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I, Kaaviyaa Palaniandavan Nagarajan, hereby submit this original work as part of the requirements for the degree of Master of Architecture in Architecture.

It is entitled:
From Organic to Organized:
A Rehabilitation of Nochikuppam Slum, Chennai, India

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From Organic to Organized

A Rehabilitation of Nochikuppam Slum, Chennai, India

A thesis submitted to the
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Master of Architecture

In the of the School of Architecture and Interior Design
of the College of Design, Architecture, Art, and Planning

by

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ABSTRACT

This thesis “from organic to organized” aims to create an architectural solution which successfully involves and resettles people coming from organic settlement patterns to more organized living conditions. It targets to give the users a sense of ownership, social inclusion, and belonging. Furthermore, it accounts for the expansion and adaptation of the community in the future, through flexible design solutions. This thesis also proposes a tsunami and a flood resistant design to equip the community to survive these natural disasters in the future.

Slums are an unhappy reality for many countries across the world. Over one billion world inhabitants live in the slums today and the numbers are climbing. The United Nations (UN) estimates that about 1.4 billion people will be occupying the slums by the year 2020. India alone will house about 65 million of the world slum population; that is 35% of the total urban population in India.

In India, drastic migration from the rural to urban areas has resulted in a population explosion across all the major cities; these cities and its infrastructure were not equipped to accommodate the overflowing population and their needs. This rapid population growth and inadequate infrastructure in the cities has led to the creation of large pockets of slums around the urban core.

Slum dwellers suffer from poor living conditions, meager sanitation, high child mortality rate, low literacy rate, dilapidated housing, inadequate infrastructure, high crime rate, and poverty. Many social activists and architects are trying new ideas to resettle the slum dwellers to an affordable and sanitary housing condition.

The government is trying to fund and encourage the urban poor to own a basic house and has built multiple slum rehabilitation housing projects for the slum dwellers. Besides all the effort the government has put in, the demand and supply chain is still facing a great lag. In this paper, a series of studies and analyses of various precedents have been conducted to understand the reasons for the success and failure of the slum rehabilitation projects, specifically in India. From these directed studies, a set of design guidelines have been derived that can function as a reference tool to address a slum project.

From organic to organized, proposes an affordable tsunami-resistant housing for the Nochikuppam slum that will allow the community to expand, adapt, and sustain; thereby alleviating the socio-economic and political issues using architectural solutions.
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CHAPTER I
INTRODUCTION
I. INTRODUCTION

By 2020, UN estimates that most of the world inhabitants will be living in slums, diploid of basic living standards. The United Nations defines slums as poor, overcrowded communities lacking adequate access to necessities like drinking water, sanitation, public services, basic infrastructure and quality housing. Unpredicted growth in the population amid poverty and the scare availability of resources, makes an environment that favors the rapid growth of slums.

“UN-HABITAT defines, slum dwellers lack one or all the following: Durable housing, Sufficient living space (not more than three persons in a room), Access to safe water, Access to adequate sanitation, and Secure tenure.”

Not all slums are the same or not all the dwellers experience the same issues. The degree of deprivation of a slum and its dwellers depends on how many of the above-mentioned conditions are prevalent. Around the world, 18% of all urban housing units are not permanent structure and most of them do not meet the urban codes. For every 10 permanent housing units about 4 houses are in natural disaster prone areas. In South Asia 66% of the urban population are deprived of one condition, 29% are deprived of two conditions, and 5% of the population are deprived of three out of five conditions. [1]

India is a developing country with many of its population living below the poverty line. * Slums in India are growing at an alarming rate, especially, cities like Mumbai, Delhi, Kolkata and Chennai have most of its urban population living in substandard housing conditions.

Chennai, the capital of Tamil Nadu state in India is a fast-growing metropolitan city facing rapid urbanization that is resulting in an urban sprawl. A survey done by the Tamil Nadu Slum Clearance Board (TNSCB) has concluded a 51.85% increase in slums in the city from 2001 to 2014. The Socio-economic survey conducted by the Tamil Nadu government has shown that 1,131 slums are spread across 17.28sqkm of the city; with 470 slums in the north, 389 slums in the center and 272 in the south. [2]

The Nochikuppam slum is located at the coastline of Marina beach, Chennai and is a big fishermen community with about 2,800 families within it. Nochikuppam was washed out by the 2004 Indian ocean tsunami and people who survived this disaster still reside in the dilapidated housing. It has been almost 12 years and they have not yet moved out of these houses. The new temporary housing that the government has built is unsanitary and has bad living conditions, thus people are reluctant to move into the new temporary houses. After a long struggle, the Slum Clearance Board of Tamil Nadu state has accepted to demolish the deteriorated houses in the Nochikuppam slum and build new houses in the same location. [3]
This Thesis ‘From organic to organized’ is a two-part process that concludes with an affordable housing proposal for the Nochikuppam slum that can withstand natural disasters like tsunami and flood. The first part of the process was to study and analyze the successful and failed slum rehabilitation projects: from these directed case studies a set of TWELVE BASIC GUIDELINES were formulated. These basic guidelines functioned as a reference tool to address the slum rehabilitation project. The second part of the process was to arrive at a design solution that incorporates all twelve of the basic guidelines and more.
II. BACKGROUND AND ANALYSIS

II.A. SLUMS

A slum is a densely populated organic settlement in urban areas characterized by substandard housing and squalor. It lacks sanitation, the supply of clean water, reliable electricity, the authority of law enforcement and other basic services. Most slum dwellers perform their daily chores outdoors and their housing is mostly deteriorated. [4]

"Slums have been defined as mainly those residential areas where dwellings are in any respect unfit for human habitation by reasons of dilapidation, overcrowding, faulty arrangements and designs of such buildings, narrowness or faulty arrangement of streets, lack of ventilation, light, sanitation facilities or any combination of these factors which are detrimental to safety, health, and morals." - Slum Area Improvement and Clearance Act of India, 1956. [5]

More than their economic conditions, it is the people’s living situation that deems them poor. The health and education packages are very limited to the people living in the slums. Crime and violence are much more rampant in the urban slums, threatening the authority of law enforcement and disturbing the peace of mind of the city dwellers. [6] Most urban poor live on the vacant government lands that they have encroached upon. These pockets of unsanitary organic settlements within a city degrade the overall health, appearance, and performance of the city.

Although migration is the major reason for the creation of slum settlements, there are other reasons. Cities act as a beacon that attracts populations from the rural areas, by providing job opportunities in the industries, or at the least people believe that the cities have better opportunities than the villages. Once the industries realize that the people depend on them, they expand and utilize the cheap manpower. This rapid urbanization and industrialization have also led to an unexpected growth in the population of the cities.

