LEAVING SPACE
LEAVING SPACE

an alternative for the chawl redevelopment in Nala Sopara
CONTENTS

introduction 7
research 9
problem statement 37
research question 49
site analysis 51
book of patterns 87
urban strategy 127
design 135
urban layout 167
atmospheric impression 209
community and privacy 217
amenities 239
community comparison 251
maximizing density 289
building technology 293
The economy and the population of Mumbai are growing, which results in an ongoing 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 where 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 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 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 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.

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
The origins of Bombay


maps of Mumbai: Rohan Varma
https://www.census2011.co.in/census/city/365-mumbai.html
URBAN GROWTH
Mumbai

1964

4,152,056

2012

12,442,373
POPULATION GROWTH and the MMR

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>19,422,000</td>
</tr>
<tr>
<td>2015</td>
<td>21,043,000</td>
</tr>
<tr>
<td>2020</td>
<td>22,838,000</td>
</tr>
<tr>
<td>2025</td>
<td>25,207,000</td>
</tr>
<tr>
<td>2030</td>
<td>27,797,000</td>
</tr>
</tbody>
</table>

Mumbai Metropolitan Region
- Population: 4.355 km²

Vasai-Virar
- Population: 311 km²

NalaSopara
- Population: 43 km²

Research
THE TRAIN TRACKS OF MUMBAI
The city of Mumbai
POPULATION in the Metropolitan Region of Mumbai

LSE Cities, Urban Age Cities Compared, https://lsecities.net/media/objects/articles/urbanagecitiescompared/en-gb/
RENT PRICES
in the Metropolitan Region of Mumbai


research
15
URBAN GROWTH
of Nala Sopara
2002
URBAN GROWTH
of Nala Sopara

2005
URBAN GROWTH
of Nala Sopara
2009
URBAN GROWTH of Nala Sopara
2017
mhada development

appartment buildings

the old village
The train track defines a clear separation in the urban fabric. West of the train track we can find bigger apartment buildings and the old village of Nala Sopara. In the east 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

THE CHAWL TYPOLOGY

THE CHAWL TYPOLOGY

one story building // alley

4/5 story building // gallery

4/5 story building // corridor
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 access
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
3. A four to five story chawl building will be built 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.
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 scarifying 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 picture shows the densification in the Rahmat Nagar area takes up extreme forms. In some cases, buildings are not more than 10 cm apart.

problem statements
39
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.
problem statements

42
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.

**NEGLACTED SPACES**
rahmat nagar area

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

Charles Correa
(DASH #12-13, 96)

System of open-to-sky space // Charles Correa

Analysis open-to-sky space // Chawls

Analysis open-to-sky space // Baithi Chawls

1. Terraces  2. front doorstep  3. water tap  4. open space for the community
THE SCALE OF THE PROBLEM

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.

problem statements
RESEARCH QUESTION

How can the crammed (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

site analysis
52
PRIMARY AND SECONDARY ROADS
Nala Sopara East
PUBLIC TRANSPORT
Rahmat Nagar area
MORPHOLOGY

built

site analysis
TYPOLOGY
chawls and baithi chawls

site analysis
58
ORIGIN OF BUILDINGS
chawls and baithi chawls

site analysis
AMENITIES
Rahmat Nagar area

school  hospital  park  religious place
<table>
<thead>
<tr>
<th>typical floorplan</th>
<th>residents per dwelling</th>
<th>m² dwelling per person</th>
<th>units per hectare</th>
<th>people per hectare</th>
<th>m² open space per person</th>
</tr>
</thead>
<tbody>
<tr>
<td>15,8 m²</td>
<td>4</td>
<td>3,95 m²</td>
<td>325</td>
<td>1300</td>
<td>3,0 m²</td>
</tr>
</tbody>
</table>
FSI = 0.75

open space index = 0.2

DENSITY
of the baithi chawls
Density of the chawls

- 0.57 m² open space per resident
- 3.95 m² dwelling per person
- 1325 units per hectare
- 5300 people per hectare

