

Dharavi: Merging Boundaries

by
Tanvi Amarsingh Kundliwal

A thesis
presented to the University of Waterloo
in fulfilment of the
thesis requirement for the degree of
Master of Architecture

Waterloo, Ontario, Canada, 2019
© Tanvi Amarsingh Kundliwal 2019

Abstract

In Mumbai, Dharavi, occupying over 525 acres, houses a million people, making it one of the world's largest informal settlements. In ever-expanding Mumbai, Dharavi, once at the city's edge, has become its heart.

With 20,000 industries specializing in leather, textile, pottery, food processing and recycling; numerous schools and hospitals; multiple religious structures, Dharavi create jobs for thousands, contributing almost 3% of Mumbai's economy. It cannot be classified as a slum - Dharavi is rather a city within a city.

While rich in culture, citizens of Dharavi live in very poor conditions. The government wants to push the dwellers aside and replace their dwellings with offices and towers. This research demonstrates that Dharavi, a place that has existed since before the British invaded India, where thousands of families have been living for generations, is worth saving. They need their lives to be upgraded, not uprooted.

The first step of creating positive change in Dharavi is to influence public perception: to present Dharavi as a vibrant place that is worth saving. The objective of this thesis is to create a significant awareness among people, so that progressive development that caters to the needs of dwellers, can begin in Dharavi.

Hence this thesis proposes an interpretation center for tourists, where they can learn about the positive aspects of Dharavi as their first stop to slum tourism. The tourists can see a preview of Dharavi by observing workers in action in its attached workshop.

Dharavi faces at least one major drawback in every industry. The aim of the workshop is to educate the workers on better practices in their respective industries, giving them the opportunity to learn and incorporate their education in their own businesses.

This project also proposes a water filtration unit to clean the now polluted river. The concept of a filtration unit along with an amenity can be used as a prototype at a certain interval along the river that would help rejuvenate Mithi River.

Author's Declaration:

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Acknowledgement

I have a lot of people to thank for where I am today. Starting with University of Waterloo, I thank the institute for giving me the opportunity to pursue my postgraduate in such a prestigious school. I thank all the professors I have been with for the past two years for helping me get acquainted with Canadian practice and standards.

I thank my supervisor Marie-Paule McDonald for being a big support and guiding me through my thesis. I thank my committee member Jane Hutton for helping me focus and be on track. I also thank John McMinn for always encouraging me and teaching me new skills.

I thank all my friends from Canada as well as India, without whom the past two years would have been dull; and John Thompson and Debora Thompson for being my adoptive family in Cambridge.

I thank Ashish Afun-Ogidan who's positive attitude helped me through hard times. I also thank Parth Parikh for being my eyes and ears on the site and helping me contribute correct facts to the project.

Last but not the least, I thank my family, my mother Kusum Kundliwal, my father Amarsingh Kundliwal and my sister Nikky Kundliwal for always loving and supporting me and encouraging me to do my best.

Table of contents

Author's Declaration	ii
Abstract	iii
Acknowledgement	iv
List of Figures	vi
Introduction	1
Chapter 1 - Dharavi	7
1.1 Location and Climate	8
1.2 History of Dharavi	16
1.3 Current Scenario	20
1.4 Environmental and Social challenges	42
Chapter 2 - Informal Development	51
2.1 Dharavi Redevelopment Plan	52
2.2 Evolution of informal settlements	56
2.3 Positive ReDevelopment	60
2.4 Developing Dharavi	64
Chapter 3 – Scope of Work	71
3.1 Approach	72
3.2 Concept	76
3.3 Site	84
3.4 Design	94
Conclusion	108
Letter of Copyright Permission	110
Bibliography	112
Appendix	114

List of Figures

All figures in the book belong to the Author, unless otherwise specified below.

Fig.001 Different Extremes around the World Extreme Density - Dharavi

Chapter 1:

Fig.101 Contrast between Dharavi and BKC

Fig.102 Average High and Low temperature in Mumbai

Fig.103 Average Rainfall in Mumbai

Fig.104 Location & Density

Fig.106 Shoppers moving aside to make way for buses on road

Fig.105 Children exiting after school into the road

Fig.107 Crowd of people on the beach

Fig.109 Station road used by street hawkers and pedestrians

Fig.108 Crowd at railway station entering the train

Fig.110 Fish market with vendors and shoppers

Fig.111 Dharavi Figure Ground

Fig.112 Manhattan: 25,846 / sq km

Google Maps. *Manhattan*. <https://www.google.com/maps/place/Manhattan,+New+York,+NY,+USA/@40.7572405,-73.9743493,252m/data=!3m2!1e3!4b1!4m5!3m4!1s0x89c2588f046ee661:0xa0b-3281fccc08c!8m2!3d40.7830603!4d-73.9712488> (Accessed November 12, 2018).

Fig.113 Dharavi: 330,000 / sq km

Google Maps. *Dharavi*. <https://www.google.com/maps/place/Dharavi,+Mumbai,+Maharashtra,+India/@19.043759,72.8558878,147m/data=!3m1!1e3!4m5!3m4!1s0x3be7c8d72abf2d35:0x-5ba0b162df2aa82e!8m2!3d19.0380334!4d72.8537589> (Accessed November 12, 2018).

Fig.114 Mumbai Redeveloped Slum: 757,894 / sq km

Google Maps. *Saki Naka*. <https://www.google.com/maps/search/wasi+naka/@19.0324398,72.8953234,474m/data=!3m1!1e3> (Accessed November 12, 2018).

Fig.115 Fishing Boat

Fig.116 Mumbai 1843

Murphy. *Copy of a map of the Island of Bombay and Colaba*. 1843. In *Gazetteer of the Bombay Presidency*. Bombay: Campbell, James M, 1896. Archives of British Library, England, 2013. Available from: Flickr Commons, <https://www.flickr.com/photos/britishlibrary/11238247766/> (Accessed September 19, 2018).

Fig.117 Mumbai 1860

City, 1860. In *A Gazetteer of the World*. London: A. Fullarton & Co, 1860. Archives of British Library, England, 2013. Available from: Flickr Commons, <https://www.flickr.com/photos/britishlibrary/11238464553/> (Accessed September 19, 2018).

Fig.118 Mumbai 1893

Bartholomew, John. *Bombay and Environs*. 1893. In *Constable's Hand Atlas of India*. Westminster: A. Constable, 1893. Available from: Wikimedia Commons, <https://commons.wikimedia.org/wiki/File:ls-landsofBombay1893.jpg> (Accessed September 19, 2018).

Fig.119 Mumbai 2018

Google Maps. *Mumbai*. <https://www.google.com/maps/place/Mumbai,+Maharashtra,+India/@19.1723277,72.8029139,10.52z/data=!4m5!3m4!1s0x3be7c6306644edc1:0x5da4ed8f8d648c69!8m2!3d19.0759837!4d72.8776559?hl=en-CA> (Accessed September 19, 2018).

Fig.120 Kids in Dharavi

Fig.121 Dharavi Overview

Fig.122 Toilet & Water Infrastructure

Fig.123 Soil Condition

Fig.124 Commercial Zone

Fig.125 Places to preserve

Fig.128 One story Commercial

Fig.126 User Typology

Fig.127 Two story residence

Fig.130 Dharavi Land Use

Fig.129 Textile industrial unit being used for sleeping

Fig.131 Unit Constructions (Stephanie, 2012)

Author: Stephanie Kaul. Source: Dovey, Kim. Tomlinson, Richard. *DHARAVI informal settlements & slum upgrading*. Melbourne: University of Melbourne, 2012.

Fig.132 Detail 01 (Stephanie, 2012)

Author: Stephanie Kaul. Source: Dovey, Kim. Tomlinson, Richard. *DHARAVI informal settlements & slum upgrading*. Melbourne: University of Melbourne, 2012.

Fig.133 Detail 02 (Stephanie, 2012)

Author: Stephanie Kaul. Source: Dovey, Kim. Tomlinson, Richard. *DHARAVI informal settlements & slum upgrading*. Melbourne: University of Melbourne, 2012.

Fig.134 Street Study

Fig.135 Street Study

Fig.136 Existing Street Section (Annie, 2012)

Author: Annie Harrison. Source: Dovey, Kim. Tomlinson, Richard. *DHARAVI informal settlements & slum upgrading*. Melbourne: University of Melbourne, 2012.

Fig.137 Existing Street Section (Annie, 2012)

Author: Annie Harrison. Source: Dovey, Kim. Tomlinson, Richard. *DHARAVI informal settlements & slum upgrading*. Melbourne: University of Melbourne, 2012.

Fig.138 Existing Street Section (Annie, 2012)

Author: Annie Harrison. Source: Dovey, Kim. Tomlinson, Richard. *DHARAVI informal settlements & slum upgrading*. Melbourne: University of Melbourne, 2012.

Fig.139 Courtyard Photos

Fig.140 Roofscape Photos

Fig.141 Types of Industries

Fig.142 Road Network

Fig.143 Dabbawala System (Lunch box delivery)

Fig.144 Outsourcing to Dharavi

Fig.146 Pottery

Fig.145 Leather

Fig.148 Textile

Fig.147 Food Processing

Fig.150 Plastic Recycling

Fig.149 Other Manufacturing

Fig.152 Small inhouse businesses

Fig.151 Commercial Stores

Fig.153 Dharavi

Fig.154 Working Condition

Fig.155 Leather Industry

Fig.156 Light & Ventilation

Fig.157 Textile Industry

Fig.158 Air Pollution

Fig.159 Pottery Industry

Fig.160 Water Pollution

Fig.161 Plastic Recycling Industry

Fig.162 Flooding (Micheal, 2009)

Kholi, Michael. *JVPD Flooded*, 2009. Digital Image. Available from: Flickr, <https://www.flickr.com/photos/mgk/3684518180> (Accessed January 07, 2019)

Fig.163 Fire (Mumbai Live, 2017)

Screenshot from *Dharavi Fire | Mumbai Live*. Youtube, uploaded by Mumbai Live, March 06, 2017, <https://www.youtube.com/watch?v=gmYKKyVv0GQ> (Accessed January 07, 2019)

Fig.164 Toilet & Sewage

Fig.165 Water & Hygiene

Chapter 2:

Fig.201 Slum Redevelopment

Fig.202 Proposed Redevelopment (Foster + Partner, 2017)

Author: Foster + Partner. Source: <https://www.fosterandpartners.com/projects/dharavi-masterplan/>

Fig.203 Proposed by Hafeez Contractor (Hafeez Contractor, 2017)

(View Print Copy in Musagetes Library due to Copywrite Restrictions)

Author: Hafeez Contractor. Source: <http://www.hafeezcontractor.com/master-planning/>

Fig.204 Slum Redevelopment

JJ College of Architecture. Wasi Naka R&R Colony – Photodocumentation, 2010. In *TYPLOGIES and BEYOND Slum Settlement Studies in Mumbai*. Mumbai: CIRT, 2010.

Fig.205 Plan & Section

JJ College of Architecture. Wasi Naka R&R Colony – Built-Form Characteristics, 2010. In *TYPLOGIES and BEYOND Slum Settlement Studies in Mumbai*. Mumbai: CIRT, 2010.

Fig.206 IF Dharavi is Redeveloped

Fig.207 Informal Settlements Overview

Fig.208 Dharavi Street Art

Fig.209 Favela Bairro, Rio-De-Janeiro, Brazil (Dany, 2013)

Dany13. *Rio De Janeiro Stacking*, 2013. Digital Image. Available from: Flickr, <https://www.flickr.com/photos/dany13/10410315896/> (Accessed May 19, 2019)

Fig.210 Santo Domingo Savio, Medellín, Columbia

Jota, Ivan Erre. *Medellin*, 2012. Digital Image. Available from: Flickr, <https://www.flickr.com/photos/15072398@N00/7186194487/> (Accessed May 19, 2019)

Fig.211 Dharavi

Fig.212 Conceptual Representation of Gradual Development

Fig.213 Conceptual Representation of Gradual Development

Fig.214 Street Upgradation and opening of Spaces

Fig.215 Redevelopment Prototype

Fig.216 Water Filtration (Bryce, 2016)

Screenshot from Water Pollution AP Environmental Science FMS APES Bostick 2013. SlidePlayer, uploaded by Bryce Hancock, 2016, <https://slideplayer.com/slide/9297556/> (Accessed January 28, 2019)

Chapter 3:

Fig.301 Proposed Design

Fig.302 Polluted River

Fig.303 Map of Mithi River (Stephanie, 2009)

Kaul, Stephanie. *Mumbai Dharavi - Scenarios for development*. New York: Columbia University, 2009.

Fig.304 Mithi River Analysis (Stephanie, 2009)

Kaul, Stephanie. *Mumbai Dharavi - Scenarios for development*. New York: Columbia University, 2009.

Fig.305 River over the years (Stephanie, 2009)

Kaul, Stephanie. *Mumbai Dharavi - Scenarios for development*. New York: Columbia University, 2009.

Fig.306 Massing Study

Fig.307 Massing Study

Fig.308 Design Options

Fig.309 Design Options

Fig.310 Existing Site

Fig.311 Proposed Site

Fig.312 Site Plan

Fig.313 Site Photos

Fig.314 Existing Street Study

Fig.315 Existing Street Study

Fig.316 Context Photos

Fig.317 Circulation Diagram

Fig.318 Water Filtration Cycle

Fig.319 Main Floor Plan

Fig.320 Second Floor Plan

Fig.321 Below Grade Plan

Fig.322 Roof Plan

Fig.323 Section A

Fig.324 Section B

Fig.325 Section C

Fig.326 Bird's Eye View

Fig.327 Entrance to Visitor Centre

Fig.328 From the river

Fig.329 Entrance to Workshop

Fig.330 Entrance Panel Representing Each Industry

Fig.331 Recycling Washing Area

Fig.332 Water Feature

Fig.333 Visitor Reception

Appendix:

Fig.401 Lamego Multi Purpose Pavillion | Barbosa & Guimarães (Jose, 2012)

(View Print Copy in Musagetes Library due to Copywrite Restrictions)

Author: Jose Campos. Source: <https://www.archdaily.com/241134/lamego-multi-purpose-pavillion-barbosa-guimaraes>

Fig.402 Bavillion | Studio Ardete (Purnesh, 2018)

(View Print Copy in Musagetes Library due to Copywrite Restrictions)

Author: Purnesh Dev Nikhanj. Source: <https://www.archdaily.com/897650/bavillion-studio-ardete>

Fig.403 Media Pavillion | Moho Arquitectos + Carlos Abadía Sánchez (Moho, 2009)

(View Print Copy in Musagetes Library due to Copywrite Restrictions)

Author: Arquitectos, Moho, and Carlos Abadía Sánchez. Source: <https://www.archdaily.com/27556/media-pavillion-moho-arquitectos-carlos-abadia-sanchez>

Fig.404 Bloomberg's European HQ | Foster + Partners (Nigel, 2017)

(View Print Copy in Musagetes Library due to Copywrite Restrictions)

Author: Nigel Young. Source: <https://www.archdaily.com/882263/bloombergs-european-hq-foster-plus-partners>

Fig.405 Corrugated-Sheet House | Daisuke Yamashita Architects (Takeshi, 2018)

(View Print Copy in Musagetes Library due to Copywrite Restrictions)

Author: Takeshi Yamagishi. Source: <https://www.archdaily.com/892404/corrugated-sheet-house-daisuke-yamashita-architects>

Fig.406 Tower of Bricks | Interval Architects (Zhi, 2018)

(View Print Copy in Musagetes Library due to Copywrite Restrictions)

Author: Zhi Geng. Source: <https://www.archdaily.com/906727/tower-of-bricks-interval-architects>

Fig.407 Alexandra Interpretation Centre | Peter Rich Architects (Iwan, 2010)

(View Print Copy in Musagetes Library due to Copywrite Restrictions)

Author: Iwan Baan. Source: <https://www.archdaily.com/58495/alexandra-interpretation-centre-peter-rich-architects>

Fig.408 Alexandra Interpretation Centre | Peter Rich Architects (Iwan, 2010)

(View Print Copy in Musagetes Library due to Copywrite Restrictions)

Author: Iwan Baan. Source: <https://www.archdaily.com/58495/alexandra-interpretation-centre-peter-rich-architects>

Fig.409 Girassol Pavilion | Brasil Arquitetura (Daniel, 2019)

(View Print Copy in Musagetes Library due to Copywrite Restrictions)

Author: Daniel Ducci. Source: <https://www.archdaily.com/913735/girassol-pavilion-brasil-arquitetura>

Fig.410 Verdun Memorial Museum | Brochet-Lajus-Pueyo + Le-Conte Noirot (Harve, 2016)

(View Print Copy in Musagetes Library due to Copywrite Restrictions)

Author: Harve Abbadia. Source: <https://www.archdaily.com/786774/verdun-memorial-museum-brochet-lajus-pueyo-plus-le-conte-noirot>

“Not all urban poor, to be sure, live in slums, nor are all slum dwellers poor.”
– Davis, Mike. *Planet of Slums*, 2005.