In a diverse country like India, socio-economic segregation is so immense that this seclusion and politics play a major role in the expansion and sustenance of the slums. Cities do not have adequate planning to accommodate the rapid industrialization, urbanization, and the resulting population explosion. Poor infrastructure and insecure tenure inhibit opportunities for resident’s ability to improve upon their home. Also, globalization promotes slum living; global economic booms lead to an uneven wealth distribution among the people, which have been proven responsible for the creation of slums in the major cities. [7]

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II.A.2. Types of slums

In general, slums are categorized based on social mobility, the period of stay and the reason for their presence. The classificatory model for the types of slums is based on two variables, first is the attitude of the slum dwellers towards the social mobility and the second is the economy of the community. These variables then provide two general classifications: Slums of hope and Slums of despair.

Slums of hope, are the slums willing to move forward and advance out of their living conditions and the socio-economic barriers. These slums are inhabited by recent immigrants.

Slums of despair, are populated by long term residents who are reluctant to move past the existing conditions or the socio-economic barriers.

Both above-mentioned types of slums have escalator and non-escalator classes. The escalator class is a group of people who are more likely to move forward and it is the most significant character of the slums of hope. The non-escalator classes are a group of people who deny moving ahead from their living conditions.[9]

Slums are also classified based on the length of stay in the slums - the permanent and the temporary residents. They stay in the slums based on the opportunities and their necessities.

“In India, for the first time in the Census 2001, slum areas were earmarked across the country, particularly, in cities and towns having a population of 50,000 or above. In 2011 every city was earmarked irrespective of their population. As per the Indian government, the slums are classified as notified, recognized and identified slums. [10]

(i) All the notified areas in a town or city notified as ‘Slum’ by State, Union territories Administration or Local Government under any Act including a ‘Slum Act’ may be considered as Notified slums.[9]

(ii) All areas recognized as ‘Slum’ by State, Union territories, Administration or Local Government, Housing and Slum Boards, which may not have been formally notified as slum under any act may be considered as Recognized slums.[10]

(iii) A compact area of at least 300 population or about 60-70 households of poorly built congested tenements, in the unhygienic environment usually with inadequate infrastructure and lacking in proper sanitary and drinking water facilities. Such areas should be identified personally by the Charge Officer and inspected by an officer nominated by Directorate of Census Operations. This fact must be duly recorded in the charge register. Such areas may be considered as Identified slums.”[10]


9 “Primary Census Abstract for Slum,” www.censusindia.gov.in, September 30, 2013, Pg: 4-5
II.A.3. Characteristics of a slum

i. Location and growth

ii. Poverty

iii. Organic settlement and insecure tenure

iv. Sanitation and pollution in the slums

v. Minimal access and transportation in the slums

vi. Social and physical disconnect in the slums

vii. Crime in the slums

viii. Natural disaster in the slums

Most slums begin at the outskirts of the city and expand their territory by enclosing the slums within the urban perimeter. New slums sprout out of existing city boundaries and in the rapidly growing metropolitan areas. Government waste and vacant lands are encroached upon by the rural immigrants and the urban poor; these illegally acquired lands then become organic slums over a period. At first, the slums originate in the least preferred part of the city, then they grow into the vacant lots and the underutilized government properties. Their houses on these illegally acquired lands have no tenure and value. They do not have any property rights over their settlement and their living situation in these lands are highly insecure.

The state of poverty in the slums depends on the location and the reasons for their stay. Rural poor is a state where the people are deprived of wealth and access to the necessities like the hospitals, food, school etc. Urban poor on the other hand, is a state of poor living condition. People might make enough money to sustain their lives but they live in a very unsanitary living condition.

The houses in the slums are substandard and overcrowded. They are very shanty, built hurriedly with unsuitable materials. The construction quality is inadequate to withstand any natural forces like rain or heavy winds. The most common building materials are plastic, mud walls, tarp, metal pieces for the roof which are held together by ropes, straw, and wood. The housing occupancy rate is so high that in some places 10 people share a 450 sq ft room.

Slums do not possess a proper public infrastructure, they lack access to safe drinking water, electricity and proper health care because they do not pay their taxes to the government. Since the settlement is unplanned, the roads are not wide enough to allow the emergency vehicles and the service vehicles to pass through. In other cases, the narrow and haphazard layout of slum streets, houses, and substandard shacks, along with the persistent threat of crime and violence, makes it hard to provide them with a safe and an efficient infrastructure.

Slum dwellers do not have a good education or a competitive job, this retains them from growing economically and socially. People in slums have meager sanitary health and cleanliness, this is mainly because of the lack of awareness about the consequences of unsanitary living. The slum dwellers are very prone to diseases because they do not have access to immunizations/vaccinations, garbage and sewage are dumped on the roads.

UN-Habitat reports some slums are more exposed to crimes with higher crime rates (for instance, the traditional inner-city slums). Crime is not the result of block layout in many slums rather, crime is one of the symptoms of slum dwelling; slums consist of more victims than criminals. Consequently, slums in all do not have consistently high crime rates; slums have the worst crime rates in sectors maintaining the influence of illicit economy – such as drug trafficking, brewing, prostitution, and gambling.

Slums are vulnerable to natural disasters, they do not have the structural support to sustain an earthquake, flood, tsunami, hurricane, etc. The organic settlement patterns, unsuitable construction materials, and the dilapidated housing gets destroyed easily during a natural disaster. In many cases, they settle in the undesirable land of a city, which makes the impact on them worse. Evacuation in slums is not very effective because the settlement does not allow the passage of emergency vehicles, it is not planned and designed to the building codes. Most of all the impact on them is bad because the slum dwellers lack awareness about a natural disaster or ways to react during an emergency.
II.B. TSUNAMI

The word tsunami is derived from a Japanese word ‘Tsu’ meaning harbor and ‘nami’ meaning a wave. A tsunami wave will behave differently depending on the underwater terrain surrounding the shoreline.

II.B.1. Causes that create a tsunami

Tsunamis are usually generated by powerful earthquakes underneath the ocean. This seismic event will create a wave that is more intense than the waves created by the wind. These large waves occurring from the trigger source will not be experienced in the middle of the ocean, where the ocean floor is still deep enough. When these large waves with a travel speed of 600 miles/hour reach the shoreline, they raise to a dangerous height where the ocean floor is shallow. The most common triggering events that cause a tsunami are the earthquakes below or near the ocean floor, but a tsunami can also be created by volcanic activity, landslides, undersea slumps, and impacts of an extra-terrestrial object, like a Meteoroid. The rise in height of the tsunami waves is caused by the decrease in velocity with the increase in height. Upon reaching the shoreline these waves can have a hazardous height and force, penetrating the inland, damaging the structures, and flooding the areas that are normally dry.

