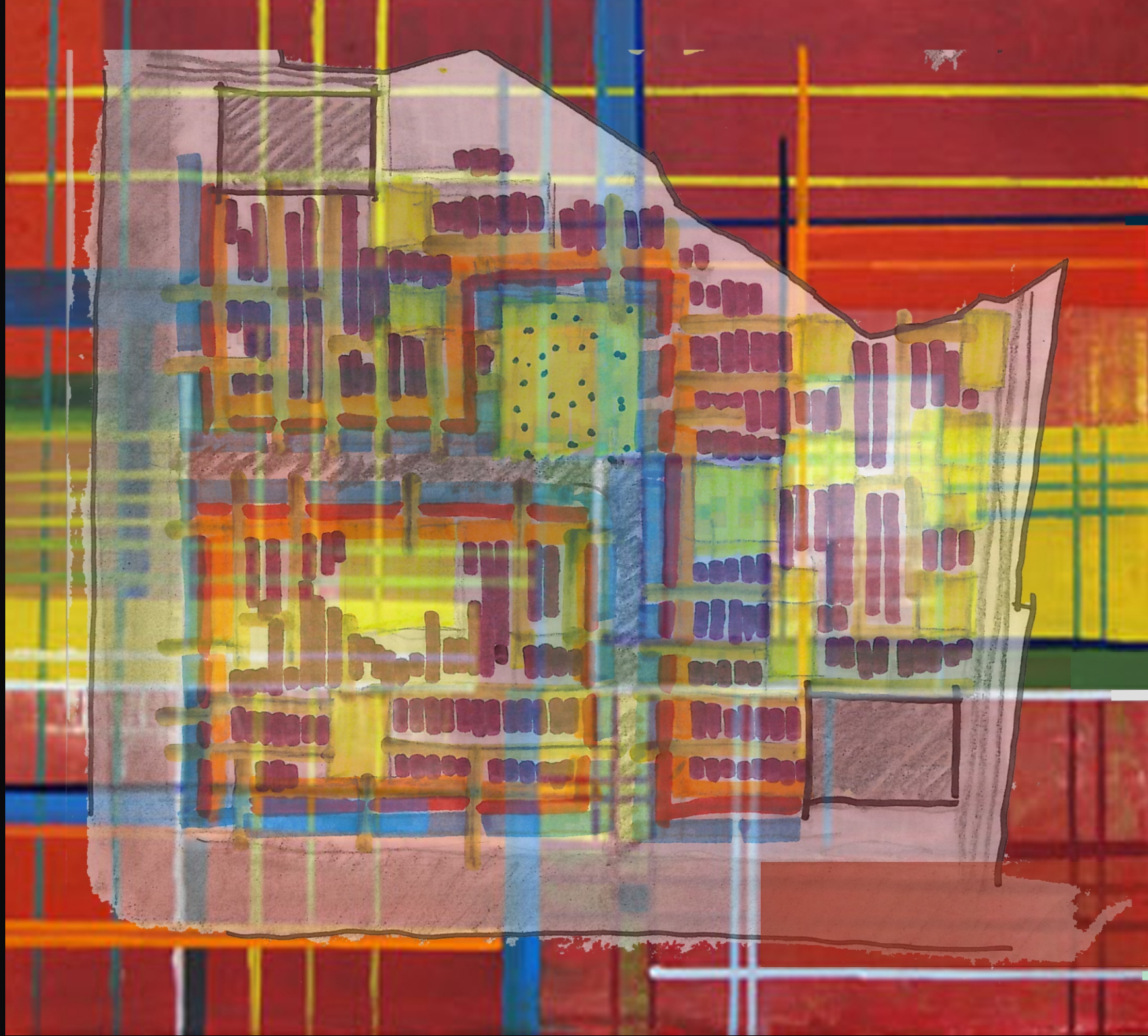


REHABILITATION OF "KUMBHARWADA", DHARAVI SLUMS, MUMBAI



BHAKTI PURANDARE
PROJECT GUIDE: PROFESSOR JOHN DURBROW

About Mumbai

About Dharavi: Location, Facts

About Kumbharwada: Location, Facts

Production Process of Pottery

Design Determinants

Design Alternatives

Concept

Set Of Rules / Rules Of Composition

Series Of Diagrams Formulating Site Plan

Site Plan

Cluster Details

Structure

Environmental Control Systems

Landscape

Perspectives

REHABILITATION OF "KUMBHARWADA", DHARAVI SLUMS, MUMBAI



NET PLOT AREA IN KUMBHARWADA

64402.23 SQ.M.
15.91 ACRES
6.44 HECTARES

EXISTING DENSITY

EXISTING HUTMENTS AS PER SURVEY = 2500
EXISTING DENSITY = 388 T/HECTARES

PROPOSED DENSITY

650 T/HECTARE X 6.44 = 4186 UNITS

VALUE OF THE HUTMENT

1997	400-450 SF	Rs 2 lakh	\$0.2 MILLION (Rs500/ sf)
1998	400-450 SF	Rs12 lakh	\$1.2 MILLION (Rs3000/ sf)
2020	400-450 SF	Rs30 lakh	\$3.0 MILLION (Rs6666/ sf)



LOCATION:

Dharavi is located between Mumbai's two main suburban railway lines, the Western and Central Railways. To its west are Mahim and Bandra, and to the north lies the Mithi River, which empties into the Arabian Sea through the Mahim Creek. To its south and east are Sion and Matunga. Both its location and poor drainage systems make Dharavi particularly **vulnerable to floods during the wet season.**

AREA:

12000000 SQ.FT.
175 hectares/ 0.67 square miles

POPULATION:

Over 1 million people, and with over 1,000,000 residents per square mile. The most densely populated neighborhood in the world

NUMBER OF TENAMENTS:

92150 (Approx.)
In expensive Mumbai, Dharavi provides a cheap, but illegal, alternative where rents were as low as 4 US dollars per month in 2006. Total turnover is estimated to be between 500 million US dollars and over 650 million US dollars per year.



ABOUT DHARAVI & KUMBHARWADA...



The word “**Mashup**” was used earlier in the world of music to refer to a song created by blending two or more compositions. When you mashup or remix, you make a creative move that borders on being a bit subversive from the point of view of the purists who believe that maintaining boundaries is important. Yet in functional terms, mashing up becomes important to respond to new needs, when old modes are not satisfying enough or tend to lose their erstwhile use. But often they help consolidate older identities and traditions too.

For a country like India, where regional diversity is so strong and profound, the biggest Mashup idea is that of India itself. An idea that has still not quite managed to come to terms with its huge contrary collection of identities.

In that hazy world of nationalism, one of the most powerful symbols was that of Mumbai itself. A city in which identities mixed and merged much more than anywhere else. Where the reality of India was more of a lived reality than in any other place. A city where the best metaphor to describe itself was that of the Bhelpuri – a mashup of ingredients from the most unexpected sources which became the signature of the city's mongrelized identity. And yet Mumbai continued to also demonstrate very clear and confident lines of tradition as well. The popularity of the bhelpuri did not mean that you could not get the most authentic forms of regional cuisine too.

Delve into the city's oldest neighbourhoods, from Bhuleshwar to Kalbadevi from Mohammadali Road to Colaba and you will find the best examples of very distinctive architecture, cuisine, languages and lifestyles even now. The reason why they managed to hold their own, even as the city kept growing and transforming, is because the diverse communities jostled next to each other, mixed, mashed and exchanged as much as they maintained their boundaries. Communities bought with them a little bit of Surat, Ratnagiri, Goa and several other memories and lifestyles and the neighbourhood allowed them to bloom in newer ways thereby keeping them alive. In the realms of popular film music, literary traditions, architectural practice and drama, city historians point out that this vast neighbourhood was crucial to the making of Mumbai's modern and cosmopolitan sensibility.

From Wilson College near Chowpatty to JJ College of Architecture near Crawford market, through the thrilling variety of Girgaum with its cherry on the cake Khotachiwadi lies an urban conglomeration that is special to all of us no matter where we live. We have all been touched by the magic of its history whether it is the way we saw movies, ate out at Irani cafes, prayed at shrines of different religious traditions, and just sat next to each other in buses and trains.

“Dharavi” is a collection of neighbourhoods, each with their own specialities, languages, activities, festivals, rituals and aspirations. Each follows its own organizational logic.



Asia's largest slum, Dharavi, lies on prime property right in the middle of India's financial capital, Mumbai (Bombay). It is home to more than a million people.

Many are second-generation residents, whose parents moved in years ago. Today's Dharavi bears no resemblance to the fishing village it once was.

A city within a city, it is one unending stretch of narrow dirty lanes, open sewers and cramped huts. In a city where house rents are among the highest in the world, Dharavi provides a cheap and affordable option to those who move to Mumbai to earn their living.



Rents here can be as low as 185 rupees (\$4/£2.20) per month. As Dharavi is located between Mumbai's two main suburban rail lines, most people find it convenient for work. Even in the smallest of rooms, there is usually a cooking gas stove and continuous electricity. Many residents have a small colour television with a cable connection that ensures they can catch up with their favourite soaps. Some of them even have a video player.

Dharavi also has a large number of thriving small-scale industries that produce embroidered garments, export quality leather goods, pottery and plastic. Most of these products are made in tiny manufacturing units spread across the slum and are sold in domestic as well as international markets.

The annual turnover of business here is estimated to be more than \$650m (£350m) a year. The state government has plans to redevelop Dharavi and transform it into a modern township, complete with proper housing and shopping complexes, hospitals and schools. It is estimated that the project will cost \$2.1bn (£1.1bn).



Pottery:

“Kumbharwada” is one of them, which occupies 22 acres of land that houses around 1200 families. A Potters in Kumbharwada have migrated from the Saurashtra in South Gujarat. They first settled in south Bombay, but as the city grew, they were pushed to the edge of city – Dharavi. Thus the potters had to relocate several times, before they were allotted land in Dharavi to establish what is called today Kumbharwada.

--- Kumbharwada

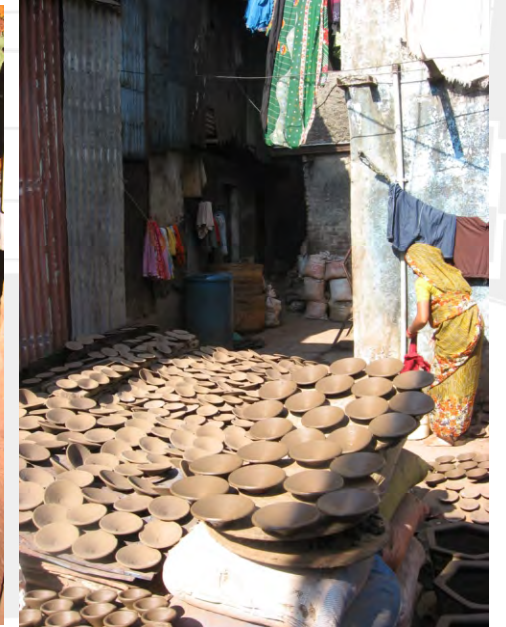
Small and unventilated dwellings serve as multipurpose spaces where a family of 8-10 people lives as well as manufactures pottery products. The dwellings are double storied with usually workshops on ground floor and family space on first floor. The terraces are used extensively for drying pottery. In Kumbharwada, wide lanes separate the houses, which are occupied by the brick kilns for firing the traditional earthenware pottery.

When it comes to production mechanisms, the potter's still depend on conventional kilns, which are, shared between two to three families. There are 120 kilns (also known as 'bhatti' in local language) in Kumbharwada shared by 600 potter families. They use cotton dust, rags /wastes and diesel & oil soaked cotton as firing fuel which is serious cause of pollution & health hazards.



