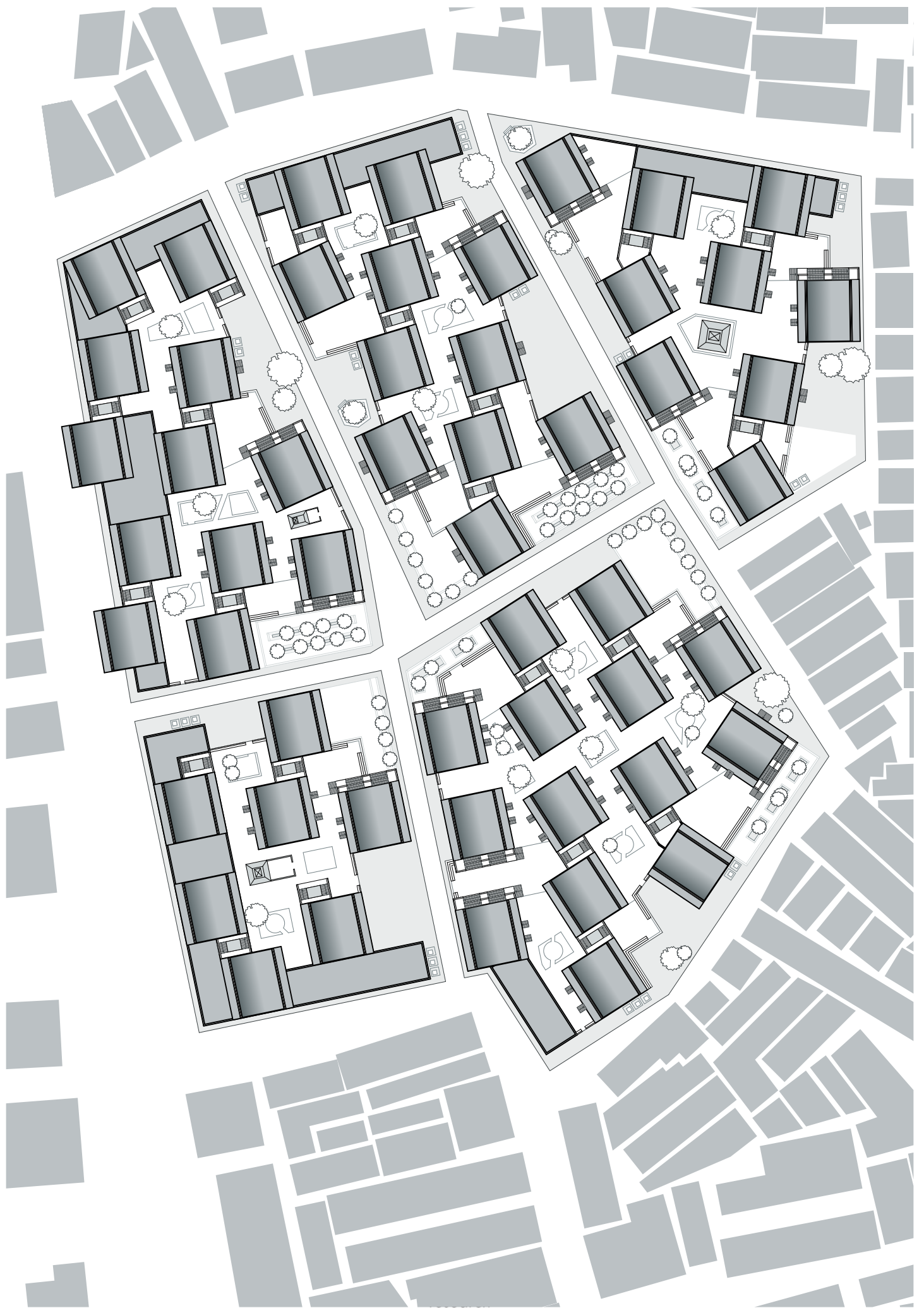
+ 24 MIG units

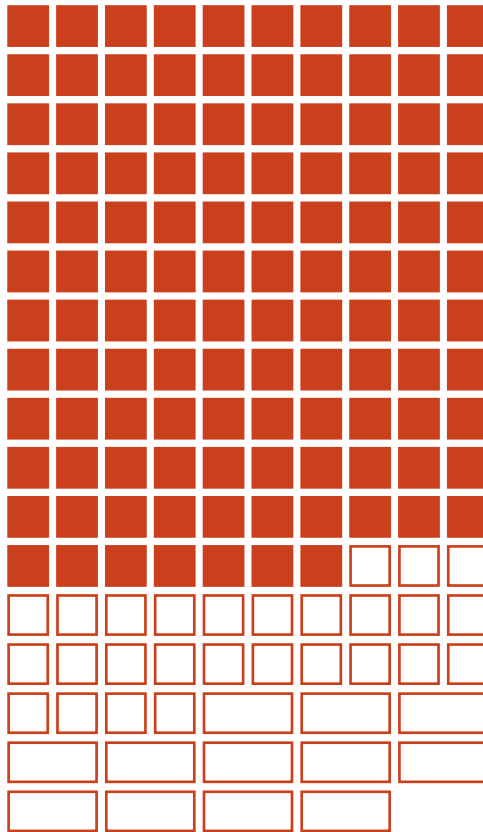




117 baithi chawl units

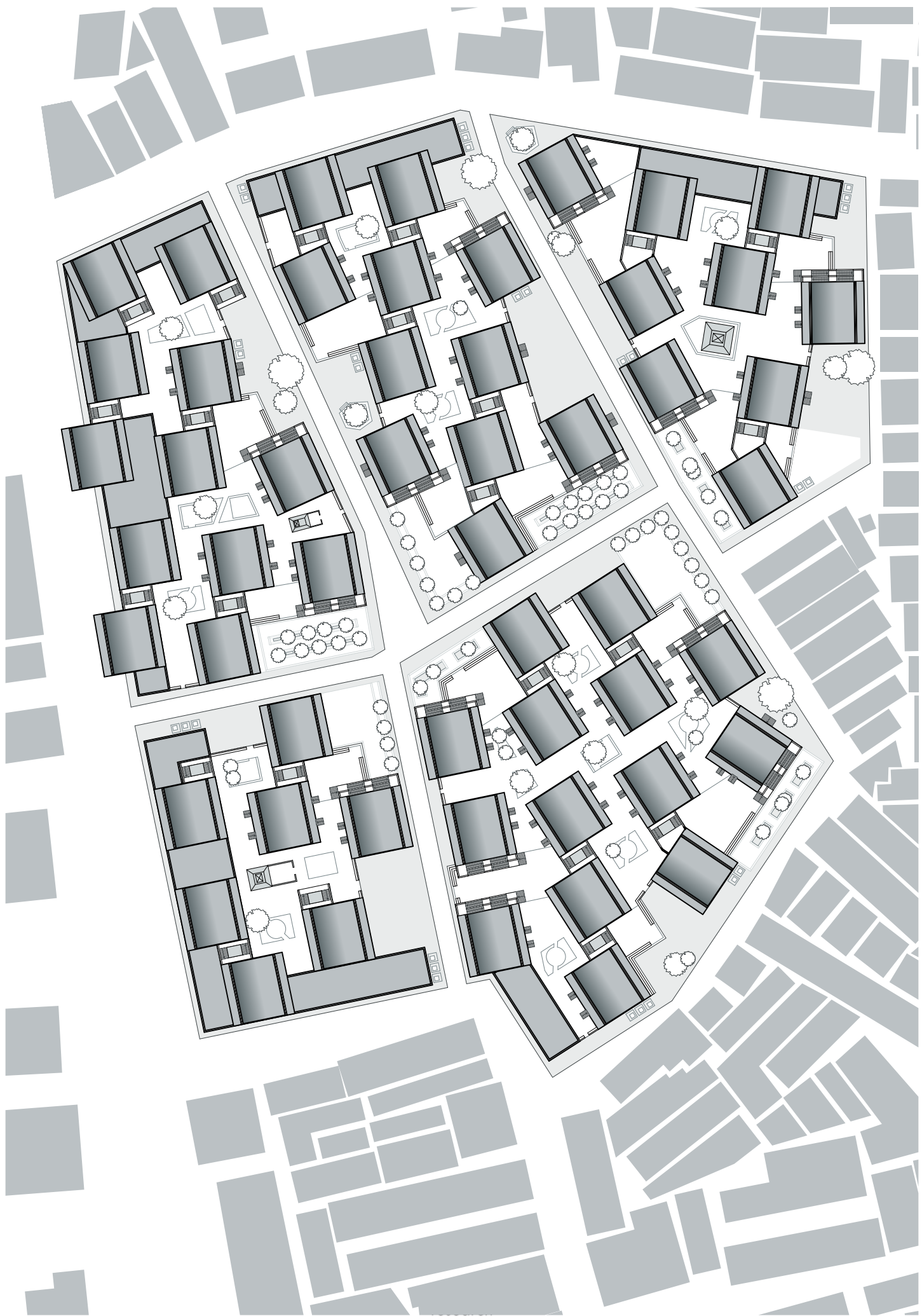






+ 27 EWS/LIG units

+ 12 MIG units



ONE CLUSTER

180 units

BENEFITS INHABITANTS:

improved living conditions

system of public space

amenities

BENEFITS NEIGHBORHOOD:

GOOD infra structure
enables buildings sites more inward the area

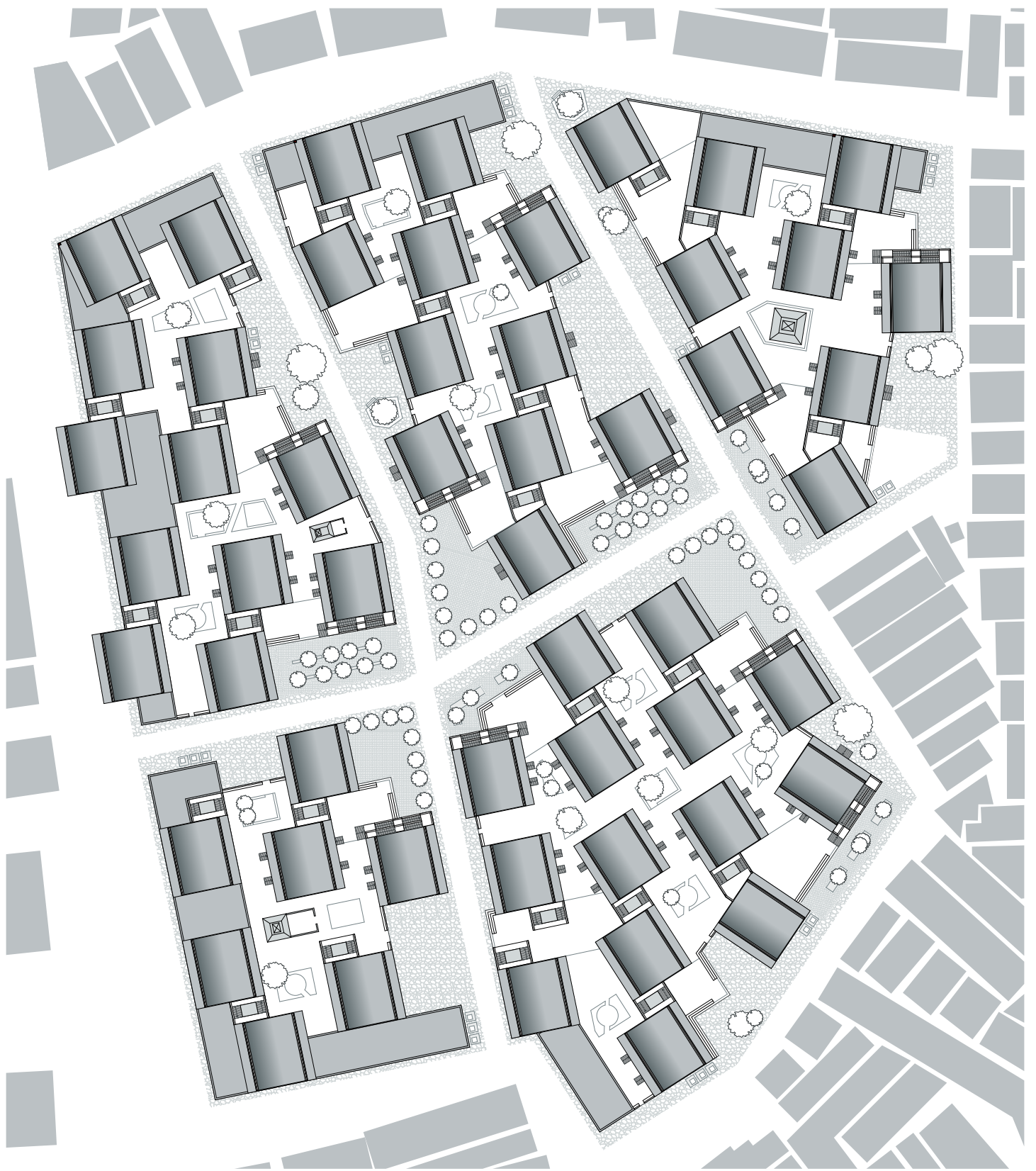
public square

network of open spaces

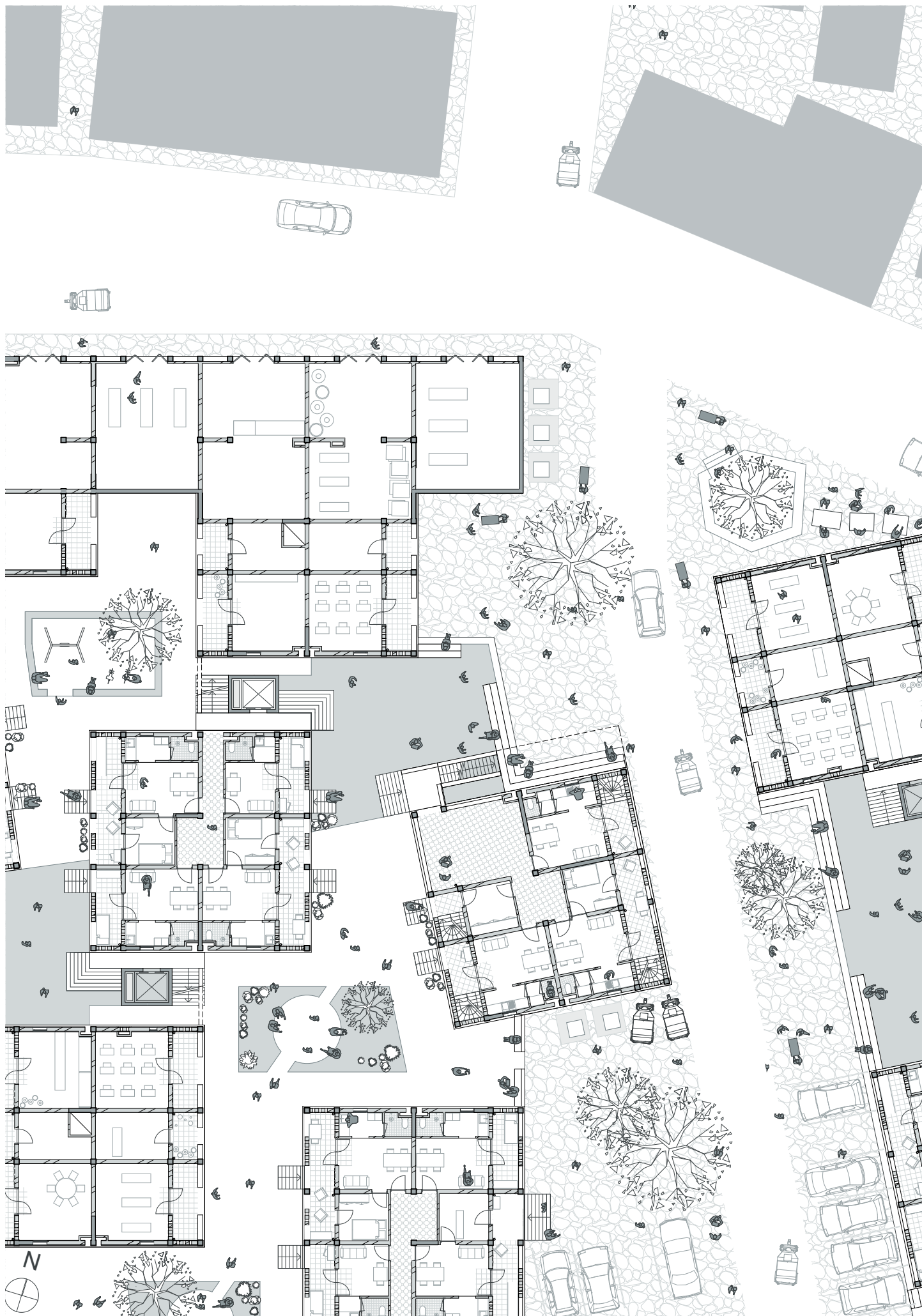
bigger open spaces at crossings

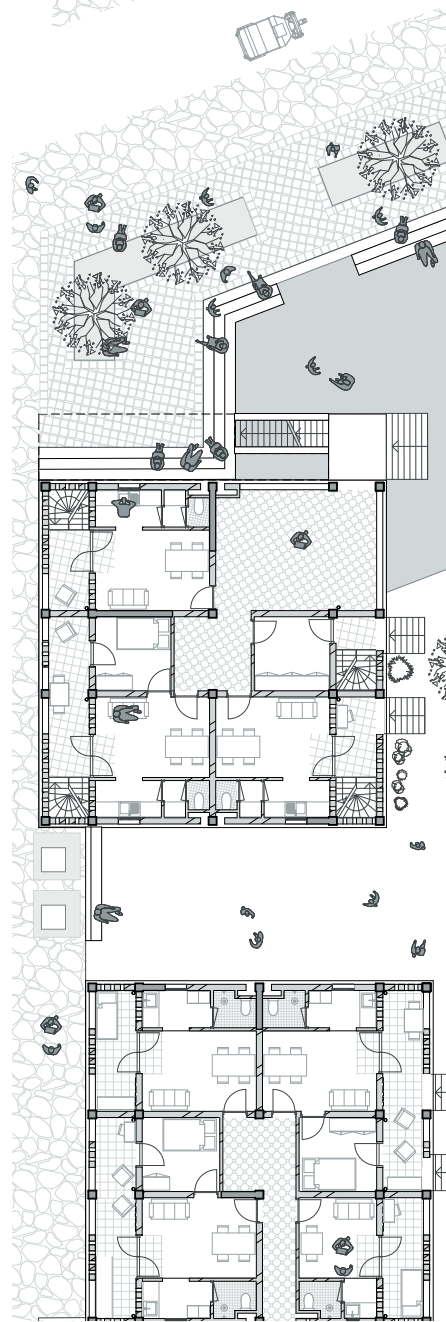
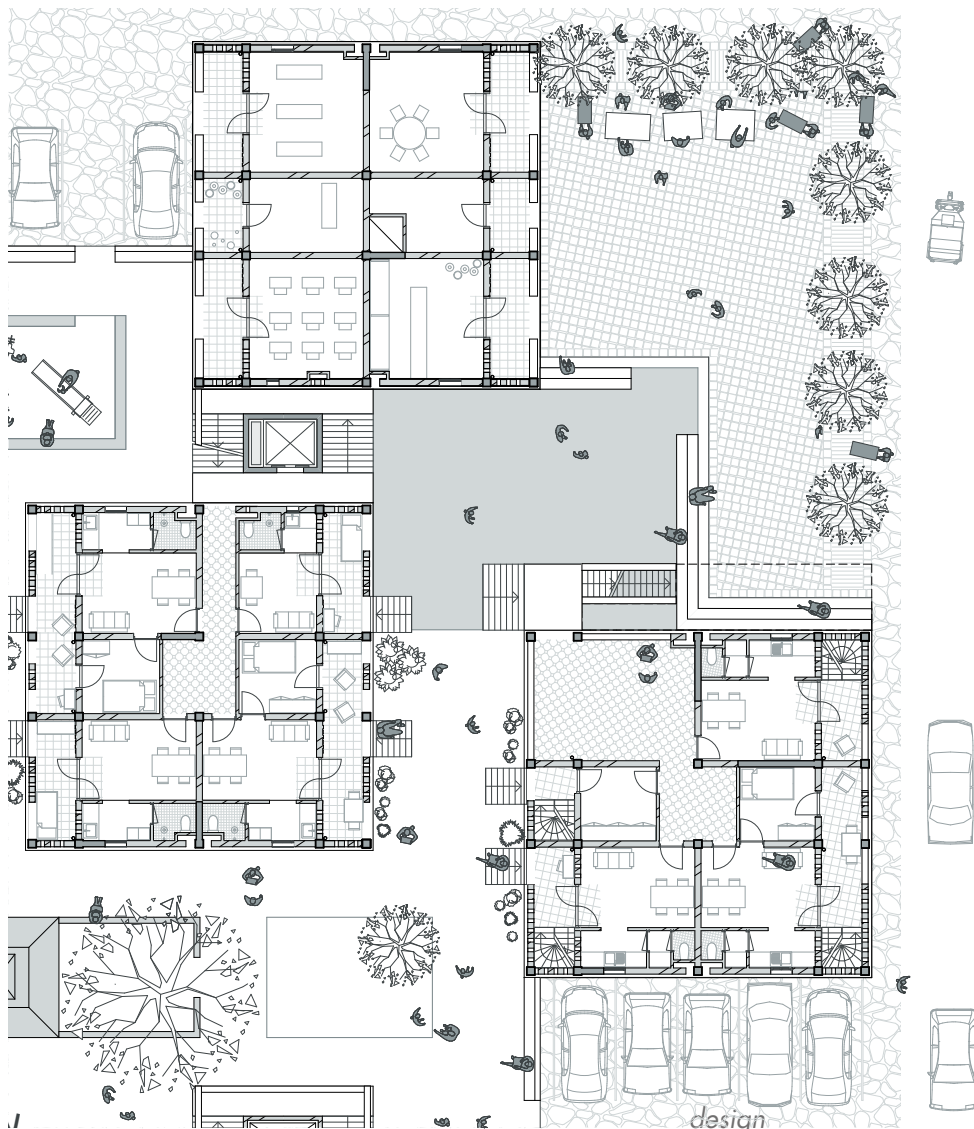
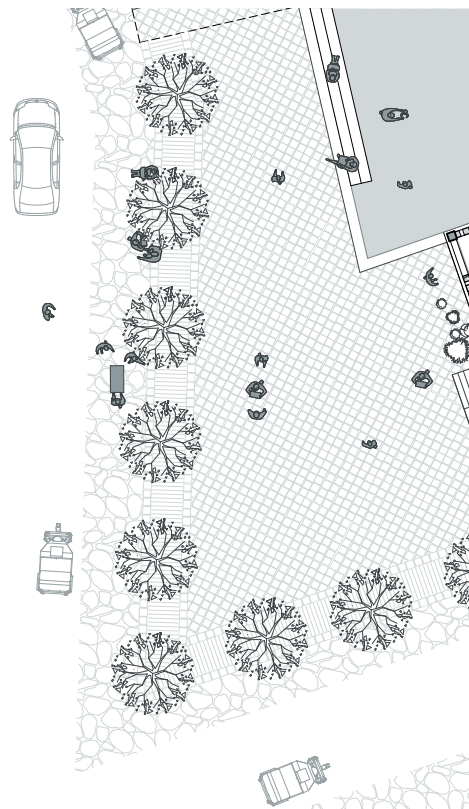
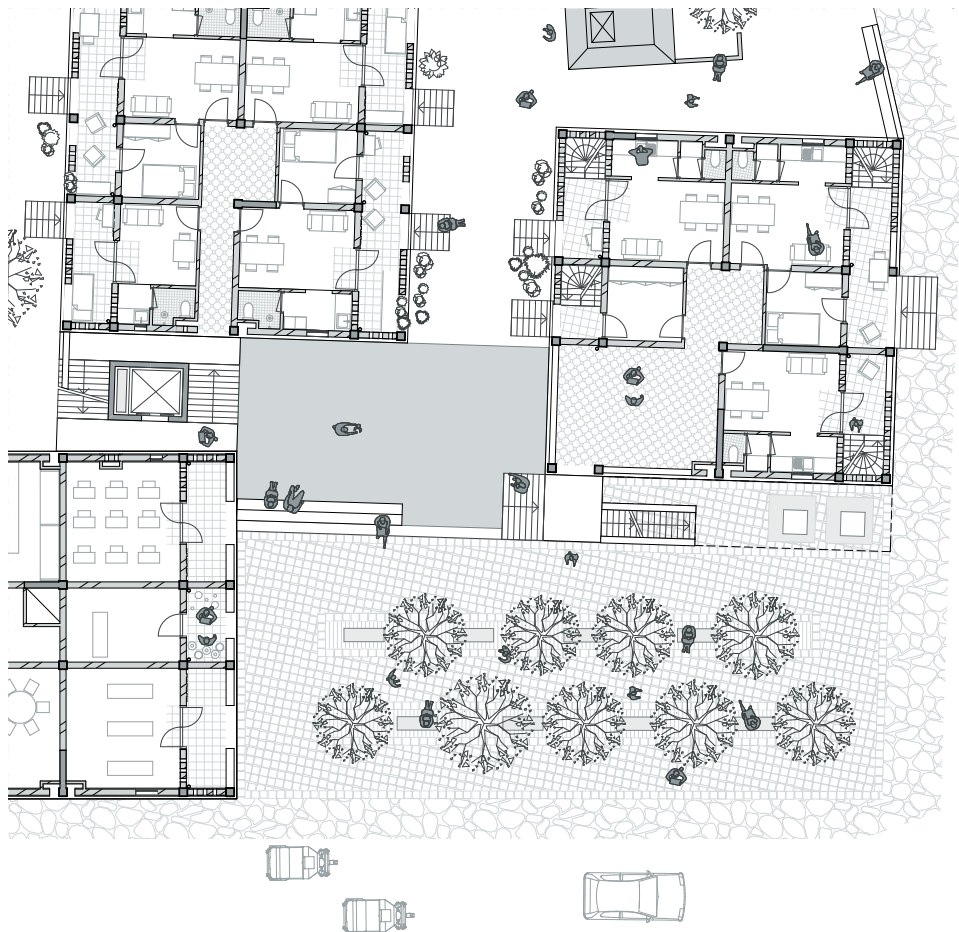
connections through the area

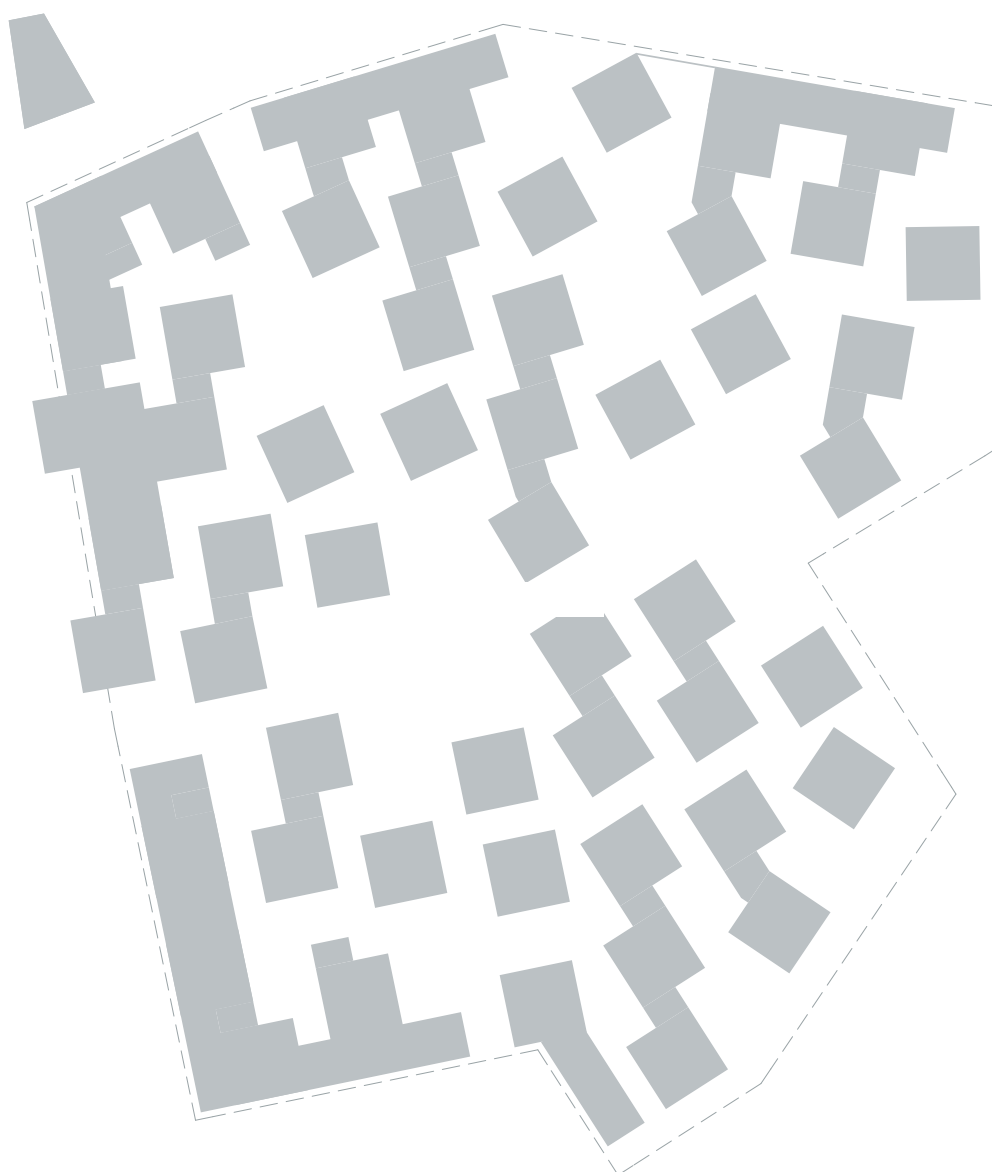
-



URBAN LAYOUT
new proposal

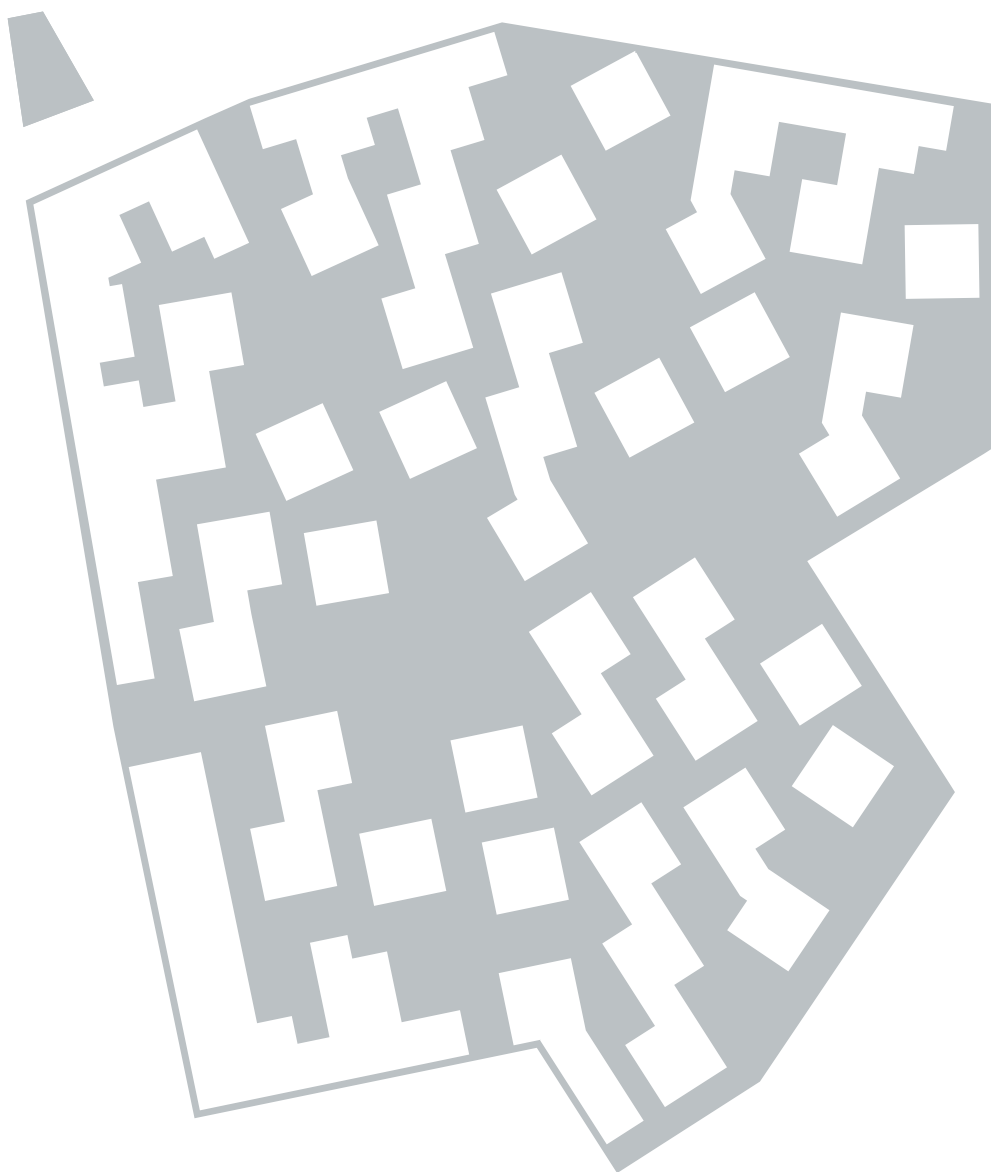






BUILT

FSI = 2,3



UNBUILT

open space index = 0,6

ATMOSPHERIC IMPRESSION

perspectives: now and future



ENTRANCE AREA
the commercial plinth and the community spine



THE PUBLIC SQUARE
bigger open spaces at central places in the area



THE INNER COURT
open space to use by the dwellers of the area



THE DWELLING
privacy close to the community



0 - newly build



1 - appropriation of space
- pots and plant -



2 - personalization and optimization of space
- washing lines, air conditioning, etc. -

GROWTH AND CHANGE
the evolution of the plan over time



3 - extending and adapting
- window grill, infill of windows, etc.