FSI = 3

Open space index = 0.3

Site analysis

Density of the chawls
HISTORY

of the built environment of Rahmat Nagar
site analysis

70
2006
Rahmant Nagar

site analysis
site analysis
2017
Rahmat Nagar

site analysis
HIGH RISE
Rahmat Nagar

site analysis
79
DENSITY CLUSTERS
Rahmat Nagar

site analysis
81
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.
site analysis
when the patterns of [baith] 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
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.
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 jwellery making happen inside the dwelling units as well as some services like teaching.
One of the sources of income come from small productive activity which supply products such as milk.
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.
In the chawls the galleries are used as an extension of the domestic space. The dwelling units at the end of the gallery close off the gallery with cages to create a private zone. This creates a limit inside the collective space.

book of patterns
The sewage canal borders in between clusters of chawls the sewage canal creates a border in the urban fabric.
The circulation gallery works 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.
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.
As a solution to make the building water proof, corrugated steel roof extenions 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.
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
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.
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.
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.

book of patterns

113
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.
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.
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.

book of patterns
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.

book of patterns

118
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 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.
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 one another.
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 laid upon the wall to support the roof made of corrugated steel.

book of patterns
122
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 cladded 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.
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.

book of patterns

125
URBAN STRATEGY

redevelopment approach and goals
ANALYSIS OF THE EXISTING 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.
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
THE BASIC UNIT

AXONOMETRY // 1:100

FLOORPLAN  // 1:100

use of space // daytime

use of space // nighttime

loft

main floor

monsoon season
dry season

usable space

design
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 27 m².
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
In the separate building, the units are all maisonette units. The units 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 separate and one cluster
COMMERCIAL PLINTH
one story plint + clusters
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
+ 18 EWS/LIG 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/IIG 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
255 baithi chawl units
+9 EWS/LIG units
+36 MG 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
117 baithi chawl units
<table>
<thead>
<tr>
<th>+ 27 EWS/IIG units</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ 12 MIG units</td>
</tr>
</tbody>
</table>
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
design
203
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

atmospheric impressions
210
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
GROWTH AND CHANGE
the evolution of the plan over time

atmospheric impressions
Atmospheric impressions

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
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-privat to the public. in this way it create communities”

Charles Correa
(DASH #12-13, 96)
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
STREET AND COMMERCIAL PLINTH
along the bigger road
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
STREETS AND COMMERCIAL PLINTH
along the inner connecting roads

community - privacy
223
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, privacy
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
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
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
INNER COURT

community - privacy
231
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 - privacy
INNER COURT
side entrance

community - privacy
233
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
COMMUNITY SPACES
inside the building

community - privacy
235
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
THE DWELLING UNIT

community - privacy
237
AMENITIES

amenities as a binding factor for communities
<table>
<thead>
<tr>
<th>social structure</th>
<th>physical structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person // 1p //</td>
<td>room</td>
</tr>
<tr>
<td>Family // 5-10p //</td>
<td>house, front yard, backyard</td>
</tr>
<tr>
<td>Neighbourhood // 100 - 150 f //</td>
<td>nursery, school, nutrition centre, basketball court, playground, small general store</td>
</tr>
<tr>
<td>Community // 500 - 750 f //</td>
<td>community centre, elementary school, health clinic, religious place, shops and stores</td>
</tr>
<tr>
<td>Zone // 1500 - 2500f //</td>
<td>Zone centre, Police Centre</td>
</tr>
<tr>
<td>New Town</td>
<td>Police headquarters, commercial area, fire station, high school, market, hospital</td>
</tr>
</tbody>
</table>


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:

amenities
amenities

243
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
DENSITY
chawls

FSI = 3

units per hectare = 1325

open space index = 0.2
DENSITY
new proposal

FSI = 2.3

435 units per hectare

open space index = 0.6
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.
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.
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.
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.
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
In the new proposal the wind can flow in between 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.
In the chawls we can find two main dwelling types. The normal apartment and the corner apartment.