The time for the tsunami wave to reach the shoreline depends on the point of origin or the trigger source. It will take about 2 hours to for the waves to hit the coastline if the source is far away or if the source is close enough to the coastline, it may hit as soon as in 15-30 minutes.

II.B.2. Effects of a tsunami

The impacts of a tsunami are spread from the point of occurrence to the post-disaster phase. The initial impact of a tsunami is often telecasted through media. However, its impacts on the country and its people continue for many years after the natural disaster had struck.

The effects of a tsunami on a country are the destruction and damage, injury and death, millions of dollars in financial loss, and long-lasting psychological problems for the inhabitants of the region.

II.B.2.i. Damage and destruction

When a tsunami wave hits the shoreline, they destroy everything on its way; This includes boats, buildings, cars, trees, electric and telephone lines, etc.

The waves destroy the shoreline and start to move towards the inland. Seven feet of water will have a pressure of 450 pounds per sq ft, 21 kN per sq m, much more than any normal structure can withstand. Furthermore, these waves will have water-borne debris like building structure, boats, trees etc. moving with them. These waves are strong enough to carry boats up into the sky and throw them at buildings. The debris that travels with the water will hurt the structures a lot more than the water pressure would by itself.

Tsunamis often occur in the seismic zones as mentioned above. Most countries that have faced a tsunami with devastating impacts were poor and had underdeveloped slum settlements abutting the shoreline. The damages were intense because these structures were substandard and were not designed to withstand a catastrophe. During tsunamis, an entire town or a village will be destroyed in minutes.

II.B.2.ii. Injury and death

The warning times for a tsunami vary from two fifteen minutes to two hours and it depends on the source of the trigger. Even if there is a two-hour warning time, dense countries like India cannot evacuate all the people on the coastline. The people who live on the coast will fall victim to the disaster. The next issue that causes the loss of lives, is the lack of awareness about the tsunami, its intensity, and consequences. The causes of death vary- they may be killed instantly, or drowned as the water moves or when a building is knocked down with people in it. Sometimes tsunamis cause fire and electric outage as they knock down the transformers or gas stations.

The 2004 Indian Ocean tsunami that struck South Asia, killed 174,296 people and 108,221 went missing in total and in India alone10,749 were killed and 5,640 went missing.

II.B.2.iii. Financial stress

There is a big financial dependence and stress on the government after a tsunami hits a country. The government needs to send in a rescue team with medical attention, provide food and necessities and track down the population that either died or went missing.

After the initial cost of rescue operations, there is the cleanup cost. Debris from the destruction caused by the tsunami needs to be cleaned away. Damaged buildings that are no longer structurally safe need to be knocked down. There is a loss of earning in the local economy resulting in the overall decline of the economy of the country.

II.B.2.iv. Psychological impacts

A study by the World Health Organization on the survivors of a tsunami found that 14%-39% of the affected children had Post Traumatic Stress Disorder (PTSD) for about 4 weeks after the disaster. Another study showed 41% of adolescents and approximately 20 % of the mothers of those children had PTSD four months after the event. People were anxious and stressed about their life and family. They lost their homes, their money, family members and some were seriously injured. [12]

CHAPTER III

PRECEDENT ANALYSIS
III. PRECEDENT ANALYSIS

III.A GOVERNMENT HOUSING IN INDIA

Housing and urban development are assigned to the state government by the constitution of India. However, the Union government is responsible for the housing and urban development schemes, initiatives and implementation of the schemes. The schemes by the Union government target the urban housing, rural housing, and Economically Weaker Section (EWS) housing.

i. The need

As per 2011 census, the population of India was 1,211 million out of which, 377 million (31.16%) lived in urban areas. The urban population grew by 2.8% and resulted in the increase of urbanization from 27% to 31%. By the end of the tenth Five-Year Plan, The Ministry of Housing and Urban Poverty Alleviation estimated the urban housing shortage in the country to be 24 million for 66 million households. This gap between the demand and supply of housing affected the Economically Weaker Sections the most because 88% of the estimated shortage pertains to EWS housing. If the current increase in housing demand persists, a minimum of 30 million additional housing units will be required by the year 2020. [12]

Most private developers target the luxury, high-end and upper-middle class housing projects. Whereas most EWS housings are provided by the government. The middle class and lower income groups are neglected in the supply chain. Also, considering the increased construction cost, low cost and affordable housing projects are very vital. Currently, only 1% of the population can afford houses over Rs10 lakh ($15,000). If the housing cost drops below Rs5 lakh ($7,500), then about 30% of the population can afford a decent living. [14]

ii. Financial assistance

The state allocates houses to the families that are officially classified as “poor” by the Indian Government. They are eligible for a government grant of up to Rs1.5 Lakh (about $2,300) towards the construction. Furthermore, the government banking institutions provide a subsidized interest rate of 7% to 7.5% for the housing loan. [13]

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III.A.1. Reasons for the failure of slum rehabilitation projects

III.A.1.i. Construction

The government houses are generally about 150-200 sq ft in floor area in the rural areas and about 400-450 sq ft in the urban areas. The houses generally consist of walls constructed with cement blocks or bricks, cement flooring, and Reinforced Cement Concrete (RCC) or asbestos roofing. Usually, there is only one room in the house, but in some cases, a half-wall may be built to separate the bedroom from the kitchen and the living room.

III.B.1.ii. Failure

Most of the government housing projects have a per-drafted set of requirements which are independent of the site, micro-climate, the users or their needs. Most of the data for the rehabilitation projects are outdated or based on the census taken every 10 years. By the time the building is planned for the execution, the census would have become old data.

The architects and urban designers are not involved in the design process for the rehabilitation projects.

The government projects are vertically stacked, multi-storied buildings and the slum dwellers are used to a horizontal living condition. These buildings fail to consider the psychology, living culture, and spatial requirements of the dwellers. Thus, the users do not relate to the built environment.

The lack of respect for the individuality of the users results in the abandonment of the government housing. The people lease out the houses built by the government and go back to living in the slums.

There are no articulation or aesthetics in the building design and are built with low-cost and subsidized quality building materials.

The government lacks the awareness about recent technological advancements in the field.

Most slum projects are relocated to a new location and this relocation fails, as it adds to the commuting cost of the dwellers.

Due to the budget constrain the quality of internal spaces and services are compromised.

The building cost is reduced in the new buildings but other maintenance costs shoot up, there are no passive strategies in the design. This adds to the hesitation of the people to move into these buildings.
III.B  SUCCESSFUL PRECEDENTS

III.B.1. Mud Architecture by Ar. Hassan Fathy

About Ar. Hassan Fathy

Hassan Fathy (1900-1989) was a noted Egyptian architect who pioneered appropriate technology for building in Egypt, especially by working to re-establish the use of mud brick (or adobe) construction.