3 - extending and adapting, income generation
- ground floor turns shop -



4 - possible future scenario

GROWTH AND CHANGE
the evolution of the plan over time

COMMUNITY AND PRIVACY

the transition from public to private

“Successful housing is a seamless continuum of spaces that go all the way from the most private, to the semi-private to the public. in this way it create communities”

Charles Correa
(DASH #12-13, 96)

Kuitenbrouwer, Paul, and Dick Van Gameren. 2015. DASH Global housing: affordable dwellings for growing cities. Rotterdam. Vol. 12-13. Rotterdam: AiO10 Uitgevers/Publishers, 96

IMPORTANCE OF COMMUNITY AND PRIVACY
and the transition between

street + commercial plinth

community spine

public square

entrance square

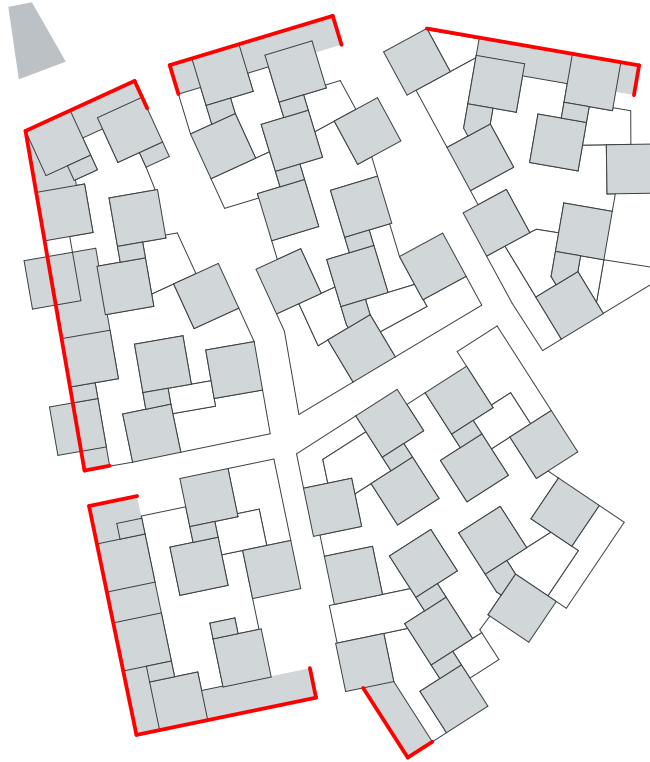
community space outside
inner courts

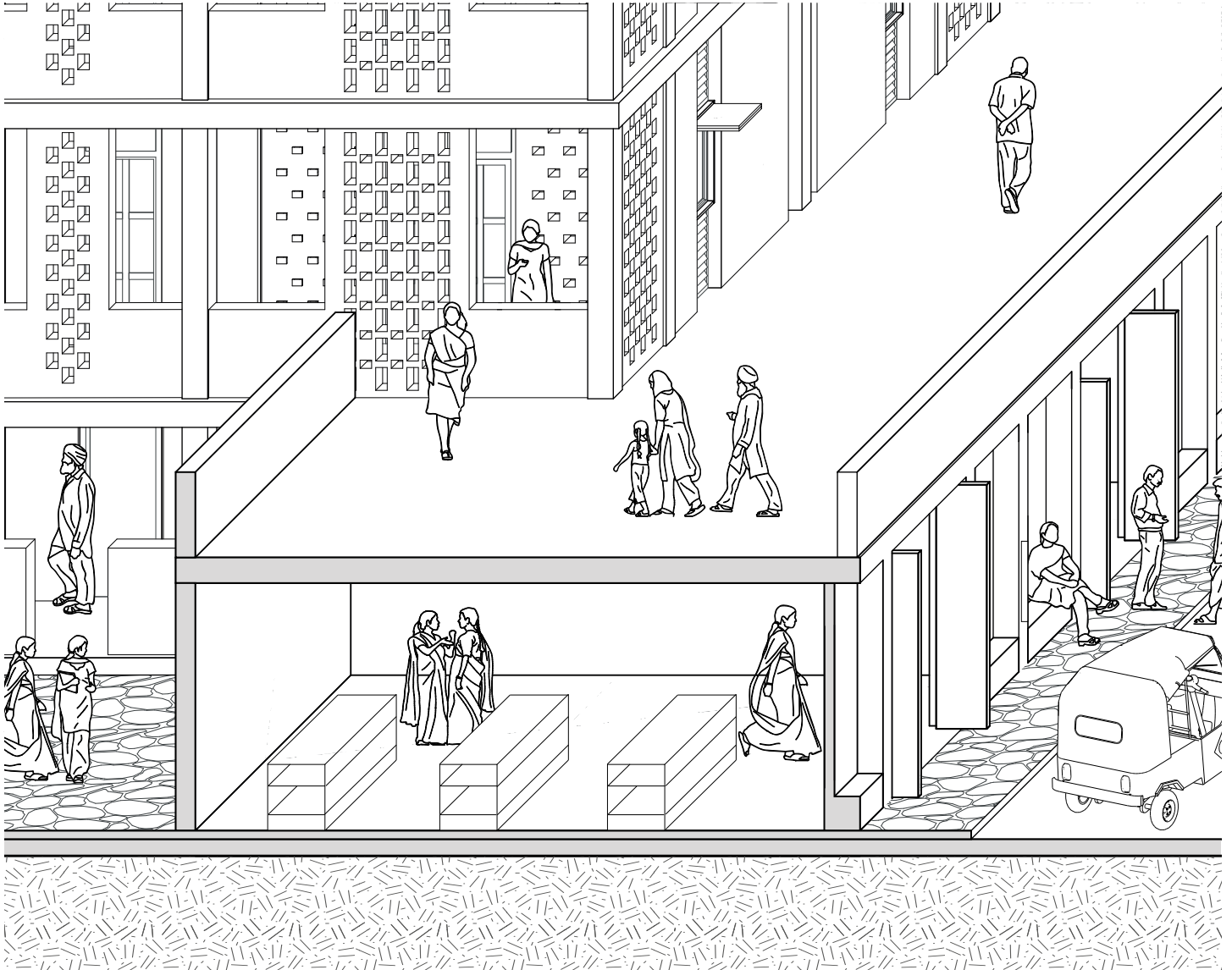
community space inside & circulation
roof top space
open areas on higher floors

the dwelling

public

private





STREET AND COMMERCIAL PLINTH
along the bigger road

street + commercial plinth

community spine

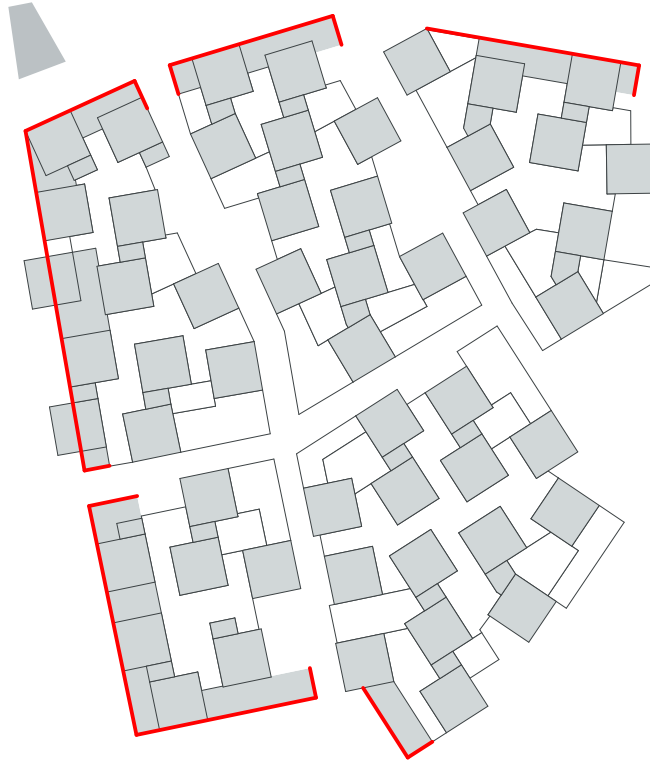
public square

entrance square

community space outside
inner courts

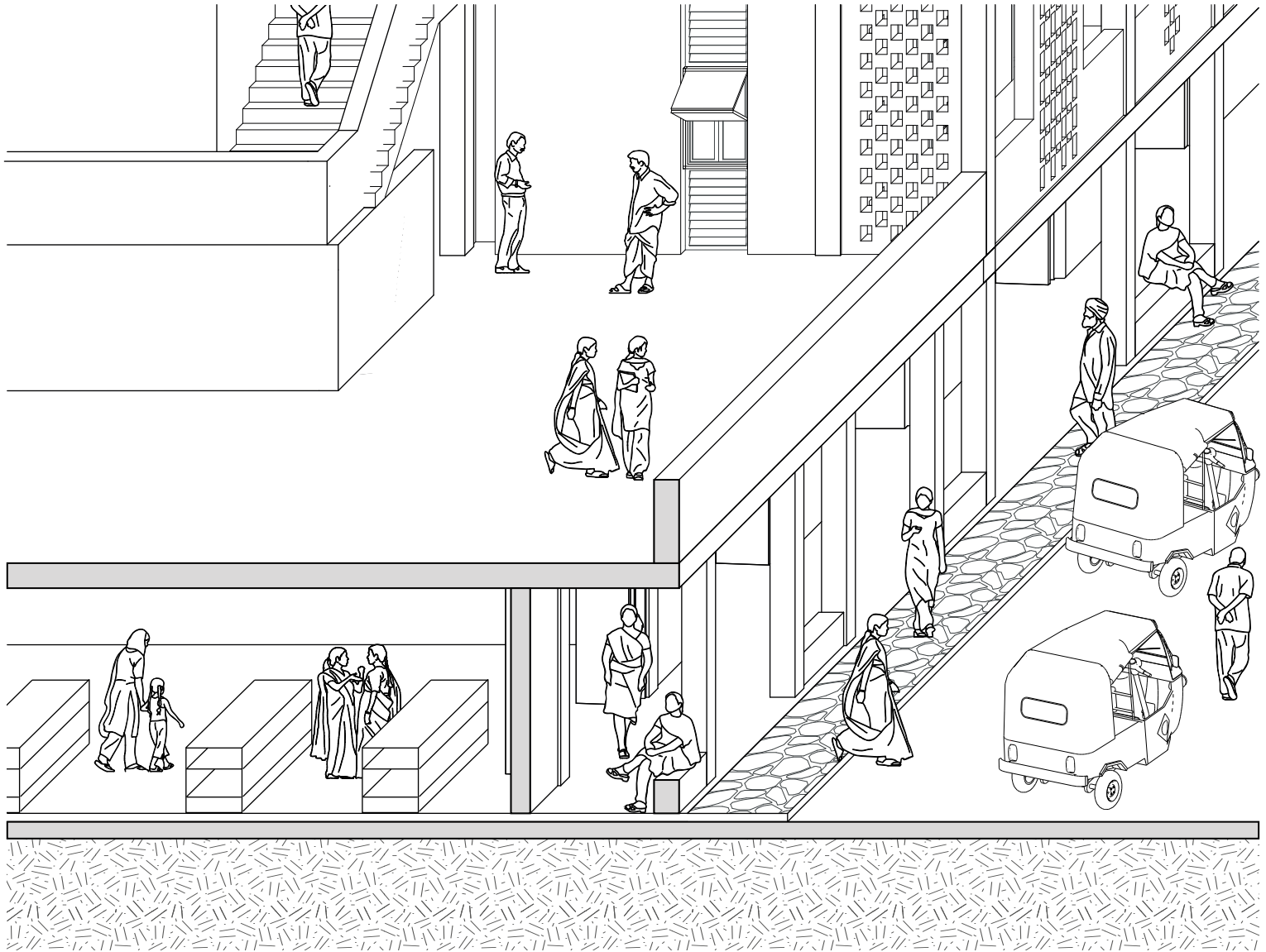
community space inside & circulation
roof top space
open areas on higher floors

the dwelling



public

private



STREETS AND COMMERCIAL PLINTH
along the inner connecting roads

street + commercial plinth

community spine

public square

entrance square

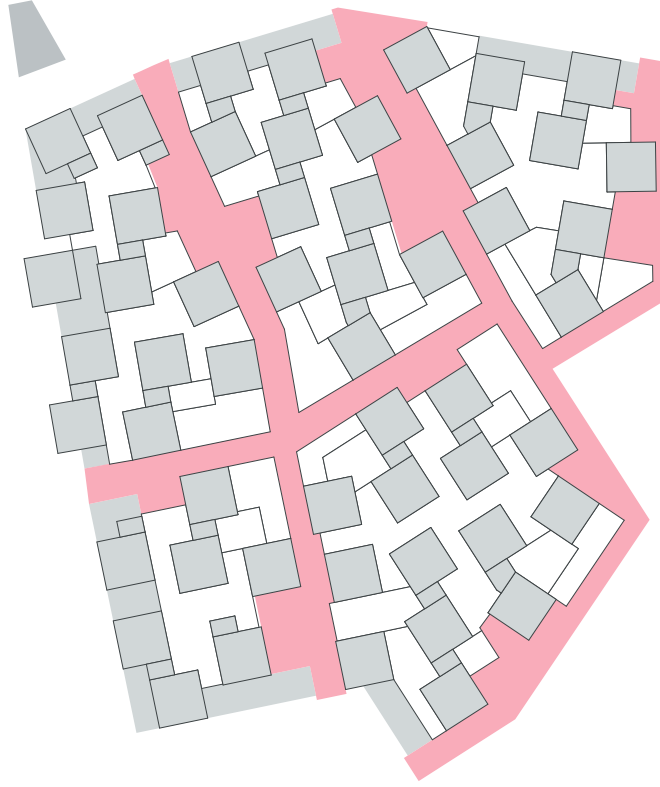
community space outside
inner courts

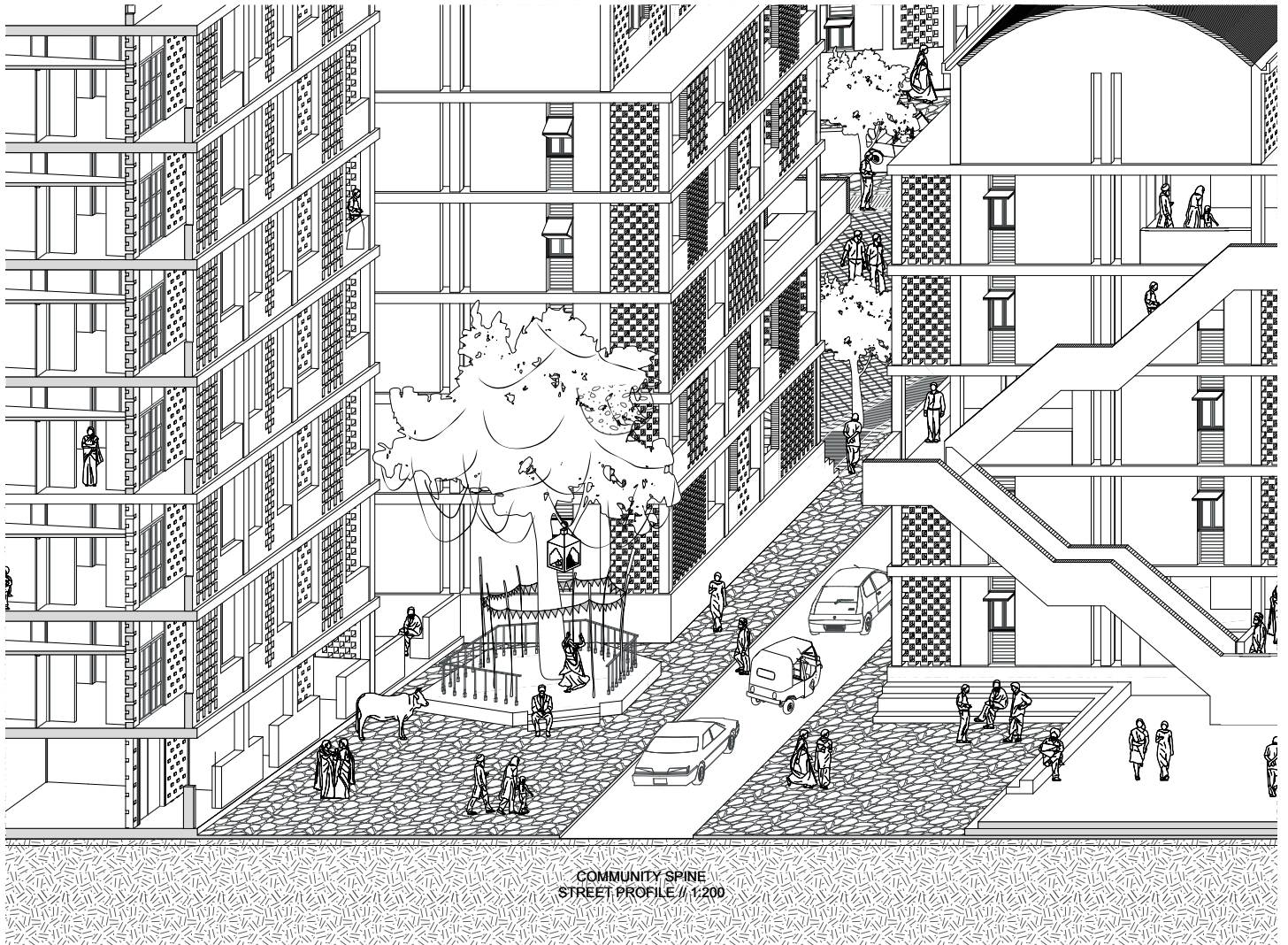
community space inside & circulation
roof top space
open areas on higher floors

the dwelling

public

private





THE COMMUNITY SPINE

street + commercial plinth

community spine

public square

entrance square

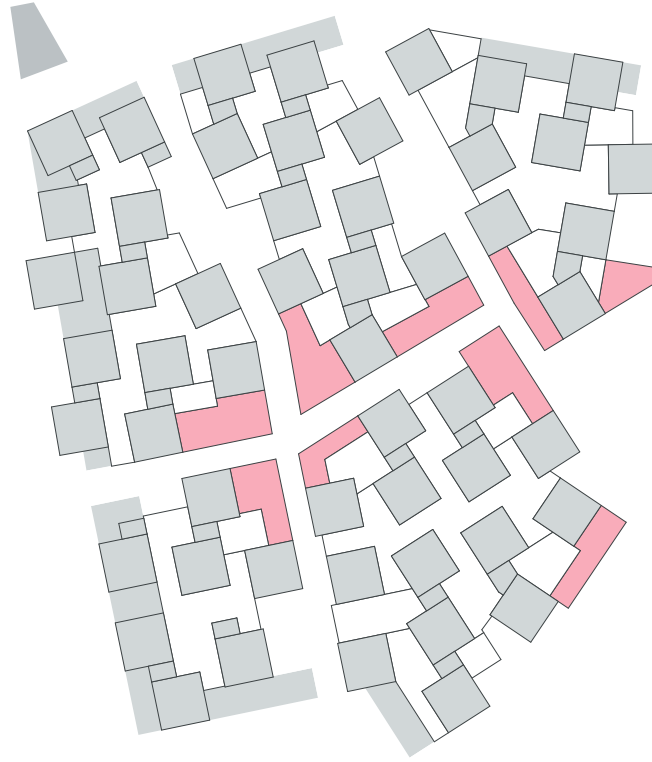
community space outside
inner courts

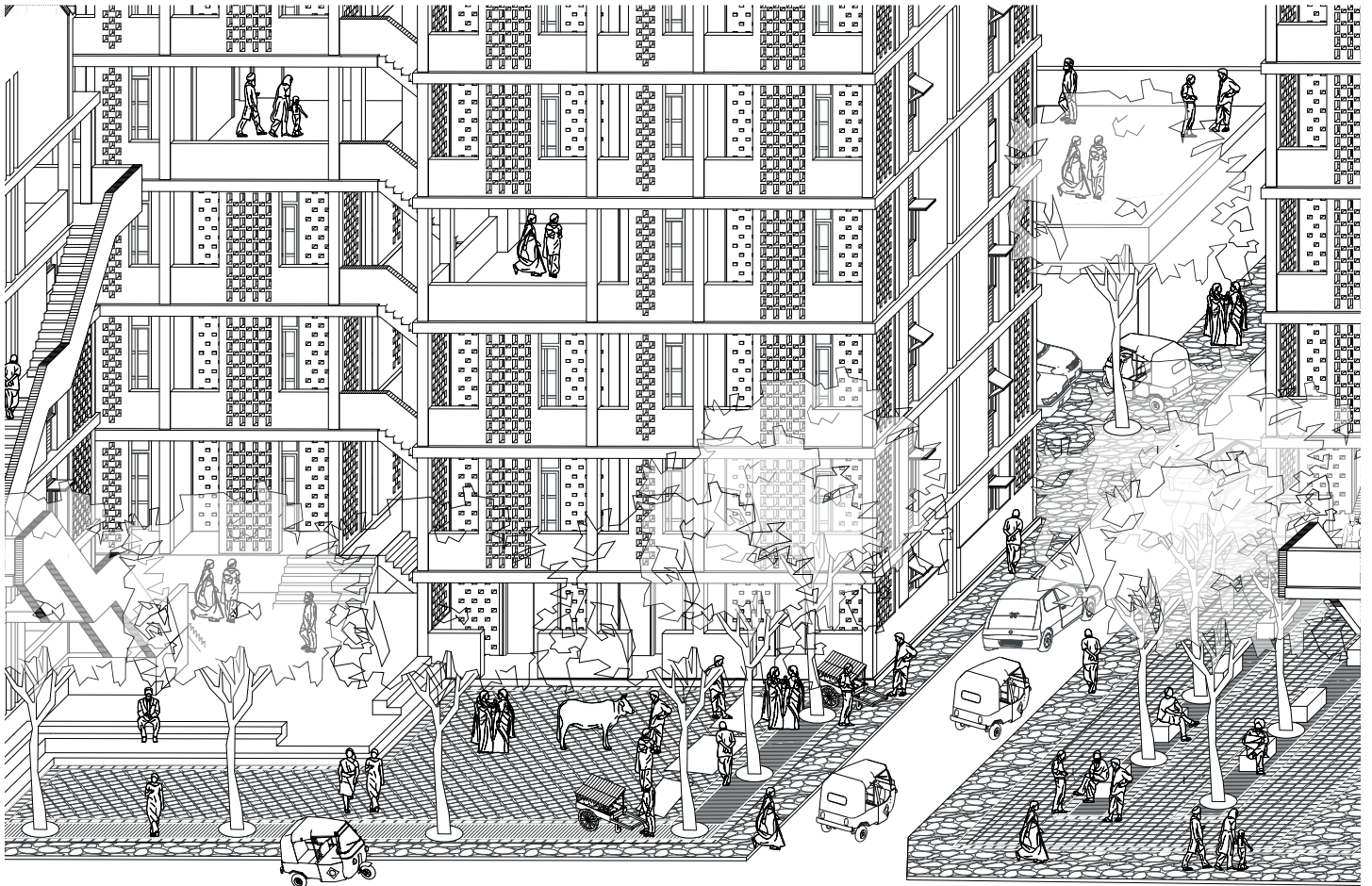
community space inside & circulation
roof top space
open areas on higher floors

the dwelling

public

private





COMMUNITY SPINE
STREET PROFILE // 1:200

THE PUBLIC SQUARE

street + commercial plinth

community spine

public square

entrance square

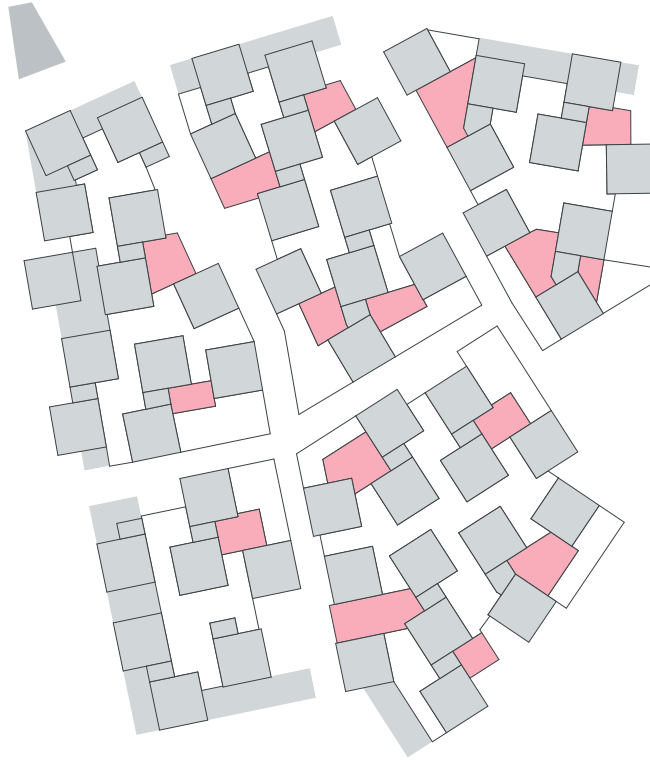
community space outside
inner courts

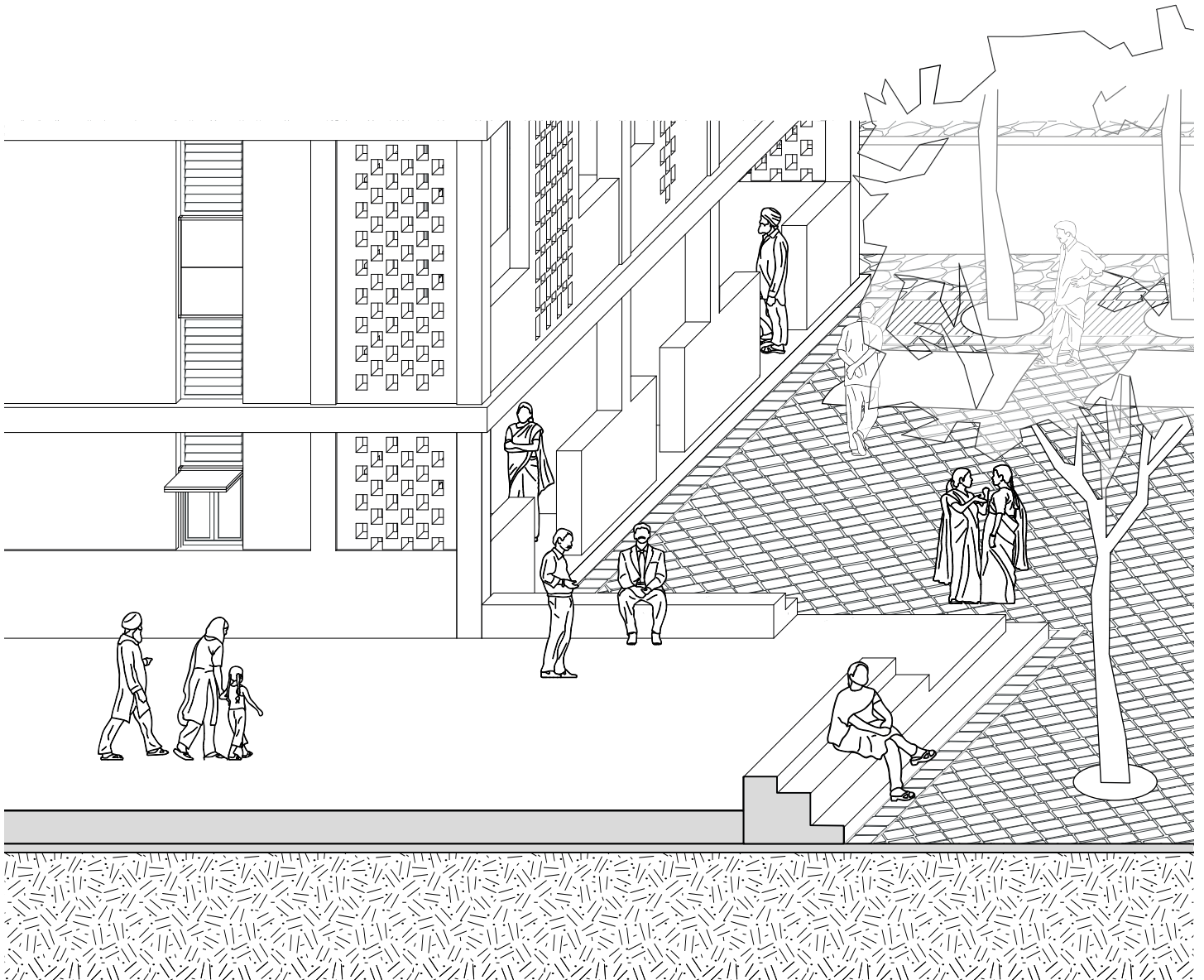
community space inside & circulation
roof top space
open areas on higher floors