1 Mix the Clay

Storage for dry clay
Storage for Mixed Wet clay
Spaces for mixing clay



2 Make the pots

Open/ Semi open spaces

3 Dry them for a day

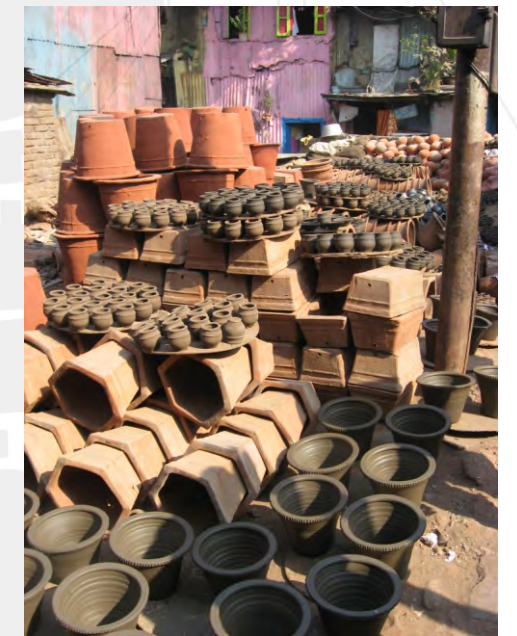
open space

4 Fire them into the kilns

kilns

5 Color

Open/ Semi open/Interior spaces



6 Dry for a day

open Space

7 Store

Outdoor/Indoor

8 sale

Retail Shops



Maximize Density

Proposed Density 600 T/Hectares
Proposing 4180 Units on 64000 sq.m.

Fluidity over space & time

Scenarios where pottery Business exists or vanishes over the period of time

Create Sense of community

- Improve life amenity without altering lifestyle
- Live work environment
- Use of shared spaces- Kilns, courtyards, alleys for production process

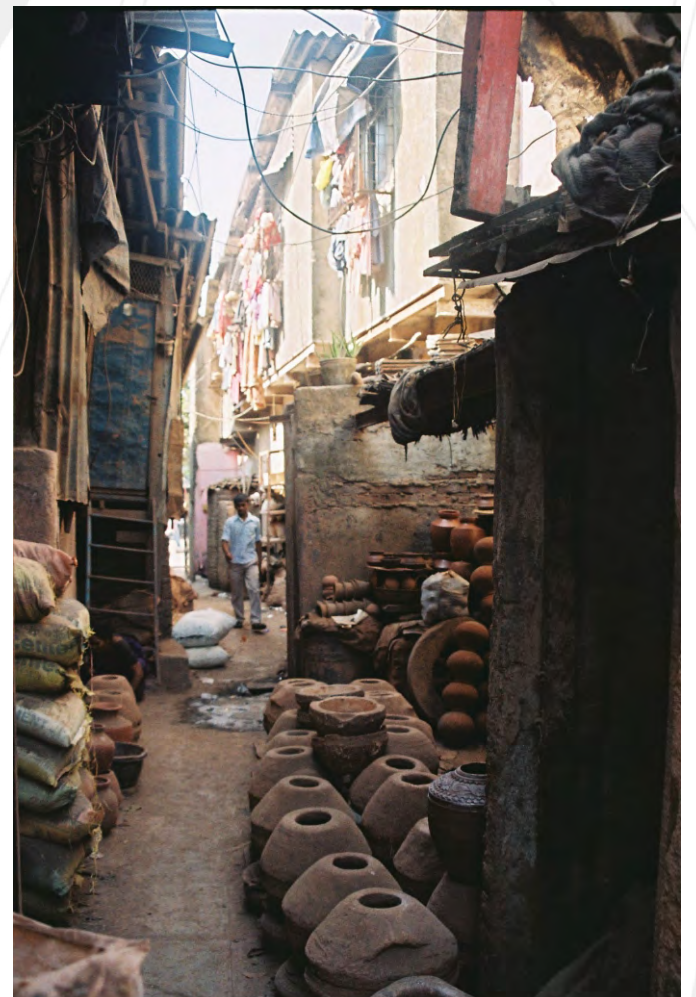
Value to the street scape

- Create Retail interface (Promote Pottery Business)
- Zone of Interaction between Public & Private

Infrastructure & utilities

- Improve life quality

Contribution to the urban environment



REHABILITATION OF "KUMBHARWADA", DHARAVI SLUMS, MUMBAI

INFORMAL SETTLEMENTS . . .

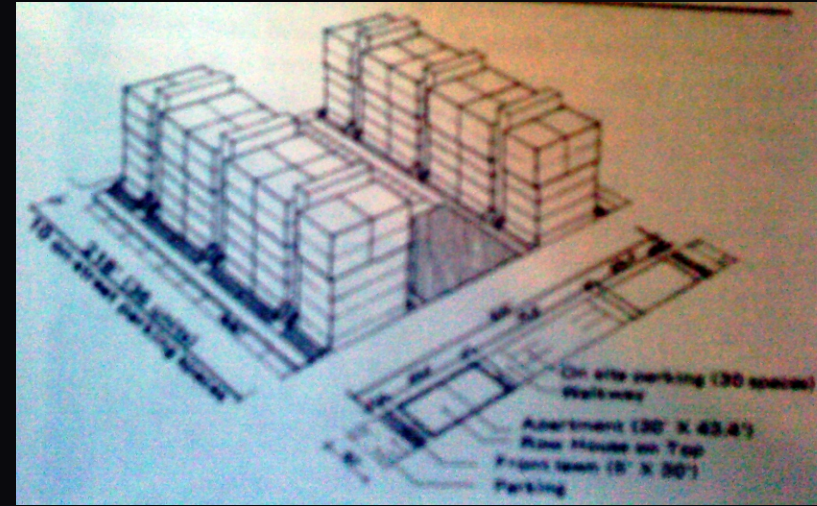


ANASAZI PUEBLO :

By a.d. 700, the Anasazi were building pueblos, or villages, along with extraordinary pottery marked by elaborate black-on-white designs. Their villages, built at the top of mesas or in hollowed-out natural caves at the base of canyons, included multiple-room dwellings and complex apartment structures of stone or adobe masonry.

- Transition between high rise & low rise with open spaces
- landscaped areas create a residential environment perfect for living
- semipublic- public - private
- different lifestyles- housing topology merged

SANDBURG VILLAGE, CHICAGO . . . Blend of Low & High rise density



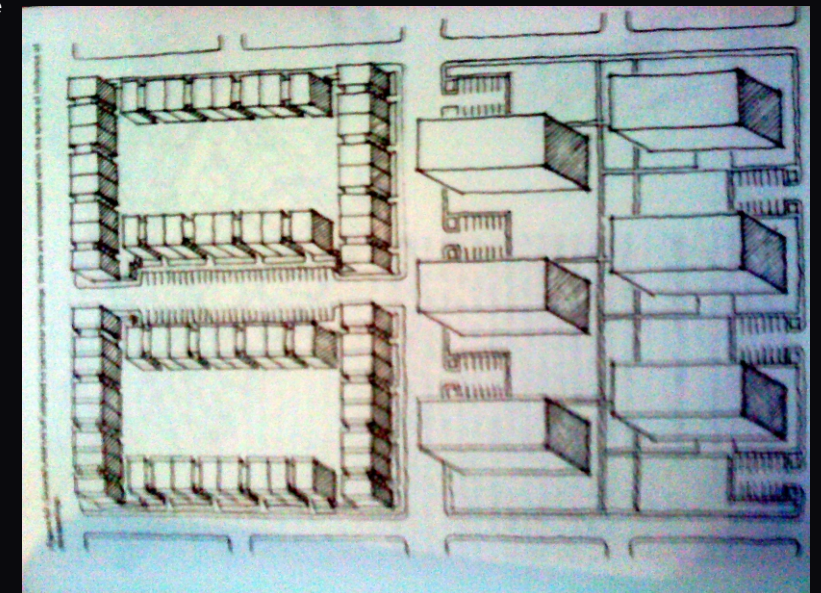
Defensible Space:

- It is a residential environments whose physical characteristics building layout & site plan- function to allow inhabitants themselves to become the key agents in ensuring their own security.
- Design mechanisms contribute to the creation of defensible space
- Dwelling units grouped together to facilitate associations of mutual benefit as determined by age, lifestyle, socializing proclivities, background, income & family structures.
- By delineating areas for particular function
- By clearly defining paths of movements
- by defining outdoor areas of activity for particular users through their juxtapositions with interior living areas
- by providing inhabitants with natural opportunities for the continued visual surveillance of these public areas, in building & outside them.

Guidelines:

- Creating Zones of influences: In laying out site of housing project, building should be positioned & grounds subdivided & allocated so that residents perceive particular areas of the project as being their specific sphere of influence
- Number: a building prototype that satisfies the density requirements but minimizes the number of families that have to share a building entry.
- Building should be then positioned that the grounds around the buildings are easily perceived as having being designated for the use of families in particular buildings
- Assignments of grounds: to create easily perceived zones of influence a project site should be subdivided so that all ground areas are related to particular buildings & building clusters.
- No area should be left unassigned or left public in nature.
- 264 units per acre (each unit: 300 sq ft)
- total unit sq ft: 79200 sqft per acre

Defensible Space:



PRECEDENTS + INSPIRATIONS . . .

REHABILITATION OF "KUMBHARWADA", DHARAVI SLUMS, MUMBAI



Formal Pattern: kilns arranged in linear fashion courtyards connect units



Informal Pattern: kilns arranged behind each retail unit acts as major element to celebrate craft & promote it



Informal Pattern: kilns arranged in central big open space

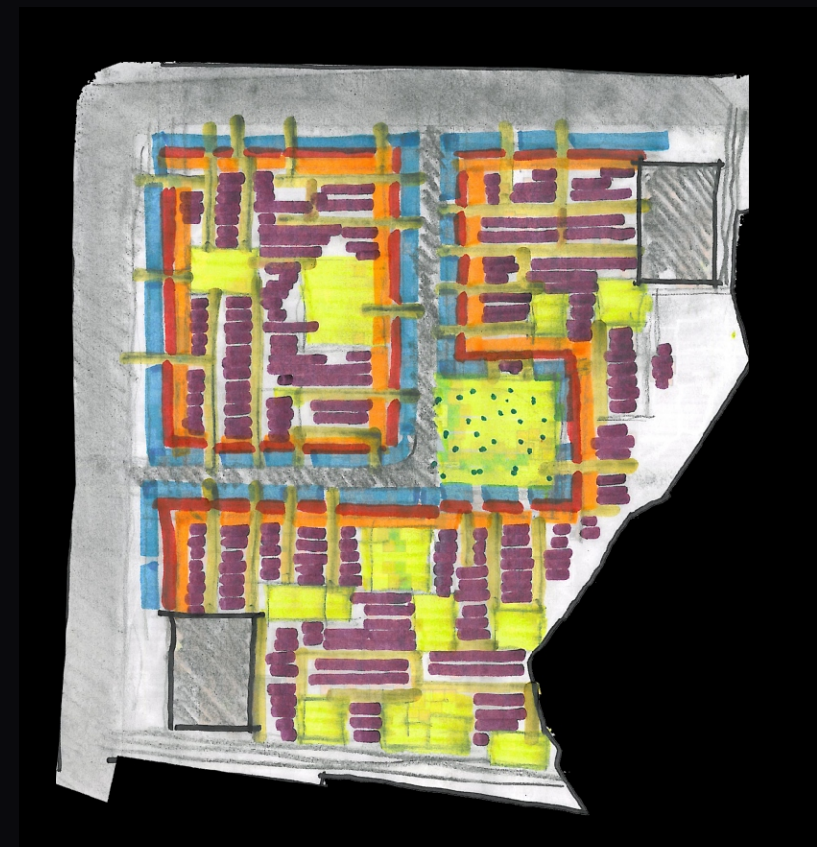


Megastructure: created around the idea of central open market

DESIGN ALTERNATIVES . . . with different urban patterns

Vehicular Roads
At least one entry exit for each high rise complex
Fire engine should reach till end of the site
2way: 7.5 m
1 way: 6 m
Pedestrian Paths
Main: 3m
Alley
1.5 m-3 m
Kilns
Accessible for 5 families
Located behind the retail
Can be accessible from basement (future plan will take them at basement level so basement should have a loop)
Max distance from residential unit to kiln: 50 ft-75 ft
120 kilns
Retail Units
25 sqm
Street frontage
Main road: within 5 m
Pedestrian: within 5 m
No dead ends
The retails should end in the Bazaar- A market place/ display of classic art collection; this is mutable space which can be converted to open community space
No dead ends
Live Work Units
5x5 module
min distance between 2 clusters 10-15 m
Ground floor lvl
Should have proper light & ventilation
At least 1 face opening into the courtyard or alley
Production Spaces
Has to be linked with pedestrian way
Has connection with the brick kilns
Open Spaces
Surrounded by live work units
Min 200 sq m
At least one Access to pedestrian street
High Rise
Access from main road
Connected to potters community at lower level
Merge with the clusters
General
Every 4-6 retails should create an avenue via pedestrian space to enter into the community which will create a unique experience of representing production process of pottery business

TARTANS GRID PATTERN FORMED BY SET OF RULES . . .