INTRODUCTION

Slums, squatters, shanti houses, favela, have been becoming an increasing issue in the cities. More than one billion people of the urban population live in these informal settlements [1]. It is estimated that by 2050, the number would triple, making it 30% of the total urban population [2]. However, are these informal settlements really an issue? Are they really as bad as they are advertised to be? I believe not. As Mike Davis says in his book, neither do all poor live in slums and nor are all slum dwellers poor [3].

So what causes the stigma against informal settlements? Slums are believed to be places that no one wants to live in. They have the reputation of being dirty and dangerous. However, is that true? Are all informal settlements just a burden to the cities? Do they not contribute to making the cities function better?

Image can be a tricky thing. People often judge by that is on the surface than what is inside. Dharavi, an informal settlement in Mumbai, is one of the examples of how one should not judge a book by its cover. This informal settlement is seen as dirty and dangerous by the rest of the world. Dharavi however, is a hidden gem of the city.

Dharavi, Asia's largest and world's third-largest slum, is situated in Mumbai, India. Spread over 525 acres of land, Dharavi houses about 700,000 to one million people, making it one of the densest places on Earth [4]. However, whatever image one might have of a slum, Dharavi is not it. It is a self-contained city within a city. Whether is schools, hospitals, pharmacies, restaurants, bars, clothing shops, electronics or groceries; Dharavi has it all. Besides consisting of temporary tin or ply sheet houses, Dharavi also has some of the nicest houses made of brick and concrete and decorated with patterned tiles. Houses range from one to three stories and range from 200 sq. ft. to 1500 sq. ft. in area [5].

Originally a fishing village, Dharavi now consists of over 20,000 industries with 80% of its population working within the slum [6]. It has one of the various genuine leather industries and textile industries manufacturing for large international clothing brands. The pottery unit in Dharavi is one of the

biggest potters' settlements in Mumbai. It also has over 300 bakeries and various other dry snack manufacturing units[7]. Not only that, 80% of Mumbai's plastic being recycled in Dharavi, making it India's biggest recycling unit[8]. The world's most complicated lunchbox delivery and return system 'dabbawalas,' which are renowned for having more than 99% accuracy, are also based in Dharavi [9]. All in all, Dharavi is less of a slum and more of a city within a city.

While rich in culture, residents of Dharavi live in very poor conditions. The government wants to push its dwellers aside and replace their dwellings with offices and towers. This research argues that Dharavi, a place that formed one of the original islands in Mumbai, where thousands of families have been living for generations, is worth saving. Dharavi's residents need their facilities to be upgraded, not uprooted.

With the vision of urbanization, the government wants to tear down this community and expand Mumbai's commercial zone which is across the creek from Dharavi. As 80% of the dwellers work within the multiple illegal small businesses in Dharavi; the government redevelopment would not only lead to about 40% of the slum's population becoming homeless but also make thousands of people jobless[10].

How can one be sensitive to the needs of the dwellers and create a design that would not only keep the housing culture alive but also give the dwellers space to continue their small scale industries which contribute to almost 3% of Mumbai's economy?

The first step of creating positive changes in Dharavi is to influence public perception: to present Dharavi as a vibrant place that is worth saving. Hence this thesis proposes a visiting center for tourists and Mumbaikars, where they will learn about the positive aspects of Dharavi, and observe workers in action in its attached workshop.

This project has three different programs: Interpretation Centre, Workshop and Water Filtration. The interpretation center for tourists acts as the first stop to slum tourism, where they can learn about the positive aspects of Dharavi. The tourists can see a preview of Dharavi by observing workers in

action in its attached workshop. Dharavi faces at least one major drawback in every industry, hence the aim of the workshop is to educate the workers on better practices in their industries, giving them the opportunity to learn and incorporate their education in their own businesses. This project also proposes a water filtration unit to clean the now polluted river. The concept of a filtration unit along with an amenity can be used as a prototype at certain intervals along the river that would help rejuvenate Mithi River.

The objective of this thesis is to create a significant awareness among people, so that progressive development that caters to the needs of dwellers, can begin in Dharavi.

One of the strategies to bring people to visit the institution is by creating public awareness. Creating mobile exhibitions and showcasing them around the city. 'Kala Ghoda Art Festival' is one of the annual festivals in downtown that exhibits various installations that is viewed by thousands of people. The idea is to present a unique piece of work that portrays the Essence of Dharavi as a means to attract people to the site.

By placing the design at the juxtaposition of two worlds, the project aims to merge boundaries.

This book will further elaborate all the topics covered below in detail.

Chapter 1 gives an overall idea of where Dharavi is located, its history and climate. It gives an understanding of the current scenario, including housing, industries and culture, and identifies some major issues in Dharavi.

Chapter 2 talks about informal settlements, what's the definition of slum, how they came to existence, and how they were redeveloped. The Chapter then moves to describe how there can be a better, less intrusive way of development and talks about different strategies to developing Dharavi.

Chapter 3 brings us to my thesis proposal – theory and design. It describes reasons why I chose to do an interpretation centre with a workshop catering to major drawbacks in multiple industries while also focusing on Mithi River Revitalization. The Chapter also walks us through the design in detail.

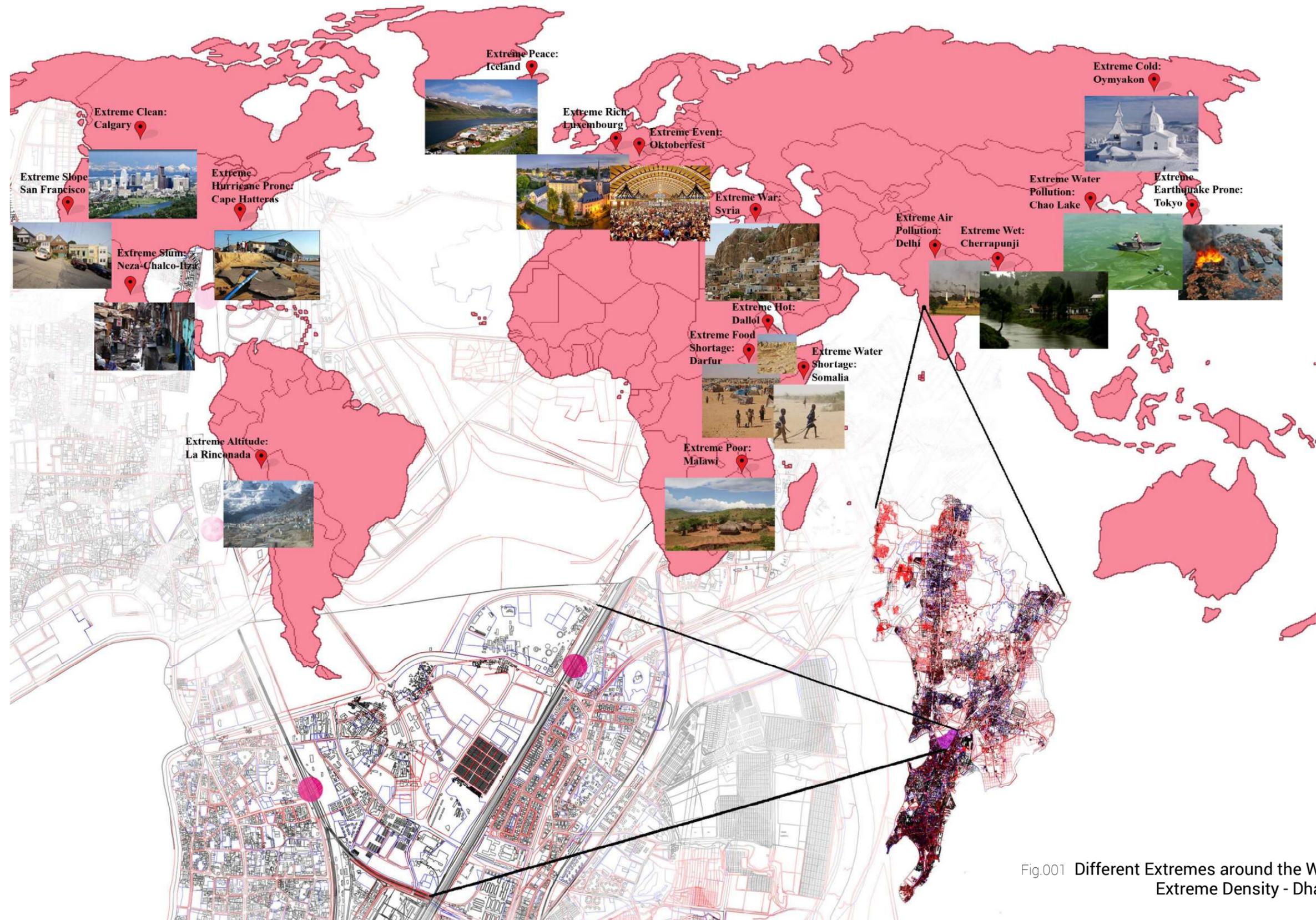


Fig.001 Different Extremes around the World
Extreme Density - Dharavi

CHAPTER 1

DHARAVI

END NOTE:

[1] UN-Habitat. *The Challenge of Slums: Global Report on Human Settlements*, 2003. London: Earthscan Publications, 2003

[2] Ibid.

[3] Davis, Mike. *Planet of Slums*. London: Verso, 2006.

[4] Iyer, Laxmi, John Maconber, and Namrata Arora. *Dharavi: Developing Asia's Largest Slum*. Boston: Harvard Business School, 2011

[5] Ibid.

[6] Assainar, Raina. *At the heart of Dharavi are 20,000 mini-factories*. Mumbai: The Guardian, November 25, 2014. <https://www.theguardian.com/cities/2014/nov/25/dharavi-mumbai-mini-factories-slum> (Accessed December 28, 2018).

[7] SPARC and KRIVIA. *Re-interpreting, Re-imagining, Re-developing Dharavi*. Mumbai: SPARC and Kamla Raheja Vidyaniidhi Institute for Architecture and Environmental Studies, 2010. <https://www.environmentandurbanization.org/re-interpreting-re-imagining-re-developing-dharavi> (Accessed October 19, 2018).

[8] Mascarenhas, Trisha. *Dharavi: Asia's largest slum or India's very own recycling and circular economy goldmine*. Green is the new Black, August 03, 2018. <https://greenisthenewblack.com/dharavi-asias-largest-slum-indias-recycling-circular-economy-goldmine/> (Accessed January 18, 2019).

[9] SPARC and KRIVIA, *Re-interpreting, Re-imagining, Re-developing Dharavi*, 2010.

[10] Ibid.

2.1 LOCATION & CLIMATE

Mumbai, also known as Greater Mumbai or Bombay is the capital city of the Indian state of Maharashtra. The 603 sq.km. city is the most populous city in India with an estimated city proper population of 12.4 million[1]. Dharavi is a triangular shaped informal settlement spread over only 2.1 sq. km. of land, and housing 700,000 to a million people making it one of the world's largest informal settlements[2]

Dharavi is situated at the edge of Downtown Mumbai, making it close to the centre of Greater Mumbai. It lies between Mumbai's two railway lines, Western and Central Railways. The newly proposed metro line would run along the north, making Dharavi covered with railway lines from all three sides.

To the west of Dharavi are Mahim and Bandra, and to the north lies Mithi River with a belt of mangrove preserve. Across the river is the newly reclaimed BKC - Mumbai's biggest commercial hub. Further north connects to Mumbai's International airport making Dharavi one of the sites viewed while travelling South towards Mumbai's downtown.