the dwelling

public

private





ENTRANCE SQUARE

street + commercial plinth

community spine

public square

entrance square

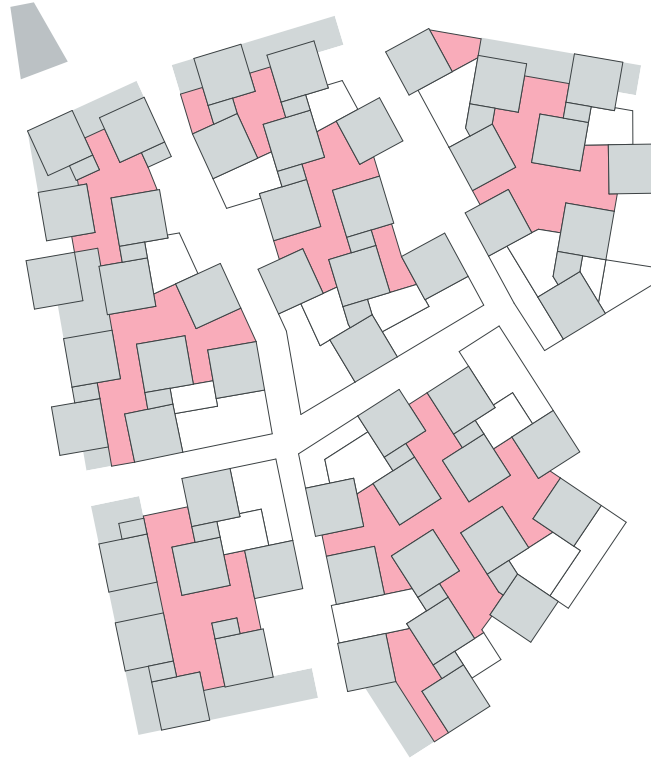
community space outside
inner courts

community space inside & circulation
roof top space
open areas on higher floors

the dwelling

public

private





INNER COURT

street + commercial plinth

community spine

public square

entrance square

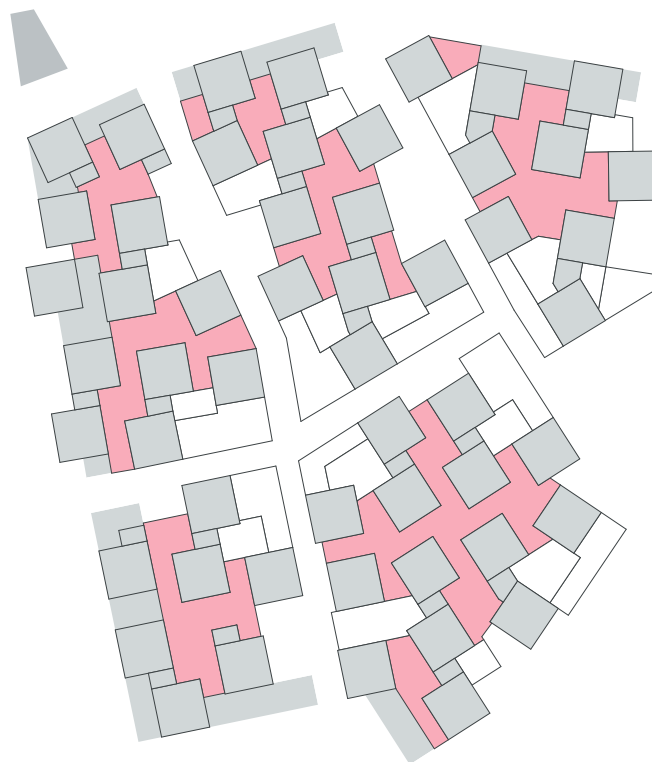
community space outside
inner courts

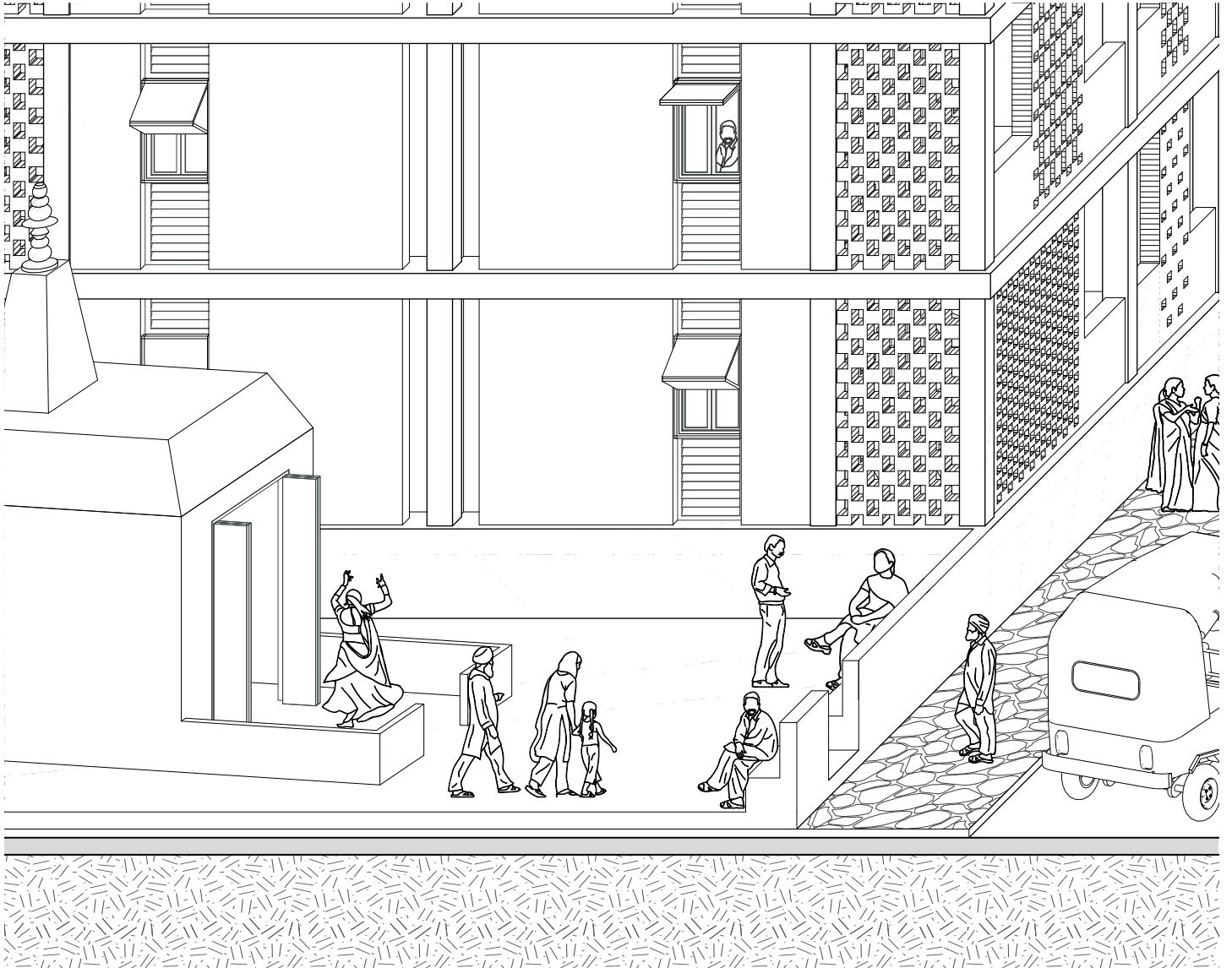
community space inside & circulation
roof top space
open areas on higher floors

the dwelling

public

private





INNER COURT
side entrance

street + commercial plinth

community spine

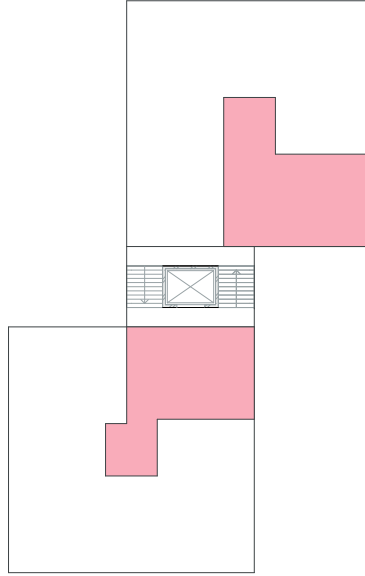
public square

entrance square

community space outside
inner courts

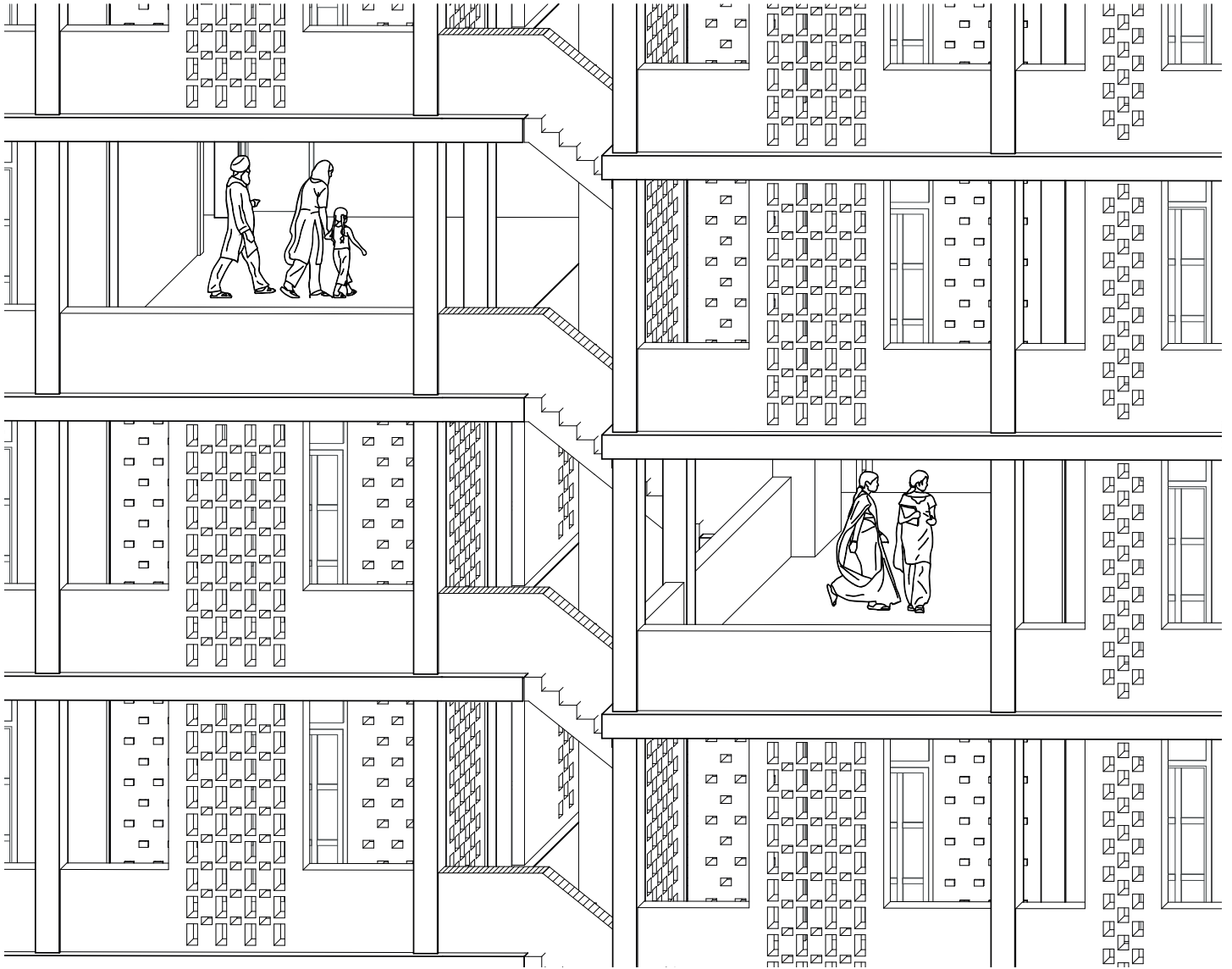
community space inside & circulation
roof top space
open areas on higher floors

the dwelling



public

private



COMMUNITY SPACES
inside the building

street + commercial plinth

community spine

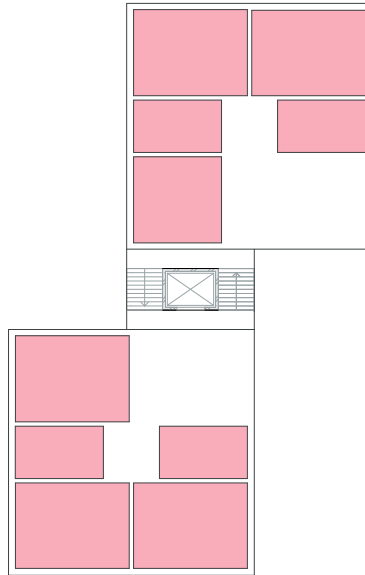
public square

entrance square

community space outside
inner courts

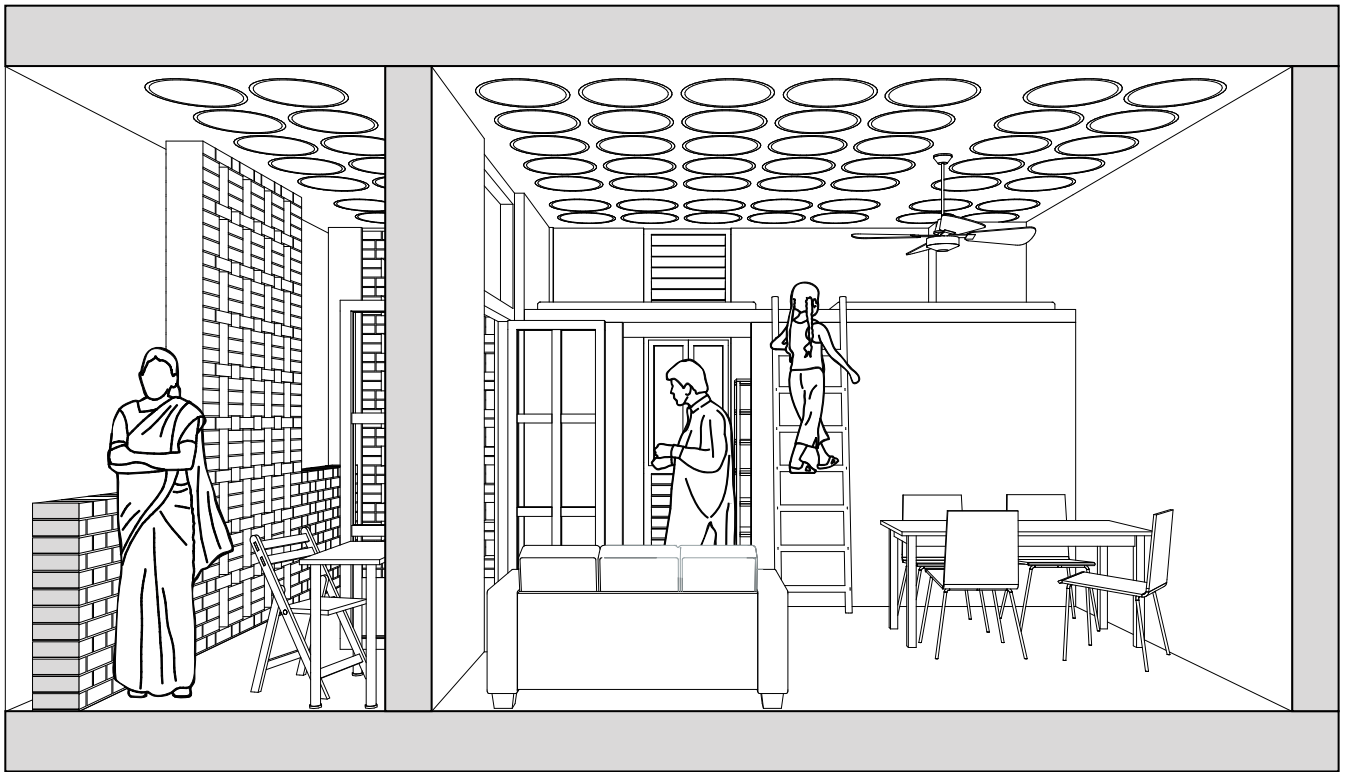
community space inside & circulation
roof top space
open areas on higher floors

the dwelling



public

private



THE DWELLING UNIT

AMENITIES

amenities as a binding factor
for communities

TOTAL COMMUNITY ENVIRONMENT DIAGRAM

social structure	physical structure
Person // 1p //	room
Family // 5-10p //	house, front yard, backyard
Neighbourhood // 100-150 f //	nursery, school, nutrition centre, basketball court, playground, small general store
Community // 500-750 f //	community centre, elementary school, health clinic, religious place, shops and stores
Zone // 1500-2500 f //	Zone centre, Police Centre
New Town	Police headquarters, commercial area, fire station, high school, market, hospital

Michael Y. Seelig, The architecture of Self-Help communities: the first international Design competition for the urban Environment of Developing countries.

THE AMOUNT OF AMENITIES NEEDED

reference project

COMMUNITY

buildings facing entrance square

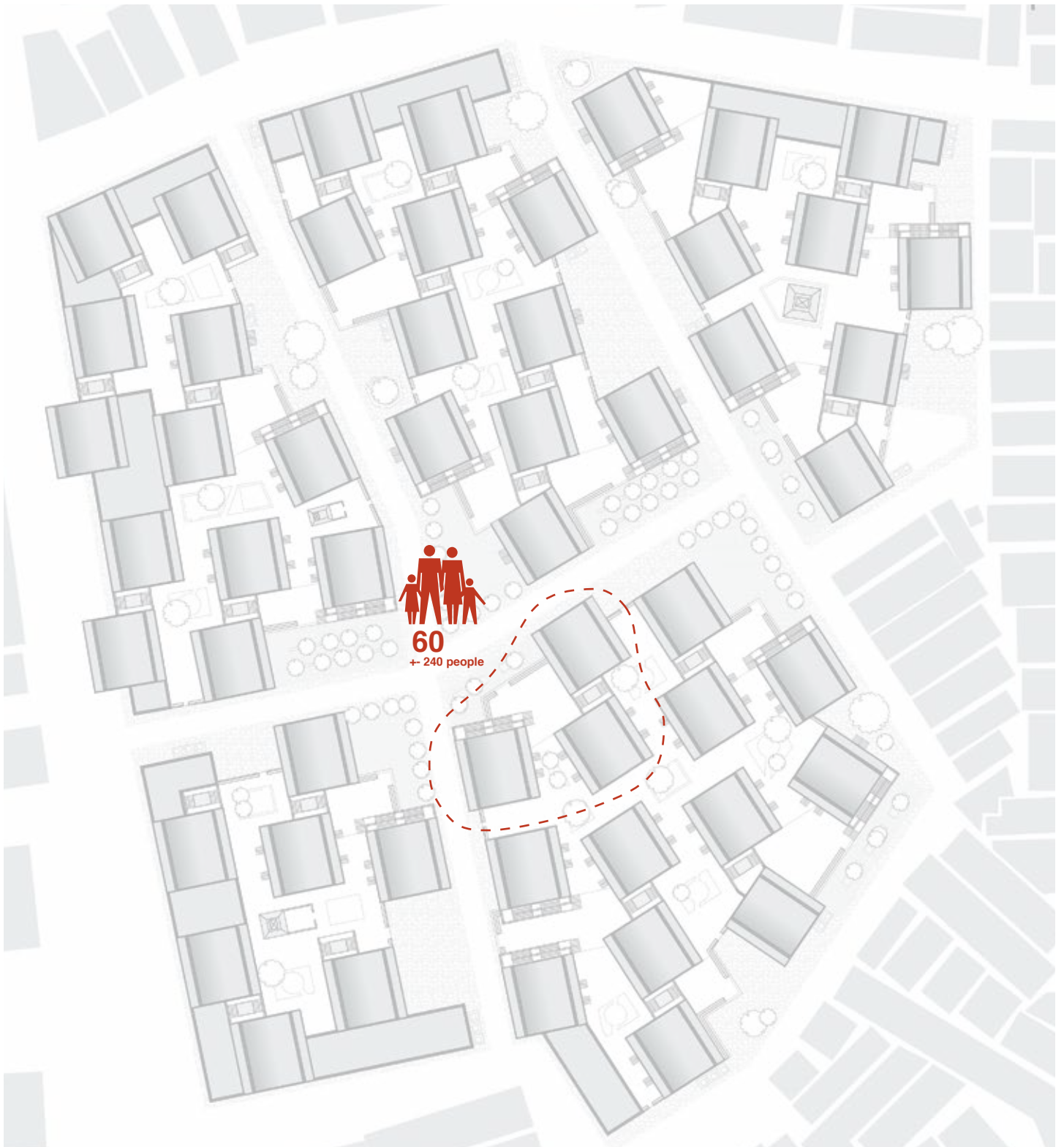
60 families

SHARED SPACES:

entrance square
vertical circulation system
community space on roof
community space on higher floors

SHARED AMENITIES:

-



NEIGHBORHOODS

area defined by community spine and/or commercial plinth

+/- 150 - 280 families

SHARED SPACES:

inner courts
with
playgrounds and places to sit

SHARED AMENITIES:

small scale amenities
like a nursery or community centre
-



AREA

+ 5 neighborhoods

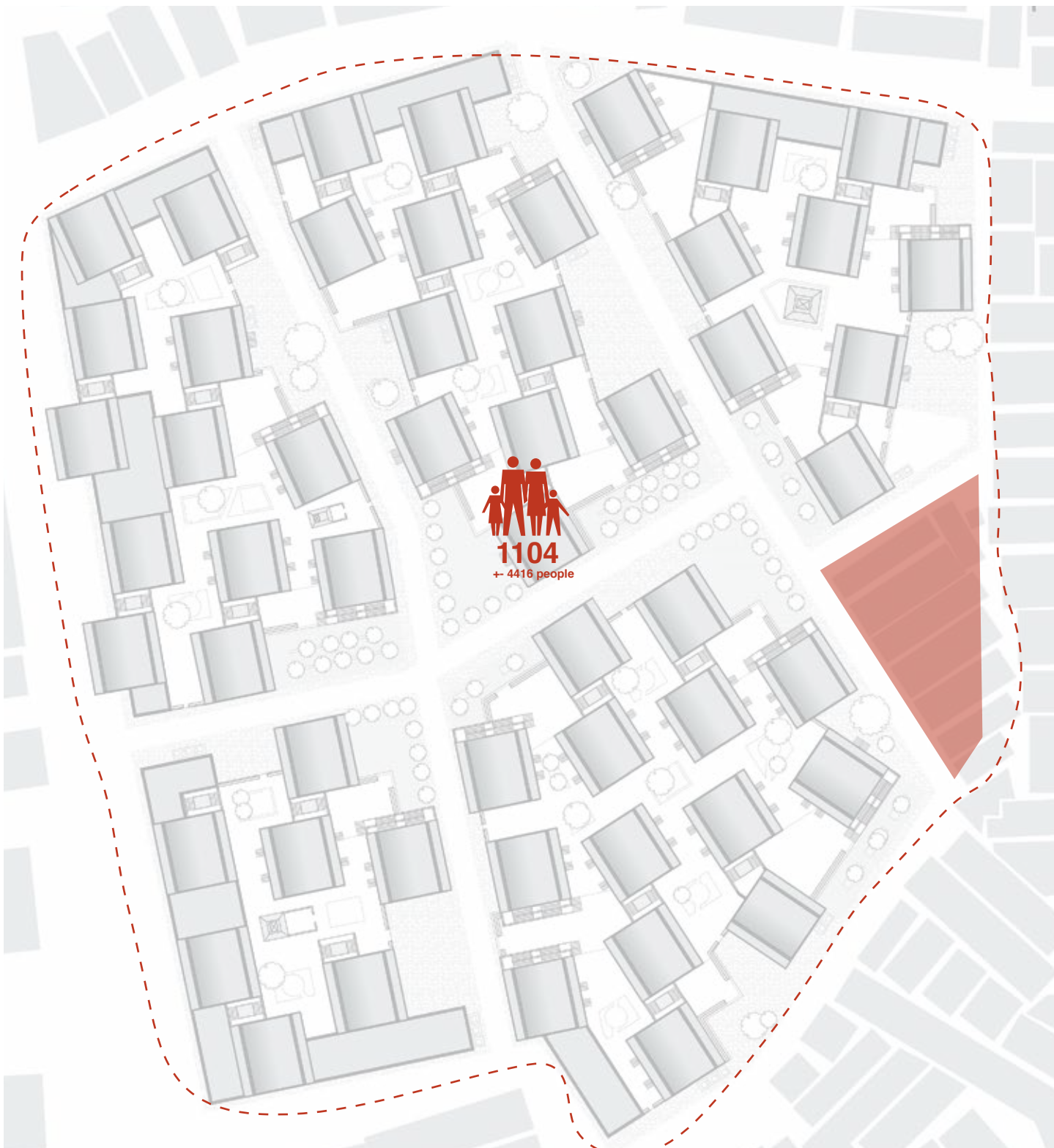
SHARED SPACES:

the community spine
public squares

SHARED AMENITIES:

one bigger amenity cluster
primary school and community centre

-



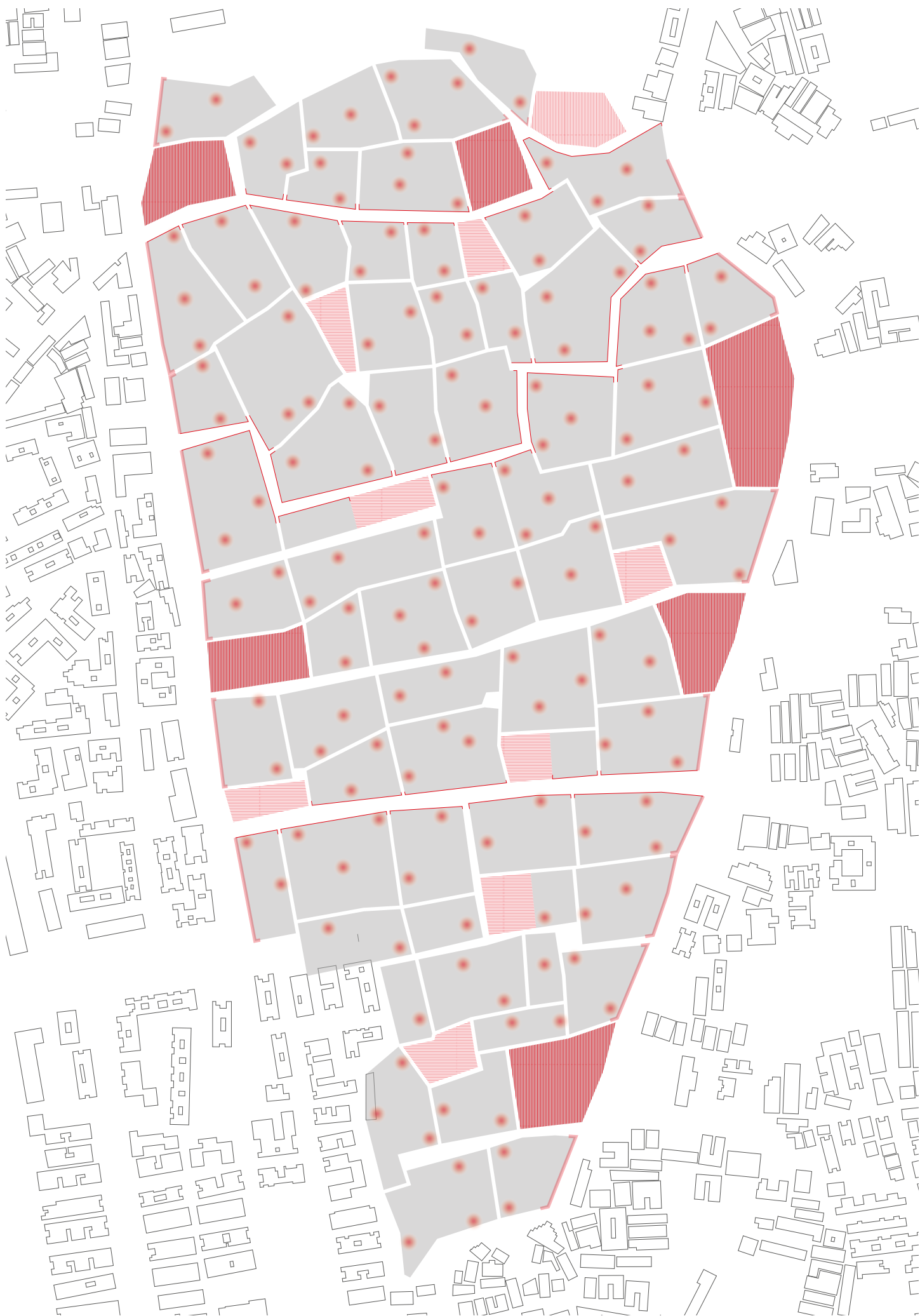
RAHMAT NAGAR

SHARED SPACES:

commercial street
pocket park

SHARED AMENITIES:

the commercial plinth
amenity pockets
-



COMMUNITY COMPARISON

(baithi) chawl compared to new approach



DENSITY
baiti chawl

FSI = 0,75

325 units per hectare

open space index = 0,2

comparison
253



DENSITY
chawls

FSI = 3

units per hectare = 1 325

open space index = 0,2

comparison
254



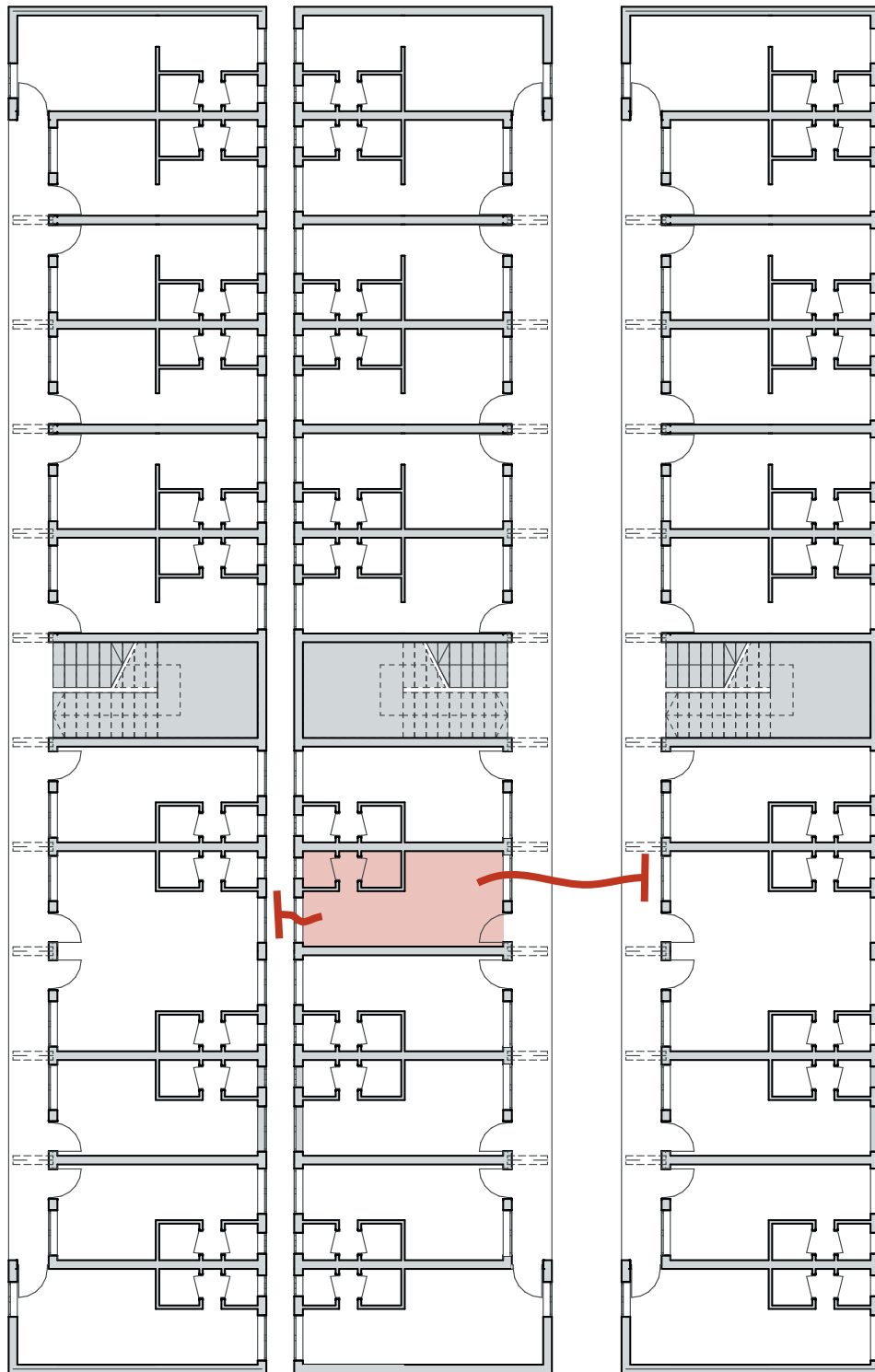
DENSITY
new proposal

FSI = 2,3

435 units per hectare

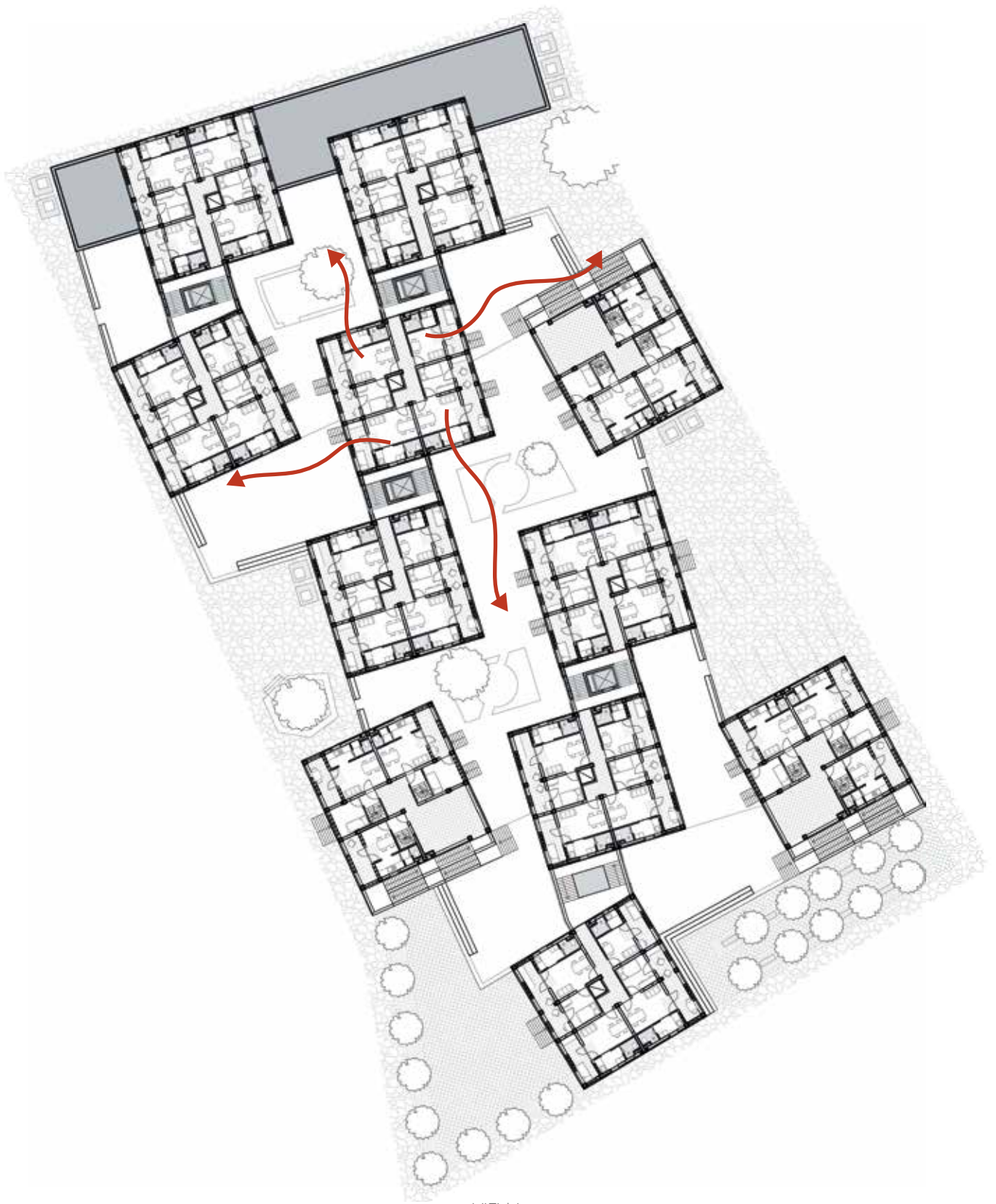
open space index = 0,6

comparison
255



VIEW
chawl

Chawls are positioned in a system of front alleys and back alleys. The average width of a front alley is 2m. The back alleys are often less than 1m in width. This urban layout compromises the daylight access on the lower floors tremendously.