INSPIRATION . . .

"TARTAN" . . . A Pattern originated in woven cloth It is a Criss-crossed horizontal and vertical bands in multiple colors . . . The set of rules & procedure creates a unique pattern/ grid in tartan cloth. The same idea to create a unique urban pattern governed by the Set of Rules makes this scheme unique over time & space.

DESIGN ALTERNATIVES & CONCEPT . . .

REHABILITATION OF "KUMBHARWADA", DHARAVI SLUMS, MUMBAI









PERSPECTIVES . . .

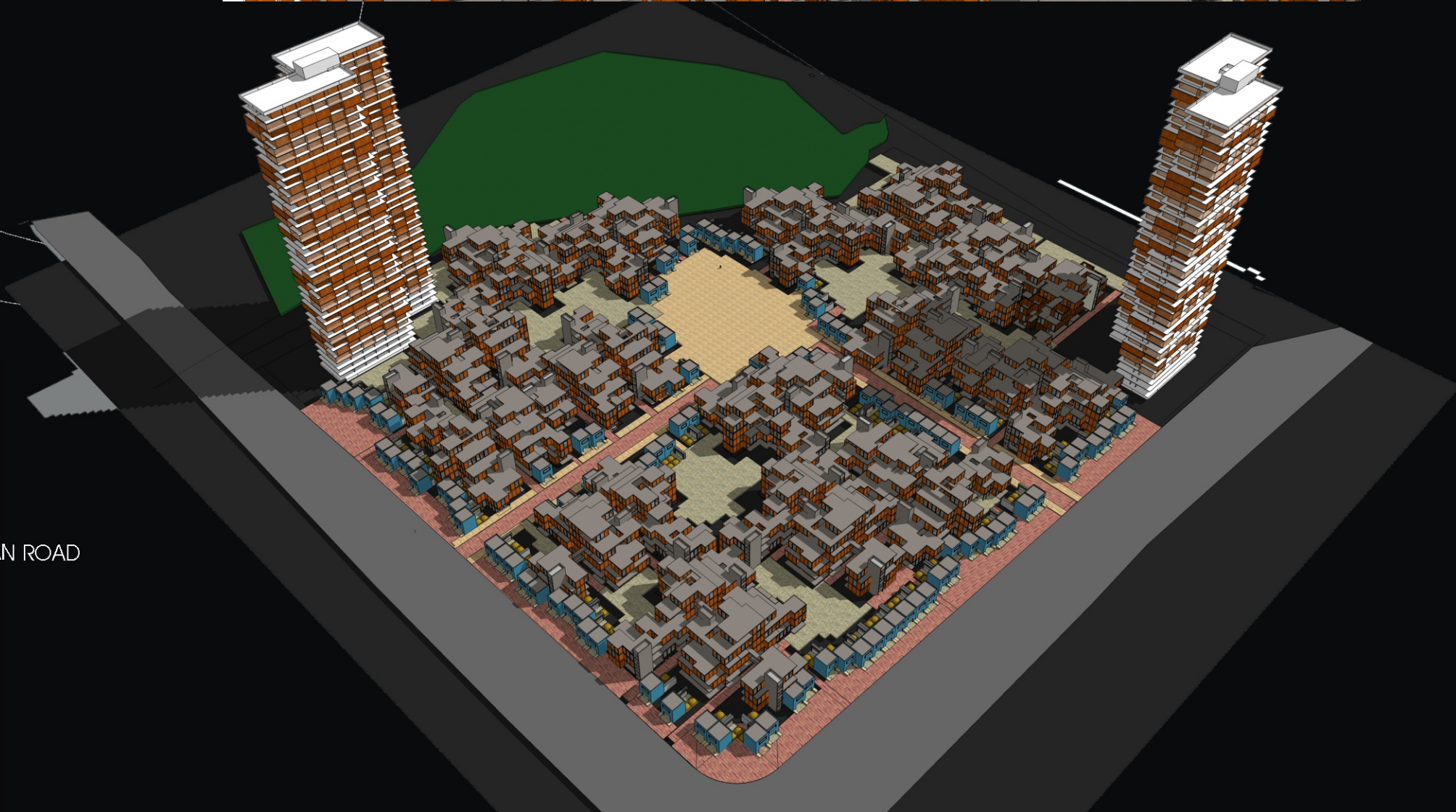
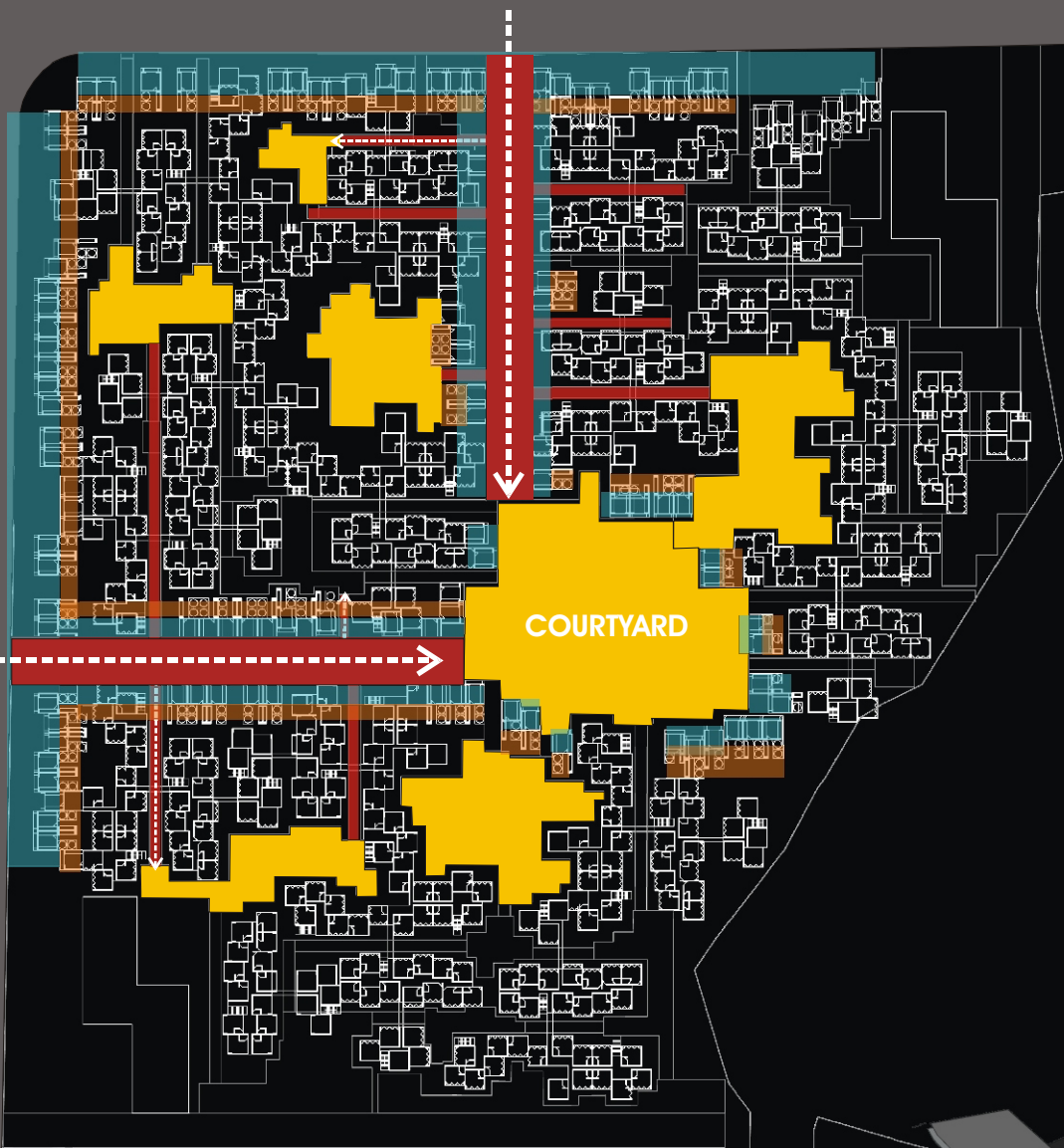
REHABILITATION OF "KUMBHARWADA", DHARAVI SLUMS, MUMBAI

DIAGRAM . . .