The Climate of Mumbai is a tropical wet and dry climate with seven months of dryness and peak of rains in July. Mumbai's climate can be best described as moderately hot with high level of humidity[3]. Its coastal nature and tropical location ensures temperatures won't fluctuate much throughout the year. The mean average is 27.2 °C and average precipitation is 242.2 cm[4]



Fig.101 Contrast between Dharavi and BKC

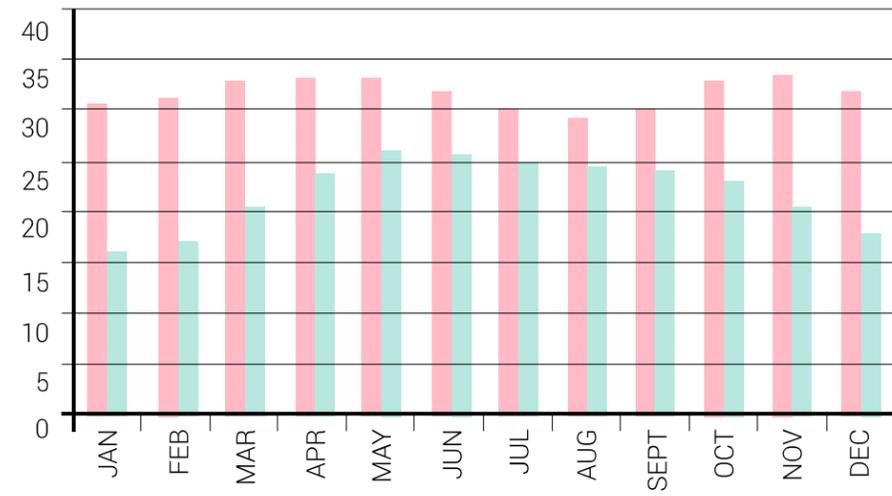


Fig.102 Average High and Low Temperature in Mumbai

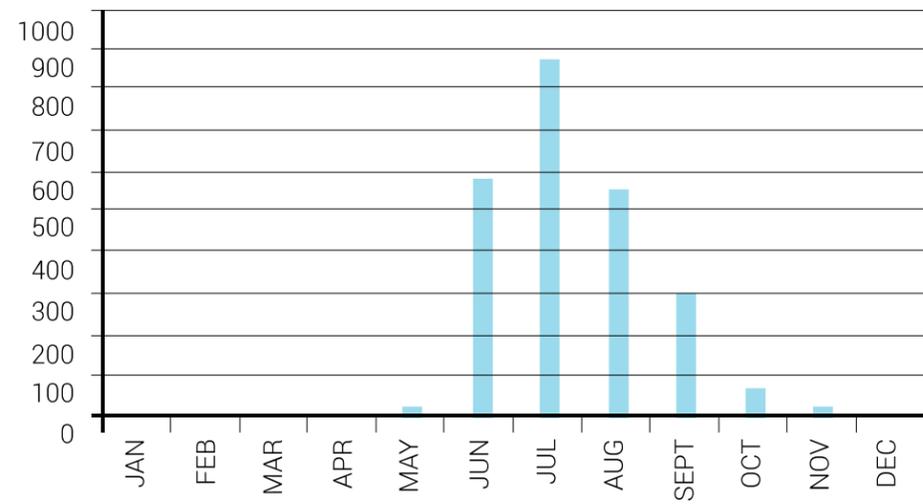


Fig.103 Average Rainfall in Mumbai

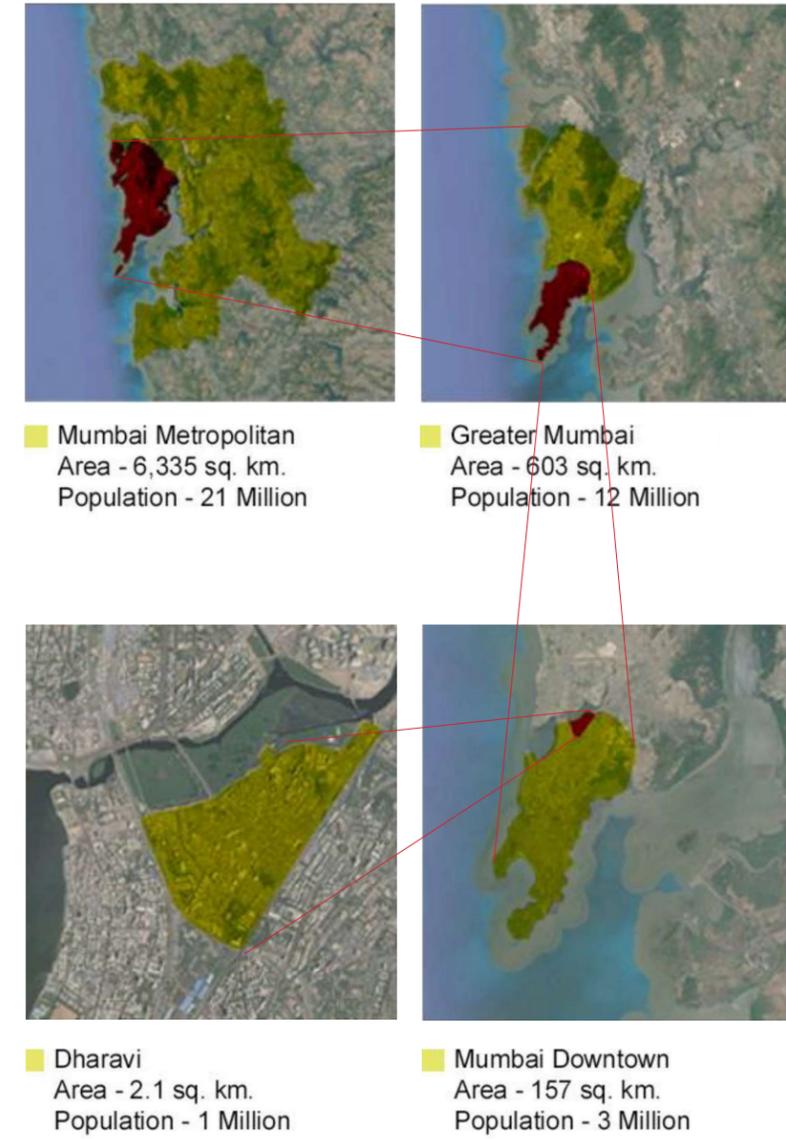


Fig.104 Location & Density



Fig.105 Children exiting after school into the road



Fig.106 Shoppers moving aside to make way for buses on road



Fig.107 Crowd of people on the beach



Fig.108 Crowd at railway station entering the train



Fig.109 Station road used by street hawkers and pedestrians



Fig.110 Fish market with vendors and shoppers

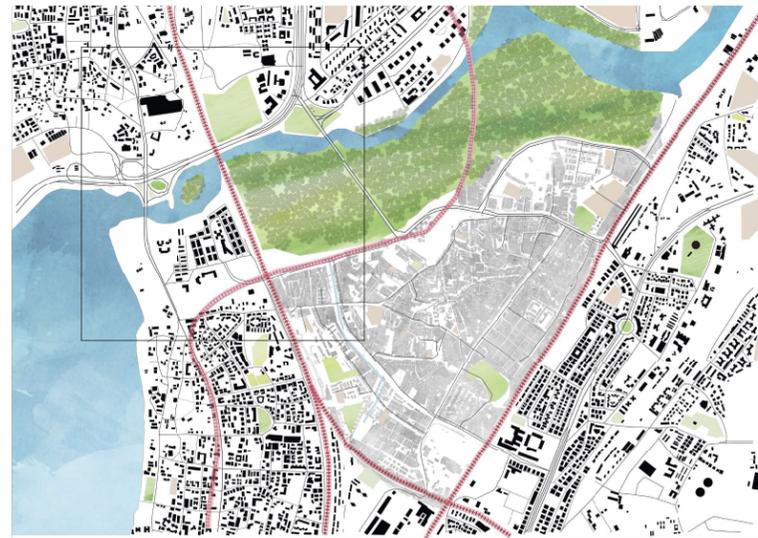


Fig.111 Dharavi Figure Ground



Fig.112 Manhattan: 25,846 / sq km



Fig.113 Dharavi: 330,000 / sq km



Fig.114 Mumbai Redeveloped Slum: 757,894 / sq km

2.2 HISTORY

Mumbai originally consisted of seven small islands and was reclaimed over the years into what you see today. The islands were connected via reclamation after the British invasion forming the city of Bombay, now called downtown Mumbai. Dharavi was one of the original islands of Mumbai and contained a small fishing village.

In 18th C, Dharavi housed a small fort, the remains of which can still be found. Being at the edge of the city, it soon transitioned into a tannery town due to the industrial revolution, and slowly started attracting other trades like textile and pottery from around the country in first half of 19th C. The sudden increase in immigrants in the second half of 19th C turned Dharavi into a working class enclave slowly turning it into a slum you see today[5].

Multiple redevelopment plans have been proposed for Dharavi over the years starting with 'Outline of Master Plan for Greater Bombay' in 1945 but none have been successfully implemented. The first plan recommended that all of Dharavi's industrial activities be removed and relocated to the outlying areas of Greater Mumbai. However, due to political and financial conflicts, the plan was put on indefinite hold and soon forgotten[6].

Government's supportive neglect lead to increase in illegal industries and settlements that slowly lead to Dharavi being one of the world's largest slums with over 20,000 industrial units today. Despite being built with fragile materials, Dharavi has remained resilient yet non static[7].



Fig.115 Fishing Boat



Fig.116 Mumbai (Murphy, 1843)



Fig.117 Mumbai (Fullarton, 1860)



Fig.118 Mumbai (John,1893)



Fig.119 Mumbai (Google Maps, 2018)

2.3 CURRENT SCENARIO

Dharavi currently consists of 700,000 to a million people living in 525 acres of land making Dharavi one of the densest places on earth[8]. Besides consisting of temporary tin or ply wood houses, Dharavi also has some of the nicest houses made of brick and concrete, and decorated with patterned tiles. The one to three stories houses range from 200 sq. ft. to 1500 sq. ft. area. Each household has an average of 7 people living in them[9].

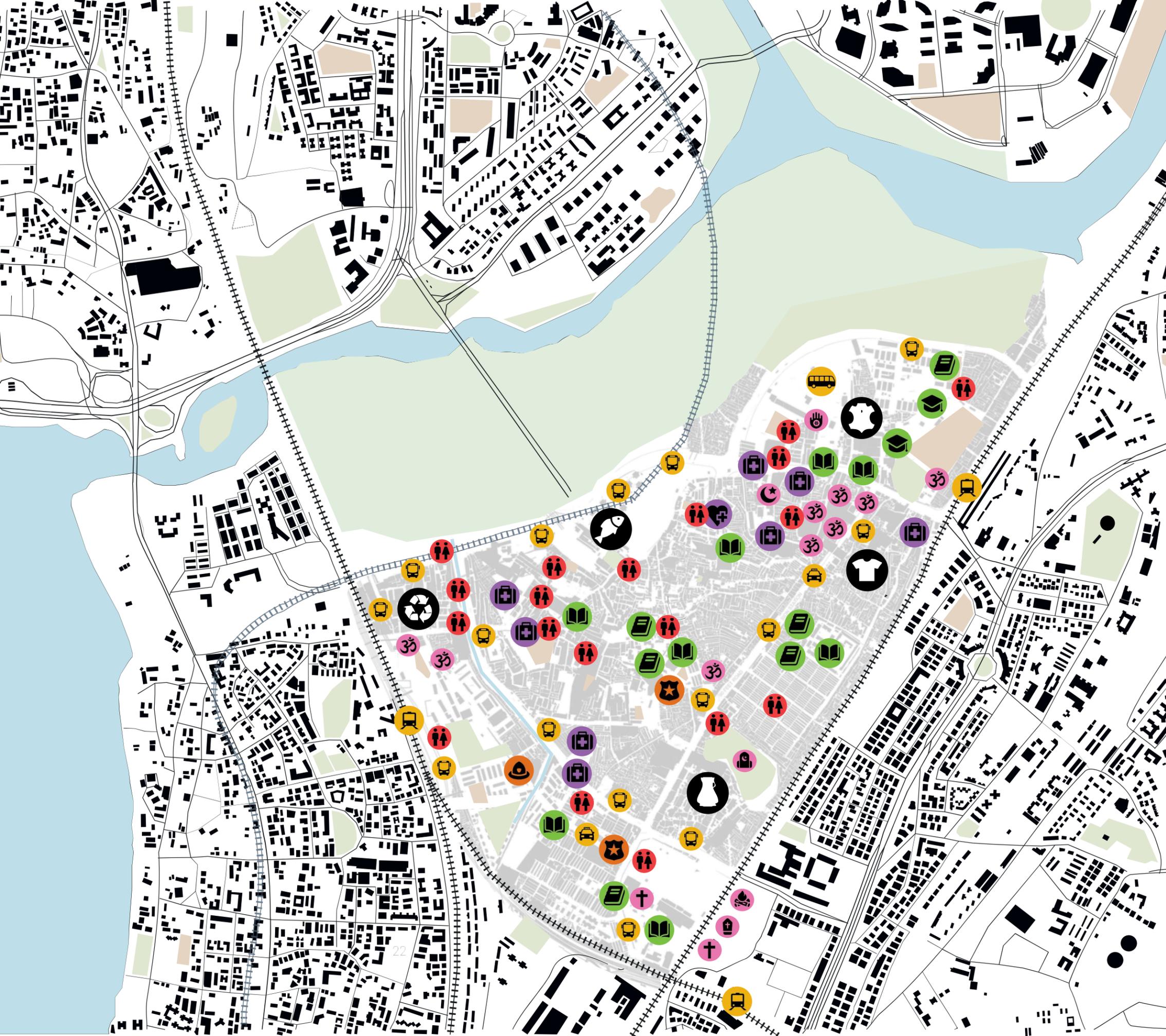
A distinguishing feature of Dharavi has always been its production and commercial activity [10]. Dharavi now consists of over 20,000 industries with 80% of its population working within the slum[11]. It has one of the various genuine leather industries and textile industries manufacturing for large international clothing brands. The pottery unit in Dharavi is one of the biggest potters' settlement in Mumbai. It also has over 300 bakeries and various other dry snack manufacturing units[12]. Not only that, with Mumbai's 80% plastic being recycled in Dharavi, it makes it India's biggest recycling unit[13]. The world's most complicated lunchbox delivery and return system 'dabbawalas', who are renowned to have more than 99% accuracy, are also based in Dharavi[14].

The slum is estimated that the annual turnover for the thriving businesses within Dharavi stands at somewhere in the region of \$500-650 million[15]. Well over three quarters of the residents living in Dharavi are employed, and the slum even has its own millionaires [16].

Dharavi is less of a slum but more of a city within the city.



Fig.120 Kids in Dharavi



-  RECYCLING UNIT
-  POTTERY UNIT
-  TEXTILE INDUSTRY
-  OLD FISHING VILLAGE
-  LEATHER INDUSTRY

-  CHURCH
-  HINDU TEMPLE
-  MOSQUE
-  JAIN TEMPLE
-  MUSLIM GRAVEYARD
-  CHRISTIAN GRAVEYARD
-  HINDU FUNERAL HOME
-  PUBLIC TOILETS
-  BUS STOP
-  TAXI STAND
-  PRIVATE SCHOOL
-  PUBLIC SCHOOL
-  POLICE STATION
-  FIRE STATION
-  PUBLIC HOSPITAL
-  PRIVATE HOSPITAL
-  TRAIN STATION
-  BUS TERMINAL

Fig.121 Dharavi Overview



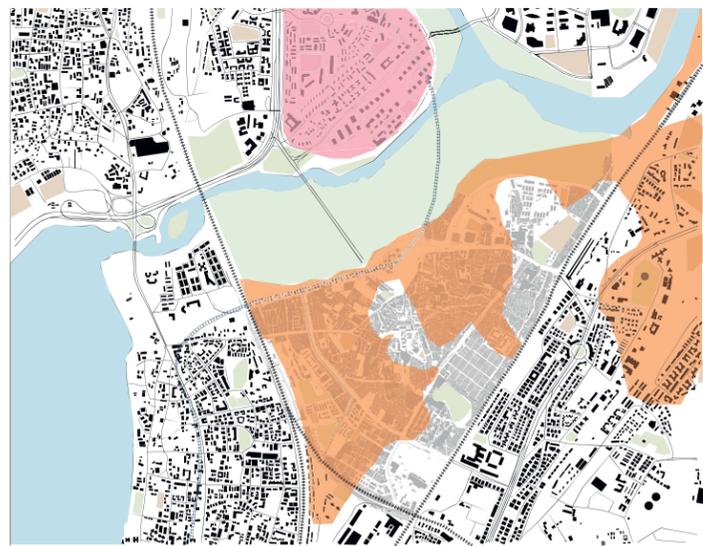
- TOILETS
- WATER TANK
- WATER MAIN

Fig.122 Toilet & Water Infrastructure



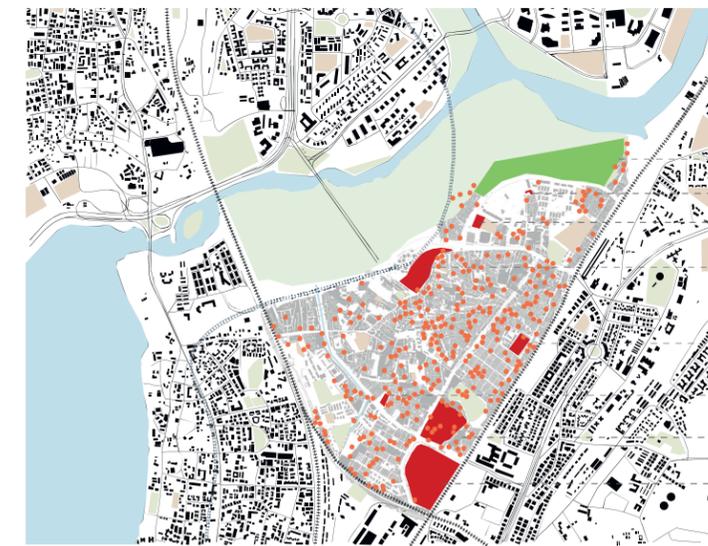
- COMMERCIAL UNITS
- COMMERCIAL AVENUES

Fig.124 Commercial Zone



- MOST RECENT LAND RECLAMATION (1980)
- LOW LYING SWAMPY LAND FILLED WITH ORGANIC WASTE

Fig.123 Soil Condition



- MAHIM NATURE PARK
- RIWA FORT
- SPORTS CENTRE
- KOLIWADA VILLAGE
- BMC PRIMARY SCHOOL
- HOSPITAL
- KUMBHARWADA VILLAGE
- TATA ENERGY PLANT
- PLACE OF WORSHIP