**corner apartment**
19m²

**standard unit**
16m²
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.
UNIT SIZE AND INCOME GROUP
according to DCR

<table>
<thead>
<tr>
<th>Group</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>EWS</td>
<td>&lt;27.88 m²</td>
</tr>
<tr>
<td>LIG</td>
<td>27.88 m² - 45 m²</td>
</tr>
<tr>
<td>MIG</td>
<td>45 m² - 80 m²</td>
</tr>
</tbody>
</table>
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
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
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.
apart from some leftover open space, which will probably turn into building sites soon, the chawls have no intended recreational open spaces. Do to 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.

comparison
273
The Mumbai DCR regulations state that 5% of developed areas should be reserved for amenities.
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.

comparison

277
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 use 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


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: 53.922 m²
added saleable floorspace: + 40.441 m²

EWS: 40.441 m²  LIG: 0  MIG: 0
## FEASIBILITY

Total new build floorspace: 46,255m²  
Added saleable floorspace: +19,907m²

<table>
<thead>
<tr>
<th>EWS</th>
<th>LIG</th>
<th>MIG</th>
</tr>
</thead>
<tbody>
<tr>
<td>2221m²</td>
<td>3875m²</td>
<td>8508m²</td>
</tr>
</tbody>
</table>
total new build floorspace: 53.922 m²
added saleable floorspace: + 40.441 m²

EWS = 40.4411 m² \times \text{average of NS} = 50.609 \text{ rupees/m}^2

= 205 \text{ crore}
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 quite 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.

**PROCEEDS**

*new proposal*

<table>
<thead>
<tr>
<th>Category</th>
<th>Area (m²)</th>
<th>MHADA Rate (rupees/m²)</th>
<th>Total Revenue (crore)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EWS</td>
<td>2221</td>
<td>72,000</td>
<td>165.08</td>
</tr>
<tr>
<td>LIG</td>
<td>3875</td>
<td>97,000</td>
<td>380.75</td>
</tr>
<tr>
<td>MIG</td>
<td>8508</td>
<td>107,000</td>
<td>911.56</td>
</tr>
</tbody>
</table>

**Total Revenue:** 196 crore
DENSITY
FSI = 3

UNITS PER HECTARE
1325

AVERAGE UNIT SIZE
16.5 m²

OPEN SPACE /pp
0.57 m²

RECREATIONAL OPEN SPACE /pp
0 m²

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 density of the scheme be increased
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.

comparison
BUILDING TECHNOLOGY
FACADE PRINCIPLES

Jali brickwork, windows and doors
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 it from the heavy rain.
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.
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.
building technology
CONSTRUCTION METHOD

construction principe, facade fragments and details
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 pots will always have a distance to the concrete columns and the lines between the columns. In this way, they form embedded beams.
ROOF
- free spanning fly-ash bricks vault
- waterproof membrane
- 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
BUILDING TECHNOLOGY
FRAGMENT II // 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

building technology
307
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

building technology
308
INNER FACADE
- concrete column 300
- bricks
- jali
- paint

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

OUTER FACADE
- concrete column 300
- bricks
- jali
- paint

i.c.o. balustrade: capped with a ceramic tile
**Roof**

Free spanning fly-ash bricks vault

- Waterproof membrane
- Cement
- Ceramic tile shards

Supported by:
- Concrete profile
- Pull rod

**Detail Roof 1 // 1:10**

Building technology

310
BUILDING TECHNOLOGY
DETAIL // ROOF I // 1:10

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

two layers of waterproof membrane

BUILDING TECHNOLOGY
DETAIL // ROOF II // 1:10

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

wooden window frame
wooden infill

hwa
BUILDING TECHNOLOGY

FLOOR

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

DETAIL FLOOR I // 1.10

building technology
312
FOUNDATION
concrete base // 2000 x 1000+
concrete foundation beams // height 1250
rammed earth infill
cement // sloping on verandah
waterproof membrane // only verandah
tile finishing