VIEW
new proposal

In the plan all apartments are corner apartments. In this layout daylight access is guaranteed in each apartment. The arrangement of the buildings is in such a way that always one of the façades of the apartment is looking inside an alley, providing a feeling of space en view.



DAYLIGHT ACCESS chawls

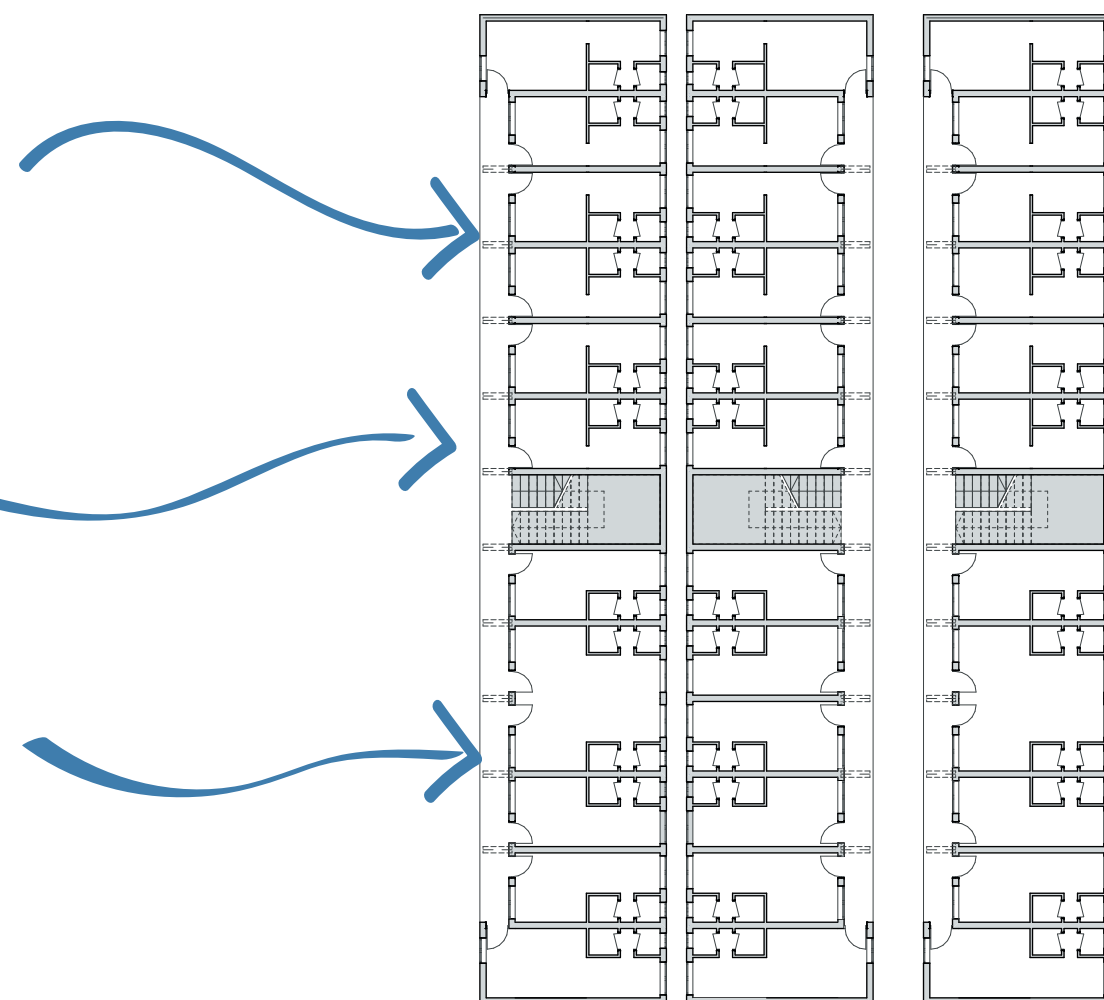
the urban layout of the chawls prevents daylight to reach the dwellings on the lower levels. only corner apartment and the top floor apartments receive enough daylight. a lack of daylight access has a negative influence on the hygienic conditions and also on the amount of electricity needed in the dwellings.



6,2 m

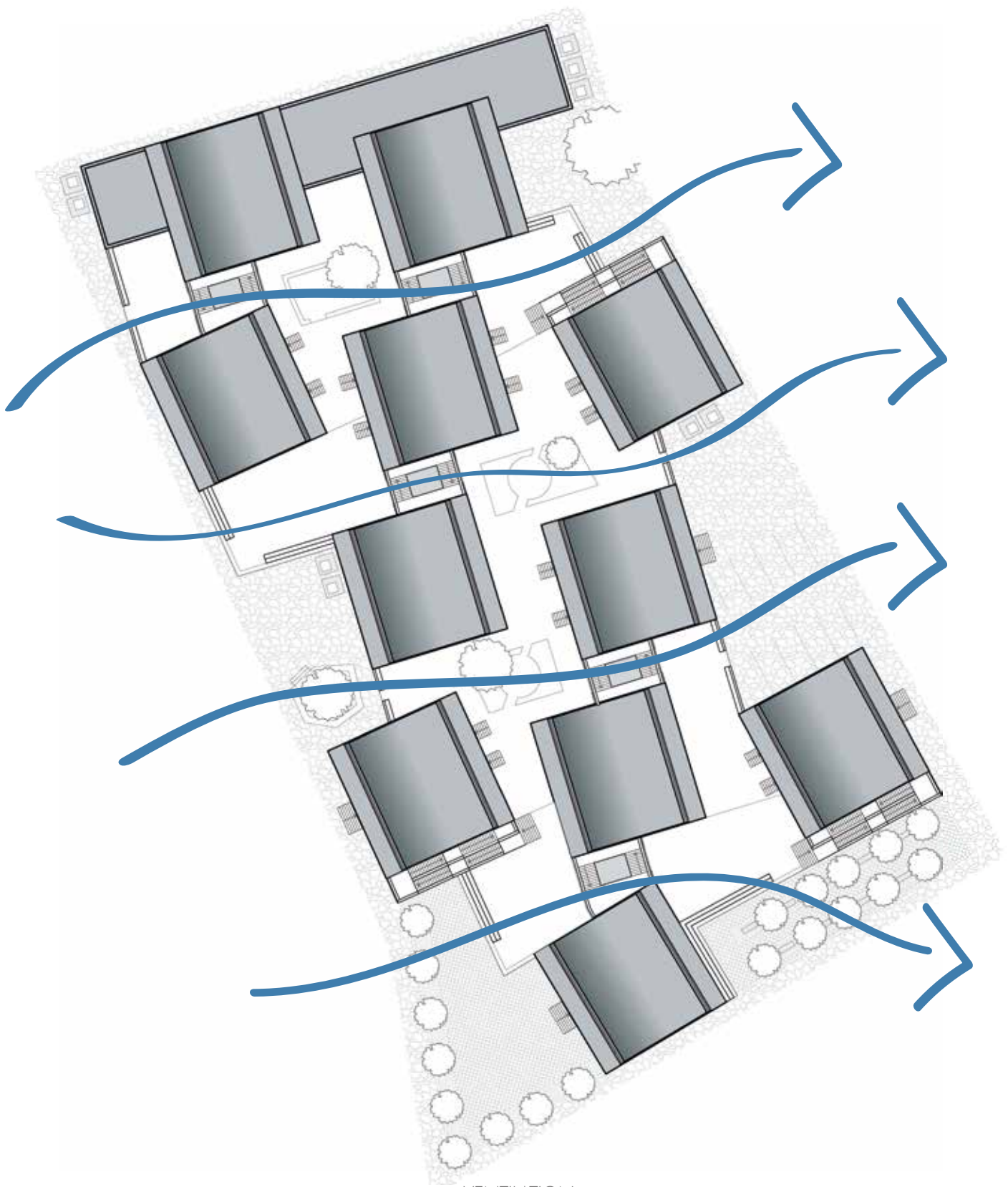
DAYLIGHT ACCESS new proposal

In the new proposal, the sunlight access is improved by placing the building further apart and by creating a square volume instead of 'walls' of buildings. the scattered placement of the buildings improves the all over light accessing the inner courts and alleys between the buildings. less electricity is needed in the apartments. all staircases can even do without during the day.



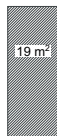
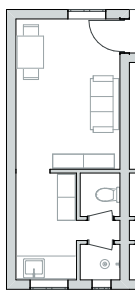
VENTILATION chawls

most of the chawls in the Rahmat Nagar area are orientated north-south. As the predominant wind direction in Mumbai is west the building block the flow of air, compromising on the ventilation in the buildings. bad ventilation can cause bad hygiene circumstances

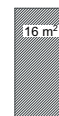
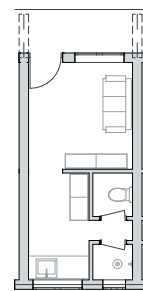


VENTILATION
new proposal

In the new proposal the wind can flow inbetween buildings as the structures always shift position. open staircases allow the wind to go through and shorter building volumes prevent the 'wall' effect that the chawls cause



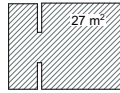
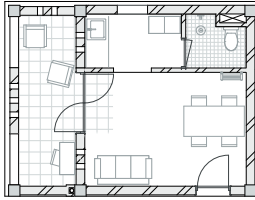
corner apartment
19m²



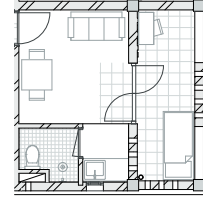
standard unit
16m²

DWELLING TYPES chawl

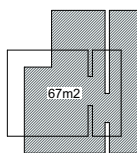
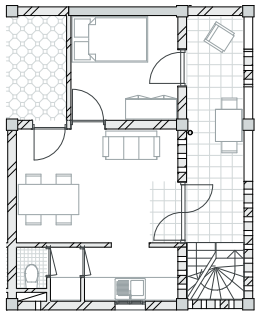
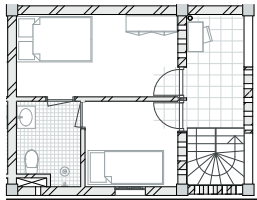
In the chawls we can find two main dwelling types. The normal apartment and the corner apartment.



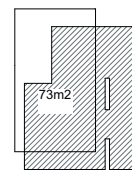
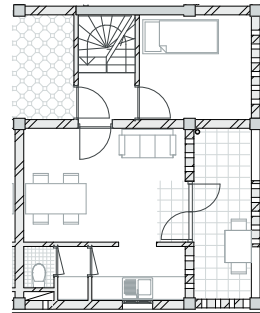
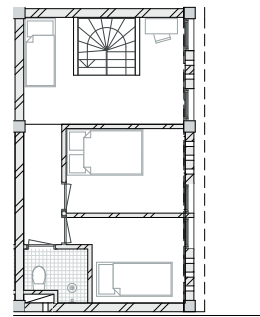
basic unit
27 - 41m²



small basic unit
20-34m²



maisonette
67 m²



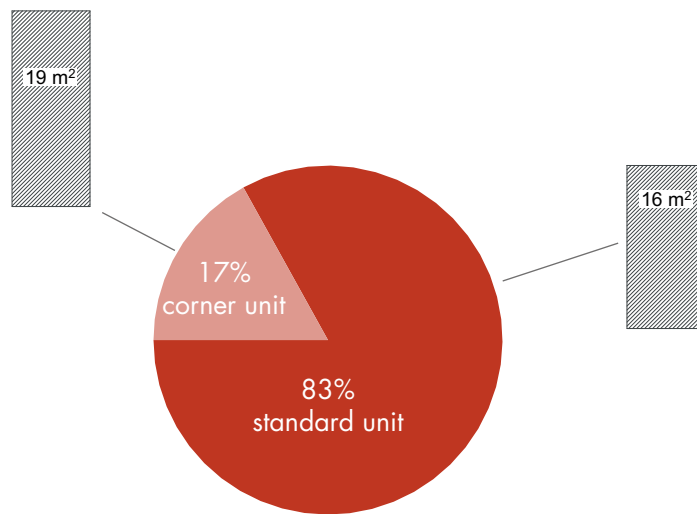
penthouse
73m²

DWELLING TYPES new proposal

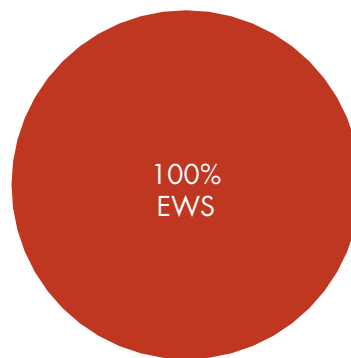
In the new proposal we can find 4 main dwelling types: the basic unit, the small basic unit, the maisonette and the penthouse. All main types have different variations to provide for different needs regarding family composition and income.

EWS	//	<27,88 m ²
LIG	//	27,88 m ² - 45 m ²
MIG	//	45 m ² - 80 m ²

UNIT SIZE AND INCOME GROUP
according to DCR



DIVERSITY



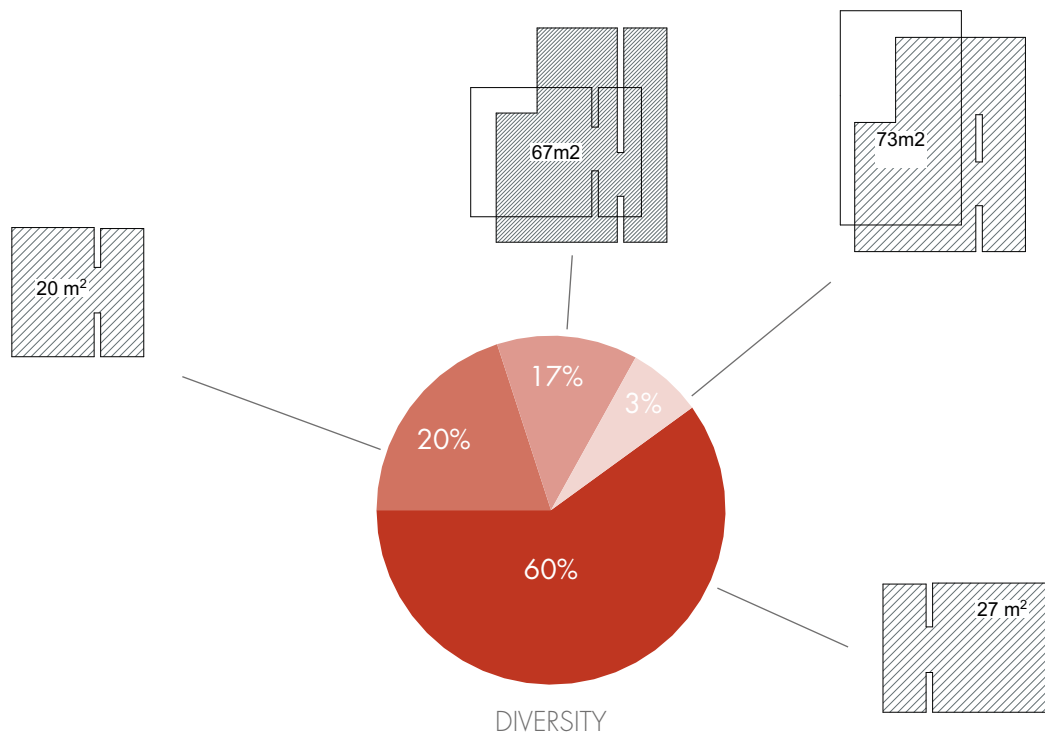
INCOME GROUP

DIVERSITY - DWELLINGTYPES AND INCOME GROUP chawl

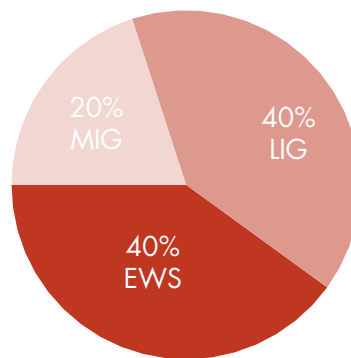
over 80% of the dwellings in the chawl area have the same layout. which leads to an enormous monotonous area. housing that does not provide for individual needs.

100% of the housing in the chawls, according to the regulations, is housing for the EWS. creating enormous areas with inhabitants of this income group only.

average unit size = 16,5m²



DIVERSITY

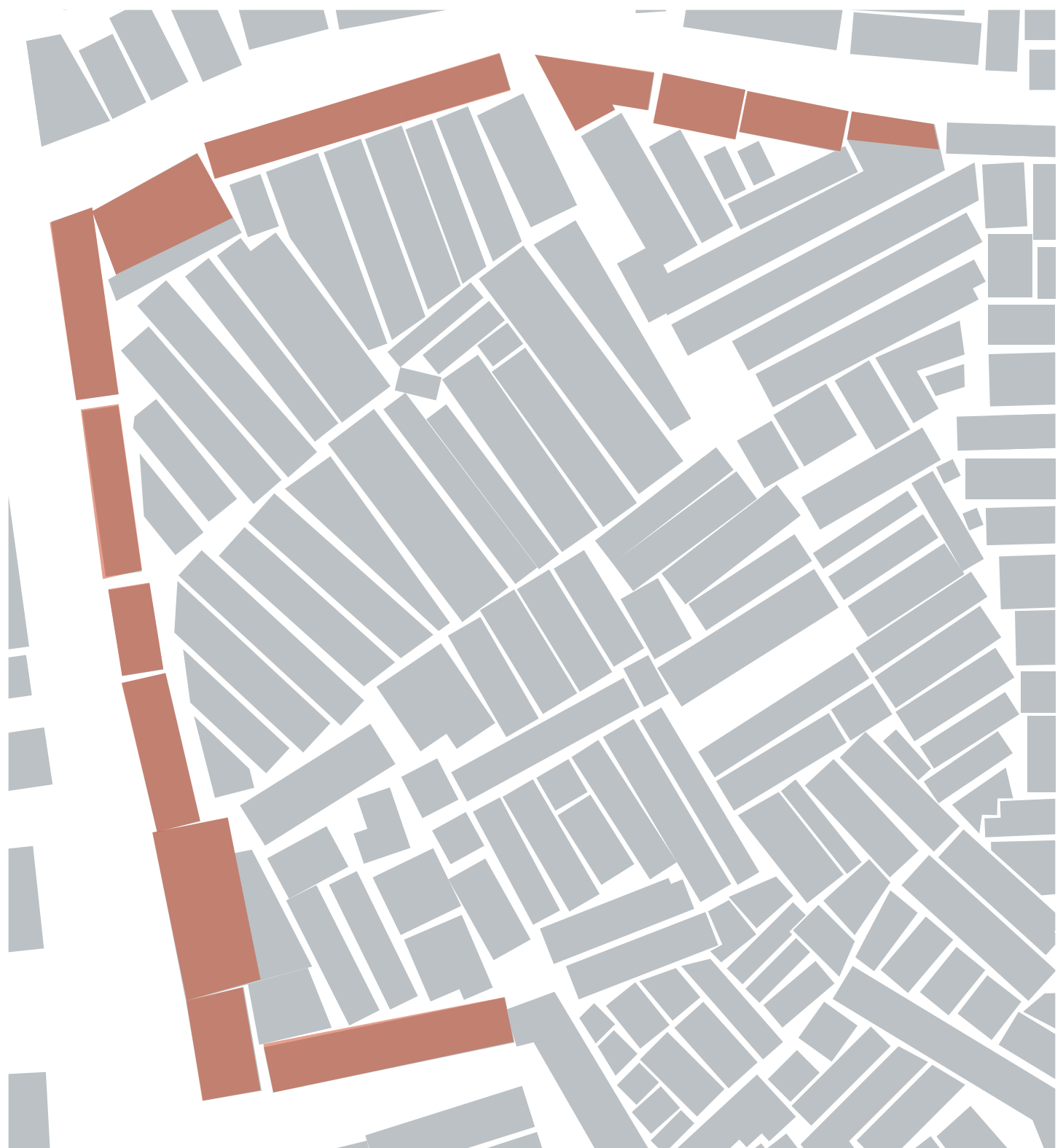


INCOME GROUP

DIVERSITY - DWELLINGTYPES AND INCOME GROUP new proposal

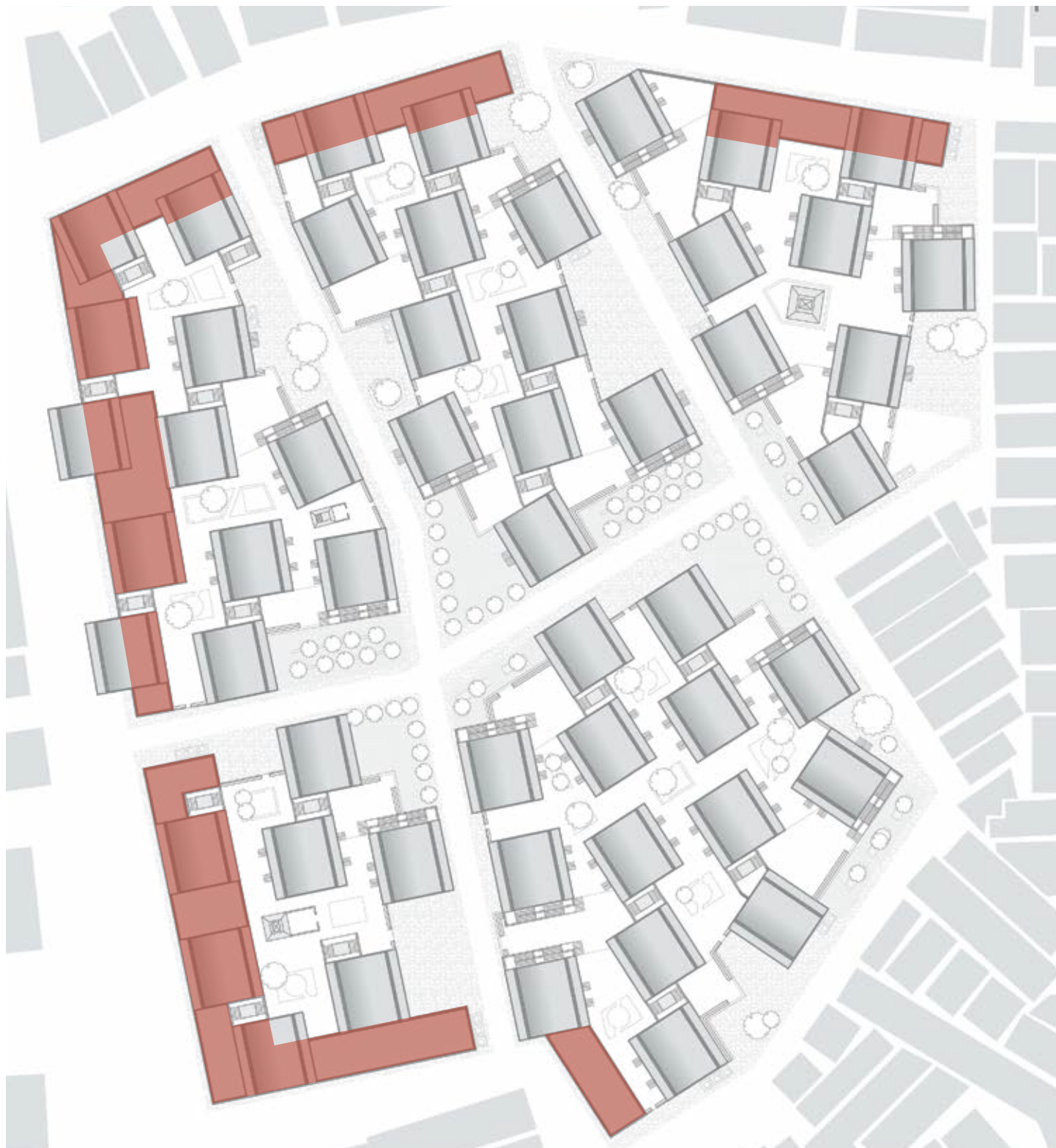
In the new proposal we can find 4 main dwelling types: the basic unit, the small basic unit, the maisonette and the penthouse. All main types have different variations to provide for different needs regarding family composition and income.

average unit size 40 m²



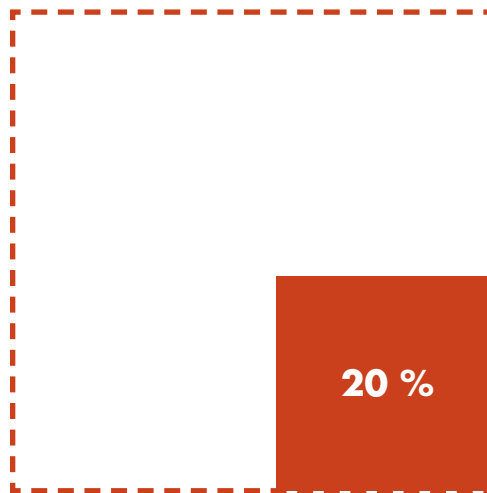
COMMERCIAL SPACE
chawls

total: 2802m²



COMMERCIAL SPACE
new proposal

total: 3.060 m²



Mumbai, Development Control Regulations, 2016

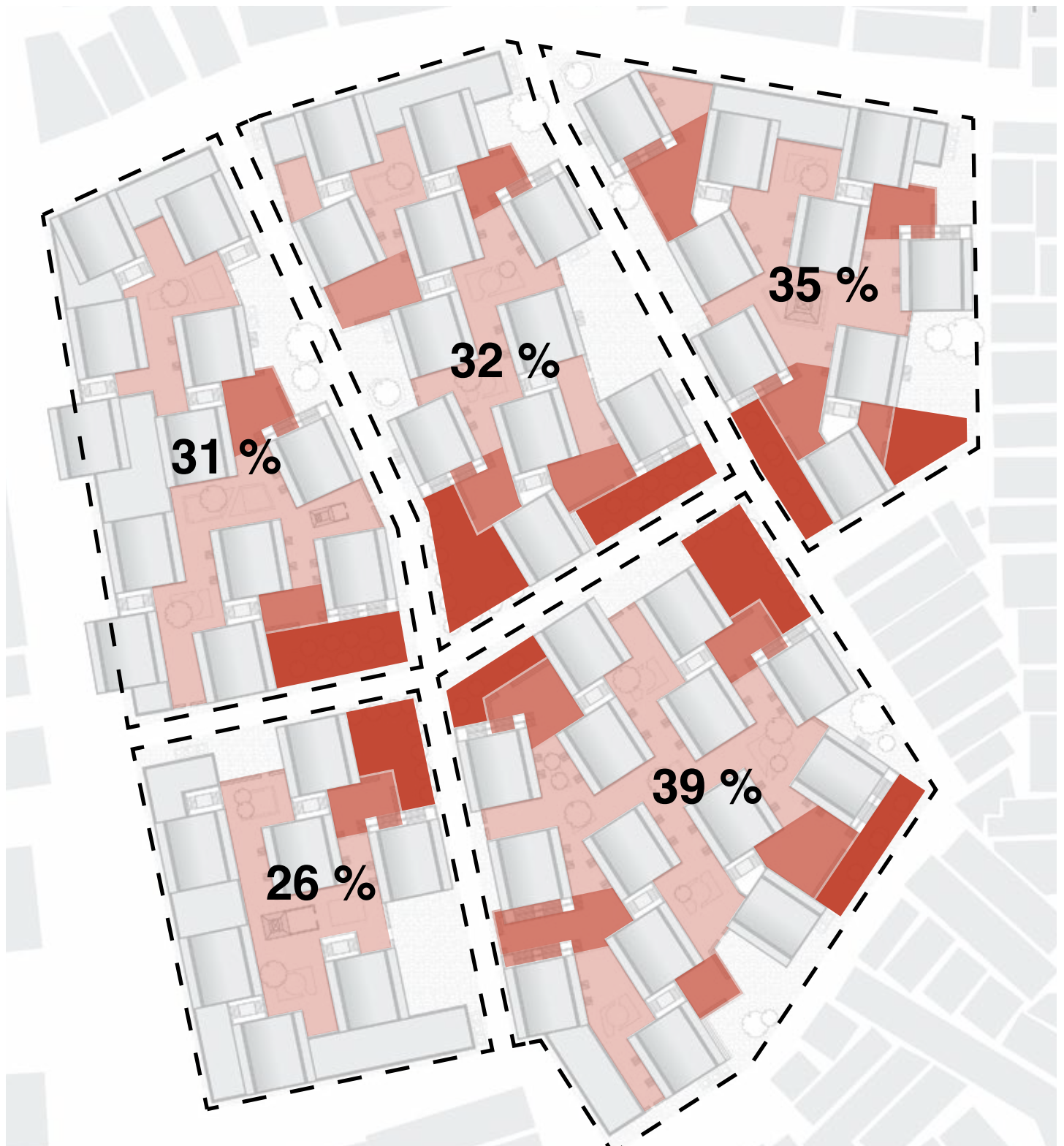
RECREATIONAL OPEN SPACE
according to DCR

The Mumbai DCR regulations state that 20% of developed areas should be reserved for ROS (recreational open space). This space should be exclusive of streets, parking and other connecting areas.