Fig.125 Places to preserve

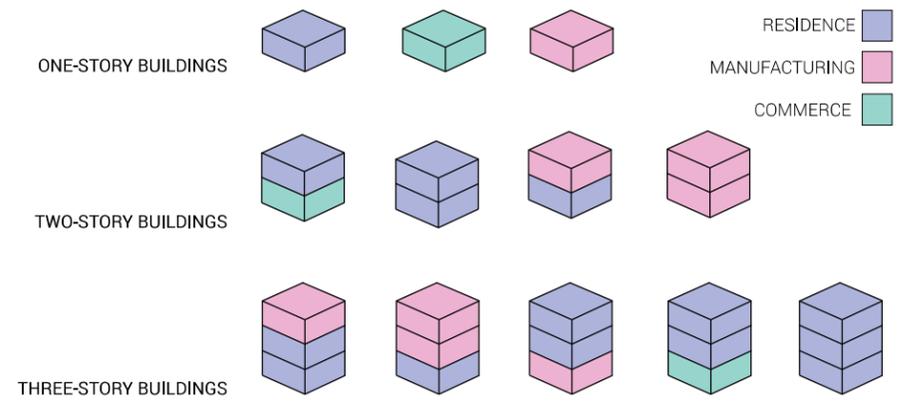


Fig.126 User Typology

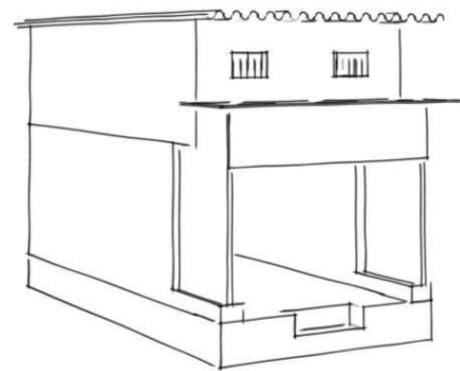


Fig.128 One story Commercial

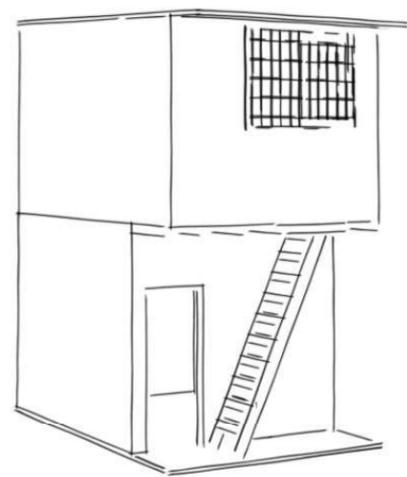


Fig.127 Two story residence

USER TYPOLOGY:

With the density of Dharavi being what it is, the 1-4 story houses are a mixture of housing, commercial and industrial units. Each unit, no matter the typology, doubles up as sleeping area for workers.



RESIDENCE INDUSTRIAL ROAD VACANT LAND
 COMMERCIAL AMENITIES OPEN SPACES NALA

Fig.130 Dharavi Land Use



Fig.129 Textile industrial unit being used for sleeping

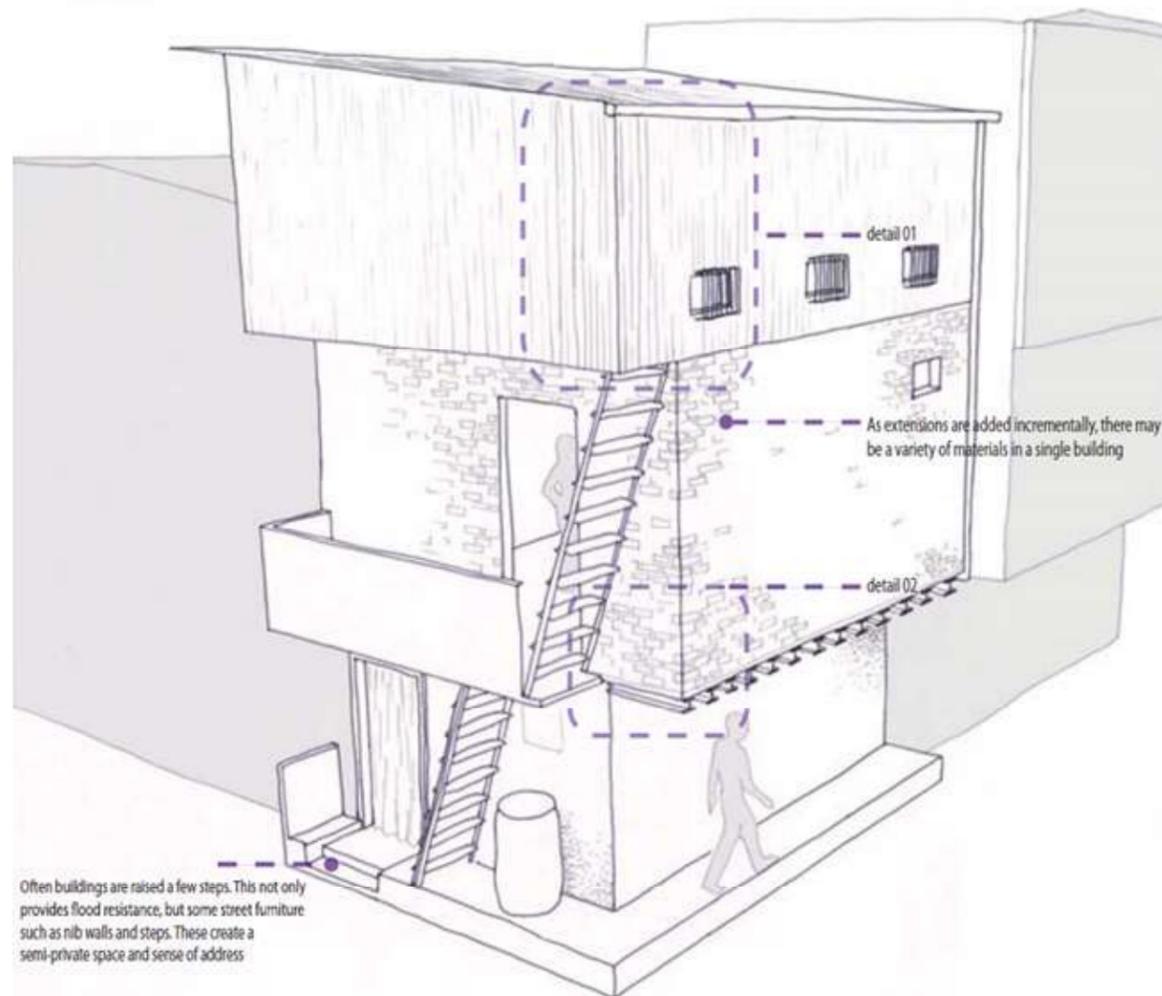


Fig.131 Unit Constructions (Stephanie, 2012)

CONSTRUCTION:

Almost all construction is one room at a time. Additional levels may be constructed by erection a working platform. Once the supporting brick walls are constructed, metal sheeting to a form a roof [17].

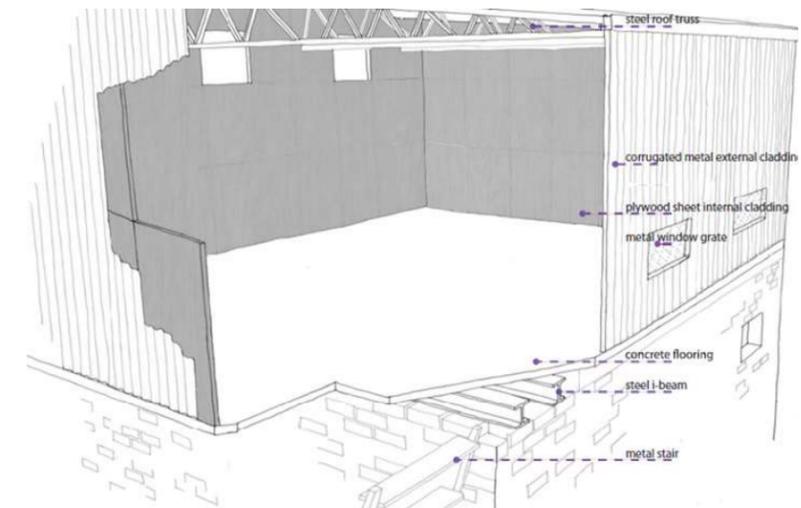


Fig.132 Detail 01 (Stephanie, 2012)

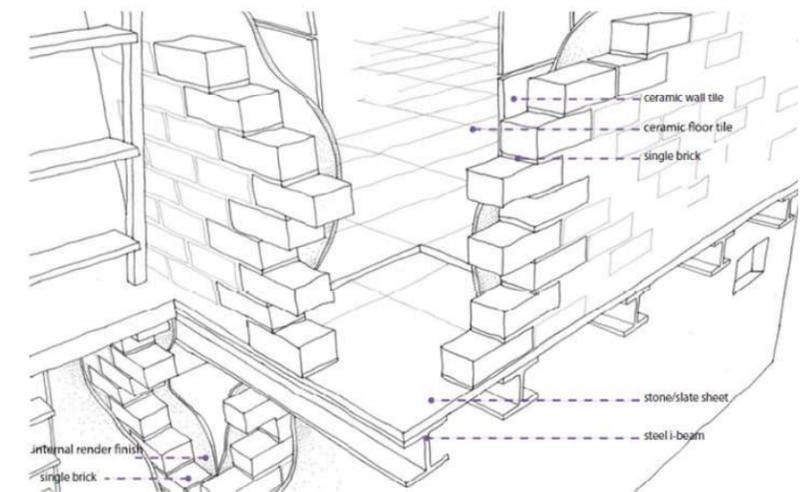


Fig.133 Detail 02 (Stephanie, 2012)

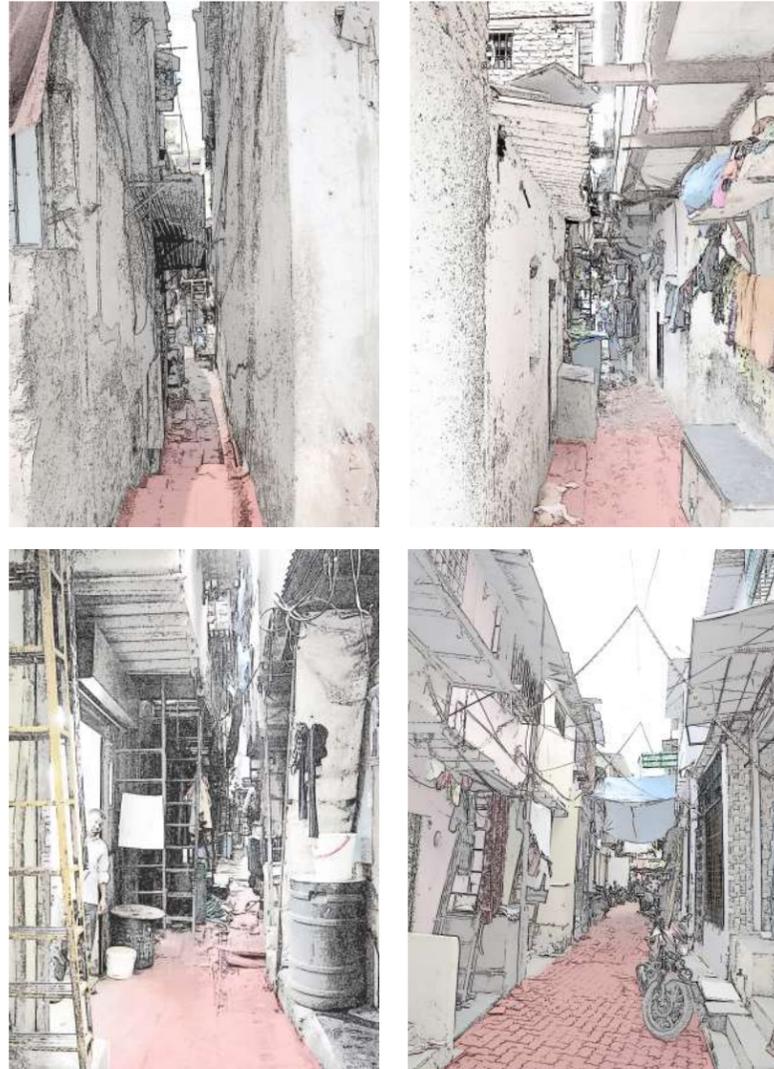


Fig.134 Street Study

LANE TYPES:

Dharavi has a wide combination of lanes, streets and roads. Ranging from 2ft lanes to 90ft roads, these streets create a huge labyrinth within Dharavi.



Fig.135 Street Study



Fig.136 Existing Street Section (Annie, 2012)

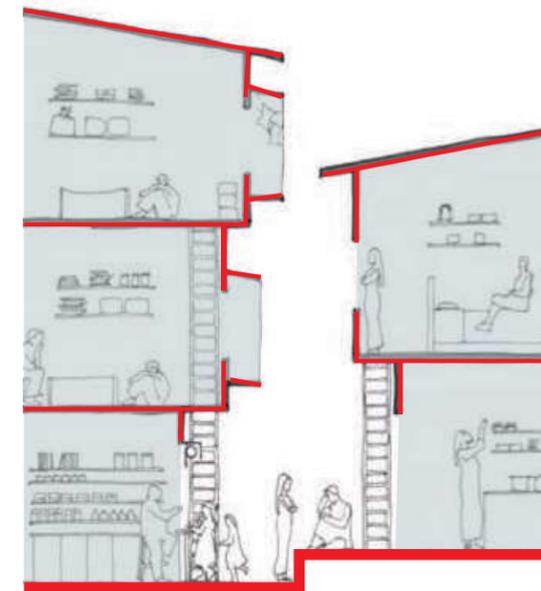


Fig.138 Existing Street Section (Annie, 2012)



Fig.137 Existing Street Section (Annie, 2012)



Fig.139 Courtyard Photos

COURTYARD:

The small relief of courtyards in the sea of buildings is not only used by kids to play but also for communities to gather and celebrate social events. together.