He designed nearly 160 separate projects, from modest country retreats to fully planned communities with medical services, markets, schools, theaters, places of worship, and recreational places. He utilized ancient design methods, materials, architectural and town planning techniques to alleviate the rural Egyptian economic He trained local inhabitants to make their own materials and build their own building. [17]

Awards

- Aga Khan Award for Architecture Chairman’s Award (1980),
- Right Livelihood Award (1980) and more.

Books

- Natural energy and vernacular architecture.
- Architecture for the poor.

III.B.1.i. Design Principals

Hassan Fathy is called the father of low-cost housing. His designs integrated the building services, community and social interaction spaces as a part of the building. The building elements were climate responsive and made the indoor spaces thermally comfortable. He incorporated stack effect and cross ventilation in his designs to passively cool the buildings in hot arid zones.

III.B.1.ii. Design Elements

- Thick walls.
- Wind catchers.
- Screen walls.
- Courtyards and vaults.
III.B.2. Poonthura Fishermen’s village by Ar. Laurie Baker

About Ar. Laurie Baker

Laurie Baker (1917-2007) was a British-born Indian Architect. He went to India in 1945 as a missionary and for that time he worked in India for over 50 years obtaining Indian citizenship in 1989. He worked as an architect for an international and interdenominational mission dedicated to the care of those suffering from leprosy.

He focused on converting or replacing asylums once used to house the ostracized sufferers of the disease – “lepers”. He used indigenous construction methods of these places and designed vernacular buildings that responded to the climate, local population, and the psychology of the people. [18]

Awards

- L-Ramp Award of Excellence (2006).
- Received the Padma Sri (1990).

Books

- Rural house plans.
- Earthquakes.
- Cost effective manual

Poonthura Fishermen’s Village, Trivandrum, India

City : Poonthura, India

Year of completion : 1974-1975

III.B.2.i. Introduction

Baker designed his fishermen’s village along the cyclone prone area of Poonthura, Trivandrum, India. The building construction was very simple with brick wall construction since there was a limitation on the availability of resources.

III.B.2.ii. Planning strategies

- Baker’s building plan was simple and staggered. Each unit has its own private courtyard.
- The building was designed with exposed brickwork and steel structure which makes maintenance of the houses very easy.
- These open spaces in between the houses were planned for drying fish and fishing nets, and functions also as a children’s play area.
- Low-sloped roofs and open courtyards serve as wind catchers to enhance cross ventilation and multiple viewpoints. [19]

Fig 32: Laurie Baker

Fig 33: Laurie Baker principles - diagrams

Fig 34: Laurie Baker principles - diagrams

Fig 35: Poonthura Fishermen’s Village - Elevation

Fig 36: Poonthura Fishermen’s Village - Axonometric view

Fig 37: Poonthura Fishermen’s Village - Plan

Fig 38: Poonthura fishermen’s village

Referenced:

III.B.3. Aranya Slum Rehabilitation by Ar. Balakrishna V Doshi

About

BALAKRISHNA DOSHI (1927) is an Indian architect and educator. After working for four years with Le Corbusier (1951-54) in Paris, B.V. Doshi returned to Ahmadabad to supervise Le Corbusier’s projects.

His studio, Vastu-Shilpa (environmental design) was established in 1955. Doshi worked closely with Louis Kahn when he was designing the campus for the Indian Institute of Management, Ahmadabad. In 1958 he was a fellow at the Graham Foundation for Advanced Studies in the Fine Arts. In 1962 he started the School of Architecture (CEPT) in Ahmadabad. [20]

Awards

• Padma Sri from the Indian government.
• Officer of the Order of Arts and Letters (2011).

Aranya Slum Rehabilitation, Indore, India

City: Indore, India
Total built up: 210 acres
Project cost: Rs100 million
Population: 60,000
Year of completion: 1989

III.B.3.i. Introduction

Doshi’s Aranya Slum Rehabilitation project is in Indore, 6km from the city center which creatively accommodates mixed income groups in 6500 residential plots, ranging from 350sq ft to 4750 sq ft of floor area. His objective for this project was to create a township that gives the users a sense of continuity, security, and a good living environment. This design values the culture of the people and their relation to the built environment. [21]
III.B.3.ii. Zoning

Doshi developed his master plan with an intention to express strong hierarchy in roads and open spaces. All the spaces are designed around a central spine that hosts the business district. In each of the six sectors, there are 7000-12,000 people. These sectors are diagonally bisected by parks or green spaces. Each sector houses a mixed income group of people that are concentrically planned with the high-income population is located along the periphery and the central spine. The low-income housing is located at the center of each of the six sectors.

III.B.3.iii. Hierarchy of roads

- The central spine is 15m (~50 sq ft) wide and holds together smaller roads that lead to the six sectors. The smaller roads are 9.5m (~31 sq ft) and function as a physical segregation between the sectors. The houses were planned around 4.5m (~15 sq ft) paved internal streets, it discourages vehicular traffic.
- The roads are not designed in a straight line. This reduces the speed of vehicular interference and creates a visual interest while traveling on them.
- The streets are designed to relate to the human scale and are mutually shaded by the buildings. The people of this community have a strong indoor-outdoor relationship and are designed to encourage stoop culture.*

III.B.3.iv. Open spaces

- Diagonal linear parks are prominent open spaces of the six sectors. Houses with courtyards at the back open into the linear parks that function as a community space for each cluster.
- There are no large opens in this settlement. This is to avoid underutilized spaces that might encourage crime or illegal activities.
- Open spaces between houses provide small interactive semi-private areas for the users.

III.B.3.v. Climate responsive features

- To reduce solar radiation from east-west direction, the plots are smaller in size with low-rise building blocks and the longer axis of the buildings is oriented towards the north-south axis.
- Exterior walls have articulated surfaces that minimize surface area exposure to the solar radiation.
- Internal roads serve as an interactive common space for the inhabitants. The road width and building height ratios are designed to mutually shade the streets and to encourage stoop culture.
- Climate responsive architectural elements in the houses include the use of windows on opposite walls to encourage cross ventilation, wind catchers in the service core to enhance stack effect, and internal courtyards to bring down the internal temperature of the building.

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22 *Stoop culture: A flat area at the front door of a house, often with steps below used for sitting.
III.B.3.iv. Observations

- Doshi’s design gave the users, the freedom, to use bricks or stones or any locally available material to construct their homes. This concept of individualizing their homes gave them a sense of ownership, belonging, freedom and pride.

- Everyone in this community, despite their economic status, was given access to amenities and public facilities.

- Details and surface finishes of the houses were inspired by the vernacular architecture of Indore.

- Incorporating spaces that allow the inhabitants to perform their day to day activities, led to the creation of relatable and sensible experience for the users.

- The Design elements were simple, cost efficient, climate responsive, and vernacular.