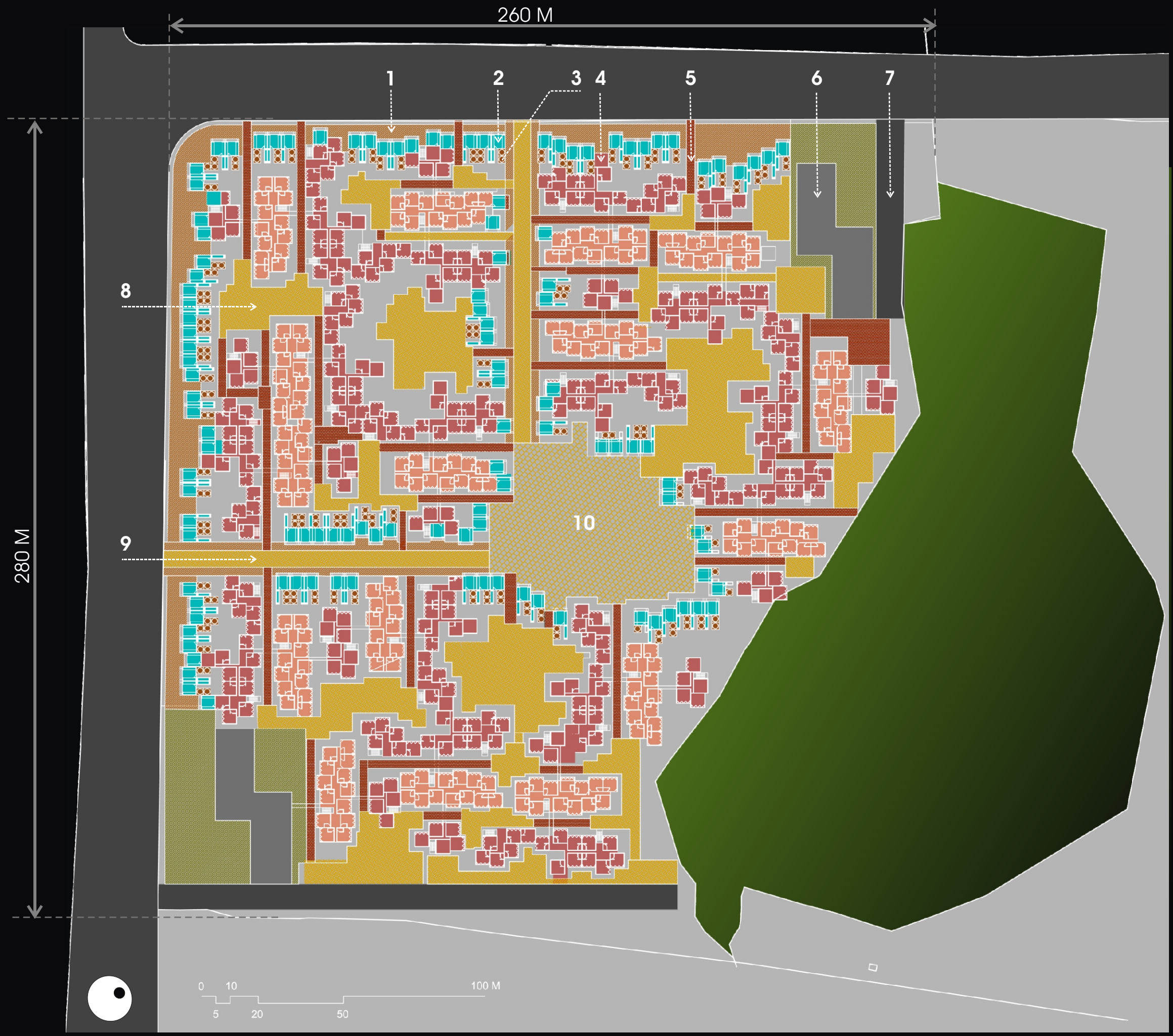


0 10 50 100 M

-  VEHICULAR ROAD
-  RETAIL
-  INTERNAL PEDESTRIAN ROAD
-  KILNS
-  ALLEY
-  COURTYARD



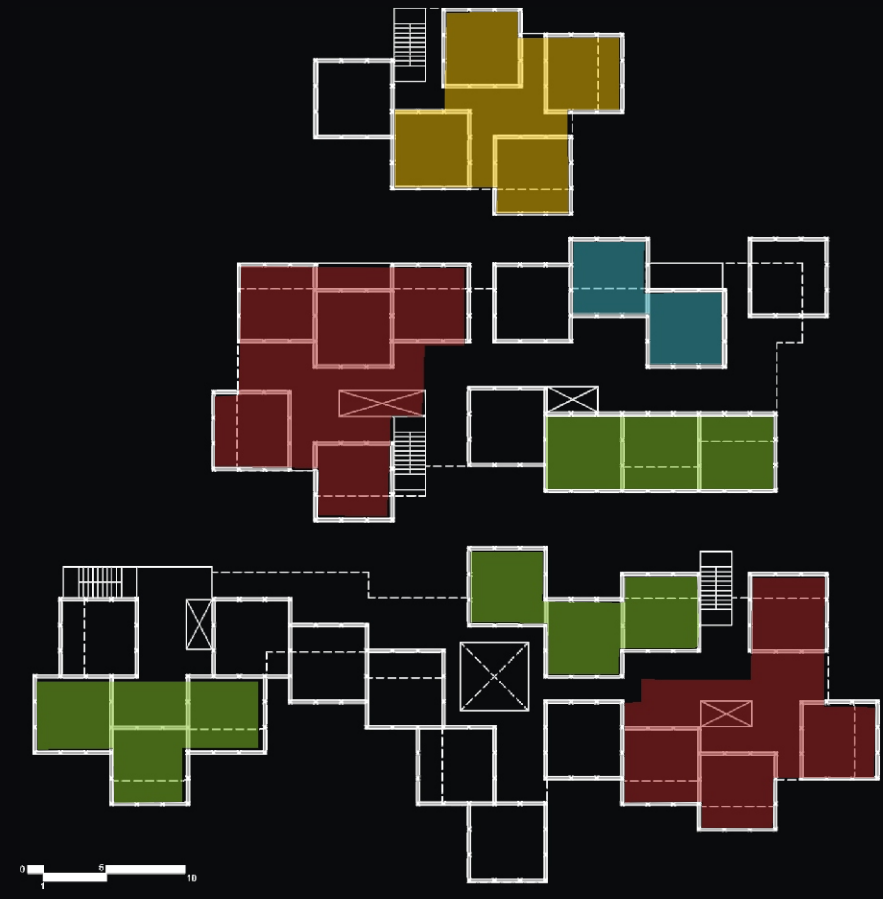
REHABILITATION OF "KUMBHARWADA", DHARAVI SLUMS, MUMBAI



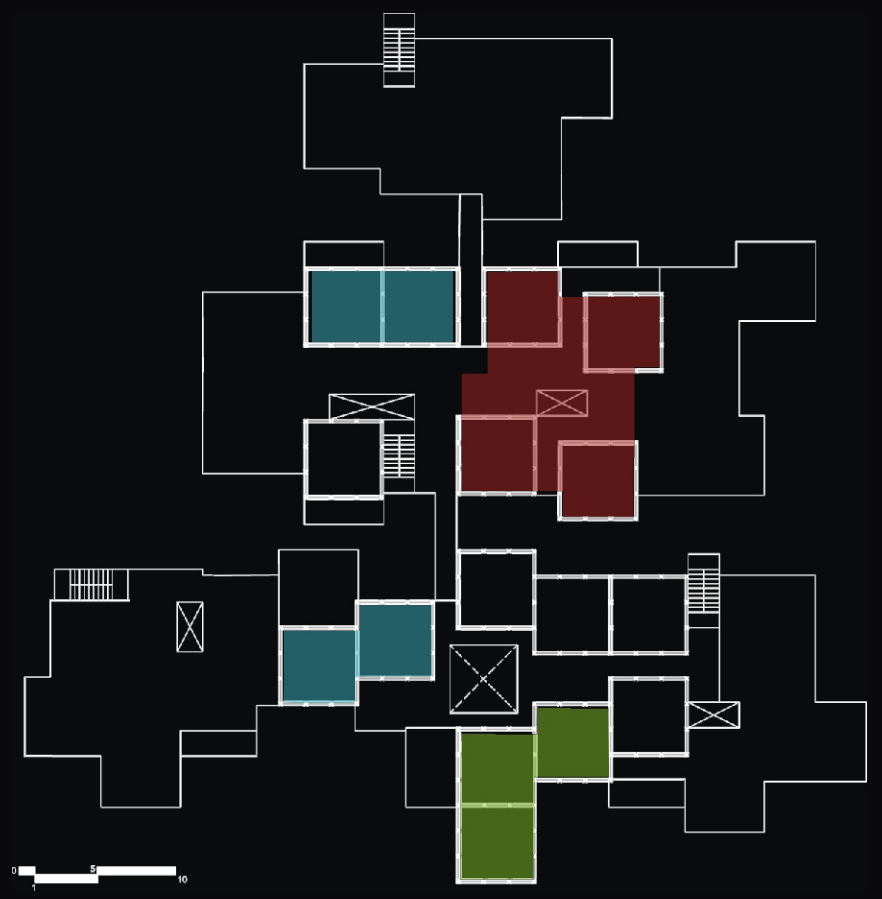
- 1 EXTERNAL WALKWAY
- 2 RETAIL
- 3 KILN
- 4 CLUSTER
- 5 ALLEY
- 6 HIGH RISE
- 7 VEHICULAR ROAD
- 8 COURTYARD
- 9 INTERNAL PEDESTRIAN WAY
- 10 CENTRAL COURTYARD

SITE PLAN . . .

REHABILITATION OF "KUMBHARWADA", DHARAVI SLUMS, MUMBAI



FIRST FLOOR PLAN



THIRD FLOOR PLAN

	1 ROOM	300 SF
	1 ROOM KITCHEN	600 SF
	1 BEDROOM	900 SF
	2 BEDROOM	1200 SF
	3 ROOM	1500 SF



GROUND FLOOR PLAN



SECOND FLOOR PLAN



FOURTH FLOOR PLAN

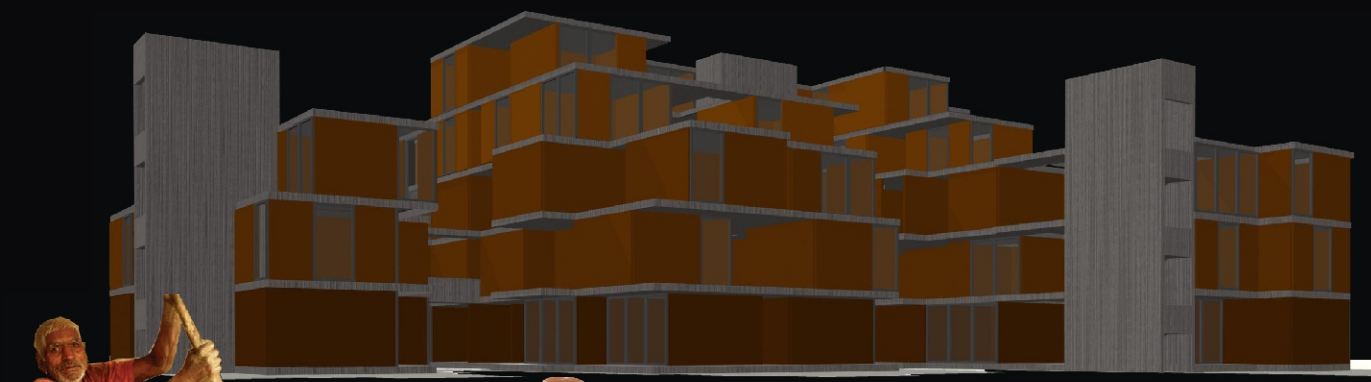
CLUSTER . . .

REHABILITATION OF "KUMBHARWADA", DHARAVI SLUMS, MUMBAI

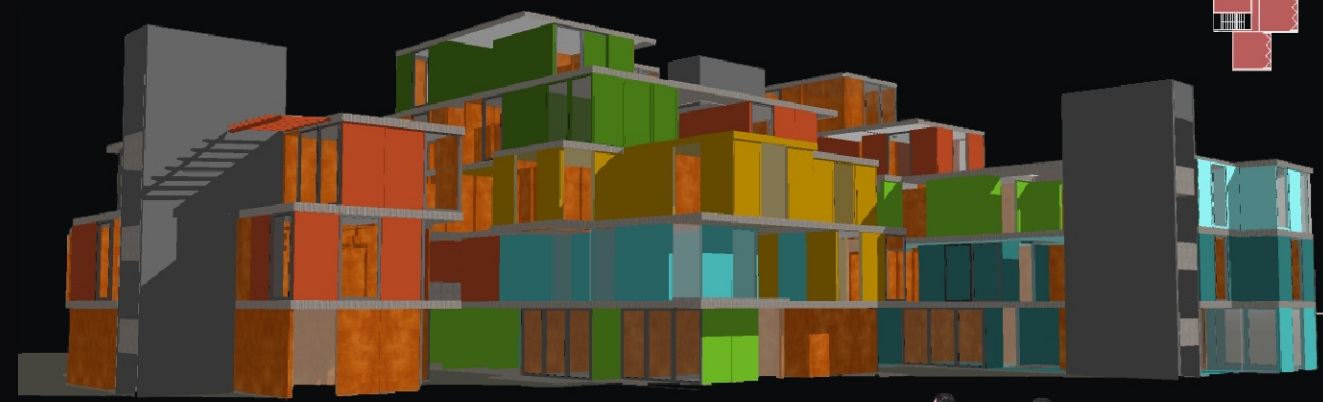
M A T E R I A L I T Y . . .



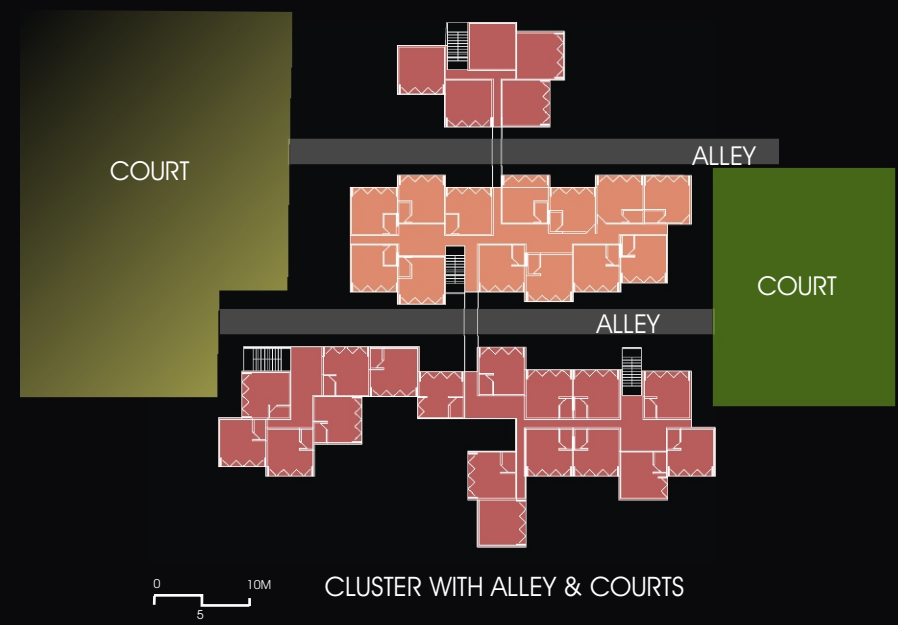
MASSING . . .