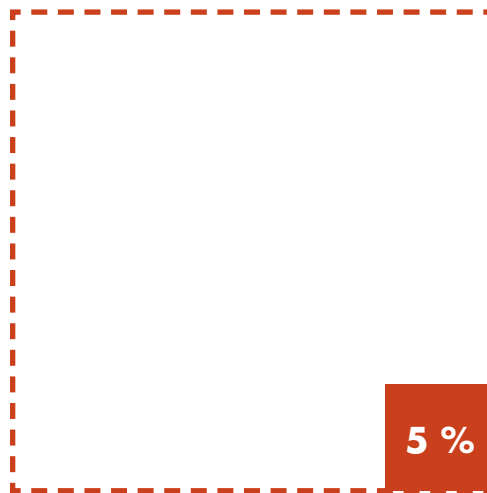
RECREATIONAL OPEN SPACE
chawls

apart from some leftover open space, which will probably turn into building sites soon, the chawls have no intended recreational open spaces. Do not provide open space other than for circulation through the area. and even that is very limited in dimension.



RECREATIONAL OPEN SPACE new proposal

the new proposal provides far more recreational open space than the required 20%. In this calculation, only the inner courts, entrance squares and public squares are counted as ROS. the community spine is not included as this is part of the circulation system of the area. but the spine adds to the open feeling of the area



Mumbai, Development Control Regulations, 2016

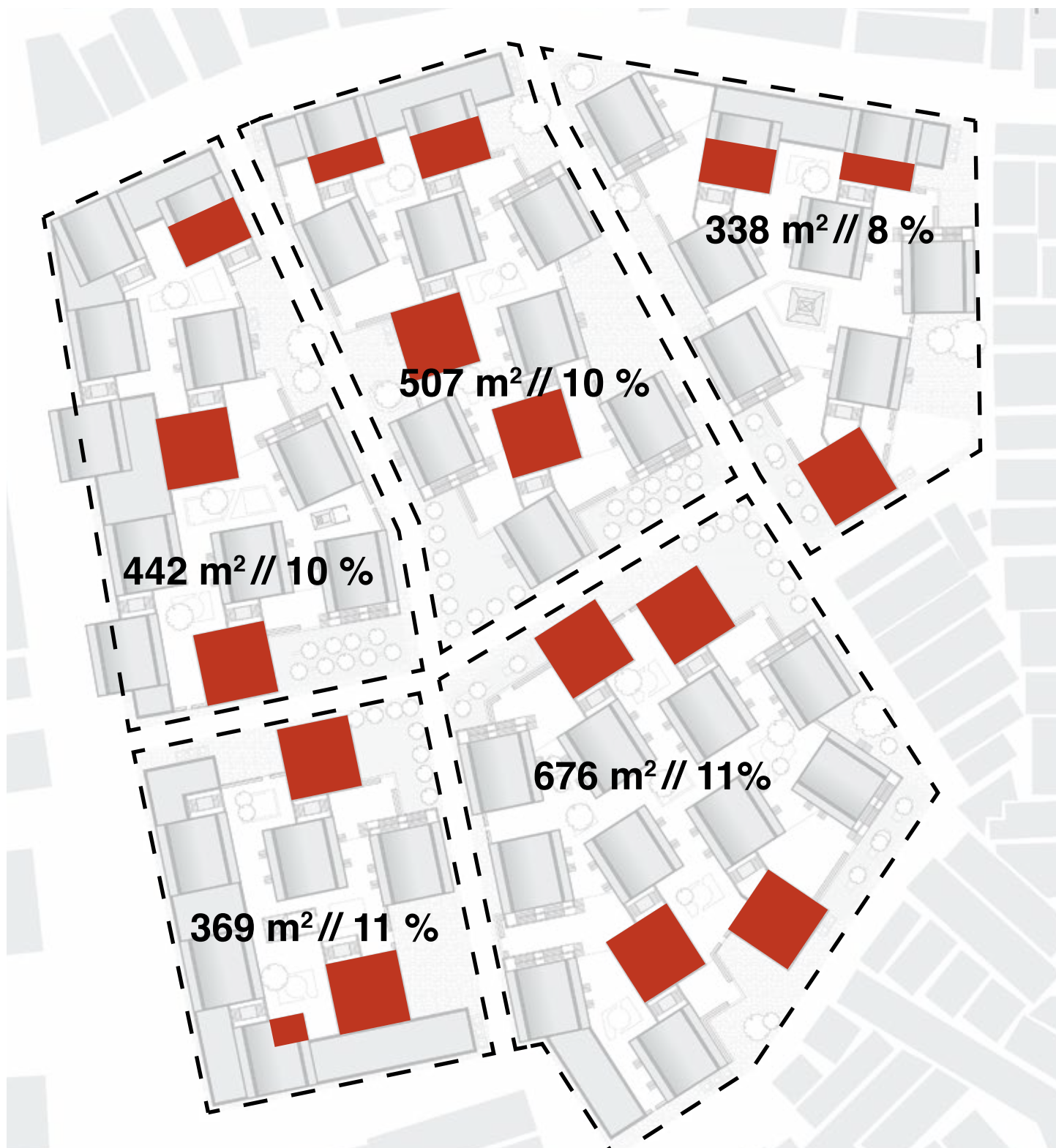
AMENITIES
according to DCR

The Mumbai DCR regulations state that 5 % of developed areas should be reserved for amenities



AMENITIES chawls

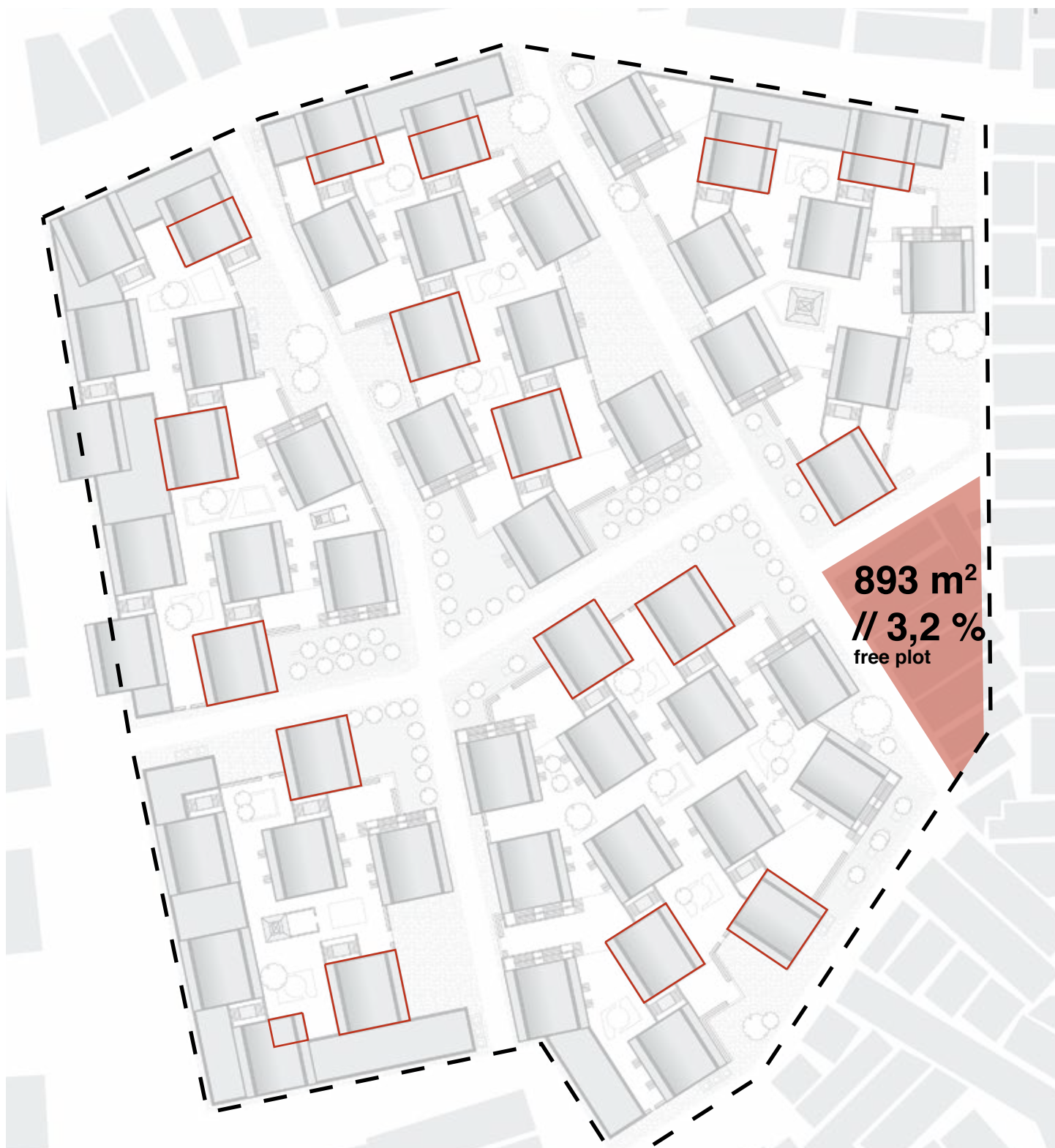
the amenities in chawl areas are very limited. single units are used for teaching and small businesses. occasionally a complete chawl is transformed into a school or health clinic. But we can conclude that the oval amount of amenities does not reach the demanded 5 % of the DCR.



AMENITIES new proposal

the reserved area for amenities almost doubles the demanded number by the DCR.

These areas can be used for amenities such as: nurseries, community centres, smaller health clinics, etc.



AMENITIES

for bigger amenities such as, primary schools, sport field, etc. extra space will be reserved in the plan. in these areas the entire plot can be used to build a particular structure. Height should be limited to a maximum of 5 to 6 floors.

average cost of tenements Nala Sopara East

50.609 rupees/m²

mhada cost of tenements // Mumbai (average, 2017)

EWS // 72.000 rupees/m²

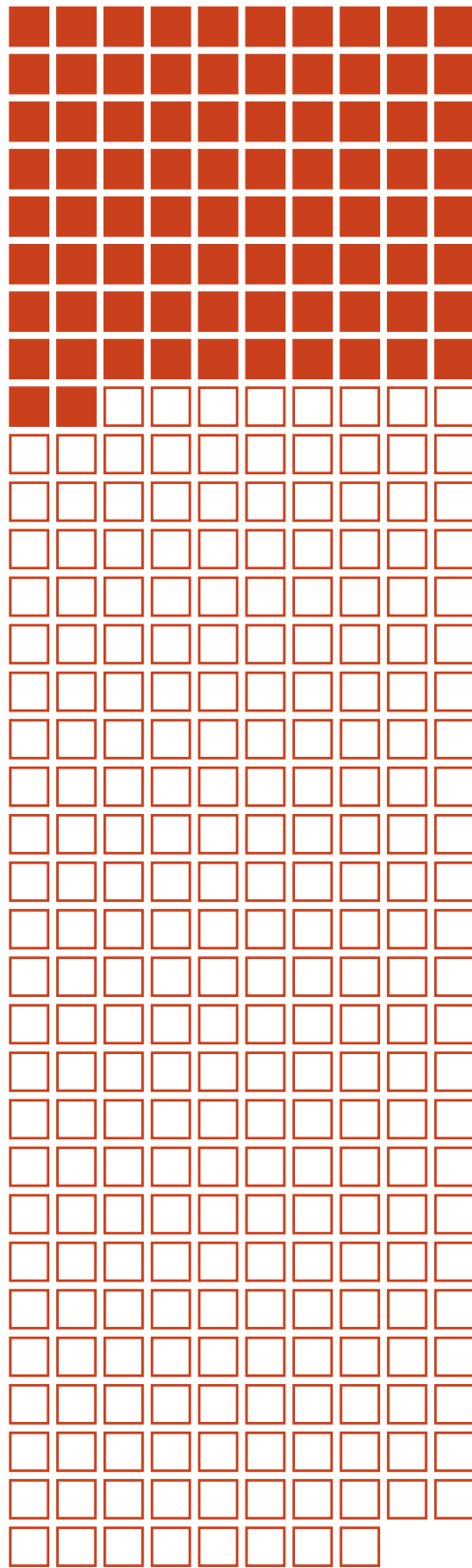
LIG // 97.000 rupees/m²

MIG // 107.000 rupees/m²

*mhada lottery 2017; <http://mhadalottery2017.in/wp-content/uploads/2017/09/MHADA-Lottery-Advt.-2017.pdf>
average sale prices Nala Sopara; <https://www.magicbricks.com/Property-Rates-Trends/Multistorey-Apartment-rates-Nalasopara-East-in-Mumbai>*

FEASIBILITY comparative figures

the MHADA lottery system prices and the average cost of tenements in Nala Sopara east are used to calculate the possible proceeds of the chawl redevelopment and the new proposal.



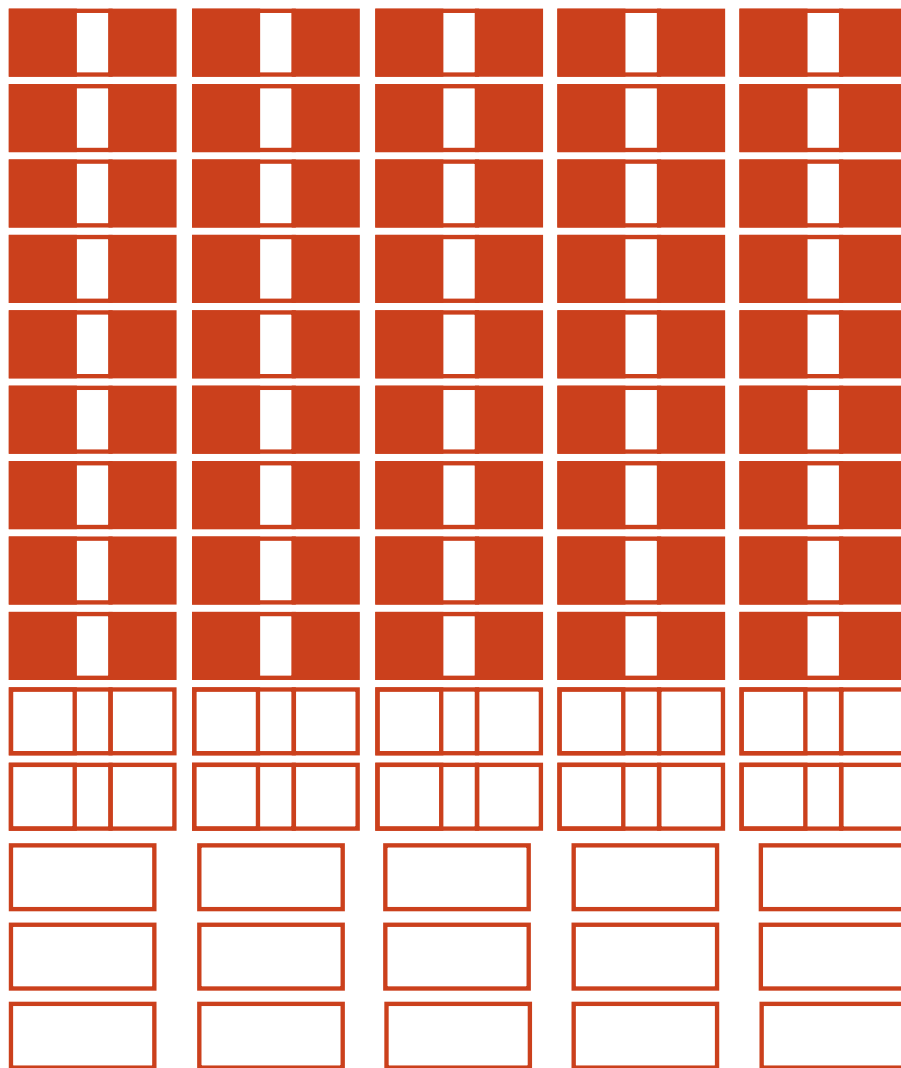
FEASIBILITY

total new build floorspace: 53.922m²
 added saleable floorspace: + 40.441 m²

EWS
 40.4411 m²

LIG
 0

MIG
 0



FEASABILITY

total new build floorspace: 46.255m²
 added saleable floorspace: + 19.907 m²

EWS
 2221m²

LIG
 3875m²

MIG
 8508m²

total new build floorspace: 53.922m²
added saleable floorspace: + 40.441 m²

$$\begin{aligned} \text{EWS} &= 40.4411 \text{ m}^2 \times \text{average of NS} = 50.609 \text{ rupees/m}^2 \\ &= \\ &205 \text{ crore} \end{aligned}$$

PROCEEDS
chawls

total new build floorspace: 46.255m²
added saleable floorspace: + 19.907 m²

EWS = 2221m² x MHADA EWS = 72.000 rupees/m²

+

LIG = 3875m² x MHADA LIG = 97.000 rupees/m²

+

MIG = 8508m² x MHADA MIG = 107.000 rupees/m²

=

196 crore

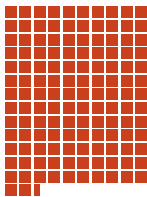
PROCEEDS new proposal

In this calculation, the plan the optimal density (as presented in the previous part of the booklet) is used. the proceeds of the new proposal are quit close to the chawl proceeds. To match the numbers two of the following options could be used: 1. increasing density slightly; by adding 8 floors in total throughout the area. 2. subsidization of the apartments for EWS and LIG

DENSITY

FSI = 3

UNITS PER HECTARE



1325

AVERAGE UNIT SIZE



16,5 m²

OPEN SPACE /pp



0,57m²

RECREATIONAL OPEN SPACE/pp

0m²

AMENITIES



< 5%



100%

COMMUNITY COMPARISON

chawls
comparison
286

DENSITY

FSI = 2,3

UNITS PER HECTARE



435

AVERAGE UNIT SIZE



40 m²

OPEN SPACE /pp



13,8 m²

RECREATIONAL OPEN SPACE/pp



7,4 m²

AMENITIES



> 10%



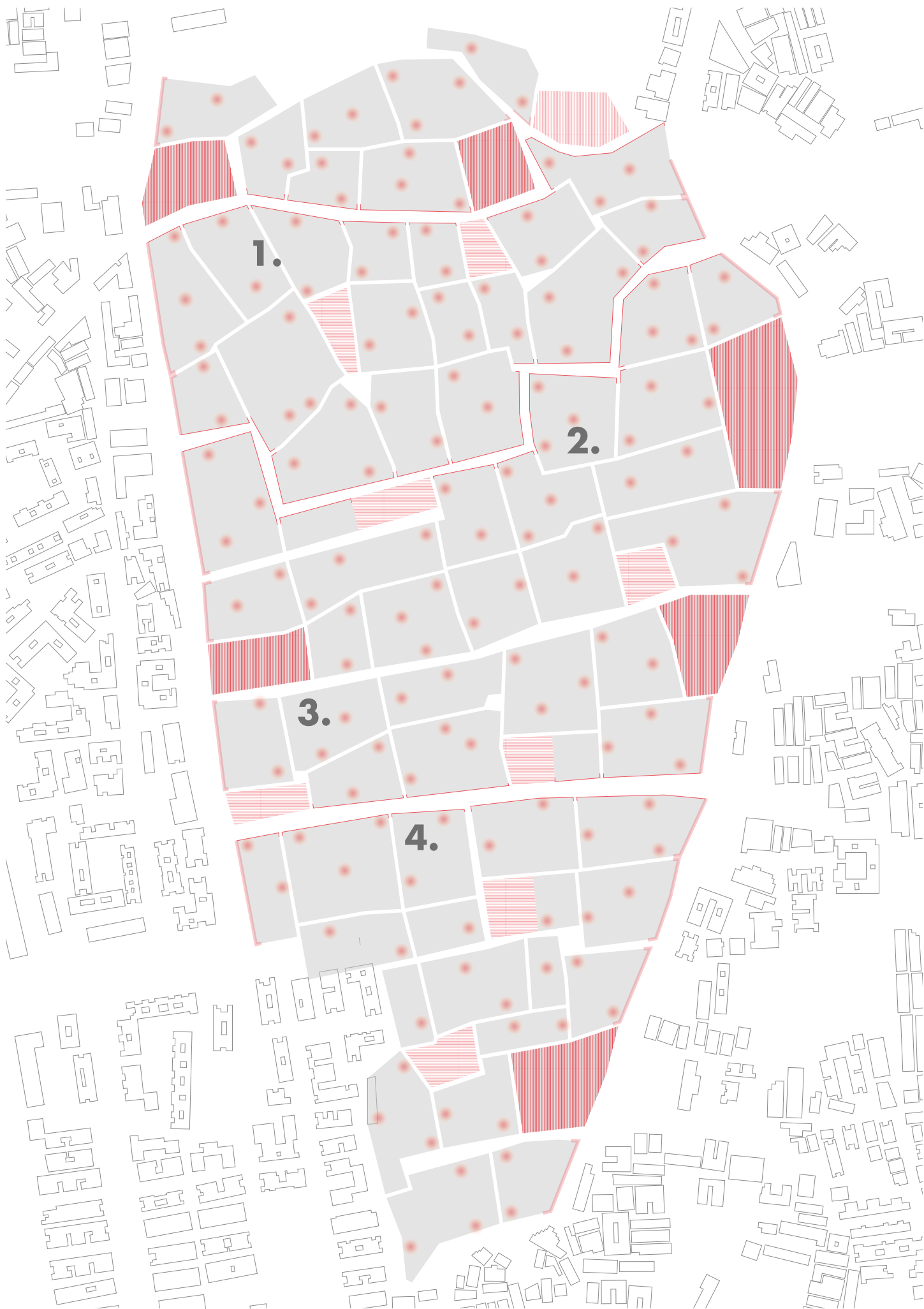
-4%

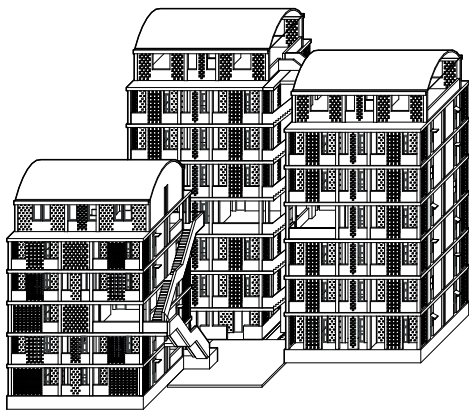
COMMUNITY COMPARISON

new proposal
comparison
287

MAXIMIZING DENSITY

to what extend can the densety of the scheme be increased





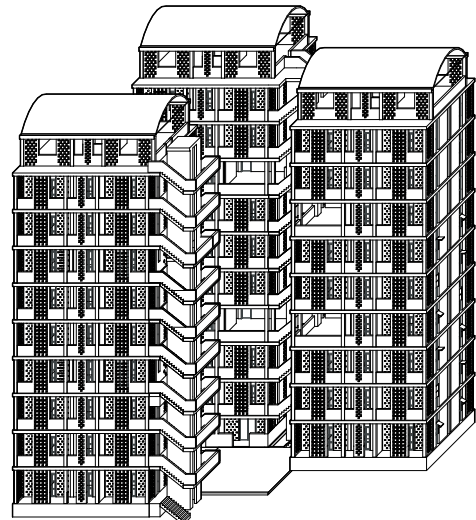
1.
6 - 7 floors
435 units /hectare
average unit size = 40m²



2.
6 - 8 floors
488 units /hectare
increase of profit: 476.196.000 rupees
+24 %



3.
6 - 10 floors
612 units /hectare
increase of profit: 1.428.588.000
+ 73%



4.
10 floors
722 units /hectare
average unit size: 31m²
increase of profit: 3.375.408.000
+172%

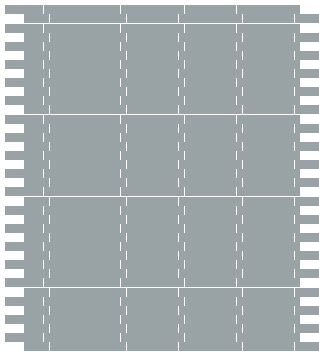
MAXIMIZING DENSITY increasing density and consequences

An optimized version of the scheme is presented. The density could be increased by adding floors to the cluster buildings. profits will increase when density increases. adding more density will affect the amount of amenities and (recreational) open space per person. This aspect should be taken into consideration when determining the desired density. For option 4 the monotonousness of the units should also be considered, as this option only provides for the LIG and EWS.

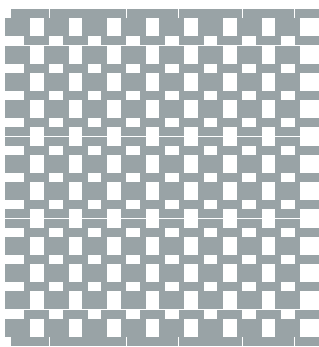
BUILDING TECHNOLOGY

FACADE PRINCIPLES

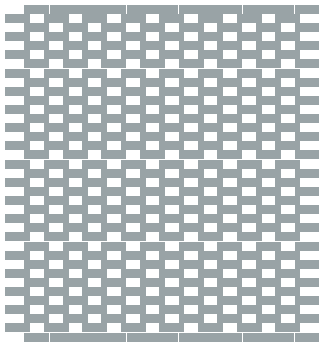
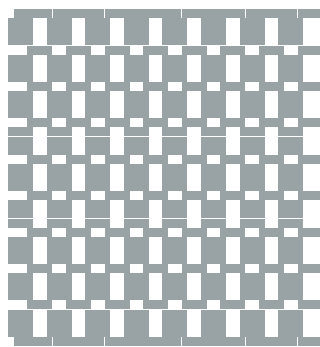
Jali brickwork, windows and doors



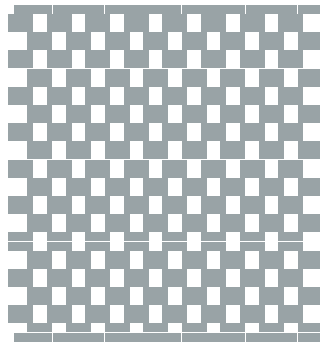
English bond brick pattern



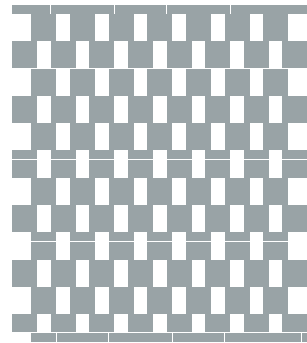
Jali pattern 1 // 45 % less brick



Jali pattern 3 // 47 % less brick



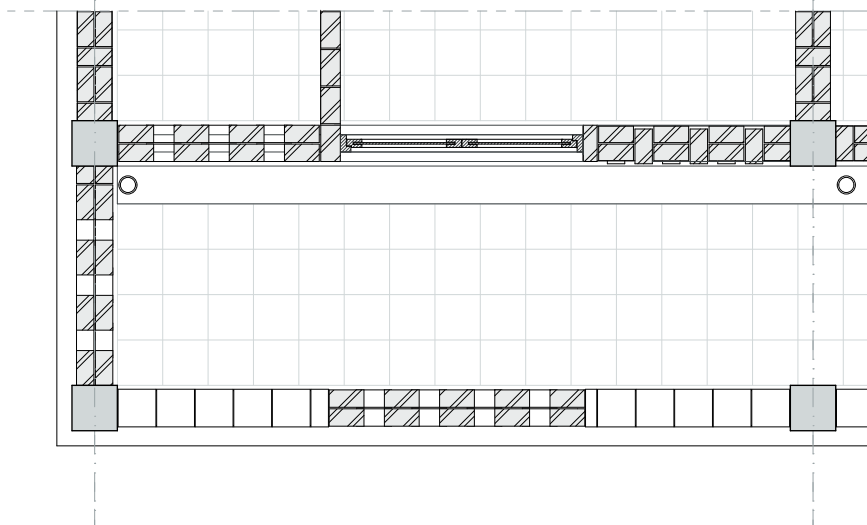
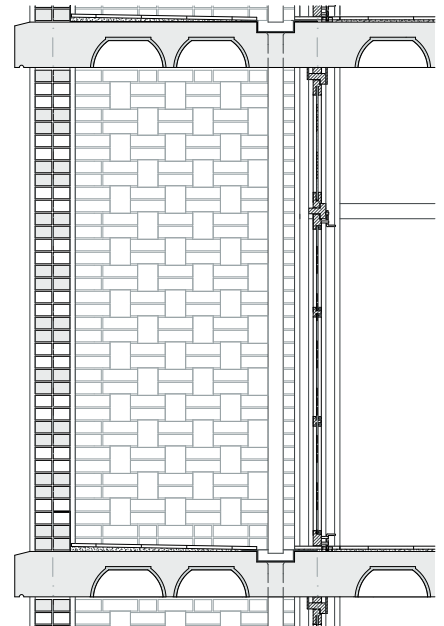
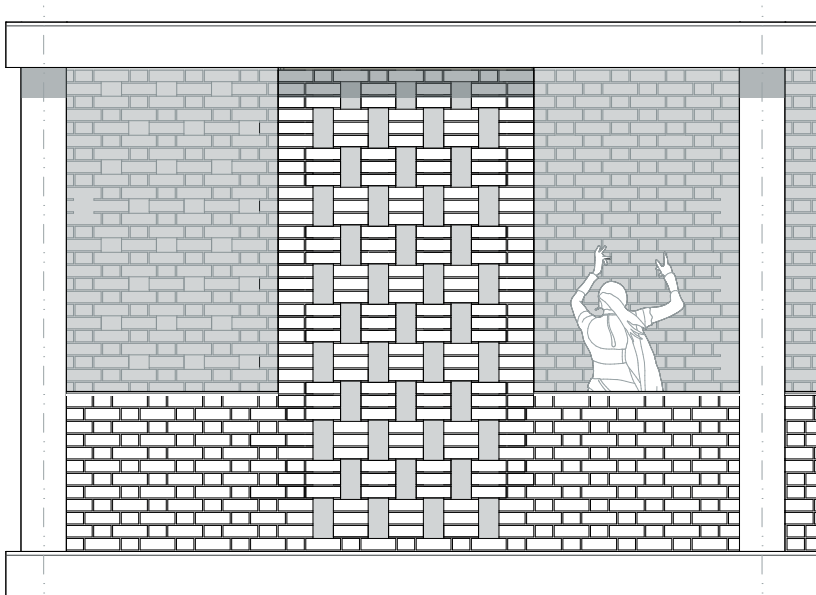
Jali pattern 4 // 47 % less brick