- This community has successfully allowed for expansion and adaptation. It has also pioneered in involving the community and considering the psychology of the users in the design process. Architect B.V Doshi has succeeded in moving the organic settlers into an organized settlement through a seamless design process.

Fig 50: Aranya slum rehabilitation, Indore, India - Building cluster

Fig 51: Aranya slum rehabilitation, Indore, India - Building plan

Fig 52: Aranya slum rehabilitation, Indore, India - Building Elevation
III.B.4. Belapur Incremental Housing by Ar. Charles Correa

About

Charles Mark Correa (September 1930 – June 2015) was an Indian architect, urban planner, and activist. He was celebrated for the creation of modern architecture in post-Independence India. He was credited for his sensitivity to the needs of the urban poor and for the use of traditional materials and architecture methods.

Correa began his higher studies at St. Xavier’s College, Mumbai at the University of Bombay, went on to study at the University of Michigan in Ann Arbor and the Massachusetts Institute of Technology (MIT) in Cambridge, Massachusetts. In 1958 he established his own Mumbai-based professional practice. [24]

Awards

- Praemium Imperiale (1994)
- 7th Aga Khan Award for Architecture for Madhya Pradesh Legislative Assembly (1998).
- Austrian Decoration for Science and Art (2005)

III.B.4.ii. Planning

Correa’s master plan was developed with a simple pattern language and a strong expression through the hierarchy of community spaces. Every housing unit is about 26’x20’ and has its own private courtyard. Seven of these housing units are clustered to form a small community. Three of these small communities are clustered to form a small town with 21 units. As per the original proposal, the area around small stream bisects the site will host a bazaar*.

III.B.4.iii. Courtyards as Access

- Correa designed this site in clusters, every cluster is accessed or entered through the town courtyard which is formed by 21 housing units. Every house is accessed through the community courtyard which is formed by 7 housing units.
- These courtyards function as a transition zone that secures the access and privacy of the individual housing units.

III.B.4.iv. Hierarchy of open space

- The people in this community do their daily chores like washing dishes or doing their laundry, outdoors. Every house is serviced with a private courtyard or an open space to adapt to people’s needs.
- Seven of these units contains a 27’x27’ community courtyards that act as a social gathering space.
- Twenty-one units combine to form a 70’x70’ that act as a common gathering space of the town.

*Bazaar: a market place.

III.B.4.v. Climate responsive features

- These courtyard spaces also act as a service connection for plumbing and water management systems.

- The climate of Mumbai is humid and humid climates require adequate cross ventilation to keep the interior comfortable. Correa’s design includes private courtyard within each unit thereby ample cross ventilation and adequate lighting are achieved.
- The design incorporates rainwater harvesting systems: the pitched roof drains the rainwater which drains into the courtyards and the water that reaches the courtyards seeps back into the ground through the impervious ground cover.
III.B.4.vi. Observations

- Correa’s Belapur housing makes a statement about equity, incrementality, pluralism, disaggregation of spaces which allows the people to form their own environment.

- The architecture is very simple that any local mason can construct these houses by their own.

- Every house was given a lot varying in size from 45 sq m (~450 sq ft) to 75 sq m (~750 sq ft) based on their income levels. Though the income levels varied at a ratio of 1:5, the lot size which was provided to the people, varied only at a ratio of 1:2. \(^\text{(22)}\)

- People were given the freedom to modify and expand their own living environment.

- Use of brick walls, wood shingles on the roof, and impervious flooring on courtyards is climate and culture sensitive design solutions. The building heights were designed in relation to the user’s perceivable scale. This gave the users a good sense of enclosure and security.

- Though diligent care was taken from laying out the plan to the execution, over a period of 30 years’ people started to move out of this community.

- The reasons why the inhabitants left this community as stated by them:
  
  - The economic status of the inhabitants grew over the period.
  
  - People felt the building aesthetics was like the villages and did not correspond to the modern buildings.
  
  - The community was purely residential without any commercial, institutional or recreational facilities.

  - People in low income were not able to expand their houses, as the previously allotted land was very small to incubate expansion.

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- Fig 66: Belapur Incremental Housing Development – Open space derivation
III.C. DEMOCRATIC ARCHITECTURE

III.C.1. A literature review of “Democratic Architecture- Donald MacDonald”[26]

Architecture predominantly serves as a luxury, to design monumental buildings and iconic high-end residential units. Architecture has not attended to the housing needs of most the people. Every human has a right to a home, not just a shelter but a private, secure, and decent place to live at an affordable cost. It is a very different attitude from what Philip Johnson expresses “The job of an architect is to create beautiful buildings. That’s all.” That is not all, architects may not have a say in the political decisions but can help create a more humane society.

III.C.1.i. Design for the people

“All buildings built should serve the liberation of mankind, liberating the lives of individuals.” Frank Lloyd Wright.

When designing homes for the people, one must understand that there is a difference between what the user wants and what a designer thinks that the user wants. There are two ends to this statement, sometimes the users do not understand what they would like to have or they would like to have more of what they already possess. On the other end, the designer would know what could be a positive addition to space.

Fig 67: ARCHITECTURE FOR HUMANITY
CAMERON SINCLAIR

HE FORMED, Open Architecture Network was a open-source community dedicated to improving living conditions through innovative and sustainable design.

Until the late 1970s, the usual approach for designing a low-income housing project was to build a large institution like high-density projects, stacking as many people as possible within a building. Psychologist, Robert Sommer describes the psychology of the designers behind high-density design projects:

“For public housing tenants, ‘if you provide good architecture, they won’t appreciate it.’ There is the same denigrating we/they dichotomy in all these assessments of people’s response to their surroundings. We know what’s best for them and they don’t. Even if we provide what they say they’d like they won’t take care of it and will probably destroy it.”

Projects like Pruitt-Igoe in St. Louis by Minoru Yamasaki which was inspired by Le Corbusier’s ideas and won National design award and Twin Parks Northeast in New York by Richard Meyer and Partners, were built with the same mentality that ‘we know what is best for them.’ Both projects failed to attract the people because it forced a pattern of living on the users and they were unable to relate to the forced pattern. These projects also failed to consider the individuality of the inhabitants.

III.C.1.ii. Participation

Participation of the users in the design process plays a key role in deciding an apt system for their everyday living. For example, when architect Alejandro Aravena was designing the affordable housing project in Chile, asked the users, “what do you need, water heater or bathtub? There is no money to do both”. 99% of the families voted for the bathtub. The reason is that they wouldn’t have the money to buy gas to make the water heater work. The bathtub, however, could be used from day one because the users had a water subsidy available.