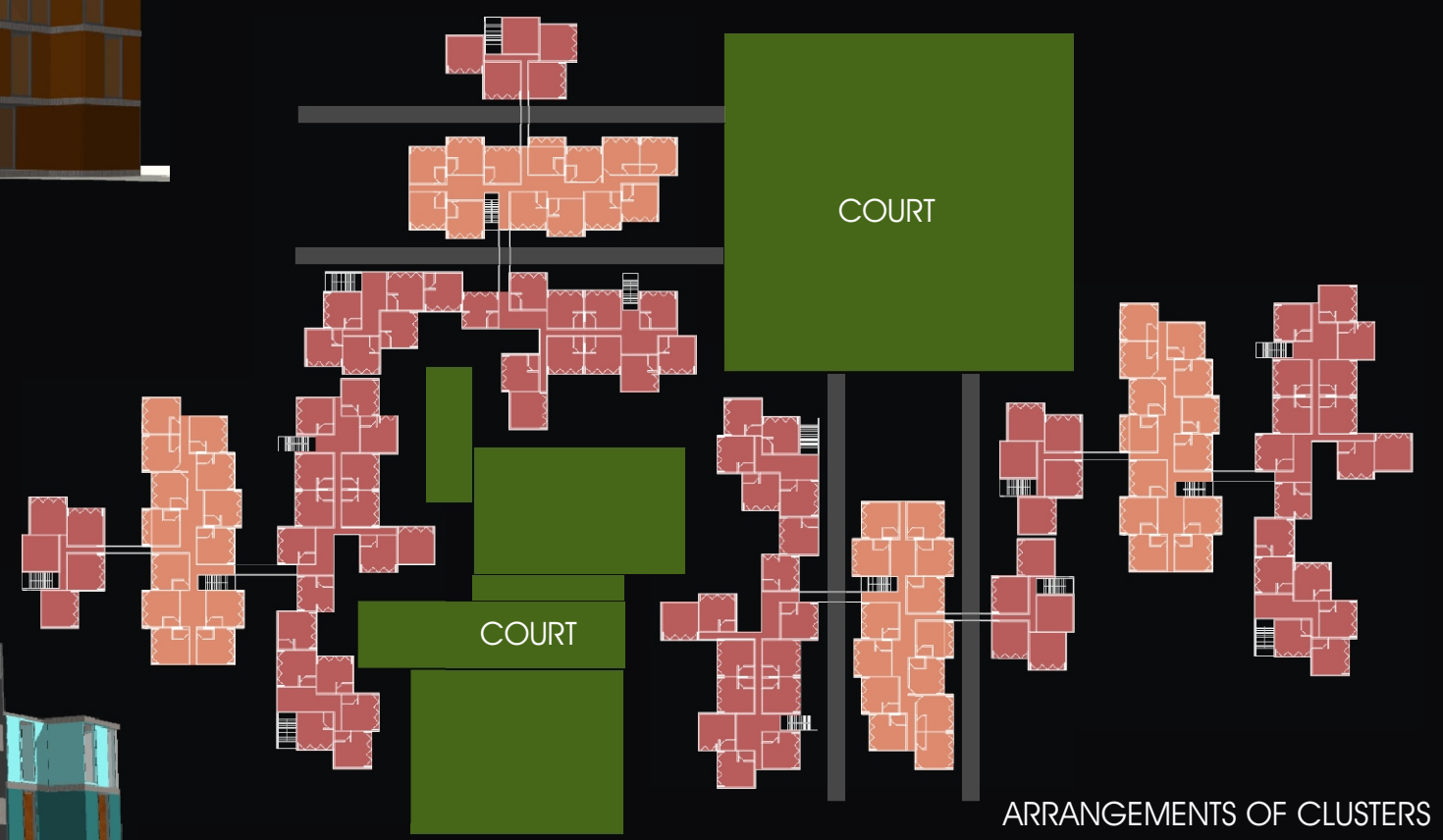
EXTERIOR FACADE IDENTIFIES EXISTING POTTERS COMMUNITY



OCCUPANTS DEVELOPING AESTHETICS . . .



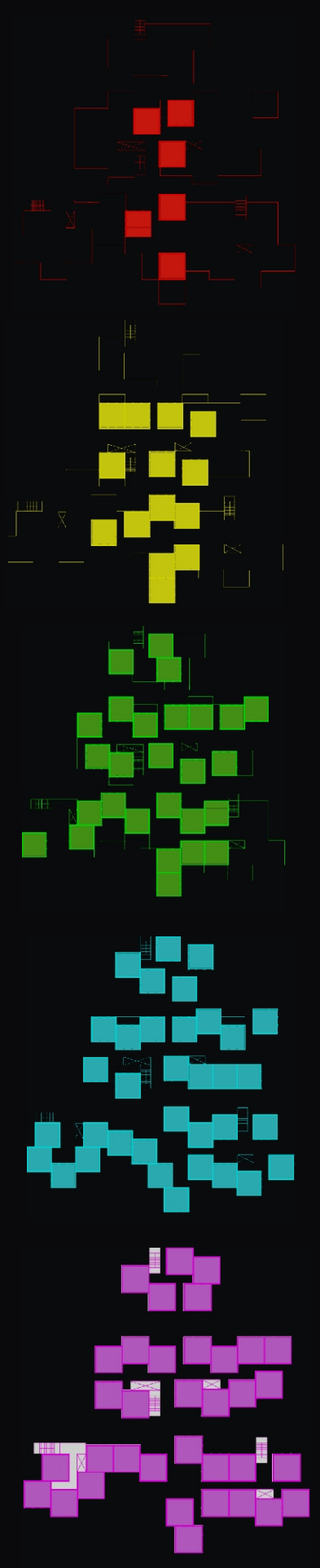
CLUSTER WITH ALLEY & COURTS



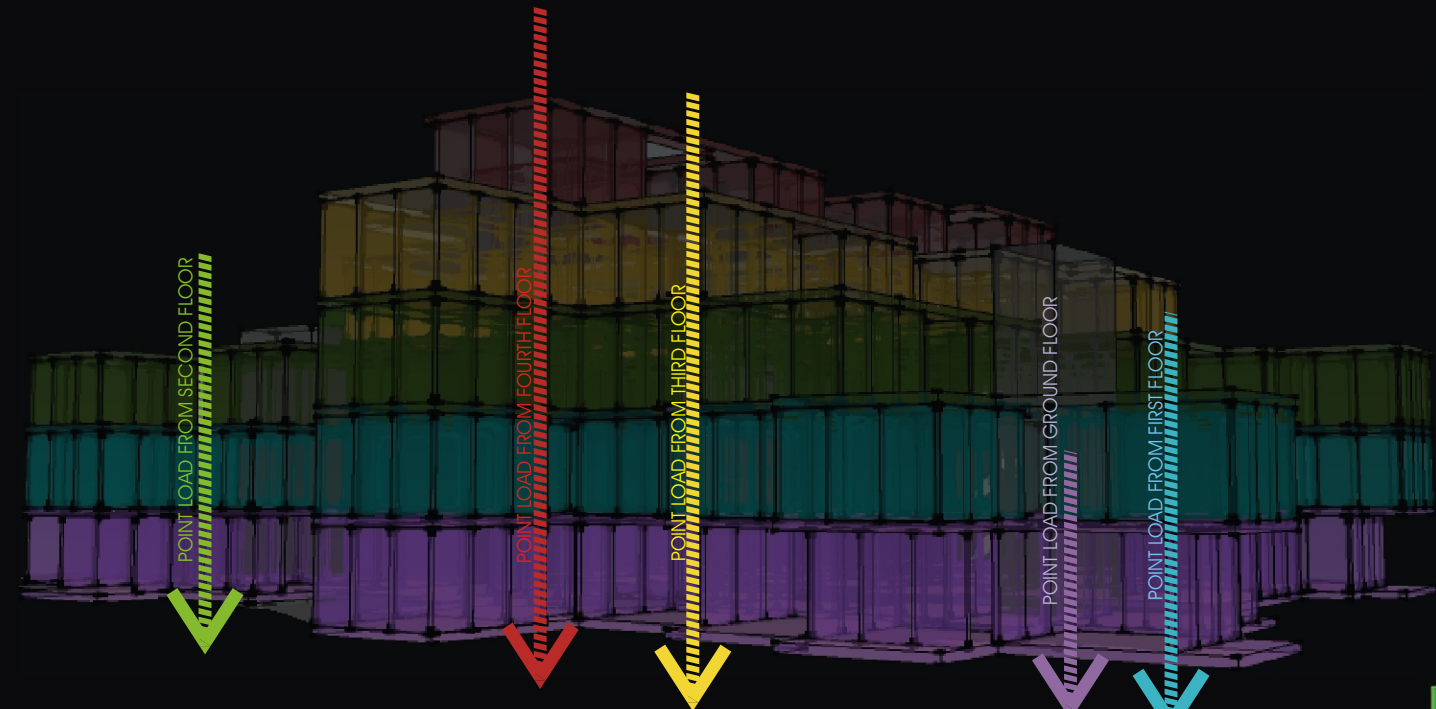
ARRANGEMENTS OF CLUSTERS

GLORY OF INFORMALITY OF SLUMS . . .