Jali pattern 5 // 47 % less brick

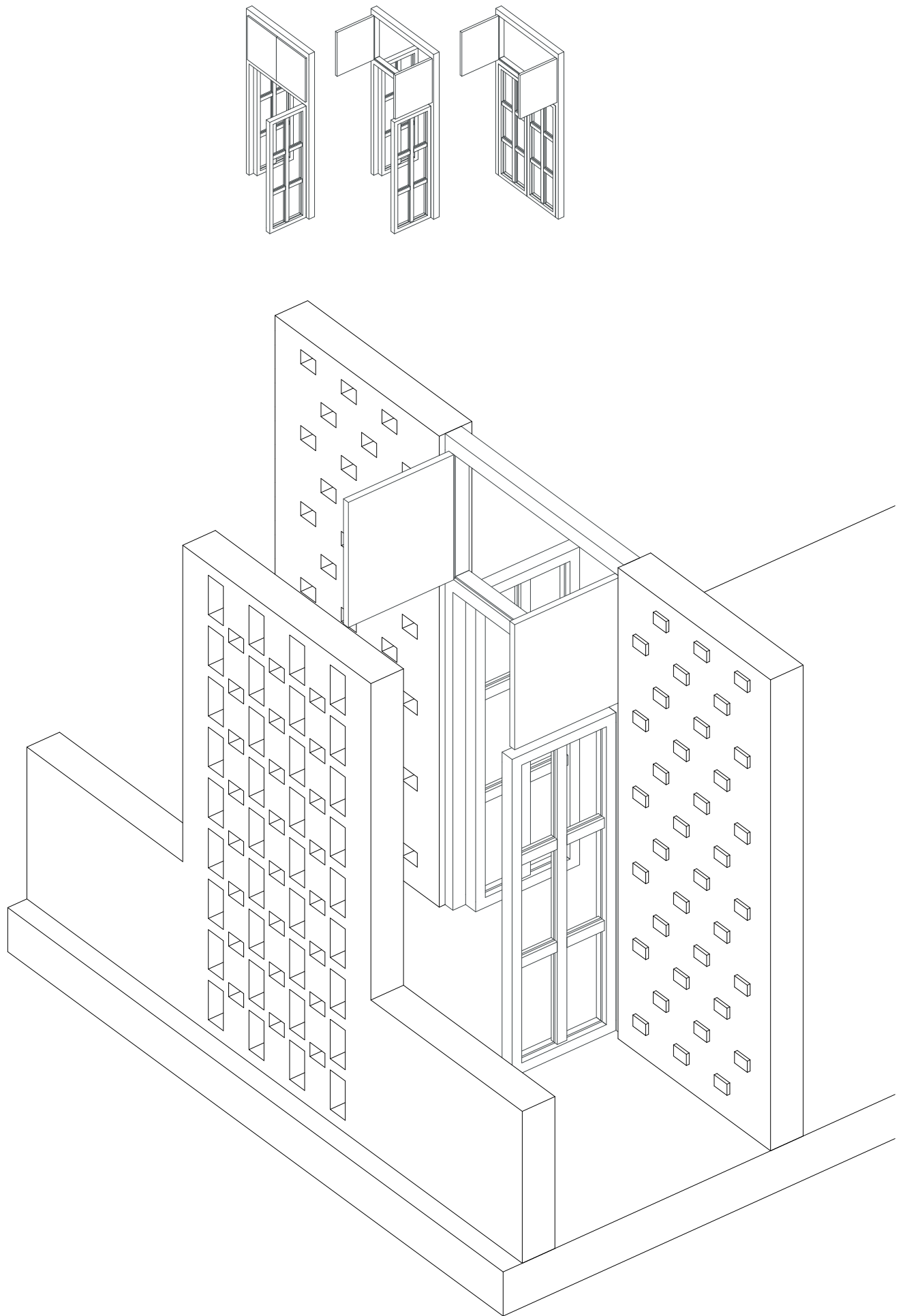
JALI PATTERNS facade system

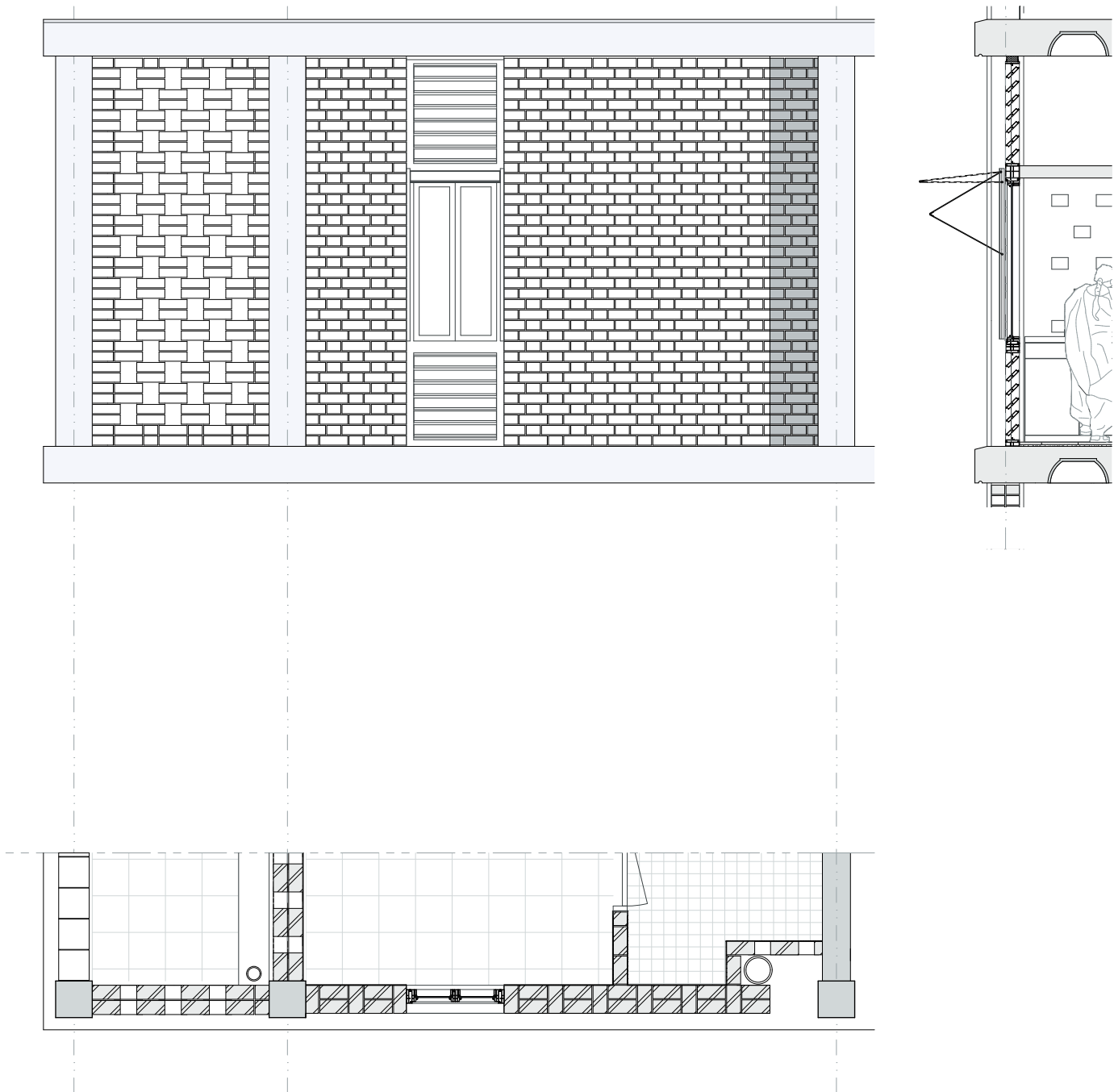
the facade of the veranda will have an infill of Jali brickwork.
different patterns will be used to create a patchwork effect.
the brickwork will then be painted to protect in from the heavy
rain.



EAST AND WEST FACADE
1.50 facade fragment

the east and west facade two layers of jali brickwork provide privacy and at the same time allow for ventilation. the two door leaves turning in opposite direction; for optimal use of the indoor/outdoor space. The two panels above the doors can be used for ventilation at night or for extra ventilation during the daytime.

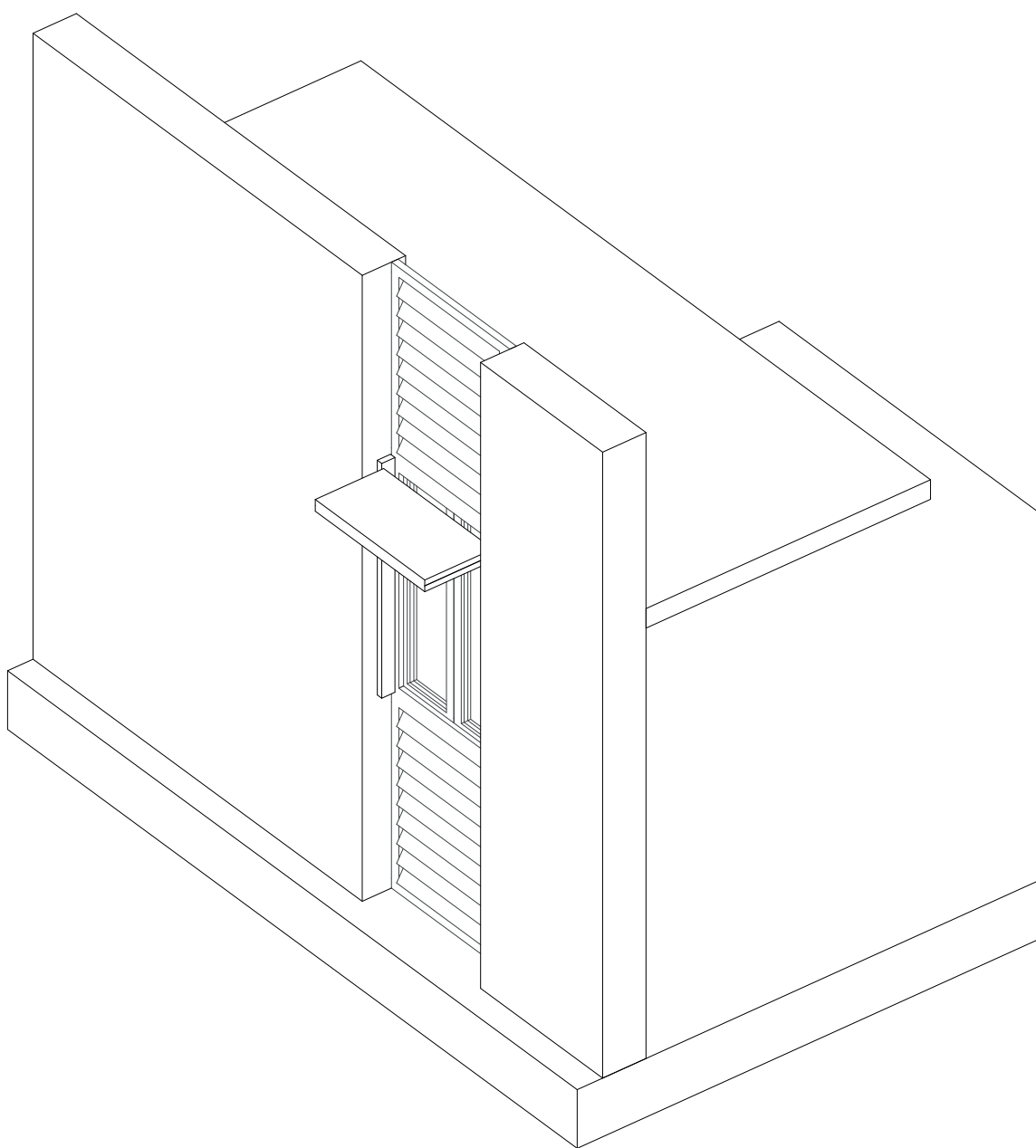
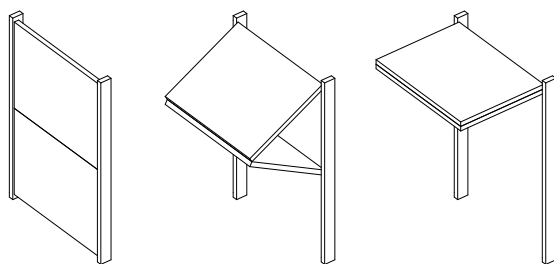




NORTH AND SOUTH FACADE
1.50 facade fragment

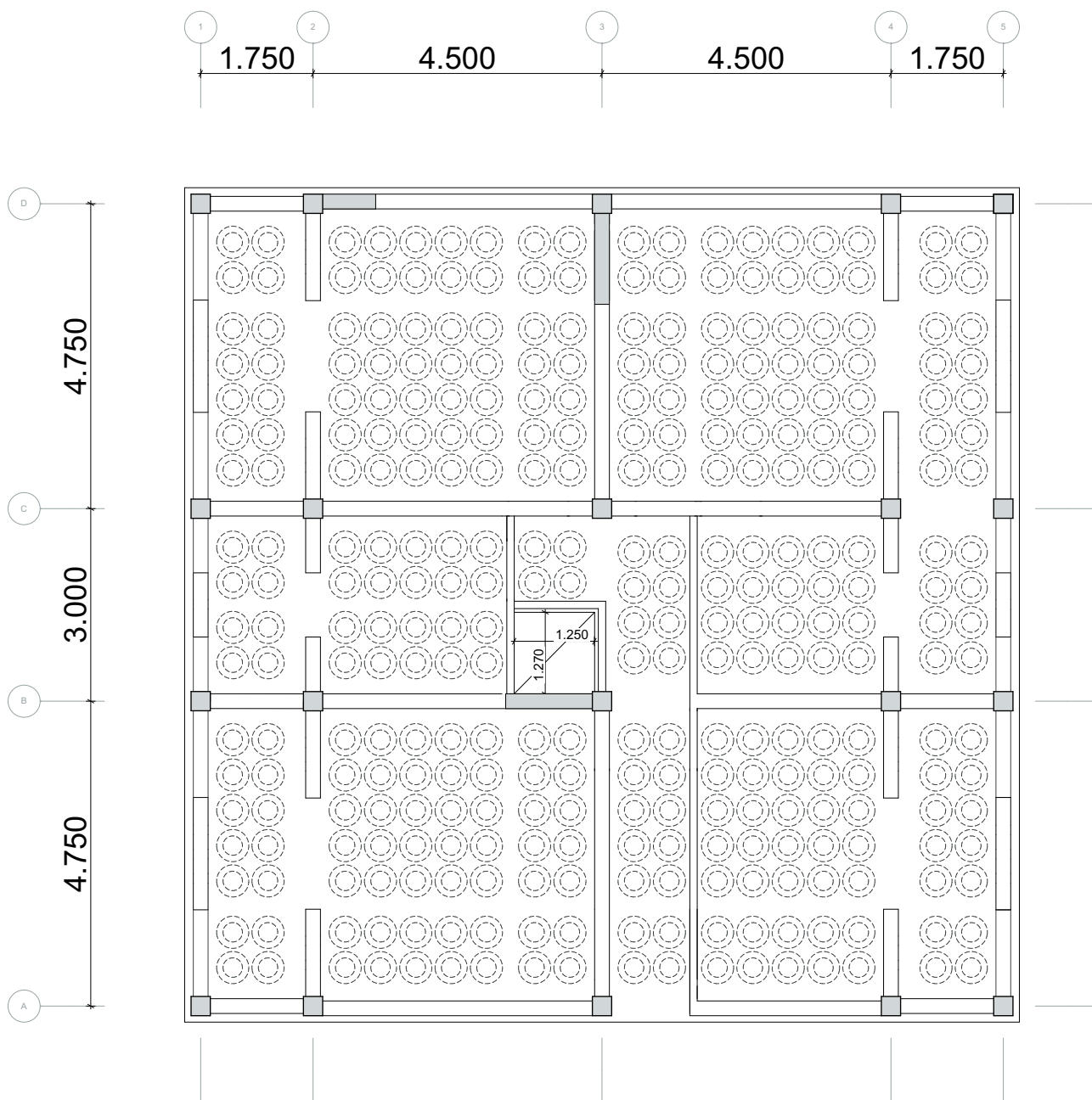
The North and South facade both have a small window with movable shutters above and below the window. In the Cluster building, the shutters above provide ventilation in the loft space. the shutters below provide extra ventilation in the kitchen area.

the big shutter above the window protects the window from direct sunlight and from the rain.



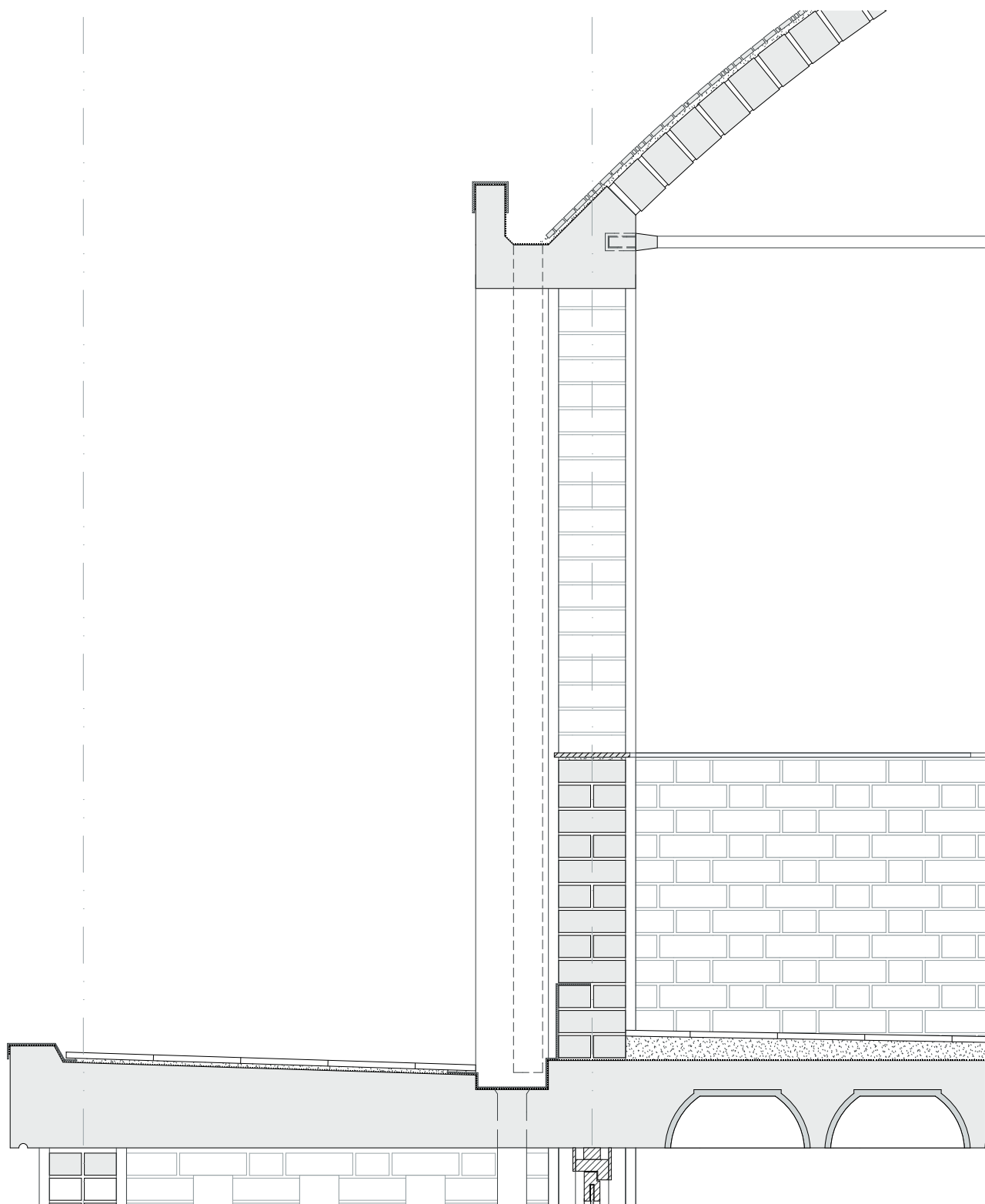
CONSTRUCTION METHOD

construction principe, facade fragments and details



CONSTRUCTION

The building is constructed out of concrete columns and concrete slabs with embedded beams. To guarantee stability 3 walls of concrete are integrated (in two directions). because of the small spans, it is possible to take concrete saving measurements with the following method; clay pots will be placed on the formwork of the floors creating hollow cavities and in that way saving on concrete. these clay post will always have a distance to the concrete columns and de lines between the columns. in this way, they form embedded beams.



ROOF

free spanning fly-ash bricks vault
waterproof membrane
cement
ceramic tile shards
supported by:
concrete profile
pull rod

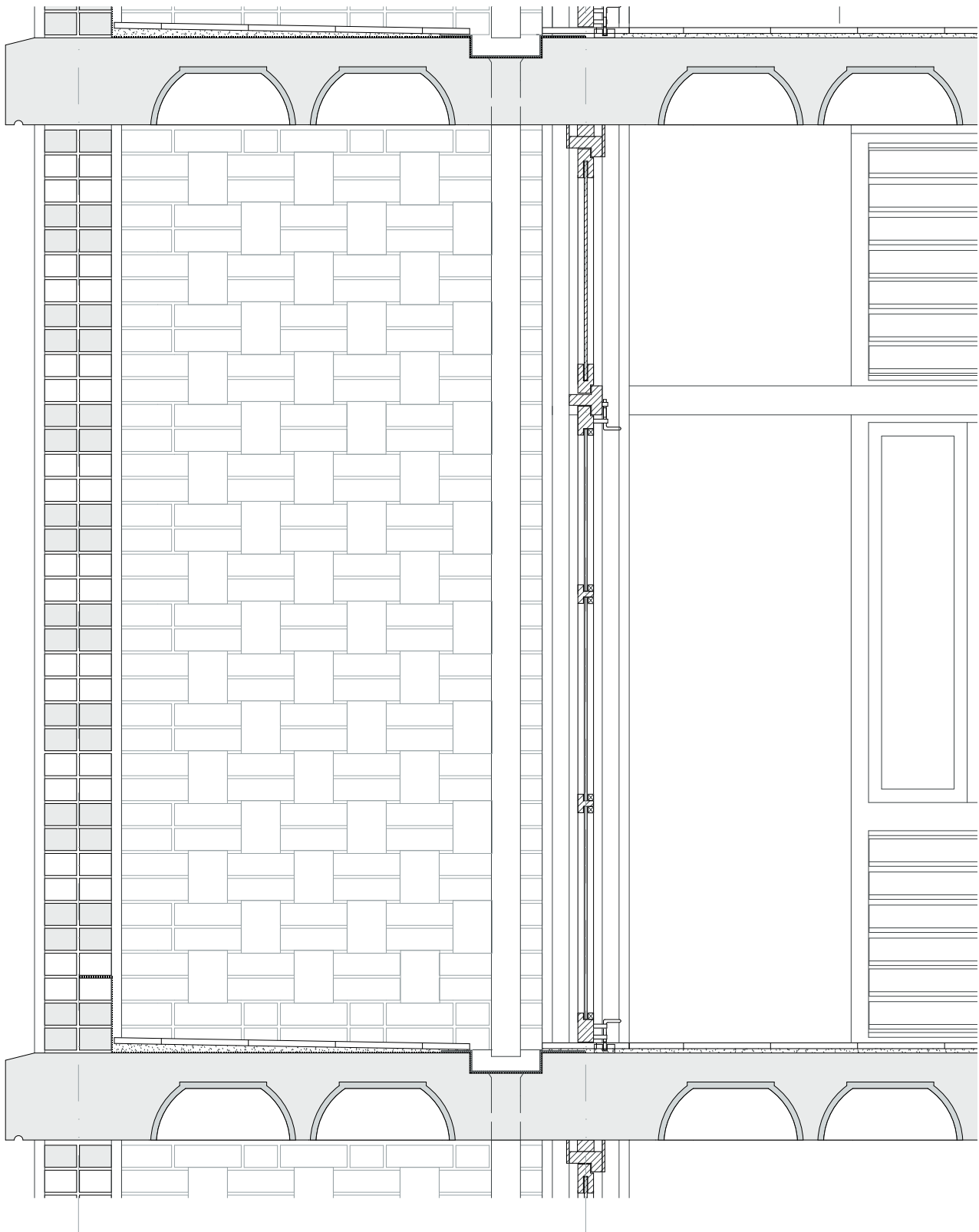
FLOOR

concrete slab // 300 //
embedded beams // clay pot infill
waterproof membrane
cement
tile finishing

WALL

concrete column // 300
bricks // jali
paint
i.c.o. balustrade:
capped with a ceramic tile

FRAGMENT I // 1.20



OUTER FACADE

concrete column // 300
bricks // jali
plaster
i.c.o. balustrade:
capped with a ceramic tile

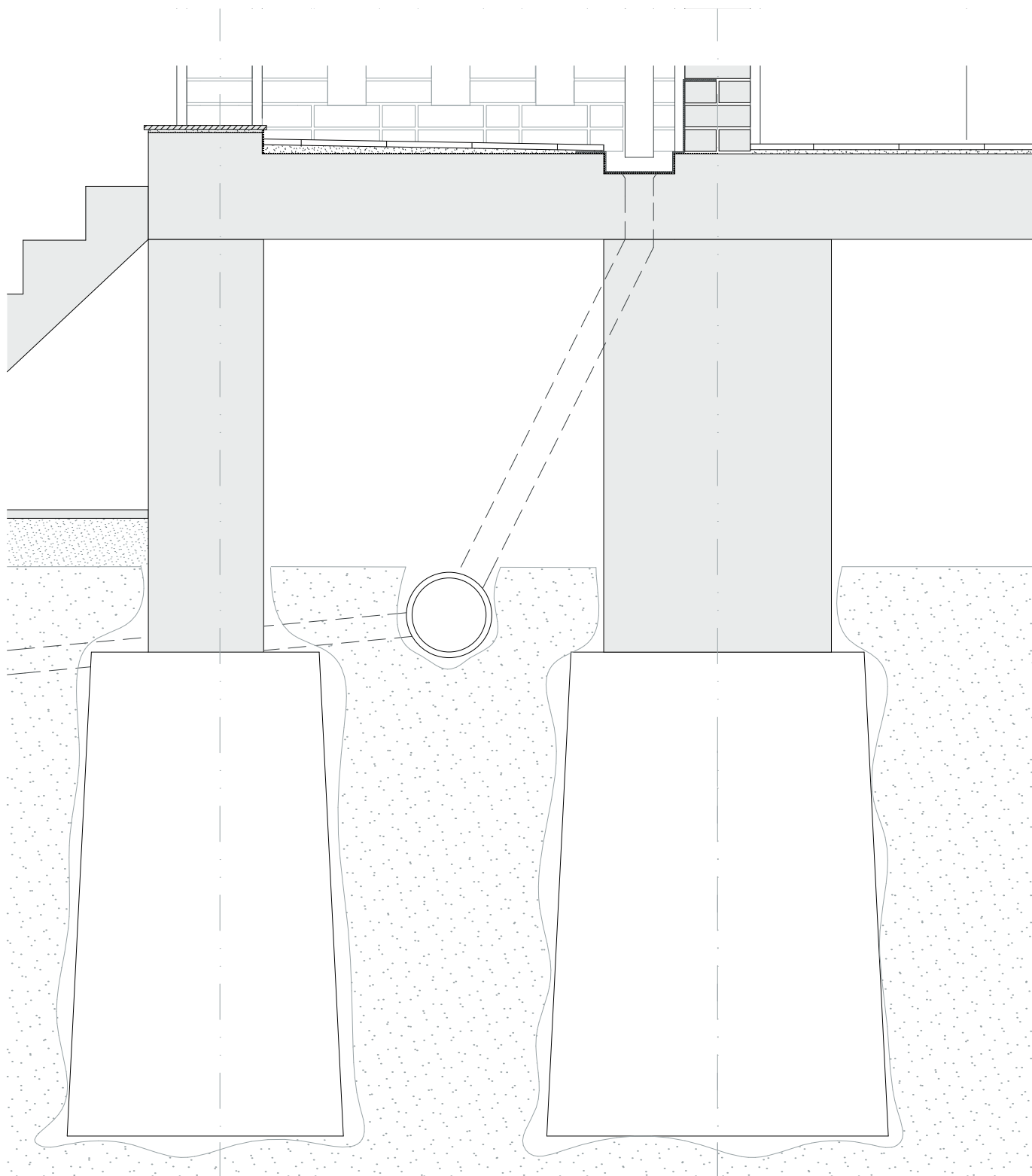
FLOOR

concrete slab // 300 //
embedded beams // clay pot infill
waterproof membrane // only verandah
cement // sloping on verandah
tile finishing

DOOR

wooden double egress door // 2700 //
wooden frame
ceramic plinth

FRAGMENT II // 1.20



OUTER FACADE

concrete column // 300
bricks // jali
paint
i.c.o. balustrade:
capped with a ceramic tile

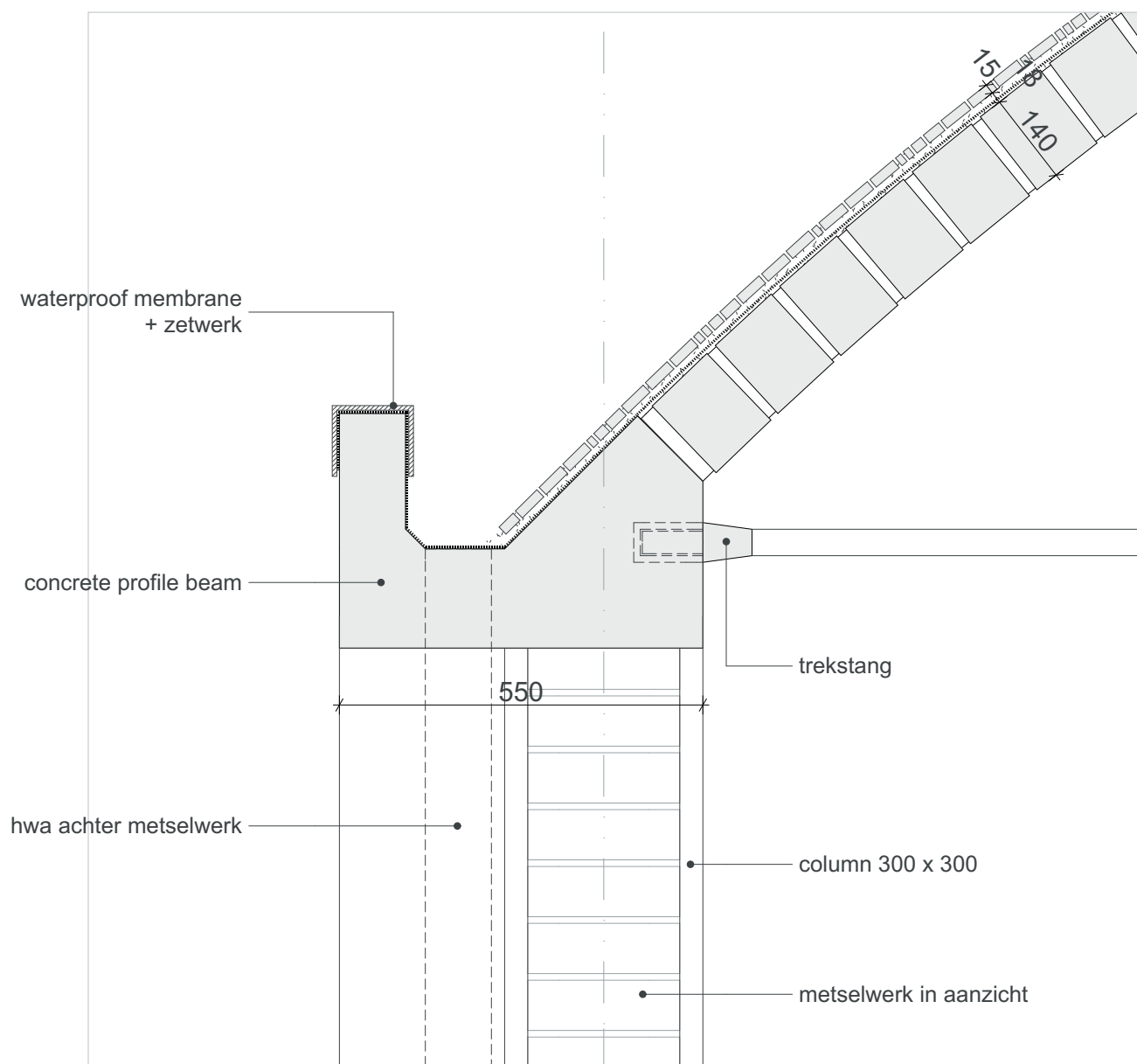
FOUNDATION

concrete base // 2000 x 1000+
concrete foundation beams // height 1250
rammed earth infill
concrete slab // 70 //
waterproof membrane // only verandah
cement // sloping on verandah
tile finishing