Fig 68: ALEJANDRO Arevena has championed an approach he describes as “incremental,” in which governments fund construction of “half a good house,” with residents completing the other portion as resources allow. Aravena has championed an approach he describes as “incremental,”
Precedent Analysis

III.C.1.iii. The checklist

Reducing the cost yet providing a good quality construction and livable space is the greatest challenge in designing low-income housing projects. To provide a holistic design we need to be certain that we have considered the following guidelines:

1. Appropriate room size, shape, scale
2. Ease of circulation and universal accessibility
3. Accommodation of furnishings
4. Visual and Acoustical privacy
5. Natural ventilation and lighting
6. Architectural details, finishes, and materials
7. Integration of building systems
8. Environmental impact and sustainability

III.C.1.iv. Individualizing architecture

“There should be as many kinds of houses as there are different individuals.” Frank Lloyd Wright

The first step towards achieving an individualized design is to conduct an interview and a directed study on what are the expectation of the users about their space. The next step is to categorize the data and group them based on the similarity of the description on their needs.

“To individualize a building, you should enable people to make adjustments themselves.” Frank Lloyd Wright.

Adding to his comment on individualizing a building, Wright developed an interesting concept of “Built-it-yourself”. This concept gives an absolute power to the users to expand, adapt, and build around the provided structure. This also gives them a sense of ownership, belonging, and pride.

III.C.1.v. Social behavior:

In a large scale, urban project, zoning and organizing the activities is vital in a macro scale, however, it is significantly important to consider designing in micro level as well. While the macro-level design influences the working of the community, the micro level details determine the social behavior of the people. The height to width ratio of the buildings and roads, sidewalk lighting and detailing, outdoor seating and shade, dynamic outdoor open spaces to accommodate a variety of community happening etc. are some example of Micro-level detailing that is important to engage the community.

“A City cannot only be art rather a complex design including the people and its surrounding” Jane Jacobs.

The micro detailing of a community can be a result of directed studies that analyze the activity pattern of the inhabitants. For example, a fishermen’s community in India needs a lot of open space in the building to perform their daily chores versus a community of industrial workers need an enclosed space to rest after a long work day.

“People tend to relate or go back to certain patterns of their lives, or people only relate to specific pattern. These patterns are not the design but the basics for the framework” Christopher Alexander.
CHAPTER IV DESIGN
IV. DESIGN

IV A. SITE

The Nochikuppam slum is one of 1,131 slums that exists in Chennai, India. The Slum is right along the coastline of the Marina beach at an elevation of 23 feet above the sea level.

DEMOGRAPHICS: Nochikuppam slum covers about 23 acres of land along the coastline of Marina. It has about 1,300 huts and 2500 permanent housing units. 7700 families reside in this slum and about 5000 of the people live below the poverty line.*[27]

OCCUPATION: Fishing

The fishing hamlet of Nochikuppam along the Marina beach in Chennai, India was established in the early 1970’s and had grown rapidly and organically ever since. Nochikuppam was one of the most affected settlement during the 2004 Indian Ocean tsunami. It has been 12 years since the disaster, not much rehabilitation or allotments for the affected families have been pursued.

The Indian government, with the help of World Bank’s funding, started building 7000 apartments for the affected people. Since the process took longer than the time allotted by the World Bank, the funding was withdrawn. After a long delay, the construction of the temporary shelters was completed in 2010 but they have not been occupied due to the differences between the fishermen and the Tamil Nadu Slum Clearance Board.

Around 1,900 temporary shelters have been built and only 600 families have reportedly moved into them. Almost 300 new houses out of the 650 built have been allotted to the people who do not belong to the Nochikuppam slum or to the fishing community. After a long protest, the Tamil Nadu government has accepted not to resettle the people, but to demolish and built new housing on the same site.

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* Internationally, an income of less than $1.90 per day per head of purchasing power parity is defined as extreme poverty. By this estimate, about 21.2% percent of Indians are extremely poor. Income-based poverty lines consider the bare minimum income to provide basic food requirements; It does not account for other essentials such as health care and education.
IV.B. Climate of Nochikuppam, Chennai, India

The site is located at the coastline of the Marina beach and it experiences warm-humid climates. In warm-humid climates the nights are usually warmer than the days. The diurnal variation is often less than 5-degree C meaning the place is likely to experience high rainfall. The radiation from the sun is very intense in the east-west direction, characterized by high and even temperature throughout the year. Because of the heat radiation, diffused light will cause strong sky glares. The humidity is very high and the buildings evaporate through the skin if proper insulation is not provided.
IV.C. CLIENT REQUIREMENTS

A mock up interview with 8 families was conducted to seek the client requirements and to understand people’s expectation from this project. These families have a totally different background, economic status, occupation, and responsibilities.

IV.C.1.i. Family members:

Husband: Fisherman  
Wife: Maid  
Sons (2): Middle school

“I will go fishing almost all day long, my wife and my son help me to sell fish in the evening. We have a spot in the fish market where we set up our stall to sell fish. My wife works as a maid for 3 families and she makes about Rs6000 ($100/month). I earn about Rs6000 -10,000 ($100-$135/month). My sons attend the corporation school.”

Requirements:

“We live in a small house with a living room, kitchen and a common toilet. We would like a living room, a small private space for my kids to study, a kitchen and a toilet/bathroom. We cannot afford 2 rooms as we are paying for our son’s education and must manage our living.”

IV.C.1.ii. Family members:

Husband: Died in 2004 tsunami  
Wife: Maid  
Father-in-law & Mother-in-law: unemployed  
Daughter: High school

“My husband died in the 2004 tsunami, he was working as a cab driver. After he died I tried if they will offer his job for me, but it was not very common to have a women employee during that time, so they denied. I have my in-laws and my daughter to take care of, I had to pay for her school and must save up money for her marriage. One of my husband’s friend got my job in the hospital nearby as a janitor. I earn about Rs7500 ($150/month).”

Requirements:

“I cannot afford two rooms, we are a big family, and we would like a bigger living room so we can all share the space. My in-laws are old so they cannot climb stairs, it would be nice to have our home on the ground level.”
IV.C.1.iii. Family members:

- Younger Son: Mechanic
- Older Son: Auto driver
- Sister-in-law: Housewife
- Niece: 1-year-old
- Mom: Housewife

“We have one room and a living room now, my brother lives in the room, my mom and I sleep in the living room. We would like 2 rooms so we can accommodate our growing family, also a small space to allow for parking my brother’s auto.”

Requirements:

- We have one room and a living room now, my brother lives in the room, my mom and I sleep in the living room. We would like 2 rooms so we can accommodate our growing family, also a small space to allow for parking my brother’s auto.”

IV.C.1.iv. Family members:

- Younger Son: Mechanic
- Older Son: Auto driver
- Sister-in-law: Housewife
- Niece: 1-year-old
- Mom: Housewife

“My brother and I started working at the age of 21 and 18. He owns his own auto and I have a small mechanic shop around the corner. My mom and my sister-in-law take care of the house chores. My brother got married about 2 years ago, very soon I will have a family of my own. I make about Rs10,000 ($130/month) and my brother makes about Rs12,000 ($200/month).”