REHABILITATION OF "KUMBHARWADA", DHARAVI SLUMS, MUMBAI

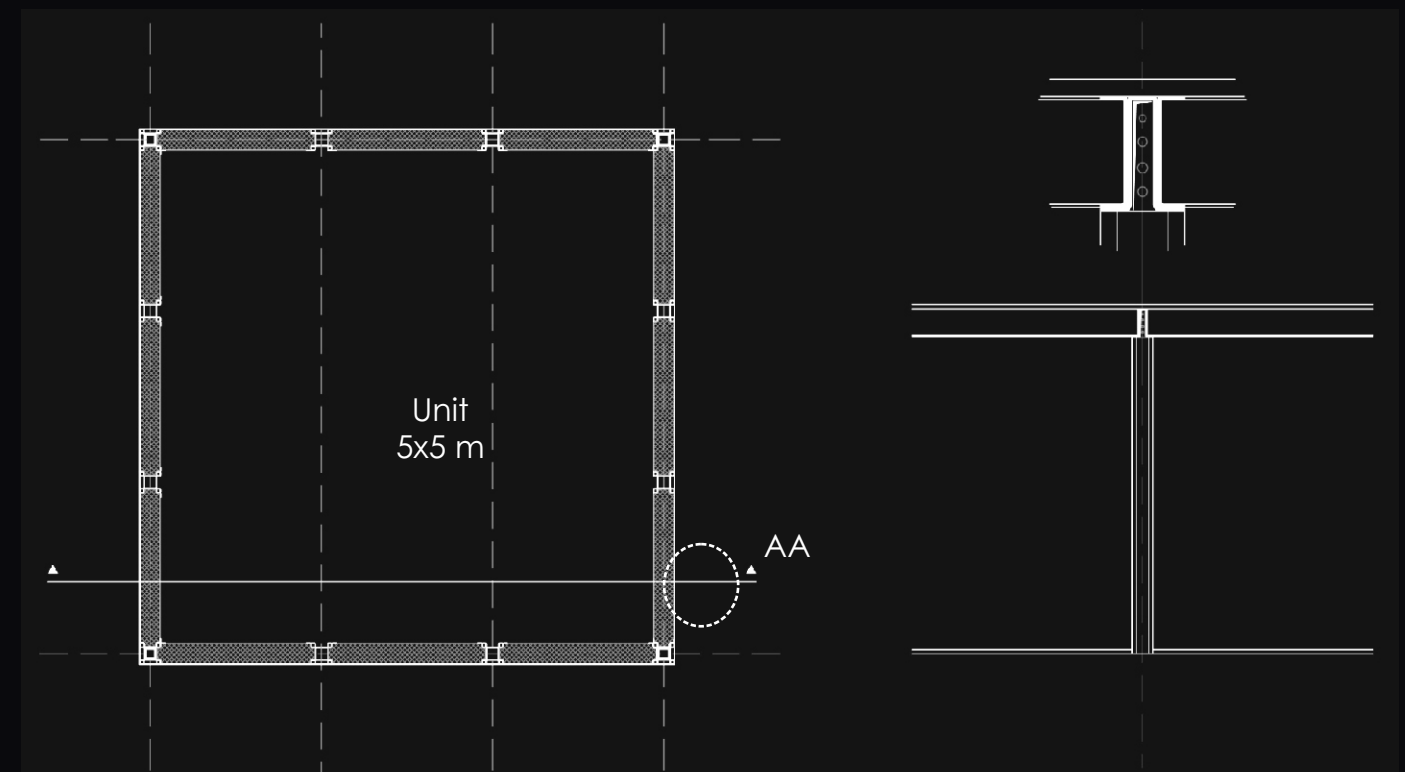


Fourth
Third
Second
First
Ground



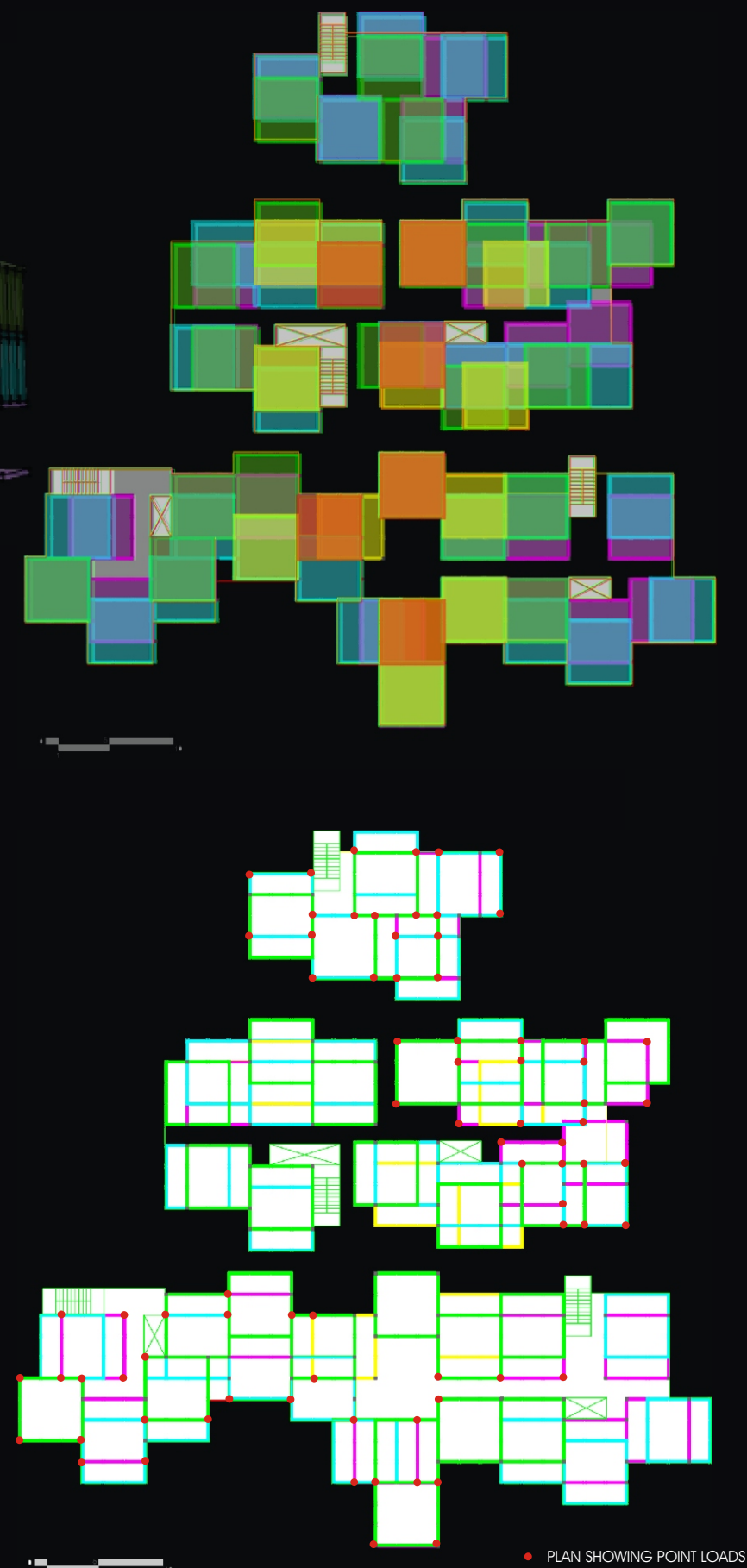
Panelised Composite Walls of Foam & Steel:

- Prefabricated System adapted to the local conditions (culture, climate, needs of the occupants)
- Allows solution to informal arrangement of cluster with point loading, flexibility over time, lightweight construction, cost effectiveness, quick erection
- Engineered panels feature 18 ga. steel tubes for strength and expanded polystyrene (EPS) foam for insulation (8" thick with R-60)
- Gunite finish on exteriors offering earthen aesthetical properties & Stucco Plaster on interior walls.



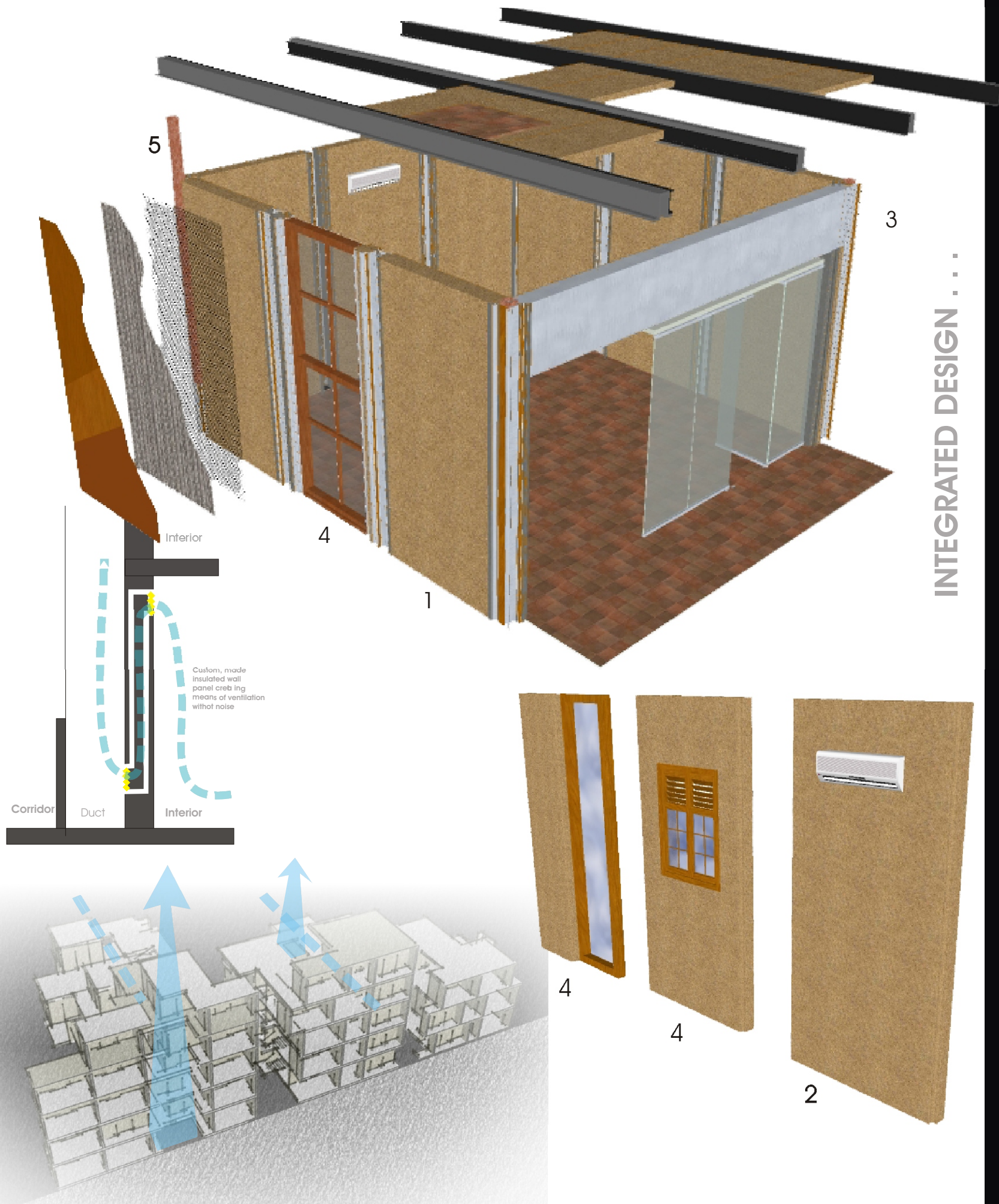
Structural Assembly in Plan

Section AA



PLAN SHOWING POINT LOADS

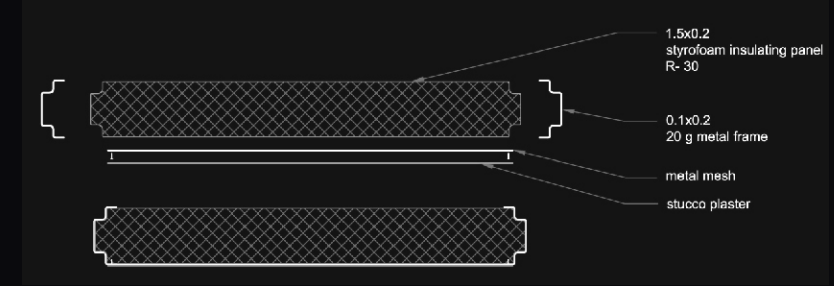
STRUCTURAL SYSTEM . . .



INTEGRATED DESIGN

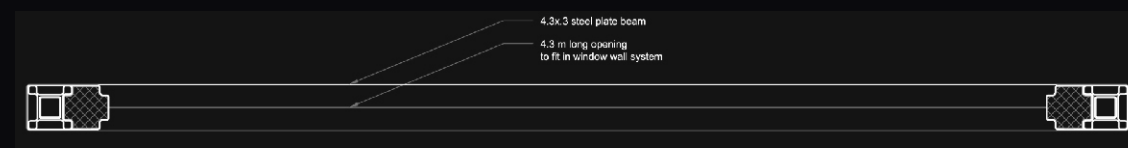
Wall Panel

- ① - Prefabricated Styrofoam Panel
- ② - Slot for wall mounted split Air conditioning Unit



Beam

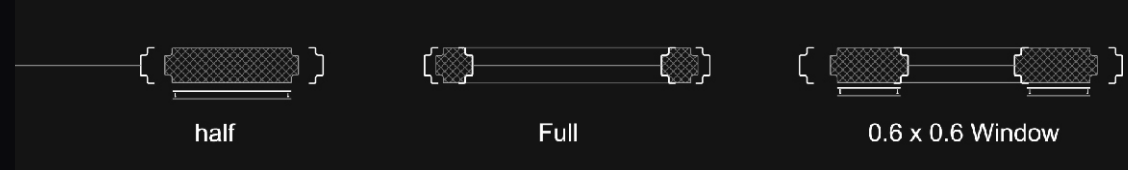
- ③ - Operable door to open up interiors into verandah, Balconies (5 m opening)
- Connect multiple units



Entire slot : opening for balconies/ opening between two modules

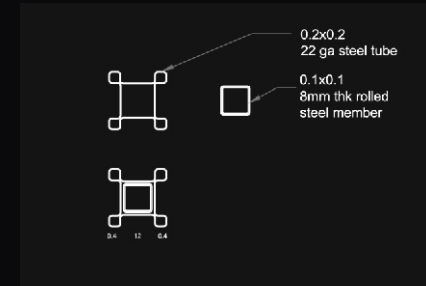
Window Panel

- ④ - Allows tie up with Operable window system



Column

- ⑤ - Steel column only at point loads



REHABILITATION OF "KUMBHARWADA", DHARAVI, MUMBAI

Passive Design Strategies:

Strategies which can reduce Air conditioning

- Building design minimizes overheating
- Use plant materials (ivy, bushes, trees) especially on the west to shade the structure (if summer rains support native plant growth)
- Good natural cross ventilation
- light weight construction with operable walls and shaded outdoor porches, raised above ground
- Locate door and window openings on opposite sides of building to facilitate cross ventilation, with larger areas facing up-wind if possible
- high ceilings and high operable (French) windows protected by deep overhangs and porches.

Design Strategies:

- On hot days ceiling fans or indoor air motion can make it seem cooler by at least 5 degrees F (2.8C) thus less air conditioning is needed
- High Efficiency air conditioner
- cool roofs (with high emissivity) to minimize conducted heat gain
- A radiant barrier (shiny foil) will help reduce radiated heat gain through the roof in hot climates.