DAKDETAIL GF // 1.10

building technology
313
CLIMATE DESIGN

building in a wet tropical climate
Mumbai has a tropical monsoon climate. The average daily sky clarity, average daily sunshine hours, maximum average temperatures, minimum average temperatures, and average rainfall in mm are shown below.

- **Average daily sky clarity**
  - Sunny
  - Partly cloudy
  - Overcast

- **Maximum average temperatures**
- **Minimum average temperatures**
- **Average rainfall in mm**

The graphs illustrate the temperature (average temperature) and rainfall (average rainfall in mm) from January to December.
CLIMATE MUMBAI

Wind

Average windspeed in km/h

Maximum and minimum windspeed in km/h

Windrose in km/h


CLIMATE MUMBAI

sun

building technology
Mumbai has a tropical monsoon climate. 

### Average Temperatures

- Maximum average temperatures
- Minimum average temperatures

### Rainfall

<table>
<thead>
<tr>
<th>Month</th>
<th>Average Rainfall in mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>500</td>
</tr>
<tr>
<td>Feb</td>
<td>250</td>
</tr>
<tr>
<td>Mar</td>
<td>0</td>
</tr>
<tr>
<td>Apr</td>
<td>15</td>
</tr>
<tr>
<td>May</td>
<td>0</td>
</tr>
<tr>
<td>Jun</td>
<td>15</td>
</tr>
<tr>
<td>Jul</td>
<td>0</td>
</tr>
<tr>
<td>Aug</td>
<td>10</td>
</tr>
<tr>
<td>Sep</td>
<td>5</td>
</tr>
<tr>
<td>Oct</td>
<td>10</td>
</tr>
</tbody>
</table>

### Sky Clarity

- Sunny
- Partly cloudy
- Overcast

### Sunshine Hours

<table>
<thead>
<tr>
<th>Month</th>
<th>Average Daily Sunshine Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>10</td>
</tr>
<tr>
<td>Feb</td>
<td>5</td>
</tr>
<tr>
<td>Mar</td>
<td>0</td>
</tr>
<tr>
<td>Apr</td>
<td>15</td>
</tr>
<tr>
<td>May</td>
<td>0</td>
</tr>
<tr>
<td>Jun</td>
<td>15</td>
</tr>
<tr>
<td>Jul</td>
<td>0</td>
</tr>
<tr>
<td>Aug</td>
<td>10</td>
</tr>
<tr>
<td>Sep</td>
<td>5</td>
</tr>
<tr>
<td>Oct</td>
<td>10</td>
</tr>
</tbody>
</table>

### Precipitation Days

<table>
<thead>
<tr>
<th>Month</th>
<th>Precipitation Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>10</td>
</tr>
<tr>
<td>Feb</td>
<td>5</td>
</tr>
<tr>
<td>Mar</td>
<td>0</td>
</tr>
<tr>
<td>Apr</td>
<td>15</td>
</tr>
<tr>
<td>May</td>
<td>0</td>
</tr>
<tr>
<td>Jun</td>
<td>15</td>
</tr>
<tr>
<td>Jul</td>
<td>0</td>
</tr>
<tr>
<td>Aug</td>
<td>10</td>
</tr>
<tr>
<td>Sep</td>
<td>5</td>
</tr>
<tr>
<td>Oct</td>
<td>10</td>
</tr>
</tbody>
</table>

---

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

building technology
323
rain water tank

building technology
325
VENTILATION
WATER MANAGEMENT

approach toward the extensive rainfall during monsoon
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.
other water that falls on the ground will be transported to the underground drainage system underneath the community spine road.