Requirements:

- We have one room and a living room now, my brother lives in the room, my mom and I sleep in the living room. We would like 2 rooms so we can accommodate our growing family, also a small space to allow for parking my brother’s auto.”
IV.C.1.v. Family members:

Husband: Retired clerk
Wife: Housewife

"My wife and I own a small petty shop attached to our home. I am a retired clerk and receive a pension from the government every month of Rs5500 ($110/month). We make close to Rs1000 ($18/month) from the petty shop. Our son abounded us after he got a job in a car manufacturing company. We took a stray dog in and we are feeding him, he is all we have got to take care of now."

Requirements:

"We would like to have a Kitchen, living room and a toilet. We would like to have a small space to have our petty shop. We are old so we prefer to stay on the ground level."

Fig 99: Client Requirements - Family 5

IV.C.1.vi. Family members:

Husband: Owns a tea/tiffin shop
Wife: Helps her husband with cooking in the tea shop

"My wife and I own a small tea and tiffin shop in front of our home. Most of the people around this area have their morning tiffin at our place. We don’t have any children, it’s just us. The shop helps us with our living expenses."

Requirements:

"We would like to have a living room, storage, and a toilet. We would like to have our house close or attached to our shop. We do not need a kitchen because our shop is open all day long."

Fig 100: Client Requirements - Family 6
IV.C.1.vii. Family members:

- Husband: Driver for a politician
- Wife: Housewife
- Daughter: Kindergarten school

“I work for a politician; my hours are very erratic. My daughter goes to kindergarten school, my wife takes care of the home. I make Rs20,000($320/month), I also get paid more if I go out of town.”

Requirements:

“We would like to have a living room, two bedrooms, kitchen, and a toilet. I would also like to have a space to park a car.”

IV.C.1.viii. Family members:

- Husband: Head of the fishermen’s community
- Wife: Housewife
- Daughter: Kindergarten school
- Father: previous head of the fishermen’s community
- Mom: Housewife

“My father was the head before me, the community voted me to lead them after my father. My wife and my mother take care of the home. Many people come to our home to talk about their problems or to ask for our advice and opinion. We have people at our home all the time. Privacy is a small issue when we have people.”

Requirements:

“We would like to have a big living room, two bedrooms, big kitchen, and a toilet. I would also like to have a space to park a car.”
IV.D. GUIDELINES

The 12 guidelines (a-l) were applied in the design at three varying scales as follows:

1. Site level design which includes site planning and design

2. Cluster level design which includes small community open spaces, road width - building ratio, interaction between the buildings and the open spaces, etc.

3. Building level design which includes typologies of the housing units, number of houses per typology, spatial quality, etc.
IV.D.1. Site

There are eight site planning guidelines (a-h) as follows:

IV.C.1.a. Climate responsive designs

The site experiences a very high humidity and temperature. The site is in zone two seismic area, it has been hit by the Indian Ocean tsunami in 2004 and faced a major flood in 2015. The design should cater to the environmental sensitivities of the site.

Buildings must be designed to provide continuous and efficient ventilation both to cool the interior space and remove excess moisture during the summer. Prominent wind direction that prevails in the site are East-West, Southeast, and Northeast (Fig 73,74).

Fig 72: Wind direction

Fig 73: East-West and Southeast streets along wind direction allowing multiple

Fig 74: Controlled wind pressure zone using building mass and varied heights.

IV.D.1.b. Tsunami-resistant structures

Tsunami-resistant structures should be at least 3 floors high. The design must accommodate vertical evacuation structures. When hit by the tsunami, most of the damage to a building occurs because of the resistance offered by the structures against the water pressure and water borne debris. The building should be planned in a way that the debris can pass through the structure without damaging its integrity (Fig 75).

If the site is raised by earth bunds and is treated with vegetation, the water pressure and the force with which the debris hits the building can be considerably reduced.

1. ENVELOPE - The ground level of the building should allow the free flow of water through it. Rigid structures will resist the water pressure resulting in the failure of the structure (Fig 76).

2. LOCATION - The location of the vertical evacuation structures should be in relation to the tsunami warning time. The access for the evacuation should clear without any hindrance. The structures must be located towards the land side, as people tend to run away from the approaching wave (Fig 77).
IV.D.1.c. Social connection:
The site plan should encourage the site to connect back into the city. The Nochikuppam slum has grown organically since 1970. The sanitary conditions, accessibility, and appearance of the place have been compromised by this rapid and organic development. Thus, the site plan should mend the current social seclusion and encourage a seamless connection to the city.

IV.D.1.d. Physical connection:
The interior roads of the existing site are inaccessible to the emergency vehicles or garbage trucks to pass through. This has resulted in an unclean surrounding (garbage dumping on the roads). The site became an island of its own without any property rights or access to public services. The design solution should cater to this problem and provide adequate physical connection to the site.

IV.D.1.e. Water management
Water management is a prime service consideration in this case. This place has faced multiple natural disasters over a period. The site should adopt stormwater management systems, means to reduce surface runoff, rainwater harvesting systems, and disaster management systems.

IV.D.1.f. Quality of living
Social and physical seclusion of the slums happen in two levels. First, the people who live in the slums do not feel confident about their living conditions and they do not believe that they can move past their current situation. Second, people who do not live in these slums, seclude the slum dwellers. This design should improve the quality the inhabitants’ life so they can grow out of their current scenario, this could in turn have a considerable change in the morale of people who live in the slums.

IV.D.1.g. Sense of ownership
The site plan should account for some level of freedom, for the users, to expand and customize their homes based to their needs and culture. A palette of materials, window types, door types etc. will be given to the users from which they can choose and use for their homes. Involving the community in the design process has proven to have a positive impact in the maintenance of the built environment.

IV.D.1.h. Clear access for evacuation
As explained before, this site has experienced many types of water born natural disasters. The site plan should incorporate access for evacuation through the basic infrastructure like roads, roofs etc. The design should allow unrestricted evacuation access in case of emergencies and should provide access for the rescue teams to access every part of the site.
IV.D.2. Cluster

Based on the precedent analyses, I have arrived at one cluster design guideline (i) that talks about the stoop and alley culture.

IV.D.2.i. Culture

1. Solar orientation should take precedence while planning community spaces especially in hot-humid climatic zones. Optimal shading will allow the inhabitants to use the alleys and outdoor spaces during the day (Fig 83).

2. The community spaces should encourage outdoor activities and stoop culture.

3. The pedestrian roads should be mutually shaded by optimal building-road width ratio (Fig 84).

Fig 82: Green Walls to reflect sun radiation and to reduce heat.

Fig 83: North-South orientation- staggered East-West wall to avoid large surface area exposure.