Fig.140 Roofscape Photos

ROOFSCAPE:

Roofs are mainly used as additional storage spaces and as pedestrian walkway for youth to easily travel avoiding the commotions of the streets below.

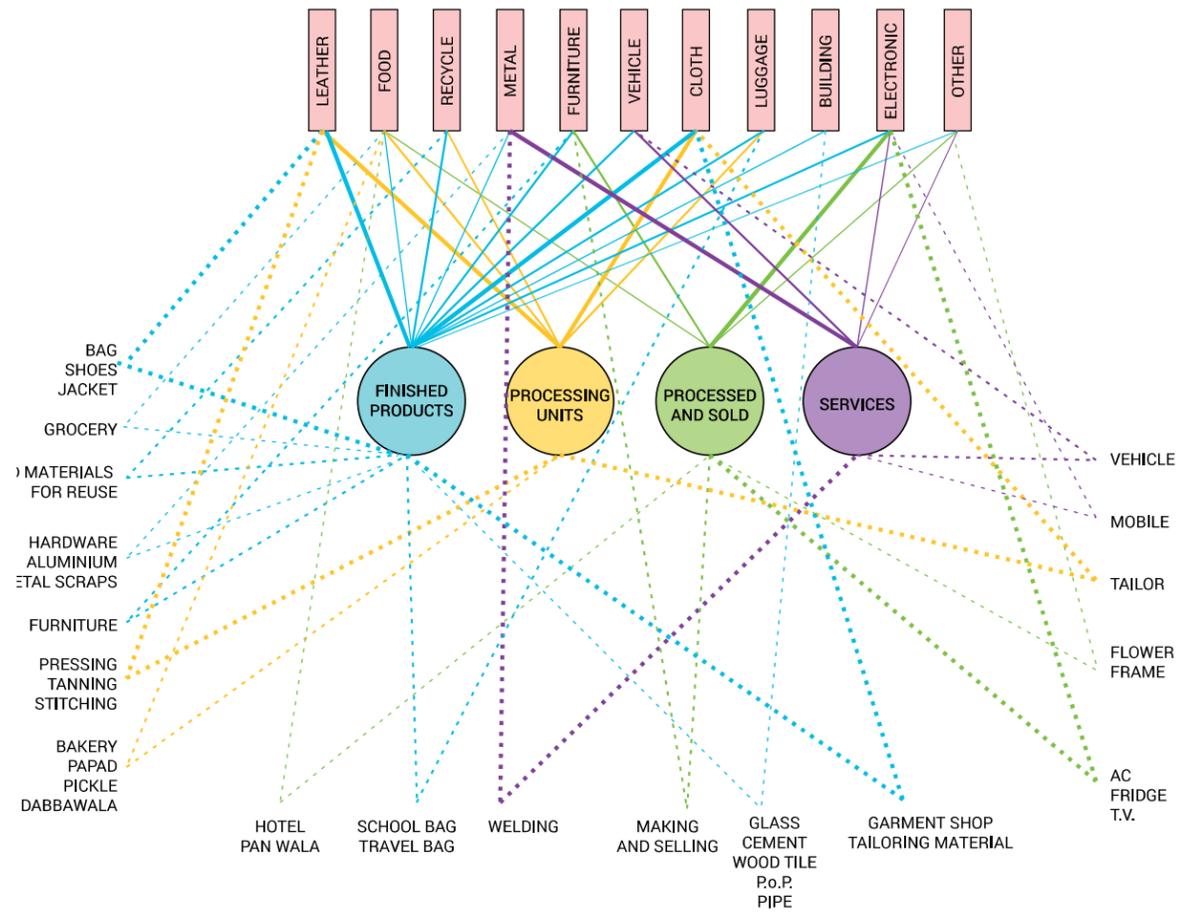


Fig.141 Types of Industries

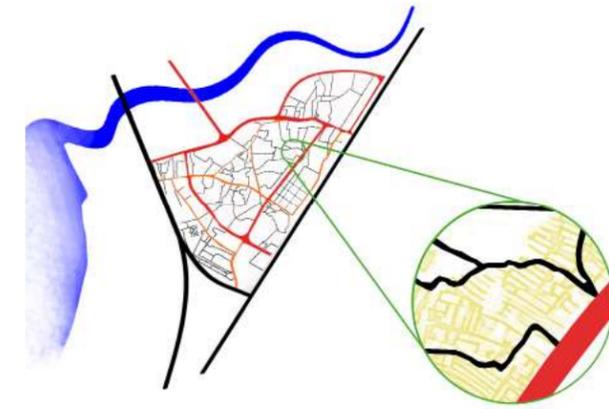


Fig.142 Road Network

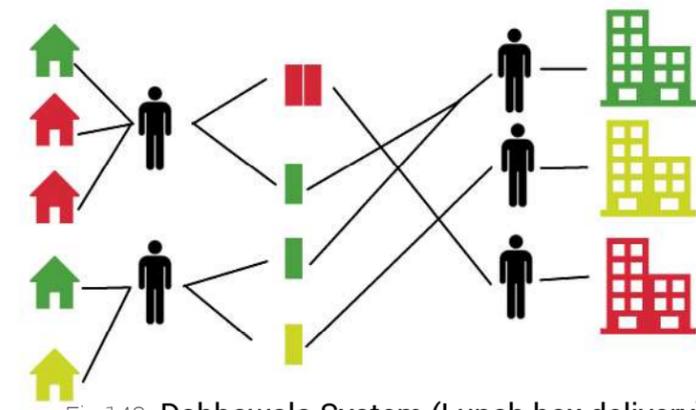


Fig.143 Dabbawala System (Lunch box delivery)

INDUSTRIES:

Dharavi has about 20,000 industrial and commercial units. The top 5 industries in Dharavi are Leather, Pottery, Textile, Food Processing and Recycling. One can buy almost anything in Dharavi due to its varying types of commercial units.

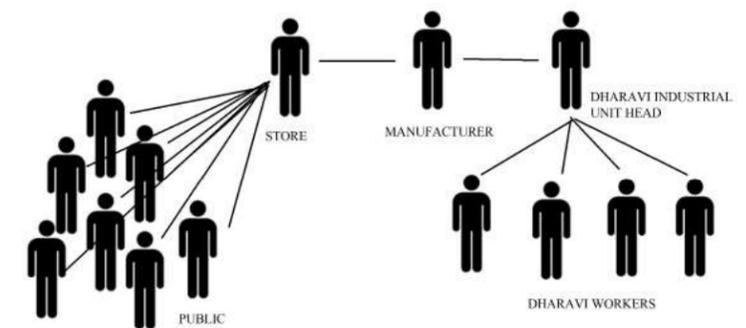


Fig.144 Outsourcing to Dharavi



Fig.146 Pottery



Fig.145 Leather

Pottery business is run by each individual household that has its pottery kiln and a shop facing the road. Leather is the prominent industry with highest share of turnover among all industries in Dharavi.



Fig.148 Textile



Fig.147 Food Processing

Large clothing brands outsource their manufacturing to Dharavi where the goods are produced and exported back. Dharavi has a big food business of manufacturing chiki, channa, chakli, papad, bread, bun and mysore pak[18].



Fig.150 Plastic Recycling



Fig.149 Other Manufacturing

One recycling unit recycles on an average 4 tons of plastic waste a day. Other industries include manufacturing soap bars, surgical threads, metal recycling, printing presses, etc.



Fig.152 Small inhouse businesses



Fig.151 Commercial Stores

Besides the industrial units, Dharavi also has multiple small businesses run from a typical housing unit. Dharavi also has thousands of commercial units that sell everything from shoes to automobiles.

2.4 ENVIRONMENTAL AND SOCIAL CHALLENGES

Dharavi, although being rich in culture, lives in a very poor conditions. Most houses are extremely poorly lit and have very poor ventilation. Leather curing produces stench of brine, sulphur, decay and human negligence.

Waste Management problems have created severe land and water pollution. The study done in March found that Mahim creek had the highest faecal coliform content, a bacterium found in human and animal faeces, 16 times the safe limit[19].

In a pollution study of Dharavi by the National Environmental Engineering Research Institute in November 2010, average suspended particulate matter was found to be more than five times higher than the permissible limit set by the Central Pollution Control Board[20].

One third of the population of Dharavi has no access to clean drinking water at all. There is a serious sanitation problem in Dharavi, with poor drainage systems causing the spread of diseases and serious public health problems. This is only exacerbated by the annual monsoons, with the flooding leading to increased spreading of contagious diseases[21].

The working conditions of Dharavi make matters worse. Whether it is the tannery releasing toxic chemicals, or the pottery kiln creating air pollution, or the recycling industry washing their materials in the river, each industry contributes towards pollution every day.



Fig.153 Dharavi



Fig.154 Working Condition



Fig.155 Leather Industry

Leather Industry: As mentioned before, cheap leather bags are made and sold in Dharavi. As vehement as animal rights groups and brand empires are about saving innocent animals, something must be said about the manner in which the lower income groups work in these units. No rubber boots, no gloves, no masks, no legal interventions to protect them from the conditions they work in[22].



Fig.156 Light & Ventilation



Fig.157 Textile Industry

Textile Industry: There are some sections in Dharavi where rooms are joined on three sides and therefore have very poor light and ventilation. Most textile industries are joined on two sides with a 0.7m wide lane at the back and 3m wide road in the front, making the working condition in the small units not apt enough to do intricate work on the fabric.



Fig.158 Air Pollution



Fig.159 Pottery Industry

Pottery Industry: In a pollution study of Dharavi, average suspended particulate matter was found to be more than five times higher than the permissible limit set by the Central Pollution Control Board [23]. The Potters use raw synthetic material from textile mills as well as remains from the leather industry as fuel as the environmentally friendly cotton is not only scarce but also costly.



Fig.160 Water Pollution



Fig.161 Plastic Recycling Industry

Plastic Recycling Industry: Mithi River flows 17.8 km before draining into the Arabian Sea. It is a critical storm water drain as during monsoon, lakes began to overflow. Clogged with plastic, garbage and sewage, water seeps onto the streets of Dharavi. A lot of these waste is produced by the recyclers who wash their plastic and throw the things that can't be recycled, into the river [24].



Fig.162 Flooding (Micheal, 2009)



Fig.164 Toilet & Sewage



Fig.163 Fire (Mumbai Live, 2017)



Fig.165 Water & Hygiene

END NOTE:

- [1] Mumbai Population 2019. *Mumbai: World Population Review*, 2019. <http://worldpopulationreview.com/world-cities/mumbai-population/> (Accesses June 29, 2018).
- [2] Iyer, Laxmi, John Maconber, and Namrata Arora. *Dharavi: Developing Asia's Largest Slum*. Boston: Harvard Business School, 2011
- [3] Rohli, Robert. Vega, Antony. *Climatology*. Burlington: Jones & Bartlett Learning, 2015.
- [4] Ibid.
- [5] Weinstein, Liza. *The Durable Slum : Dharavi and the Right to Stay Put in Globalizing Mumbai*, edited by Inc ebrary. Minneapolis: University of Minnesota Press, 1977-. 2014.
- [6] Ibid.
- [7] Ibid.
- [8] Iyer, Laxmi, John Maconber, and Namrata Arora. *Dharavi: Developing Asia's Largest Slum*. Boston: Harvard Business School, 2011
- [9] Ibid.
- [10] Dovey, Kim. Tomlinson, Richard. *DHARAVI informal settlements & slum upgrading*. Melbourne: University of Melbourne, 2012. <http://www.placeresearch.net/pdf/DHARAVI%20report.pdf> (Accessed October 23, 2018).
- [11] Assainar, Raina. *At the heart of Dharavi are 20,000 mini-factories*. Mumbai: The Guardian, November 25, 2014. <https://www.theguardian.com/cities/2014/nov/25/dharavi-mumbai-mini-factories-slum> (Accessed December 28, 2018).
- [12] SPARC and KRIVIA. *Re-interpreting, Re-imagining, Re-developing Dharavi*. Mumbai: SPARC and Kamla Raheja Vidyaniidhi Institute for Architecture and Environmental Studies, 2010. <https://www.environmentandurbanization.org/re-interpreting-re-imagining-re-developing-dharavi> (Accesses October 19, 2018).
- [13] Mascarenhas, Trisha. *Dharavi: Asia's largest slum or India's very own recycling and circular economy goldmine*. Green is the new Black, August 03, 2018. <https://greenisthenewblack.com/dharavi-asias-largest-slum-indias-recycling-circular-economy-goldmine/> (Accessed January 18, 2019).
- [14] SPARC and KRIVIA, *Re-interpreting, Re-imagining, Re-developing Dharavi*, 2010.
- [15] Life is a slum. Mumbai: BBC News. http://news.bbc.co.uk/2/shared/spl/hi/world/06/dharavi_slum/html/dharavi_slum_intro.stm (Accesses January 18, 2018).
- [16] Dobiwala, Imran. *Asia's Largest Slum Dharavi: Redevelopment Plan & It's Challenges*. Master's thesis, AURO University, 2013. Retrieved from <https://edoc.pub/queue/dharavi-2-pdf-free.html> (Accessed October 23, 2018).
- [17] Dovey, Kim. Tomlinson, Richard. *DHARAVI informal settlements & slum upgrading*. Melbourne: University of Melbourne, 2012. <http://www.placeresearch.net/pdf/DHARAVI%20report.pdf> (Accessed October 23, 2018).
- [18] Sharma, Kalpana. *Rediscovering Dharavi*. Penguin, 2003
- [19] Chatterjee, Badri. *Untreated sewage has polluted 7 spots along Mumbai's coast*. Hindustan Times, June 19, 2018. <https://www.hindustantimes.com/mumbai-news/untreated-sewage-has-polluted-7-spots-along-mumbai-s-coast/story-K7wlsRVOokcWBi0tK402PL.html> (Accessed October 17, 2018).
- [20] Ibid
- [21] Dobiwala, Imran. *Asia's Largest Slum Dharavi: Redevelopment Plan & It's Challenges*. Master's thesis, AURO University, 2013. Retrieved from <https://edoc.pub/queue/dharavi-2-pdf-free.html>
- [22] *Sound Mapping in noisy/busy/lovely Dharavi*. Mumbai: Word Press, January 26, 2015. <https://dharavibiennale.wordpress.com/tag/recycling/> (Accesses February 8, 2018).
- [23] Ghaneekar, Nikhil. *It's a burning issue in Dharavi*. Mumbai: Hindustan Times, February 04, 2013. <https://www.hindustantimes.com/mumbai/it-s-a-burning-issue-in-dharavi/story-uWRSZUfYu3QpVwCc9Gd4yJ.html> (Accesses February 21, 2018).
- [24] Sharma, Rohit and Arpita Bhagat. *The story of Mumbai's abused, polluted Mithi river is anything but sweet*. Mumbai: Scroll, December 26, 2015. <https://scroll.in/roving/750928/the-story-of-mumbais-abused-polluted-mithi-river-is-anything-but-sweet> (Accesses February 21, 2018).

CHAPTER 2 INFORMAL DEVELOPMENT

2.1 DHARAVI REDEVELOPMENT PLAN

Dharavi is located between downtown and the international airport. Due to the points discussed above, Dharavi is seen as an eye sore. While a small proportion of Dharavi is privately owned, most of Dharavi is legally owned by the State [1].