Design Determinants

Maximize Density

- affordability
- local problems

Fluidity over space & time :

- Expandable/Resizable units
- allows for different community growth

Create Sense of Community

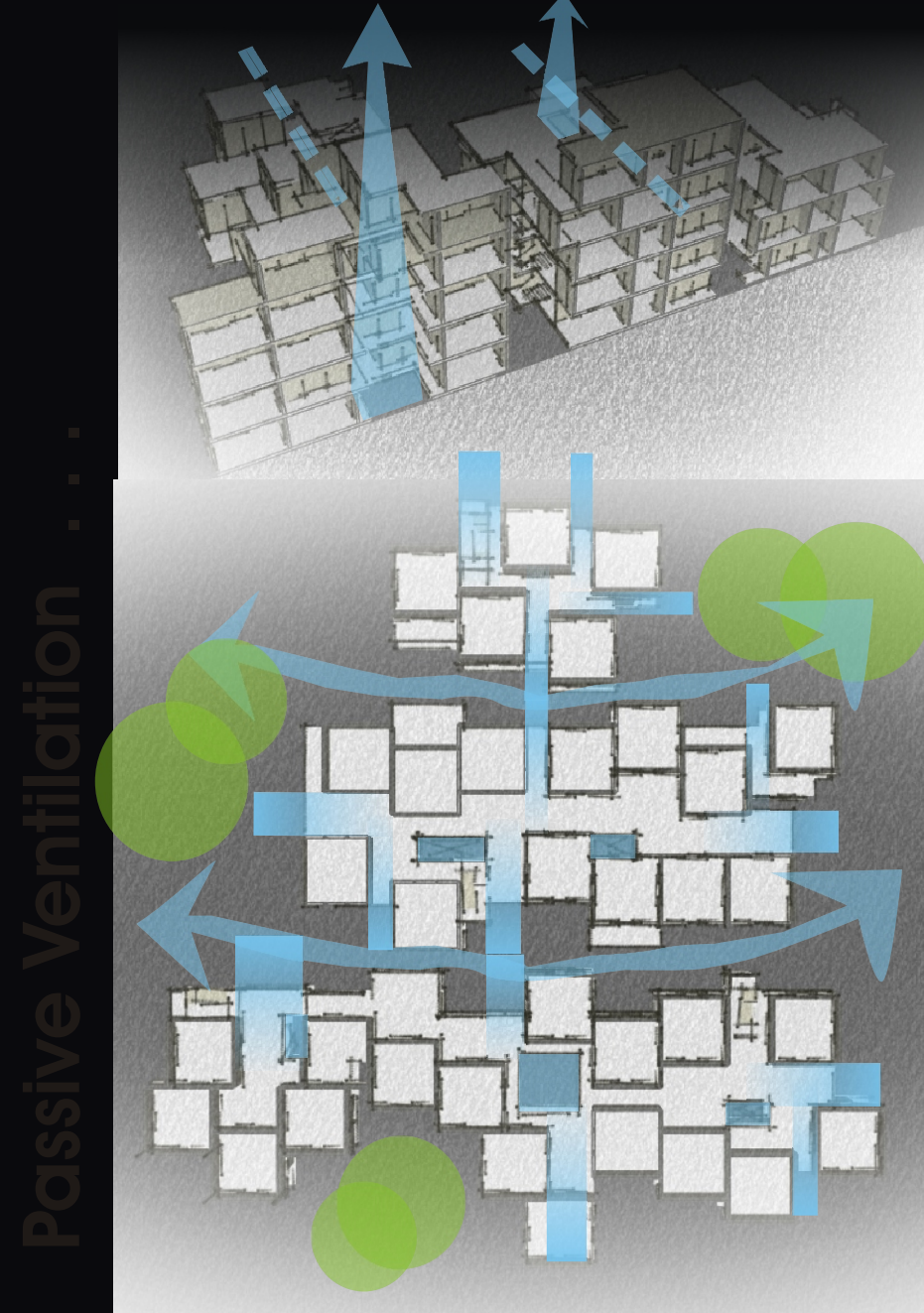
Environmental Control System strategies

Practical solutions
Local solutions

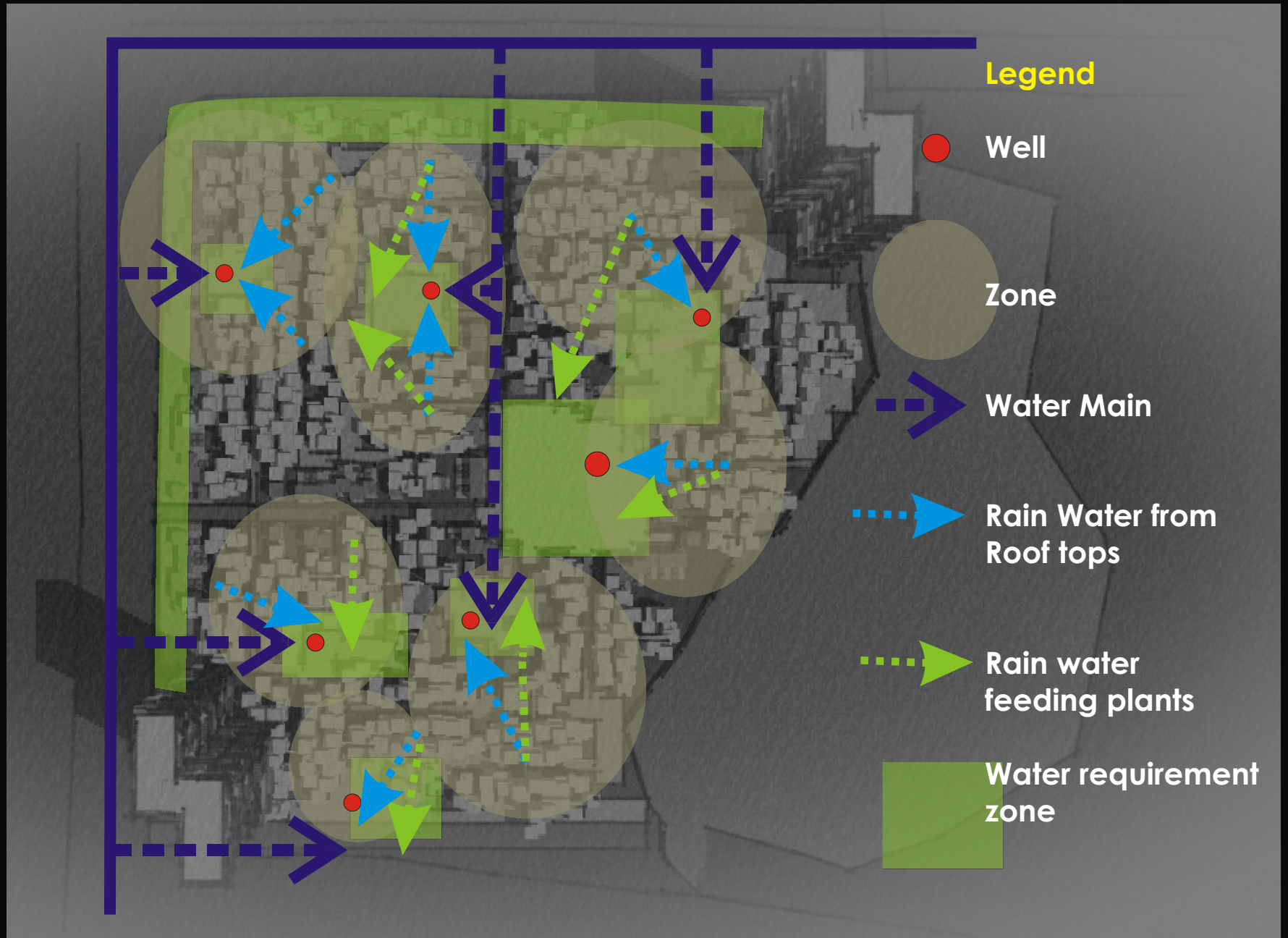
ECS ideas developed to incorporate this flexibility

Futuristic yet practical approach
Different Systems takes over different phases

Elements in ECS acts as elements in the community spaces



Passive Ventilation . . .



Water management . . . ENVIRONMENTAL CONTROL SYSTEMS . . .

REHABILITATION OF "KUMBHARWADA", DHARAVI, MUMBAI

Source
Collection/
Conversion

Distribution
Control

Phase 1

Air - Passive Ventilation
- Electric Ceiling fans

Water
Domestic hot water - Electric unit heaters
Pottery Production - Rain water

Heating Kilns - Use of bio mass

Phase 2

Air - Split air conditioning

Water
- Gas fired absorption chillers

Heating Kilns - Use of bio mass

Phase 3

Solar Powered Air Conditioning

Water
Solar collectors

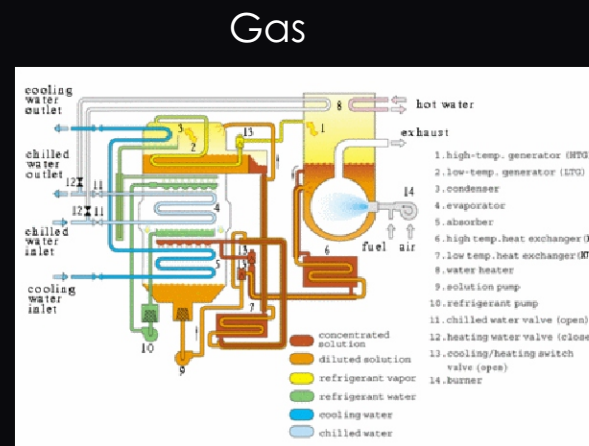
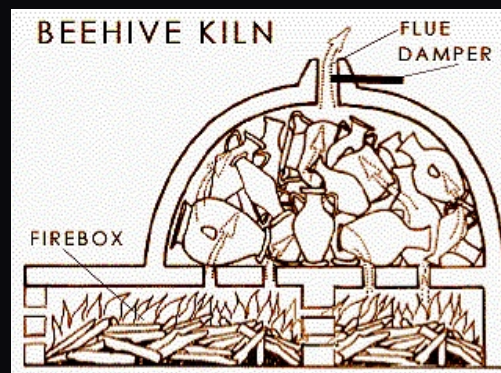
Heating Kilns - Use of bio mass



Pellets made in the vicinity of site
(Dharavi has waste materials to make pellets)



Pellets : source of energy



Chiller plant Located outside the building

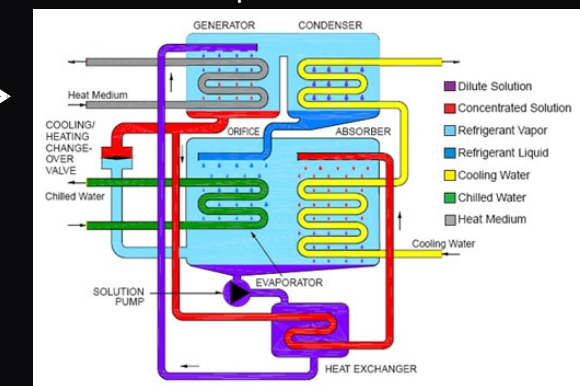


Pipes connected to wall mounted units for making cool air & extra heat goes to kilns
- waste heat from kilns directed to chiller for reuse