Fig 84: Taller West and South buildings to mutually shade the streets and common courtyard spaces.
IV.D.3. Building

There are three building design guidelines (j-l) as follows:

IV.D.3.j. Relatable design and Easy maintenance

The place should be relatable to the users and their way of living. The zoning and landuse distribution should complement their culture. This will result in the good maintenance of the place, since people have a sense of control and ownership over the place. Buildings must be designed to provide continuous and efficient ventilation. Ventilation to both cool and remove excess moisture in the summer. The prominent wind direction in the site is East-West, Southeast, and Northeast.

IV.D.3.k. Expansion

The Buildings will have enough structural support to allow the residents to add a mezzanine in the future if their family grows in size or grows economically.

IV.D.3.l. Adaptation

People will have the freedom to choose the building exterior finish materials for their houses. Having an opportunity to contribute to the design of their houses, will give them a sense of ownership and belonging.
Fig 92: Building Fenestrations

Fig 93: Building Fenestration to deflect sun and wind

Fig 94: Window Opening - The Venturi effect

Fig 95: Roof ventilation - The Stack effect
DESIGN RESULTS
IV.E.1. Site Design

The following iterations explores the eight site planning guidelines

OPTION A
- This design has a central spine.
- It has multiple courtyards.
- Most of the roads are pedestrian friendly.
- Commercial /Institutional blocks are located around the courtyards.
- High-Income housing units are located in the south end of the site.

OPTION B
- This design has horizontal axis creating multiple vistas towards the ocean.
- Courtyards and open spaces are located at the end of every axis.
- Commercial and institutional building are located around the central courtyard.
- Low-income housing units are located in the North and middle-income housing units are located in the South end of the site.
OPTION C

- Many of the axis run along the direction of the wind.
- The central courtyard functions as a pedestrian walkway.
- Commercial and institutional buildings are located at the edges of the site.
- Mixed-income housing units are dispersed to the north and south end of the site.

OPTION D

- Most of the axis are straight and will also function as an evacuation path in case of emergencies.
- All the open spaces are aligned along the central courtyard.
- Most pedestrian walkways are perpendicular to the vehicular road.
- Commercial and institutional buildings are located at the edge of the site.
- Mixed-income housing units are dispersed to the north and south end of the site.
IV.E.1.i. CONCEPT DIAGRAM I - ACCESS

- Main access road - vehicular traffic
- Perpendicular access road - Tsunami evacuation
- Cluster segments - community
IV.E.1.ii. CONCEPT DIAGRAM II-SECTOR

- Smaller subdivision
- Central Community space
- Central Community Green Space
IV.E.1.iii. CONCEPT DIAGRAM III - VERTICAL EVACUATION AND COMMERCIAL SPACES

Clusters: Small Communities
Central Community open space
Commercial spaces

Vertical Evacuation Structures
Commercial Spaces
Low-Income Housing
Mid-Income Housing
Central Community Green Space
IV.E.1.iv. CONCEPT DIAGRAM IV - NODES AND COMMUNITY OPEN SPACES
IV.E.1.v. CONCEPT DIAGRAM V - HOUSING CLUSTER IN THE
IV.E.1.vi. SITE SECTIONS

Fig 108: Transverse Site Section
IV.E.2. Cluster Design

IV.E.2.i. CLUSTER PLAN

Fig 109: Cluster plan
IV.E.2.iii. VIEW OF AN INTERNAL STREET THAT MUTUALLY SHADED TO ENCOURAGE STOOP CULTURE
IV.E.3. Building Design

IV.E.3.i. BUILDING BLOCK 1

- This housing type is predominantly for low-income user groups.
- There are 6 type-1 buildings with 4 individual houses within it and a total of 52 houses.
- This building block could be 2-3 floors high, depending on its location in the site.
- These buildings have vertical evacuation structures on its roof.
IV.E.3.ii. BUILDING BLOCK 2

- This housing type is predominantly for low-income user groups.
- There are 12 type-2 buildings with 6 individual houses within it and a total of 168 houses.
- This building block could be 2-3 floors high, depending on its location in the site.
- These buildings have vertical evacuation structures on its roof.
IV.E.3.iii. BUILDING BLOCK 3

• This housing type is predominantly for low-income user groups.

• There are 32 type-3 buildings with 7 individual houses within it and a total of 728 houses.

• This building block could be 3-4 floors high, depending on its location in the site.

• These buildings have vertical evacuation structures on its roof.
• This housing type is predominantly for low-income user groups.

• There are 14 type-4 buildings with 9 individual houses within it and a total of 473 houses.

• This building block could be 3-4 floors high, depending on its location in the site.

• These buildings have vertical evacuation structures on its roof.
IV.E.3.v. BUILDING BLOCK 5

• This housing type is predominantly for mid-income user groups.

• There are 25 type-5 buildings with 8 individual houses within it and a total of 856 houses.

• This building block could be 4-5 floors high, depending on its location in the site.

• The vertical height of each unit (floor to floor height) is increased to accommodate vertical expansion in the future.
“From Organic to Organized" is an attempt to create an architectural solution which successfully involves and resettles people coming from organic settlement patterns to more organized living conditions. It targets to give the users a sense of ownership, social inclusion, and belonging.

The design output is the result of a two-step process; the first step was to study and analyze the success and failure of multiple slum rehabilitation projects in India and the second step was to arrive at a set of guidelines that can be used as a reference tool to handle this slum rehabilitation project. These guidelines were applied in the design at three varying scales as follows:

1. **Site level design** which includes site planning and design
2. **Cluster level design** which includes small community open spaces, road width - building ratio, the interaction between buildings and open spaces, etc.
3. **Building level design** which includes typologies of the housing units, the number of houses per typology, spatial quality, etc.

The first phase of this design is the site level-macro designing. The site accommodates 2,280 housing units with water management systems, flood and tsunami-resistant structures, commercial zones and recreation facilities. The second phase of this design is the micro level designing which will be the node for every cluster. There are 17 clusters in the site and each of the clusters has semi-permeable flooring on an interactive courtyard. With the appropriate road width and building height ratio, the smaller pedestrian roads will become mutually shaded alleys that will encourage the already existing stoop culture of the place. The final phase of this design is the building level- private zone design. This design phase talks about the comfort of the users within their homes. The building design also allows the user to choose their own building material from the provided options for their homes. This phase accounts for the sense of pride of ownership of the users over their community. There are five typologies of buildings with varying building heights, every building has a private courtyard, tsunami-resistant structures, climate sensitive design elements

Although every slum is unique with rich culture and various issues, from Organic to Organized can be used as a guiding tool to approach a slum project. The two-step research process and the three step design process has proven to be an effective method to handle a complex slum rehabilitation project.
**VI. BIBLIOGRAPHY**