With the vision of urbanization, the government wants to tear down this community, and expand Mumbai's commercial zone which is across the creek from Dharavi. This would not only lead to about 40% of the slum's population becoming homeless, but also make thousands of people jobless, as 80% of the dwellers works within the multiple illegal small businesses in Dharavi [2].

According to the current redevelopment plan proposed by the government, people who built houses in Dharavi before year of 2000, would be relocated to a legal house of 300 sq. ft. area[3]. This means two things; One – 60% of Dharavi's resident would not be eligible [4]. Second – the ones who are eligible would be downsized from their average 700 sq. ft. homes [5].

Not only this, since most businesses in Dharavi are not registered, they would not be able to continue their livelihood after the redevelopment. The legal businesses, again, would have a tremendously decreased area to carry their trade. Not only this, if the redevelopment happens, India would also lose its largest plastic recycling unit.

The state government of Maharashtra, of which Mumbai is the capital, is trying again and recently put the redevelopment out to tender. A Dubai-based developer backed by royal families from the United Arab Emirates emerged as the highest bidder [6].

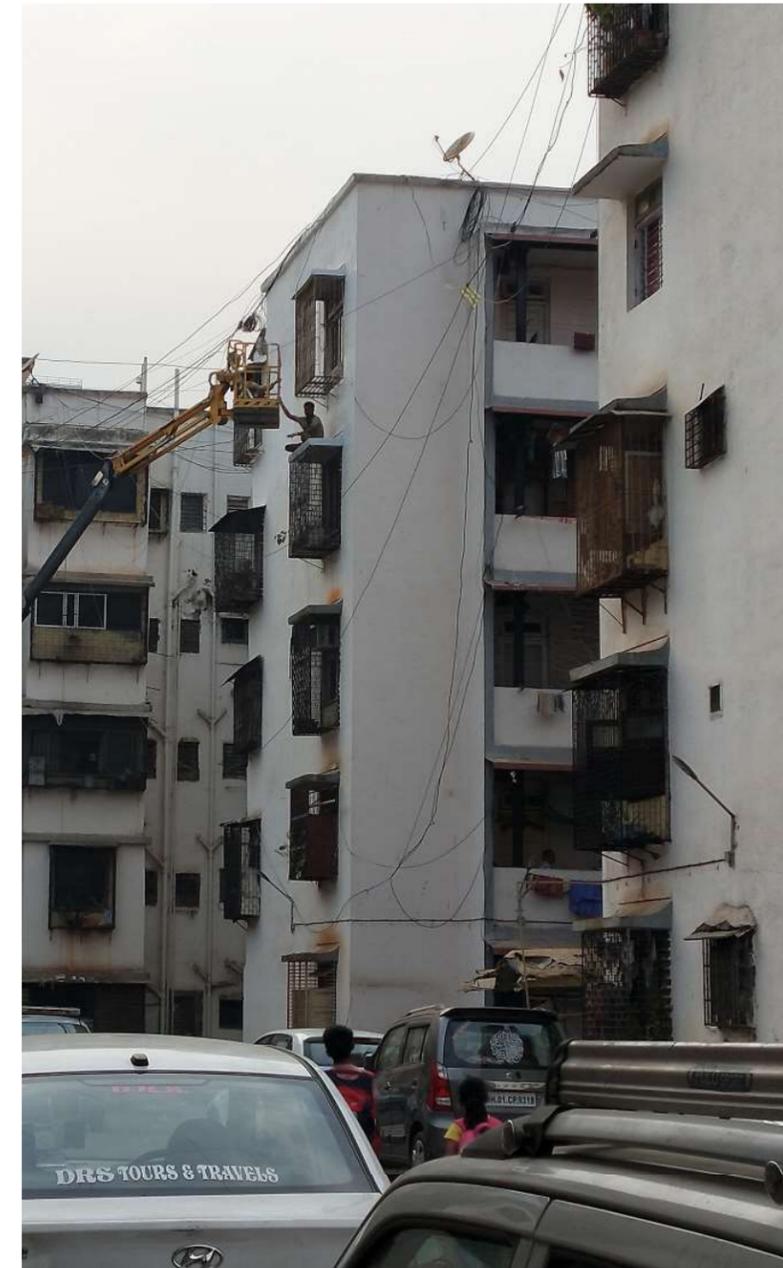


Fig.201 Slum Redevelopment



Fig.202 Proposed Redevelopment (Foster + Partner, 2017)

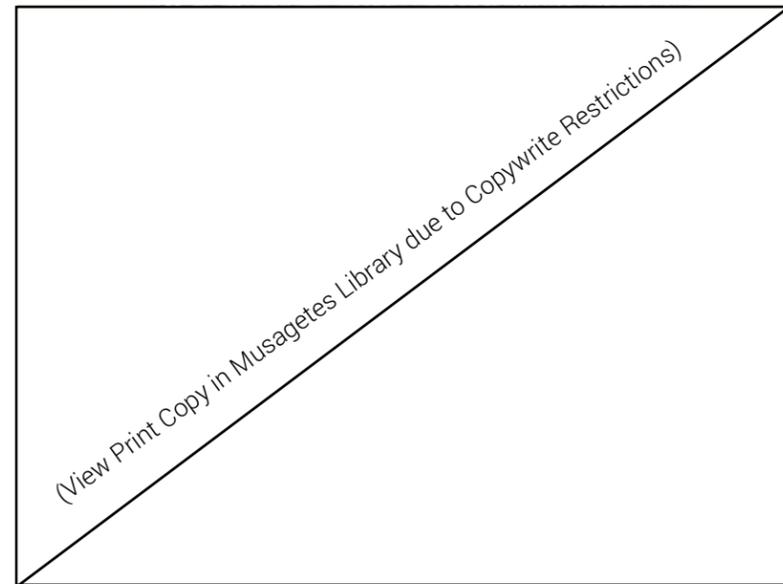


Fig.203 Proposed Proposed Redevelopment (Hafeez Contractor, 2017)

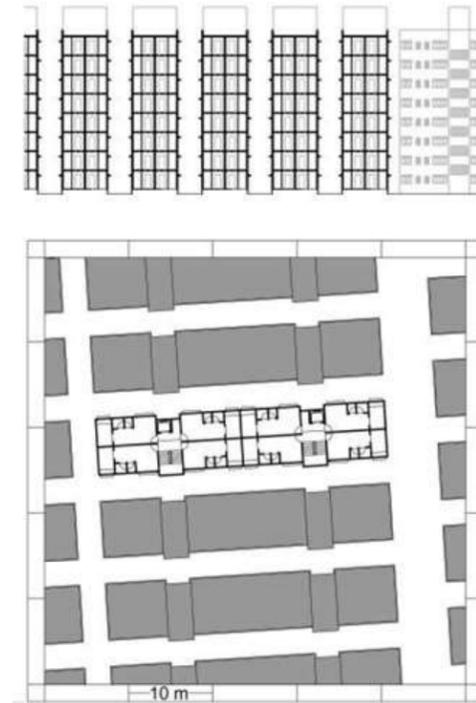


Fig.205 Plan & Section (JJ College, 2010)



Fig.204 Slum Redevelopment (JJ College, 2010)

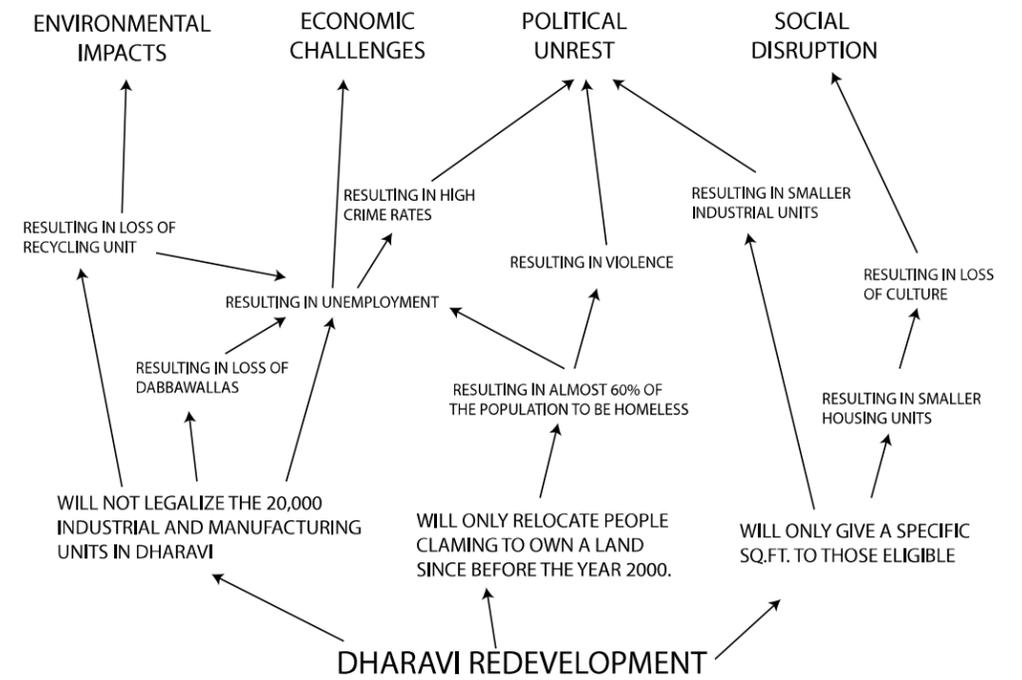


Fig.206 IF Dharavi is Redeveloped

2.2 EVOLUTION OF INFORMAL SETTLEMENTS

'UN-HABITAT defines a slum household as a group of individuals living under the same roof in an urban area who lack one or more of the following:

1. Durable housing of a permanent nature that protects against extreme climate conditions.
2. Sufficient living space which means not more than three people sharing the same room.
3. Easy access to safe water in sufficient amounts at an affordable price.
4. Access to adequate sanitation in the form of a private or public toilet shared by a reasonable number of people.
5. Security of tenure that prevents forced evictions.' [7]

However every city has their own definition and consider three or more of the following criteria to define a slum. They include but are not limited to land legality, construction material, temporary nature, low income, basic services, poverty, crowding etc [8]. However with 20,000 industries specializing in leather, textile, pottery, food processing and recycling; numerous schools and hospitals; multiple religious structures, Dharavi cannot be classified as a slum. It is rather a city within a city.

The reasons for formation of informal settlements vary from industrialization to colonization to droughts to socio-economic change to post war growth [9]. One of the major reasons for population increase in informal settlements is over-urbanization where the majority of the population are born within these settlements.

Different agencies around the world have taken different approaches to developing informal settlements, Six main types of slum redevelopment seen are (i) Turnkey Projects. (ii) Site-and-service. (iii) Slum Upgradation. (iv) Reproductive small towns. (v) Structural reforms. (vi) The NGO revolution [10].

They all have their positives and negatives. Turnkey Projects is where the government relocates the slum dwellers to a different, outskirts location. Site-and-service is where the government provides basic infrastructure on a site and the dwellers build their houses themselves. Slum Upgradation is where basic infrastructure is put in an existing slum condition. Reproductive small towns is where the government provides additional infrastructure and facilities to a town closest to a large city so as to divert the migrants to a different location. Structural reforms is where the land is given to private developers. The NGO revolution is where the NGOs try to help the community in different ways [11].

The government fails to account for all the inhabitants in the settlement and their capability to buy the standard subsidized houses, which more often than not are at the edge of the city, increasing the travel cost for the dwellers. Redevelopment projects concentrate on housing only and do not tackle the (if any) businesses present in the settlements before the redevelopment.

Dharavi is one such example where the industries are a big part of the community and rehousing the dwellers without their businesses would essentially mean taking away their livelihood.

2.3 POSITIVE REDEVELOPMENT

Positive ReDevelopment is a term I coined which in this context means means progressive, non-intrusive re-development. A re-development, which occurs for the benefits of the residents living in the area. Better housing and slum upgrading will contribute to reducing social inequalities and also improving urban safety through their social and spatial impacts. Upgraded slums improve the physical living conditions, quality of life, and access to services and opportunities in cities.

A committed and flexible city government is very important to its success. Policy changes need to be implemented to make it work. There needs to be city programs for implementing low-income urban settlement policy, increasing their scope, improving their effectiveness. The government needs to be present as a long-term stakeholder, rather than the provider of short-term solutions. A sizable financial commitment from the city is important, particularly as a way to build trust with the community.

The changes need to be gradual and non imposing. They need to cater to improve and upgrade he lives of the residents living in these communities. It is important to bridge the gap between the rich and the poor and a positive redevelopment is the key to solving that problem.

The following pages talk about a couple of precedent cities that tried to improve the lives of their citizens by upgrading their informal sectors and not imposing a drastic redevelopment plans.



Fig.208 Dharavi Street Art



Fig.209 **Favela Bairro, Rio-De-Janeiro, Brazil (Dany, 2013)**
Favela Bairro, a slum upgrading program in Rio-De-Janeiro, was a project meant to increase access of the state to previously impenetrable favelas, including public transit, emergency and police vehicles, via paved and widened roads. Residents enjoyed increased mobility as their pathways were better integrated with the formal city's streets. These infrastructure investments played a significant role in increasing the incomes of the urban poor and improving access to basic services such as health, education, housing and transportation [12]. The project involves 253,000 residents in 73 communities. Key to the success of this large project was a committed and flexible city government and the use of intra- and extra-institutional partnerships with NGOs, the private sector, churches, and the general population[13].



Fig.210 **Santo Domingo Savio, Medellín, Columbia (Ivan, 2012)**
The Northeast Comunas, specifically Comunas 1 and 2, were some of the most violent neighborhoods in Medellín, and were characterized by informal squatter settlements, high unemployment rates, and conflict among the (now defunct) Medellín Cartel, paramilitary forces, and local militias[14]. Rather than ignoring the problem or demolishing the troubled areas, the city government chose to actively focus on upgrading transportation and addressing the needs of the communities[15]. The Northeast Integral Urban Project was a city initiative to improve infrastructure in the poorest two zones in the north-west. A scheme for five Library parks was planned, the fourth one built and the most famous of which today is the Spain Library. The project planning included a strong emphasis on the participatory process of the community.

2.4 DEVELOPING DHARAVI

There is definitely a need for an improvement in Dharavi, however, the decisions need to be for the people of Dharavi and not against them. The Government needs to recognize that they do not need to break down Dharavi to create a new commercial hub for Mumbai, because Dharavi itself is a commercial hub.

All the people living in Dharavi need to be compensated proportionately based on their current land possession. Relocating them into buildings with the density of 757,894 / sq km is not only unethical, but also inhumane. Seeing as 80% of Dharavi works within Dharavi, the industries need to be made legal and supported. This would not only increase the economy of Mumbai, but also create more jobs.

There needs to be a pollution policy in place. Mithi river needs to be cleaned. Land pollution needs to be addressed and there needs to be a better garbage collection and disposal system. There also needs to be a better sewage and water system, along with more toilets and proper roads and units built with proper materials, light and ventilations.

However, these changes need to be progressive; they need to be gradual. One of my attempts for the thesis was to create an urban master plan where I suggest that the change needs to start with some key projects, and gradually develop Dharavi part by part over the course of several years.

My thesis concentrates on designing an institute that would mark the beginning of a positive change.