Solar Energy



Rooftop Solar Panels



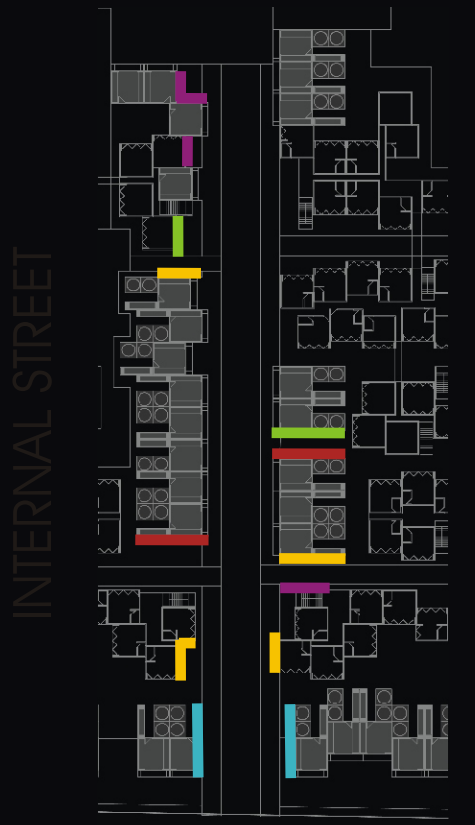
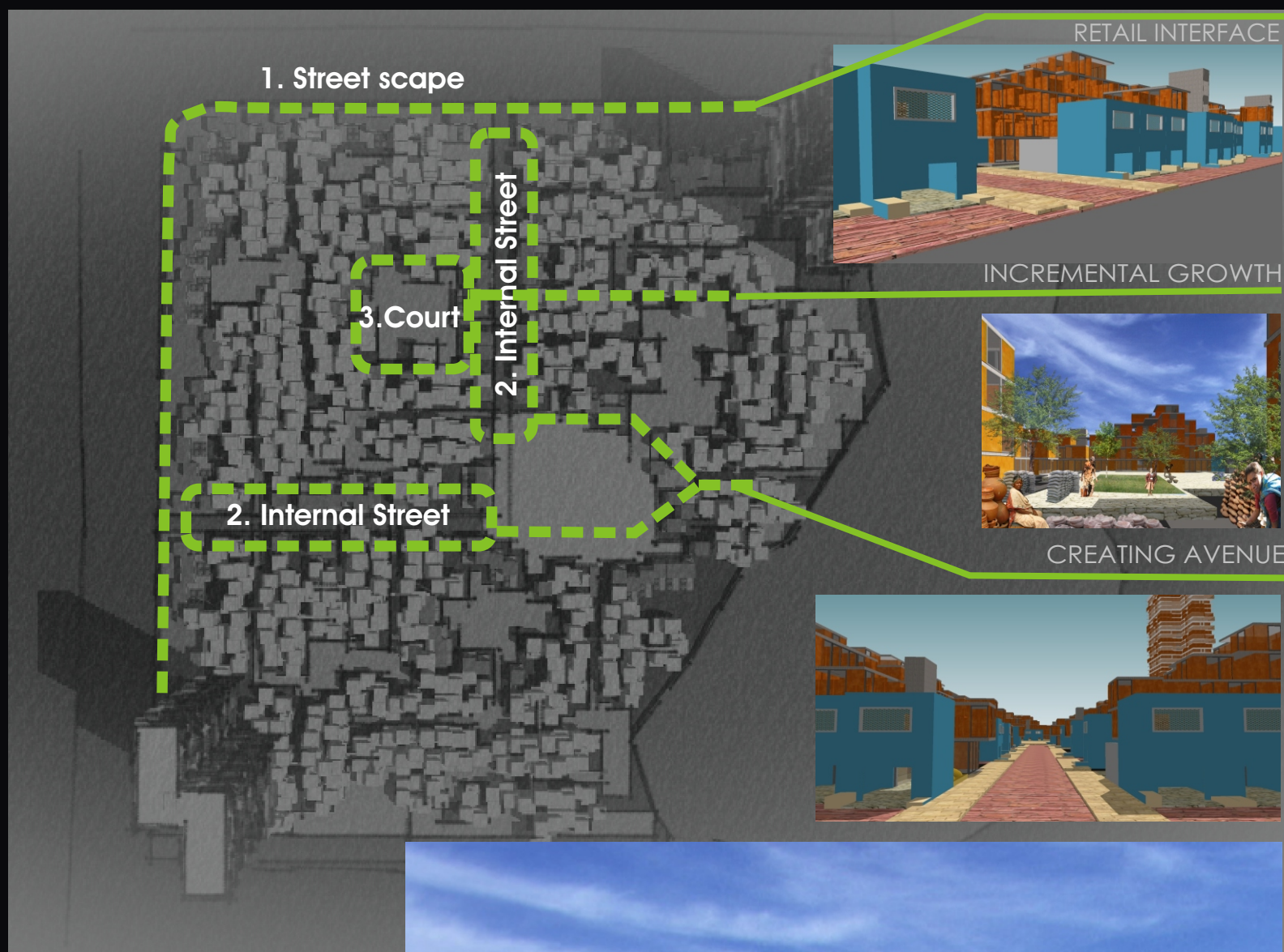
Cooling cycle



Wall mounted split unit
(multizone)

ENVIRONMENTAL CONTROL SYSTEMS . . .

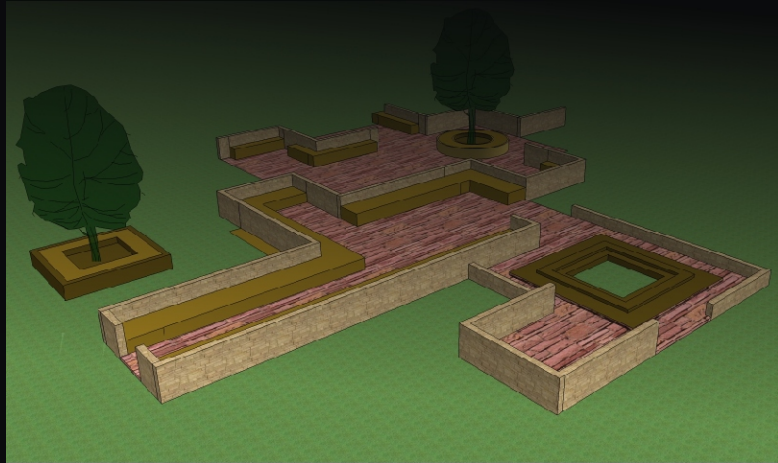
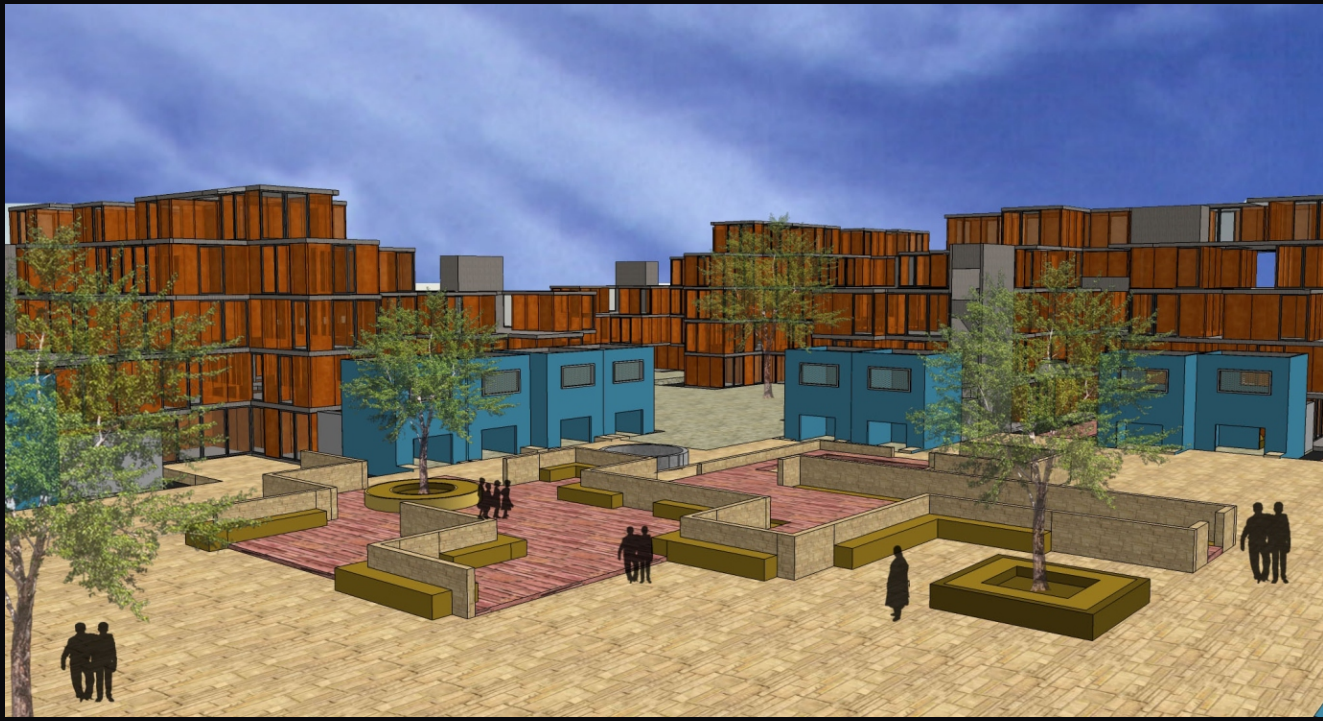
REHABILITATION OF "KUMBHARWADA", DHARAVI, MUMBAI



LANDSCAPE . . .

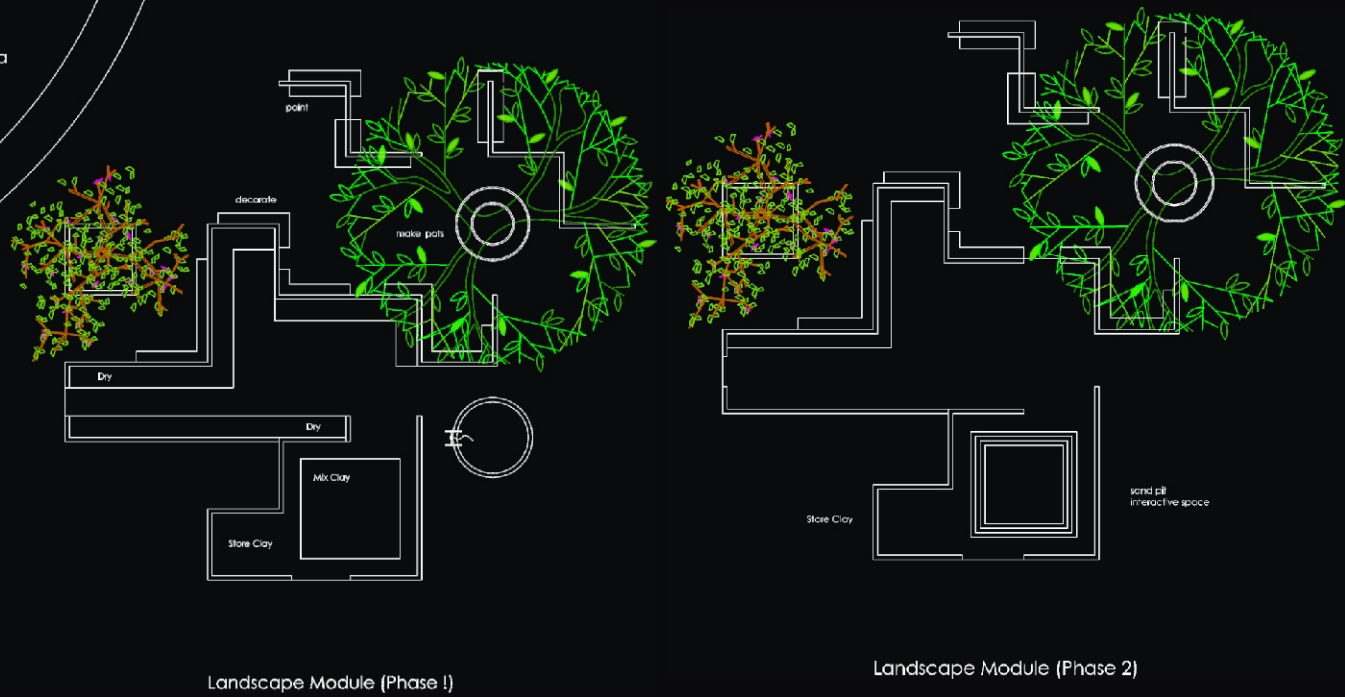
REHABILITATION OF "KUMBHARWADA", DHARAVI SLUMS, MUMBAI

CENTRAL COURTYARD



MODULE

Play Area



Landscape Module (Phase 1)

Landscape Module (Phase 2)

COURTYARD PHASE 1



COURTYARD PHASE 2



LANDSCAPE...

REHABILITATION OF "KUMBHARWADA", DHARAVI SLUMS, MUMBAI



PERSPECTIVES . . .

REHABILITATION OF "KUMBHARWADA", DHARAVI SLUMS, MUMBAI