INNER FACADE

concrete column // 300
bricks // jali
paint

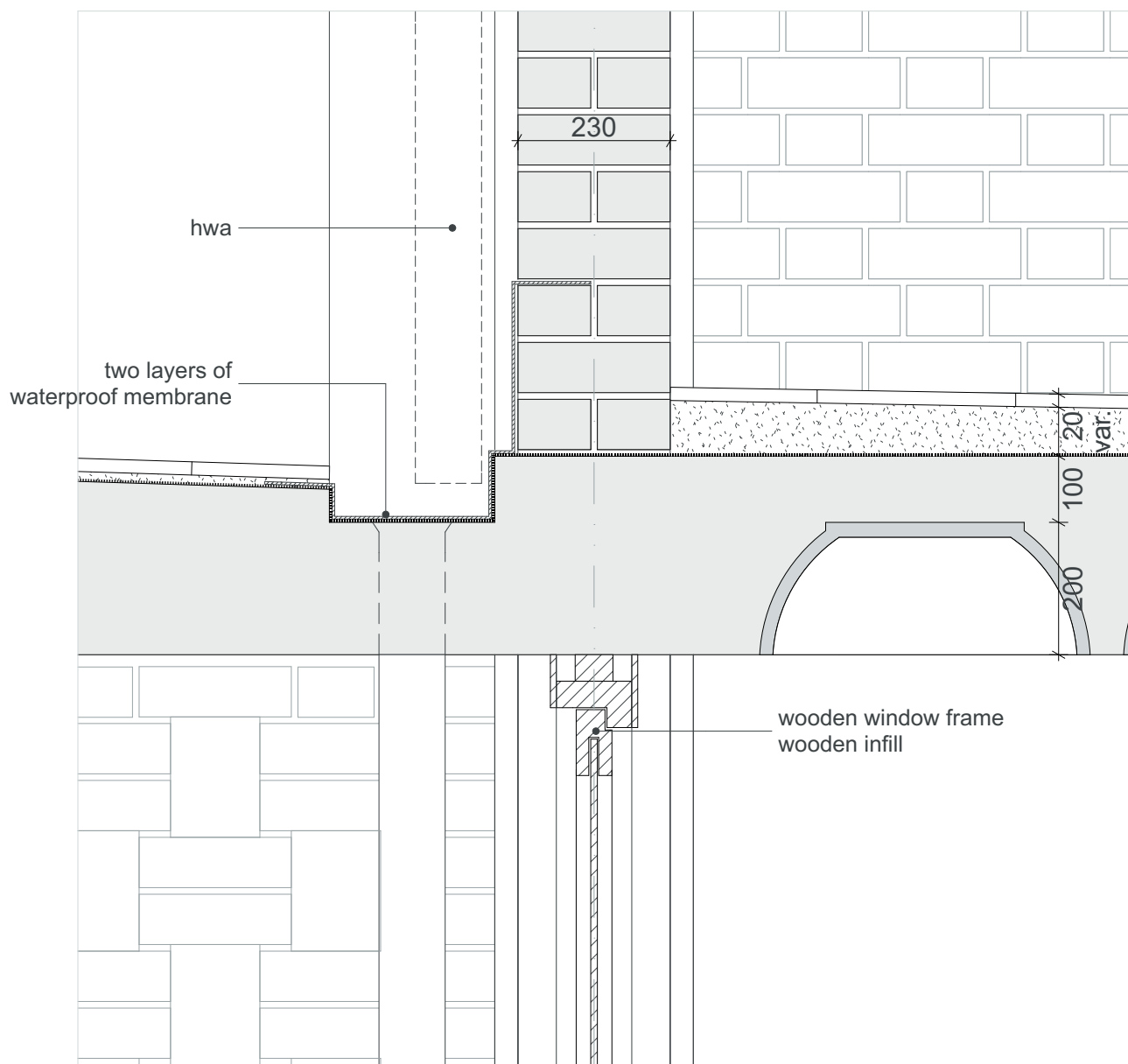
FRAGMENT III // 1.20



ROOF

free spanning fly-ash bricks vault
waterproof membrane
cement
ceramic tile shards
supported by:
concrete profile
pull rod

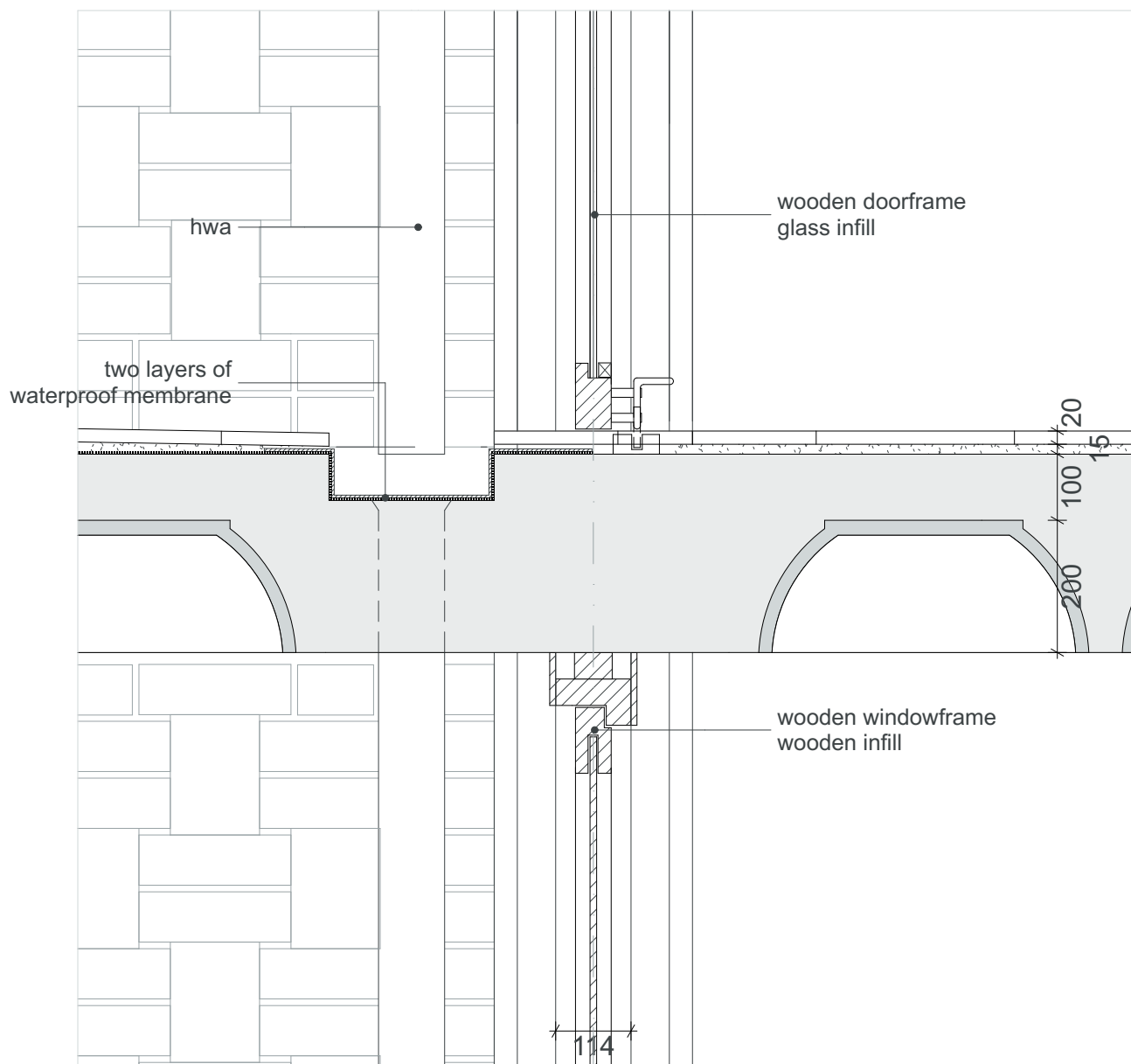
DETAIL ROOF I // 1.10



FLOOR

concrete slab // 300 //
 embedded beams // clay pot infill
 waterproof membrane
 cement
 tile finishing

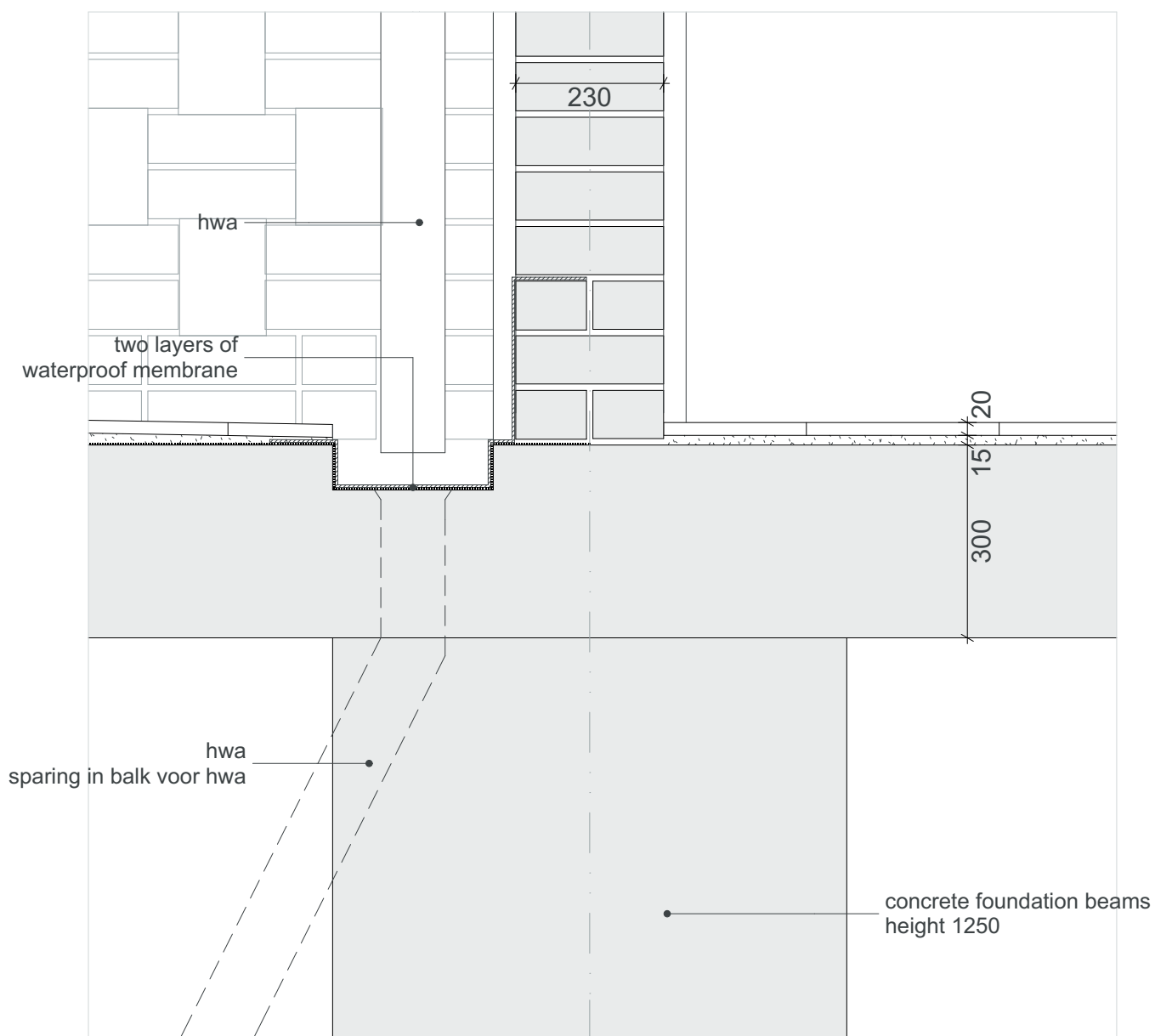
DETAIL ROOF II // 1.10



FLOOR

concrete slab // 300 //
 embedded beams // clay pot infill
 waterproof membrane // only verandah
 cement // sloping on verandah
 tile finishing

DETAIL FLOOR I // 1.10



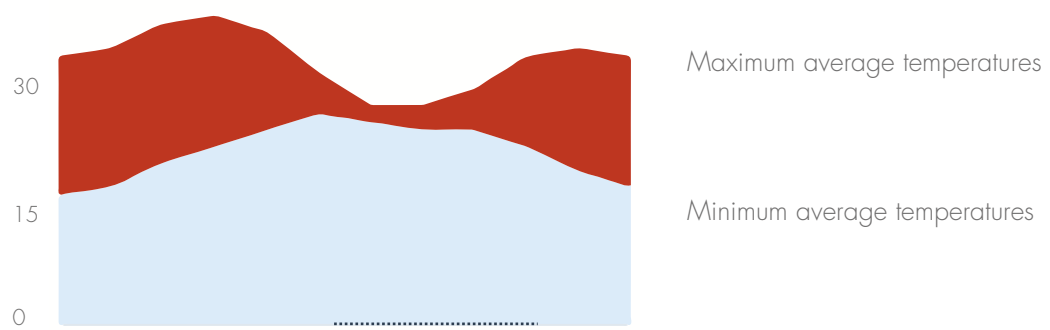
FOUNDATION

concrete base // 2000 x 1000+
 concrete foundation beams // height 1250
 rammed earth infill
 concrete slab // 70 //
 waterproof membrane // only verandah
 cement // sloping on verandah
 tile finishing

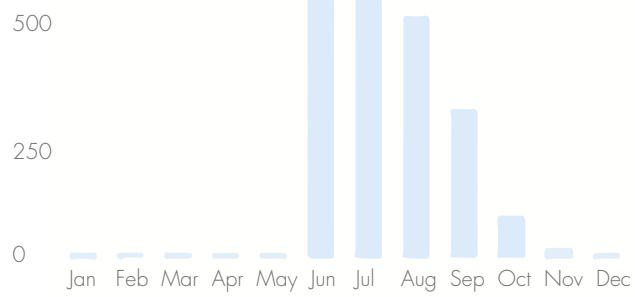
DAKDETAIL GF // 1.10

CLIMATE DESIGN

building in a wet tropical climate

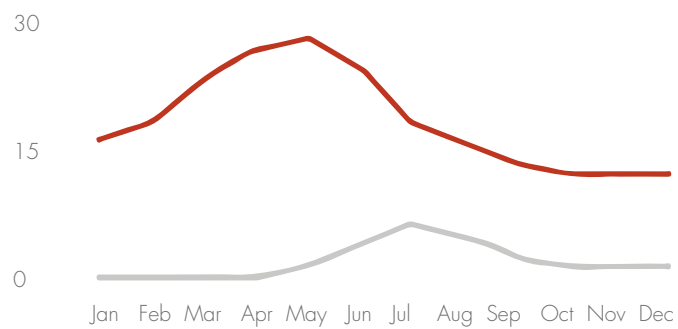


temperature
average temperature

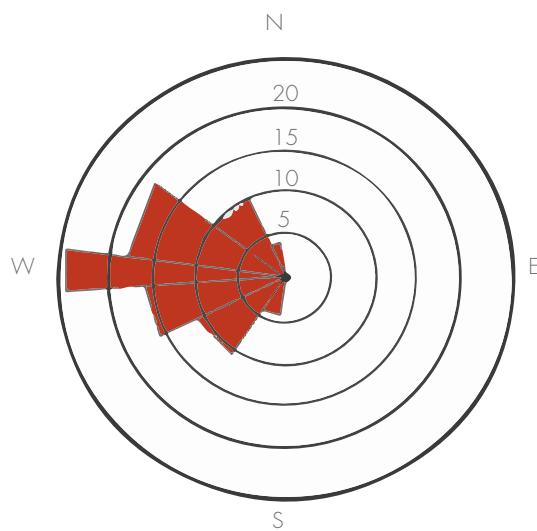


rainfall
average rainfall in mm

CLIMATE MUMBAI
temperature and rainfall



windspeed
maximum and minimum windspeed in km/h

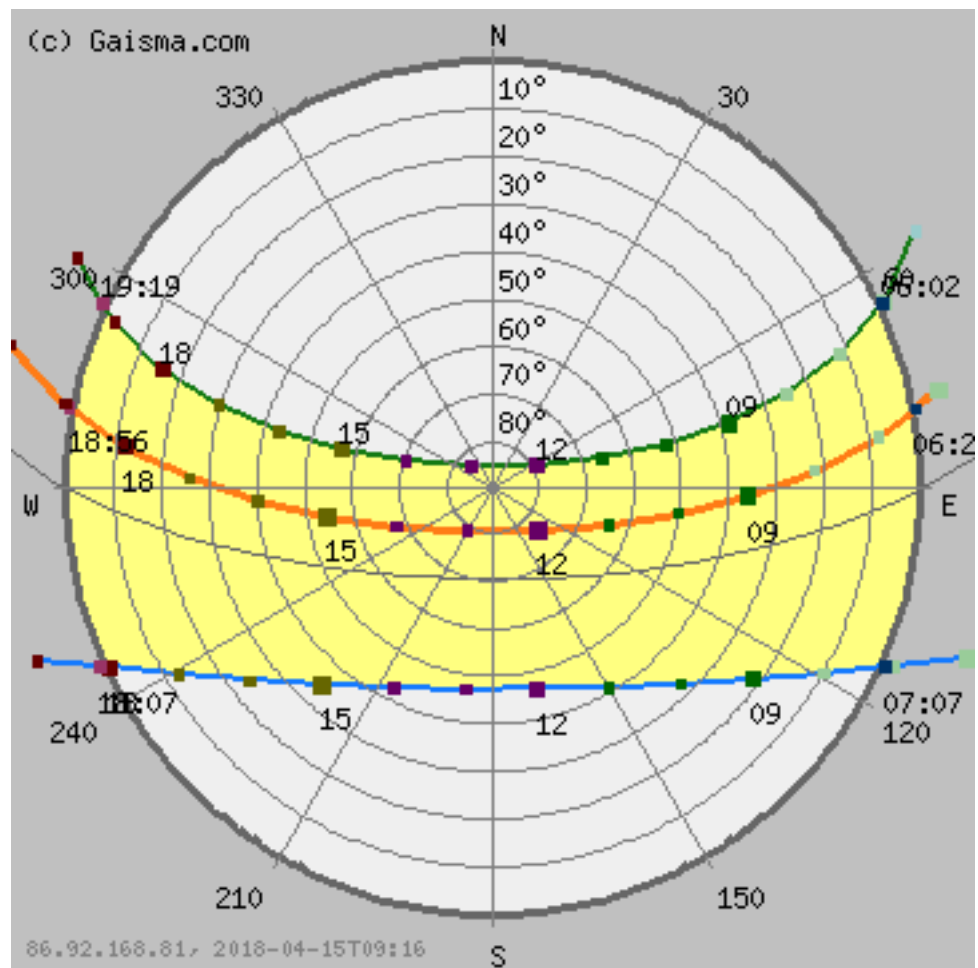


windrose
in km/h

Climate Mumbai, https://www.meteoblue.com/en/weather/forecast/modelclimate/mumbai_india_1275339

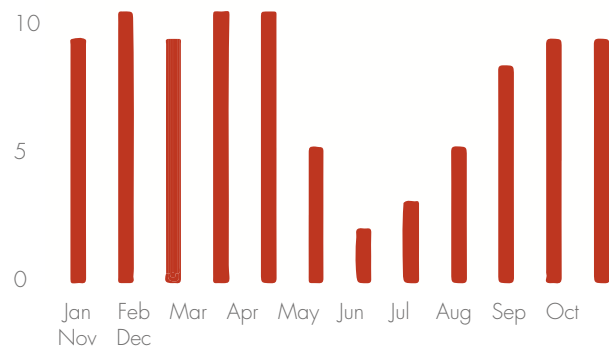
Klimaatinfo Mumbai, https://www.meteoblue.com/en/weather/forecast/modelclimate/mumbai_india_1275339

CLIMATE MUMBAI
wind



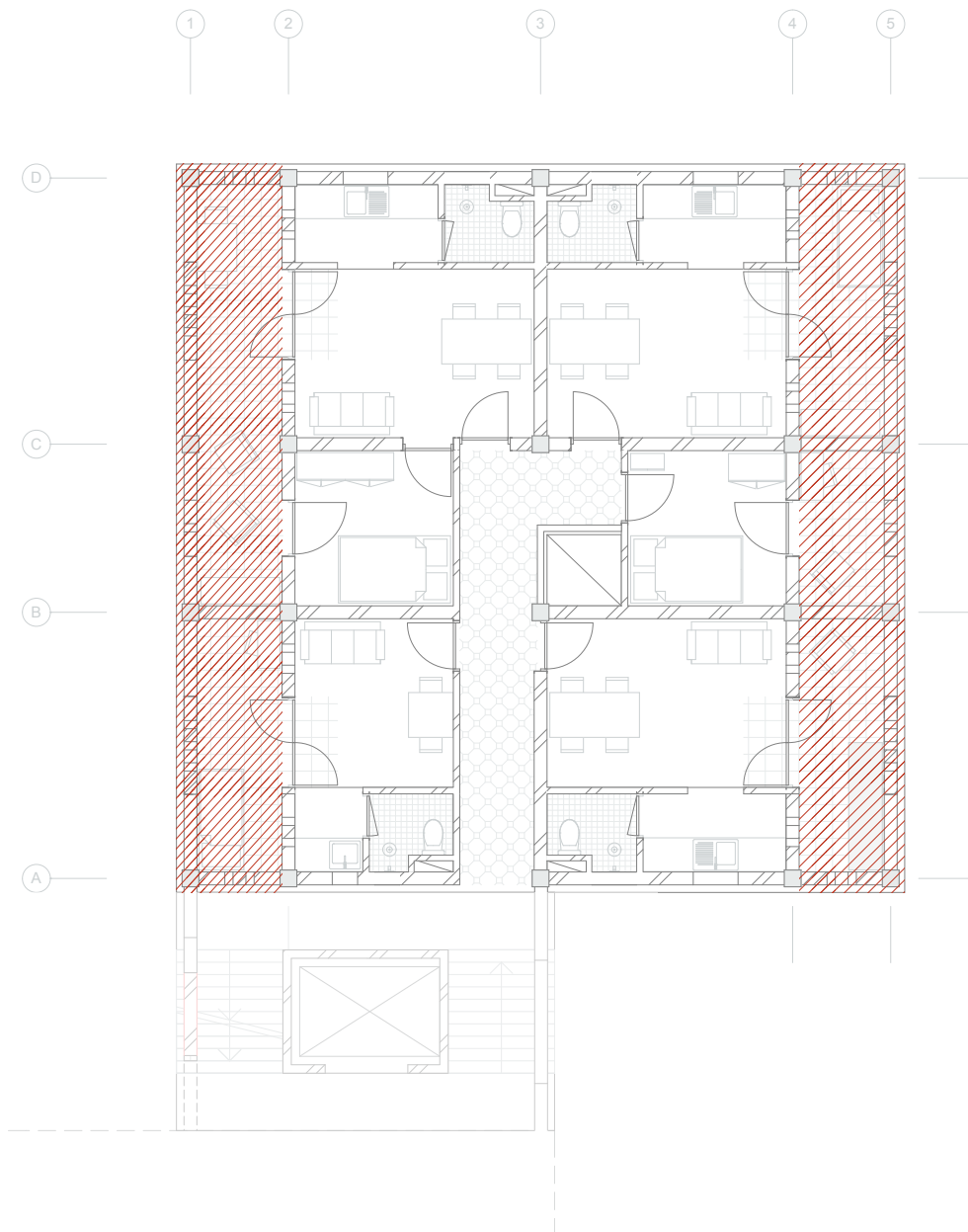
CLIMATE MUMBAI
sun

ours

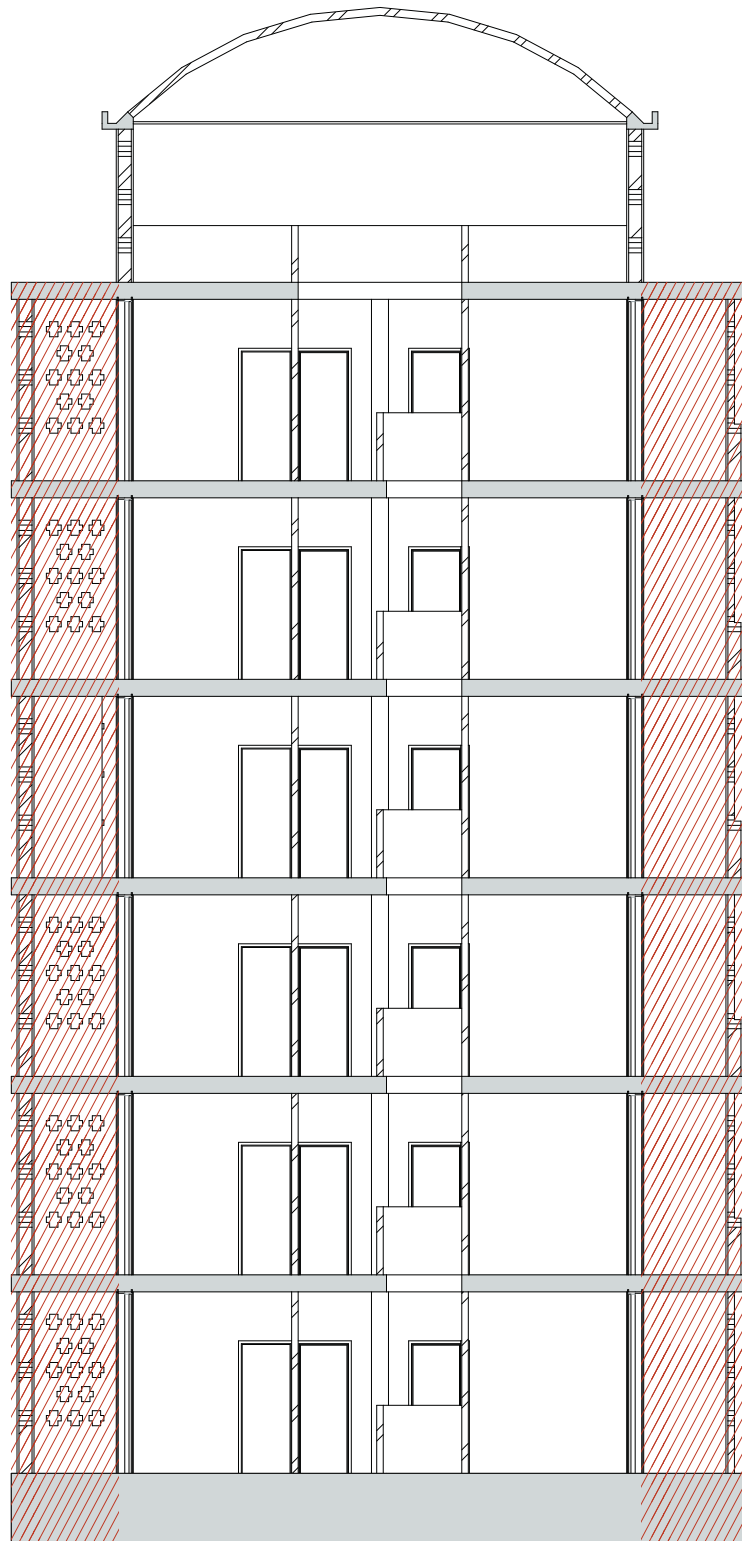


<https://www.gaisma.com/en/location/bombay.html>

CLIMATE MUMBAI
sun



CLIMATE BUFFER ZONE
floorplan



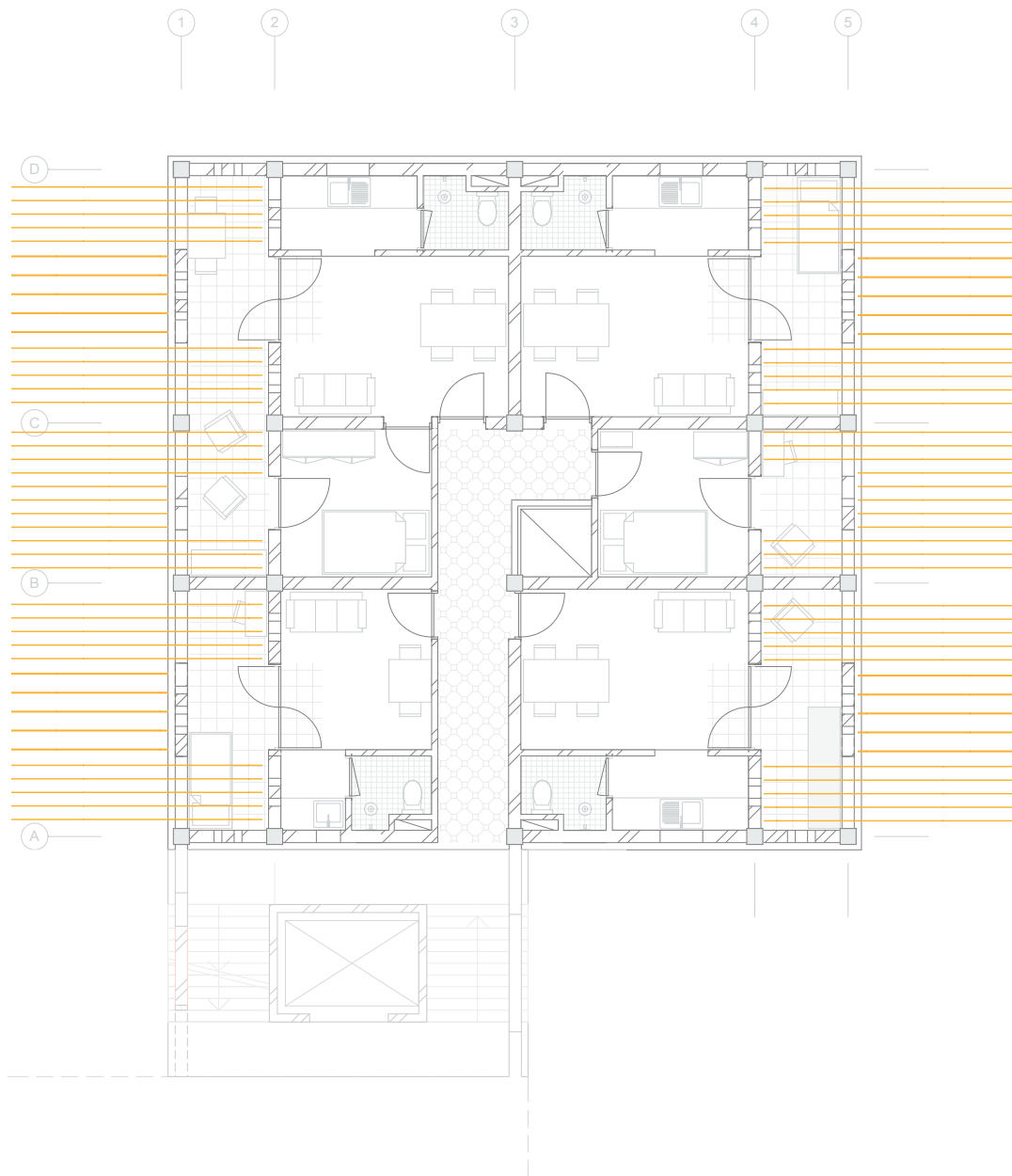
CLIMATE BUFFER ZONE section

HOT and HUMID CLIMATE:

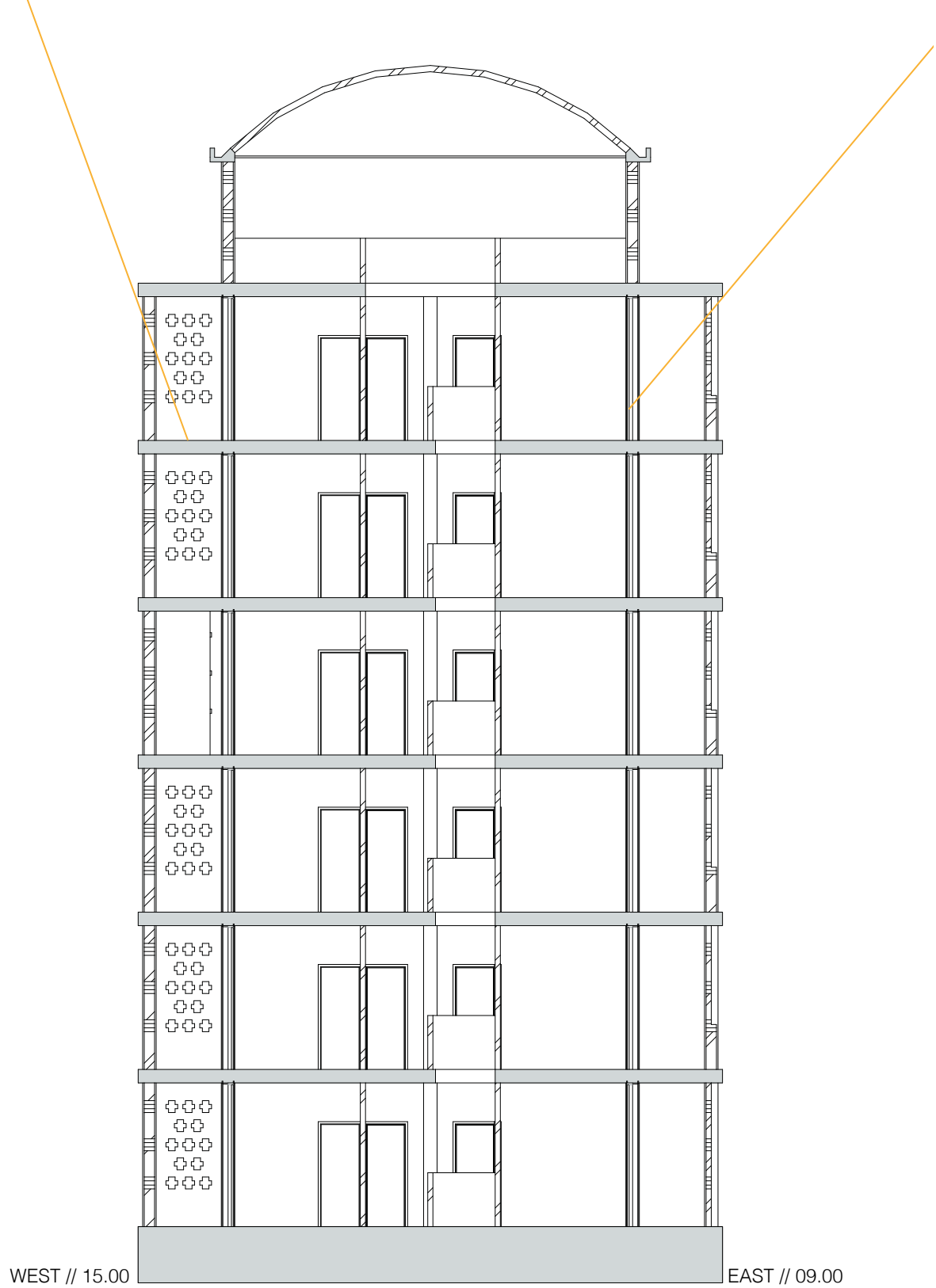
june - septembre : protection from the rain

summer: protection from the sun

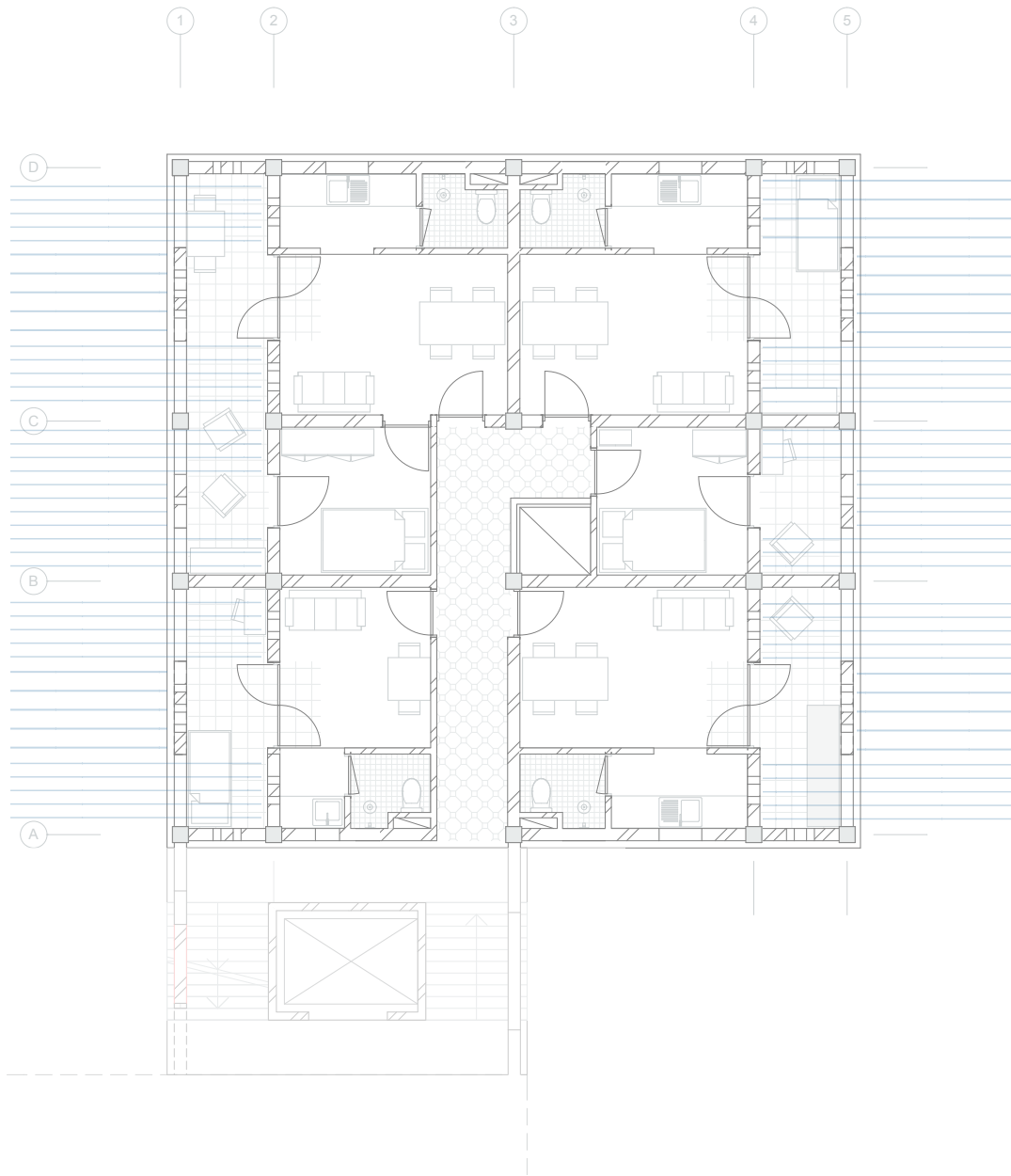
all year: ventilation to cope with the humidity



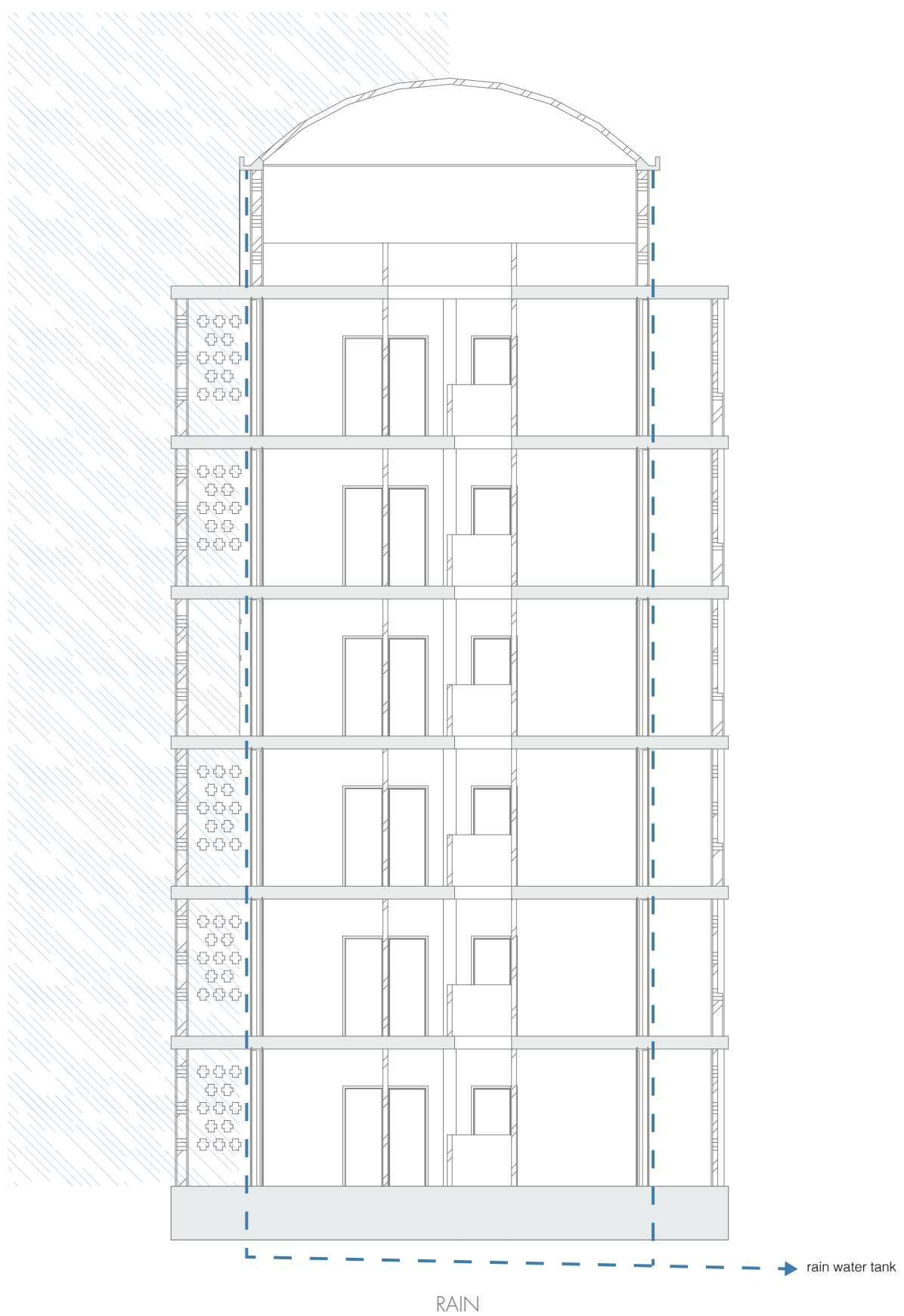
SUN

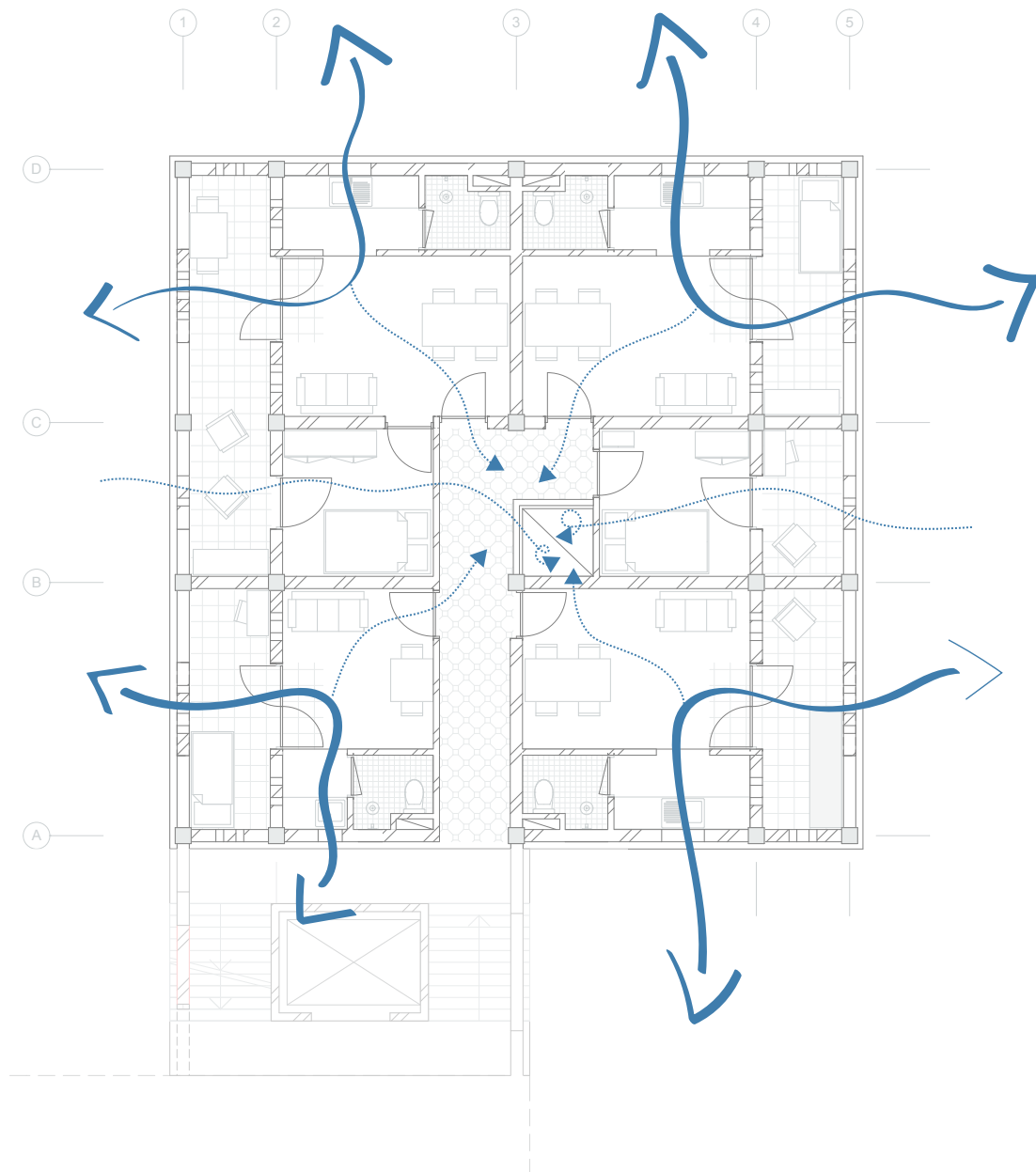


SUN

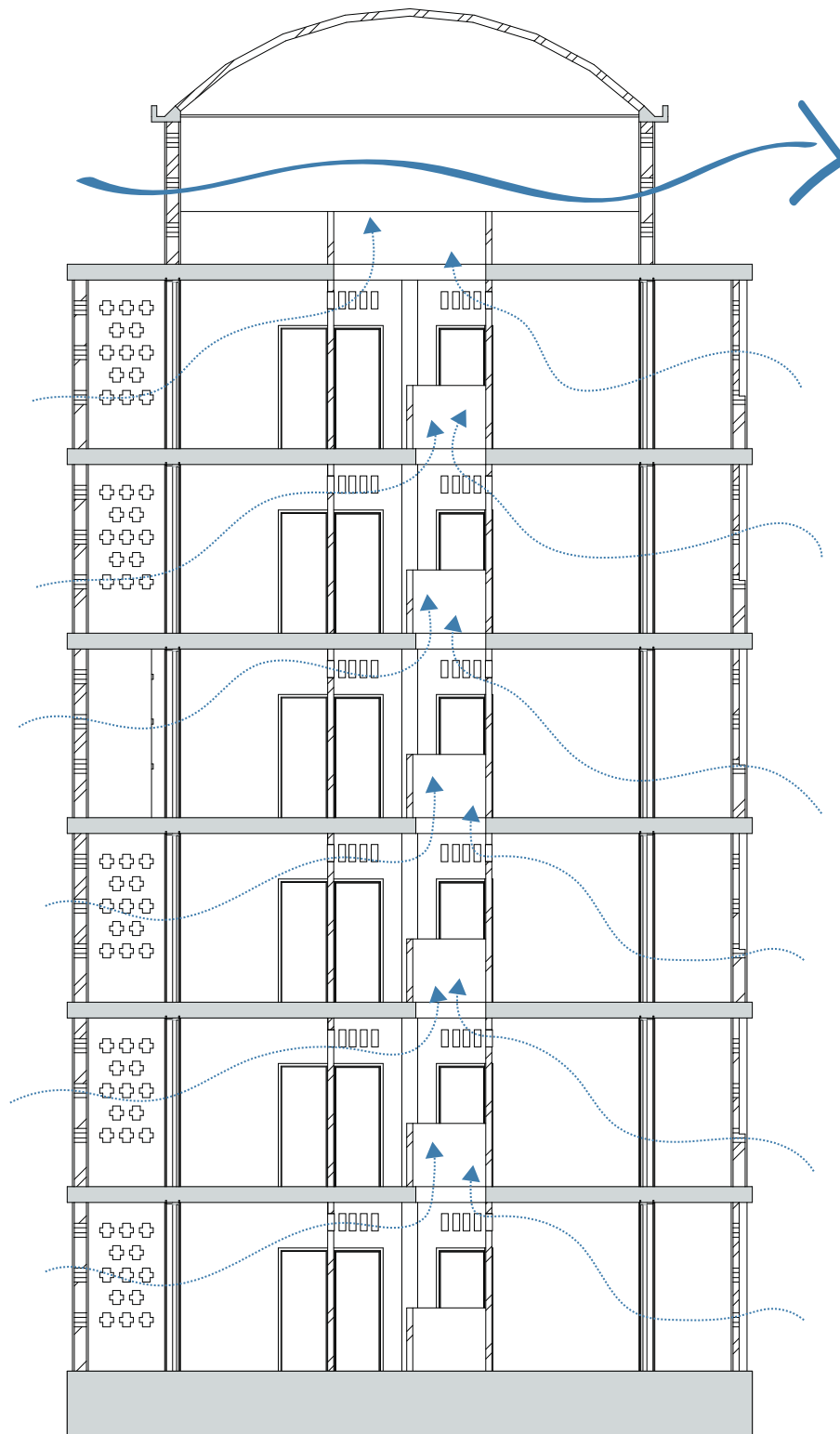


RAIN





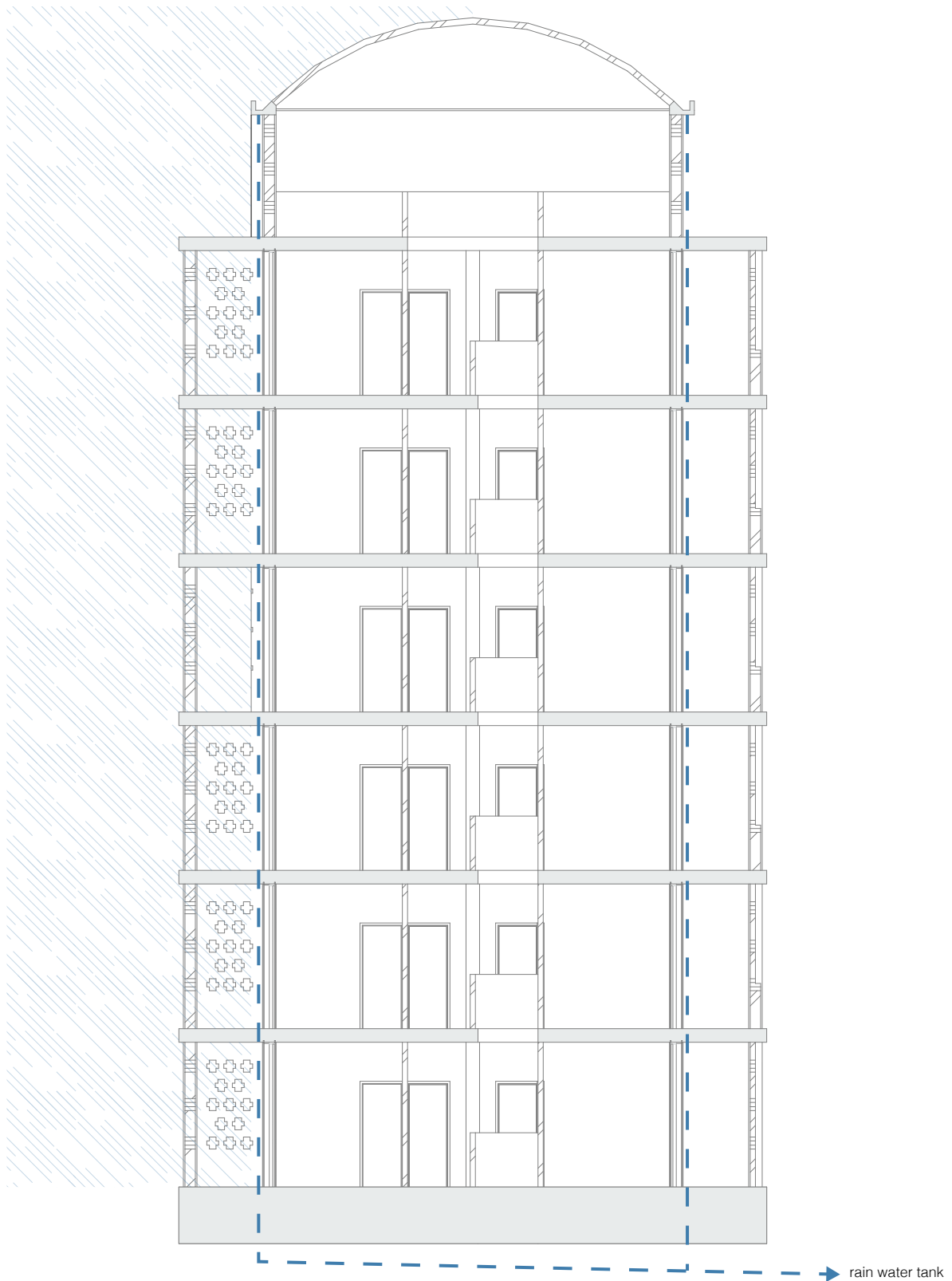
VENTILATION



VENTILATION

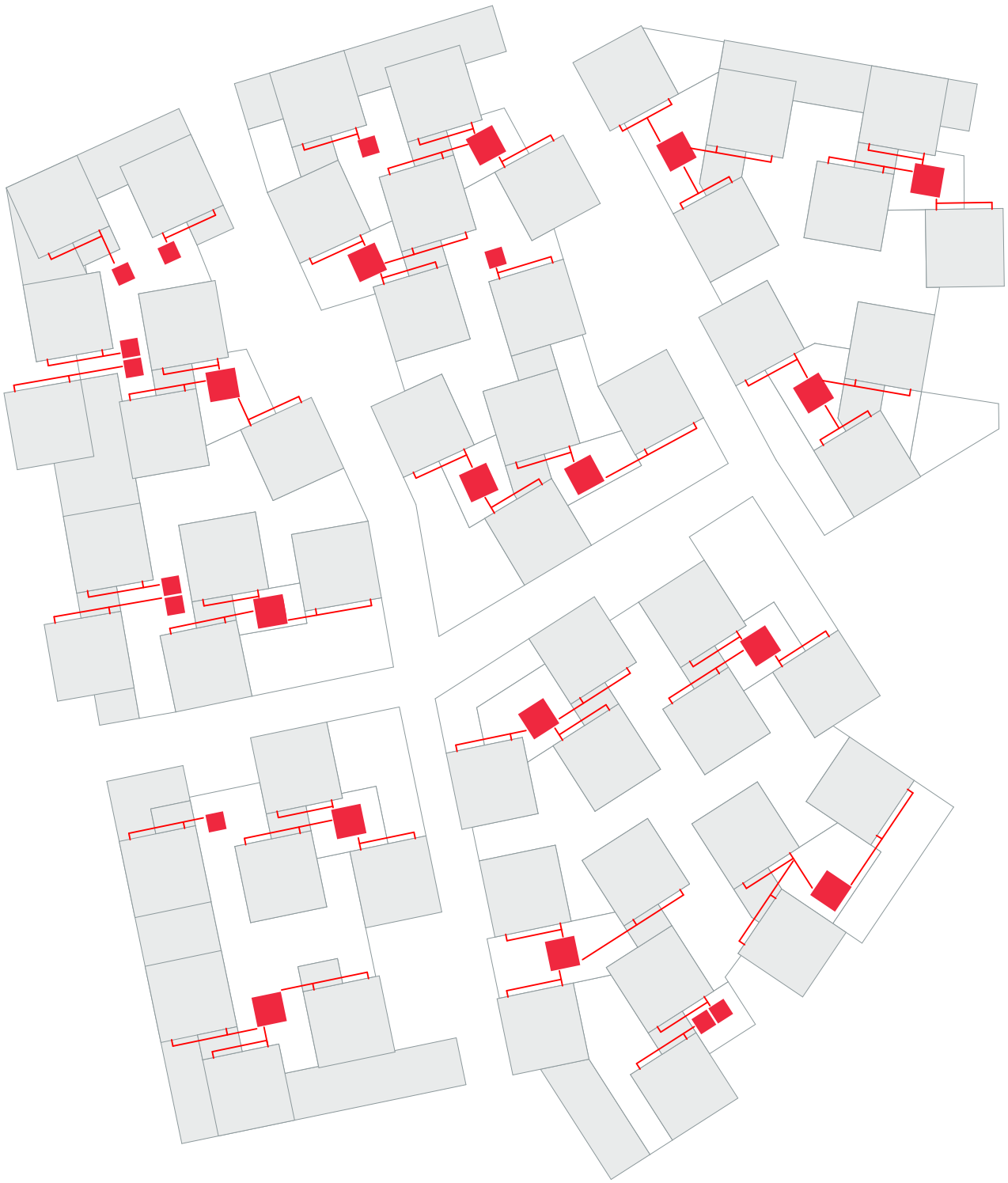
WATER MANAGEMENT

approach toward the extensive rainfall during monsoon



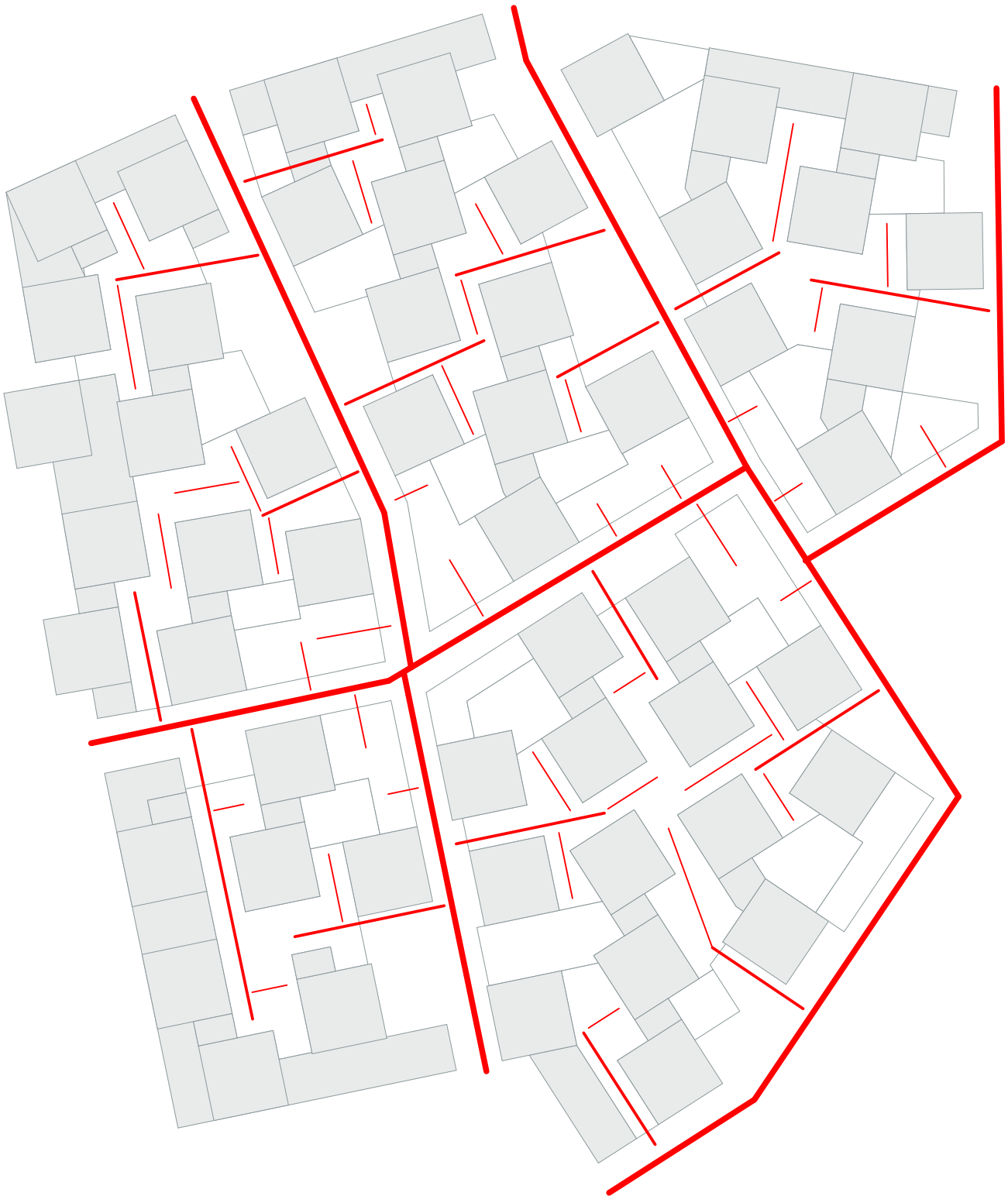
WATERMANAGEMENT

the water from the roof will be guided downward through the buffer zone. In this way, the actual dwelling will stay completely free of water risks. all dwellings are raised from the ground floor level by at least 1250mm. In this way, even during the monsoon, they are guaranteed to stay dry.



RAINWATER COLLECTION SYSTEM

during the monsoon season rainwater from the roofs is collected underneath the entrance squares in underground water tanks.
during the dry season this water can be used to flush the toilets,
for cooking and cleaning the house.



RAINWATER DRAINAGE SYSTEM

other water that falls on the ground will be transported to to underground drainage system underneath the community spine road.