Fig.211 Dharavi

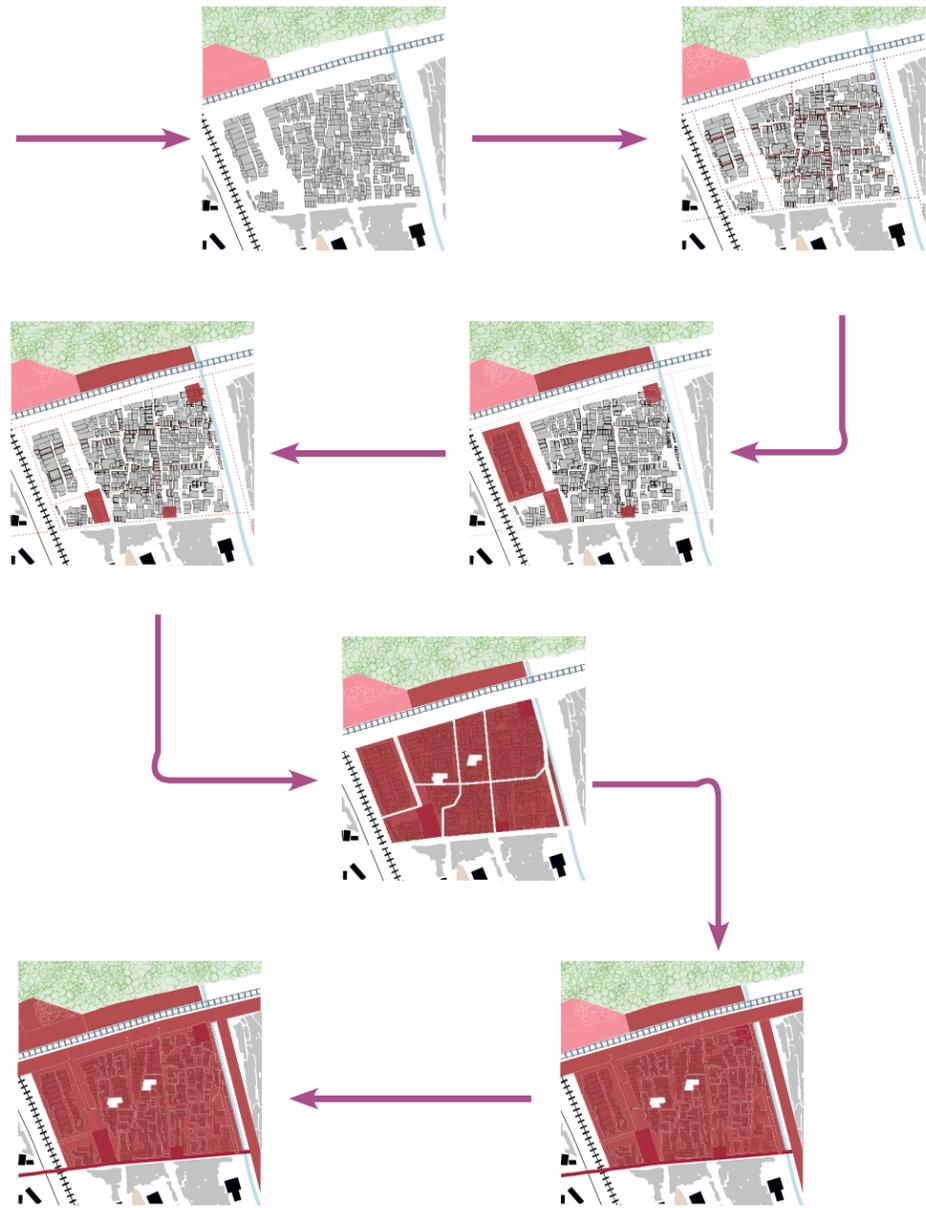


Fig.212 Conceptual Representation of Gradual Development
Attempted Proposal in December 2018

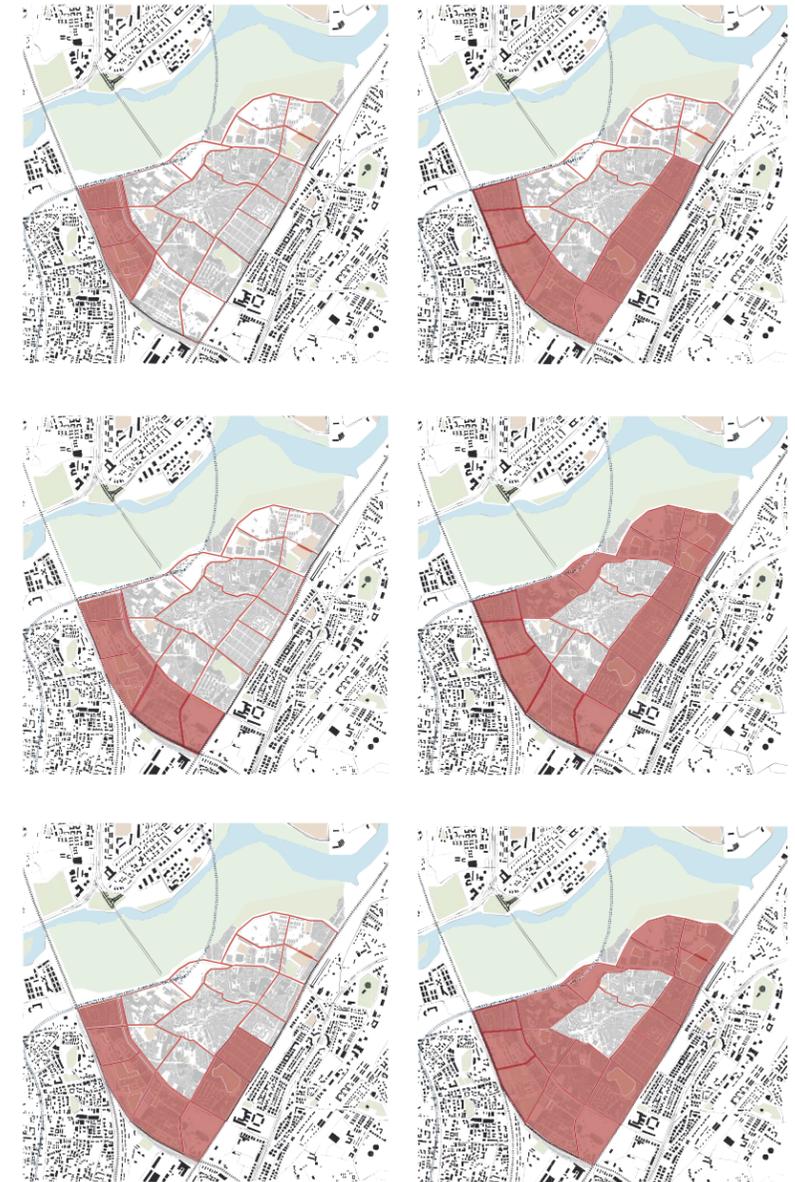


Fig.213 Conceptual Representation of Gradual Development
Attempted Proposal in December 2018



Fig.214 **Street Upgradation and opening of Spaces**
Attempted Proposal in February 2019

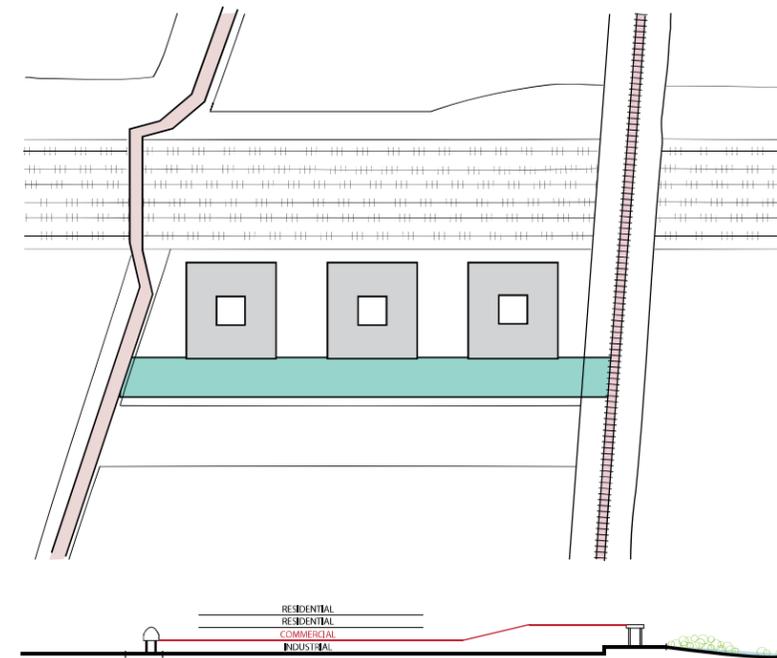


Fig.215 **Redevelopment Prototype**
Attempted Proposal in October 2018

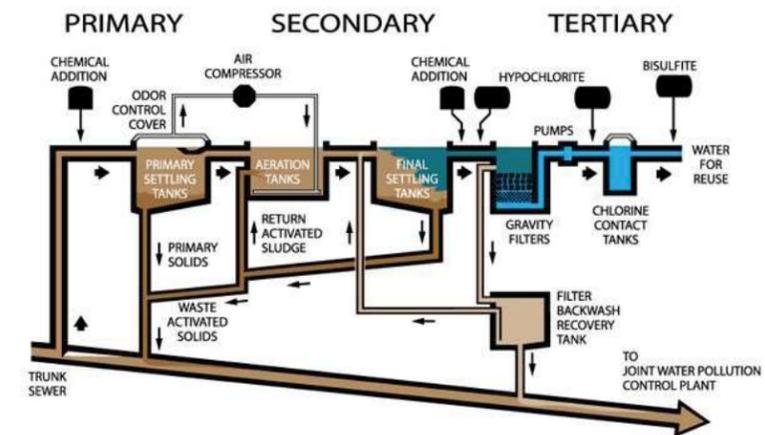


Fig.216 **Water Filtration (Bryce, 2016)**
Attempted Proposal in April 2019

From trying to propose a prototype unit that can be used in redevelopment to proposing an urban scheme to concentrating on street upgradation to trying to propose a filtration unit, this project has jumped through a lot of hoops.

END NOTE:

[1] Dovey, Kim. Tomlinson, Richard. *DHARAVI informal settlements & slum upgrading*. Melbourne: University of Melbourne, 2012. <http://www.placeresearch.net/pdf/DHARAVI%20report.pdf> (Accessed October 23, 2018).

[2] Weinstein, Liza. *The Durable Slum : Dharavi and the Right to Stay Put in Globalizing Mumbai*, edited by Inc ebrary. Minneapolis: University of Minnesota Press, 1977-. 2014.

[3] Dovey, Kim. Tomlinson, Richard. *DHARAVI informal settlements & slum upgrading*. Melbourne: University of Melbourne, 2012. <http://www.placeresearch.net/pdf/DHARAVI%20report.pdf> (Accessed October 23, 2018).

[4] Ibid.

[5] 5Weinstein, Liza. *The Durable Slum : Dharavi and the Right to Stay Put in Globalizing Mumbai*, edited by Inc ebrary. Minneapolis: University of Minnesota Press, 1977-. 2014.

[6] Hutchison, Peter. "Mumbai slum-dwellers fear Dharavi redevelopment." AFP, June 20, 2019. Accessed July 3, 2019. <https://news.yahoo.com/mumbai-slum-dwellers-fear-dharavi-redevelopment-035232028.html>

[7] UN-Habitat. *The Challenge of Slums: Global Report on Human Settlements, 2003*. London: Earthscan Publications, 2003.

[8] Ibid.

[9] Davis, Mike. *Planet of Slums*. London: Verso. 2006.

[10] Gonzalo Lizarralde. *The Invisible Houses*. New York: Routledge Ltd, 2015.

[11] Ibid.

[12] Handzic, Kenan. *Favela Upgrading in Rio de Janeiro, Brazil* - Garden Works.The World Bank Group, 1999-2001.http://liu.xplorex.com/sites/liu/files/Publications/HumanSecurityAndCities/Handzic_Favela_Upgrading_in_Rio_de_Janeiro_Brazil.pdf (Accessed October 3, 2018).

[13] FAVELA-BAIRRO PROJECT, BRAZIL - web.mit.edu. <http://web.mit.edu/urbanupgrading/upgrading/case-examples/ce-BL-fav.html>

[14] Bullivant, Lucy. *Masterplanning Futures*. Abingdon, Oxon ; New York: Routledge, 2012

[15] *Medellín, Colombia: A Case Study for Healthy Cities*. Healthy Medellin. <https://healthymedellin.weebly.com/northeast-comunas.html> (Accessed November 26, 2018).

3.1 APPROACH

Image can be a tricky thing. People often judge by what's on the surface than what's inside. Slums are believed to be places that no one wants to live in. They have the reputation of being dirty and dangerous. The Government currently does not recognize the potential of Dharavi. People living in Mumbai (outside Dharavi) perceive Dharavi to be like a stereotypical slum.

However, we have established that Dharavi is not a slum. It is a place of culture and hard work and lots and lots of potential. The first step of creating positive changes in Dharavi is to influence public perception: to present Dharavi as a vibrant place that is worth saving. Hence my thesis proposes a visiting center for tourists and Mumbaikars.

The idea is to create an institution where people can learn about the positive aspects of Dharavi. It would be the first stop for the blooming slum tourism where the tourists can learn correct information before they continue their visit within the settlement.

This project not only seeks to educate the people living outside Dharavi of its importance, but also cater to educating the people within. The industries in Dharavi are well organized and the people have come to form a kind of a symbiotic relationship. However, that does not mean that everything is perfect. There are room for improvements in each major industry. Hence this design also proposes a workshop providing solution to one major drawback in each industry.

The aim is to educate the workers of better practices in their respective industries, giving them the opportunity to learn and incorporate their education in their own businesses.

This project will not only merge the gap between the people living in Dharavi and people living outside of Dharavi, but also merge the boundaries between the different communities working within the settlement. This project will give a chance to bring people together and lobby for a positive change for Dharavi.

This design also provides the workers with a place to showcase their work in an exhibition space which gives the tourists the opportunity to not only see different industries working together in a single place, but also see the beauty of their finished products. The goal is to give the tourists a small preview of Dharavi, giving them the opportunity to decide whether or not they want to go within the settlement and see more.

One of the strategies to bring people to visit the institution is by creating public awareness. Creating mobile exhibitions and showcasing them around the city. 'Kala Ghoda Art Festival' is one of the annual festivals in downtown that exhibits various installations that is viewed by thousands of people. The idea is to present a unique piece of work that portrays the Essence of Dharavi as a means to attract people to the site.



Fig.301 Proposed Design

3.2 CONCEPT

Water is essential for human life. Humans cannot go a day without water. Water is not only necessary for survival but it also has importance due to religious aspect and women hygiene.

However, acquiring water has always been a struggle to mankind and Dharavi has been no different. Originally being a marshy island, Dharavi and a river flowing next to it, Dharavi was never short of fresh water. The river was rightfully named “Mithi River” which translates to Sweet River.

However, due to overpopulation and rapid growth of Mumbai, the river was slowly reclaimed and mangroves torn down. The river slowly became polluted and now has the highest faecal coliform (FC) content, a bacterium found in human and animal faeces, 16 times the safe limit. Meanwhile, the level of biochemical oxygen demand (BOD) – indicating the level of oxygen that aquatic life need for survival – is six times the safe limit.

This project not only acts an institute including interpretation centre, exhibition space and industrial workshop, but is also a water filtration prototype to clean the now polluted river. The idea is to have several of such filtration areas across the river that not only cleans the river but also atc an an amenity to the city.

Water filtration is the key concept behind the design of this project.

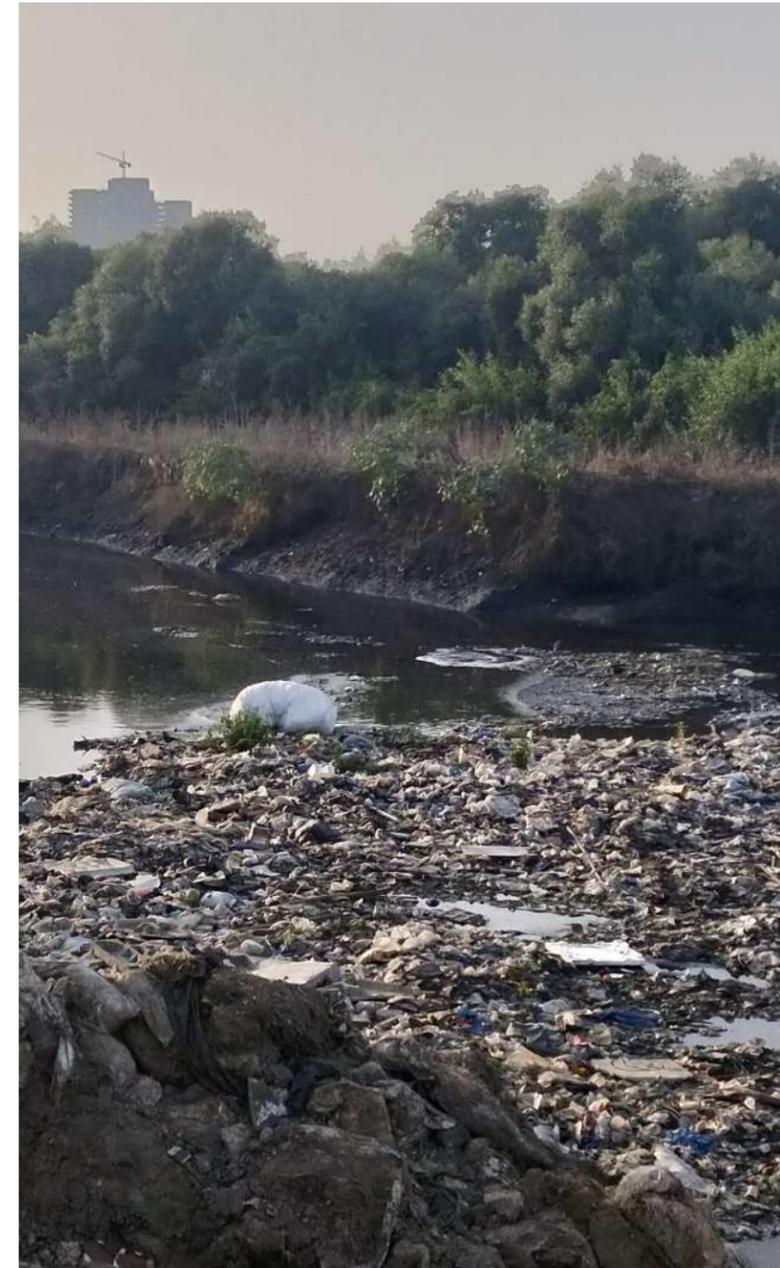


Fig.302 Polluted River

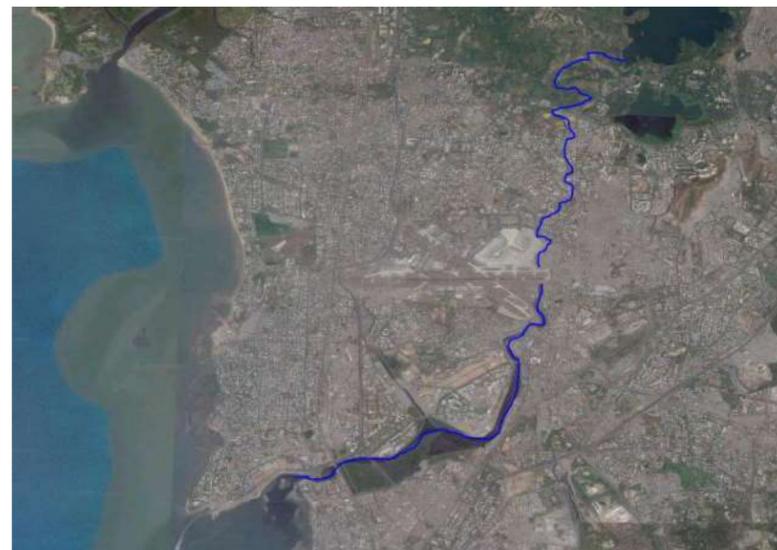


Fig.303 Map of Mithi River (Stephanie, 2009)

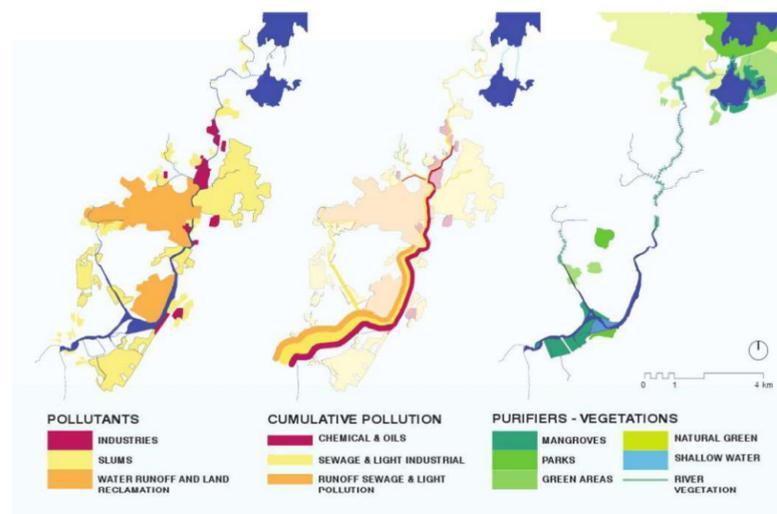


Fig.304 Mithi River Analysis (Stephanie, 2009)

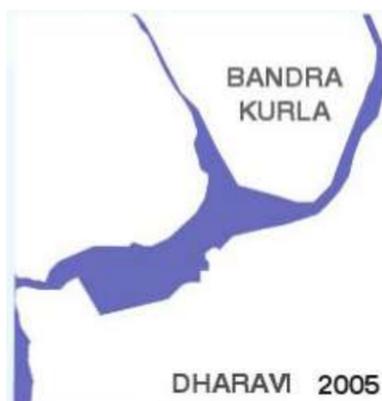
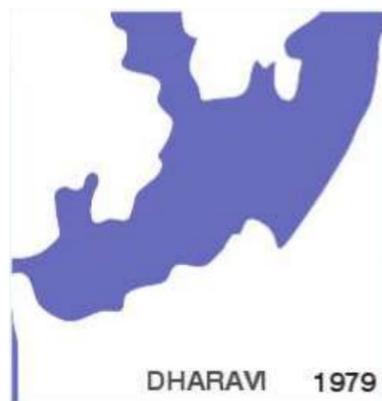


Fig.305 River over the years (Stephanie, 2009)

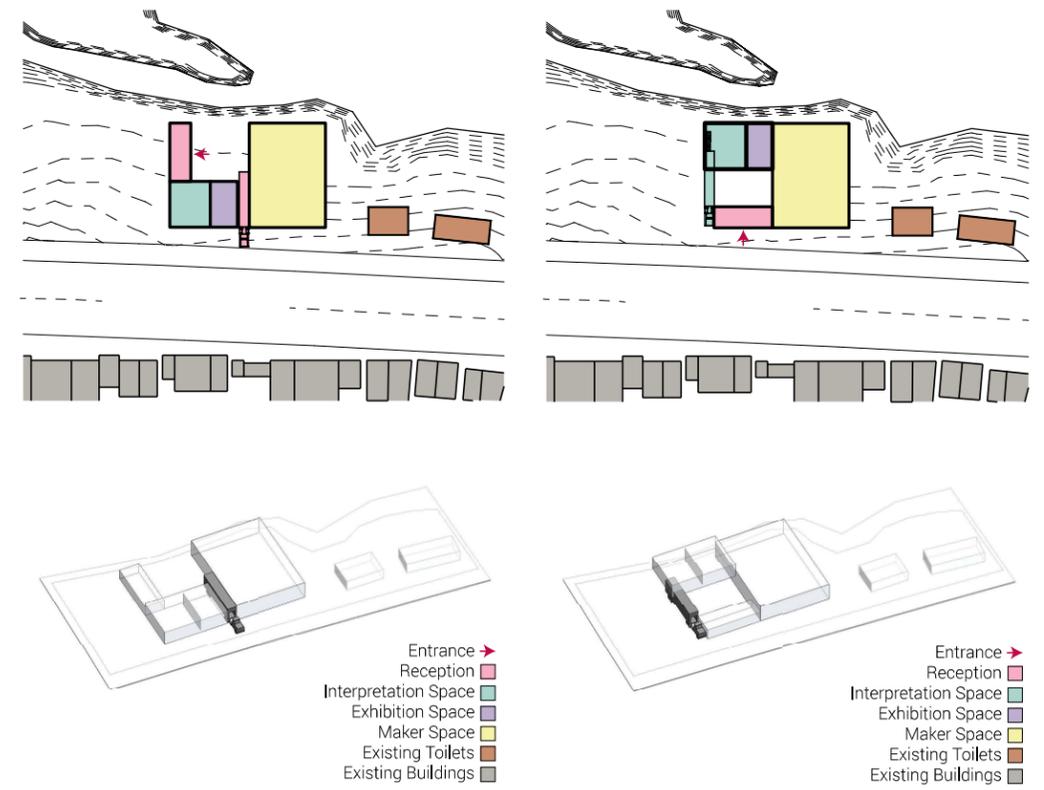
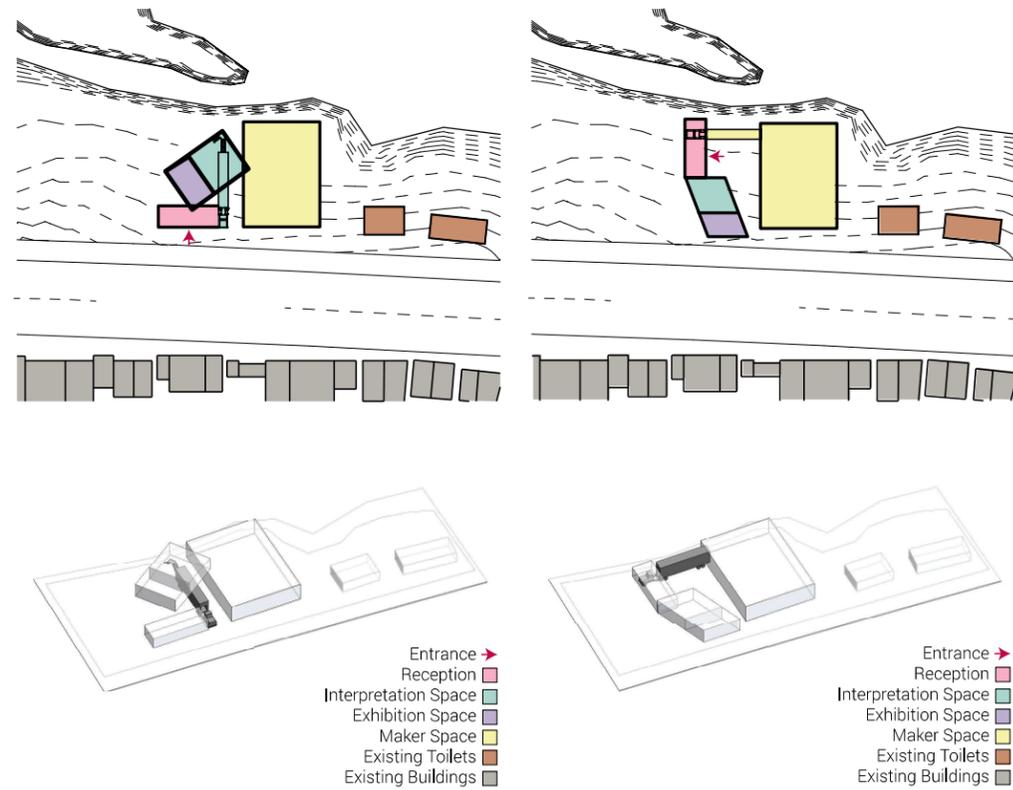
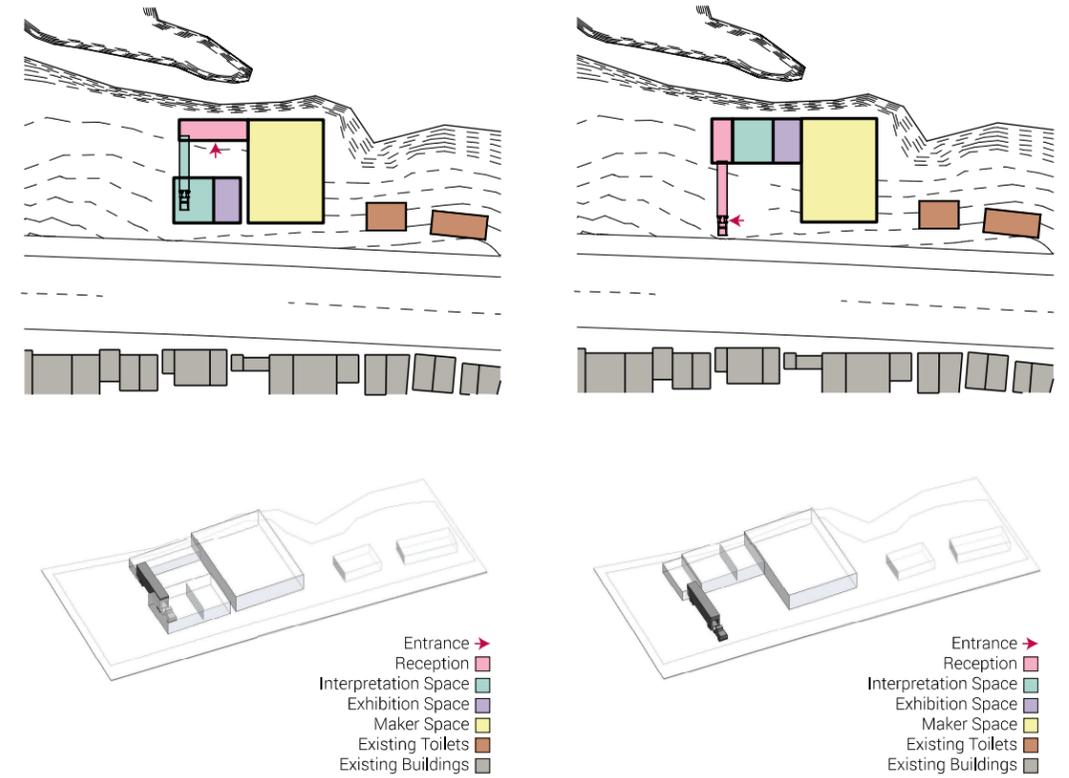
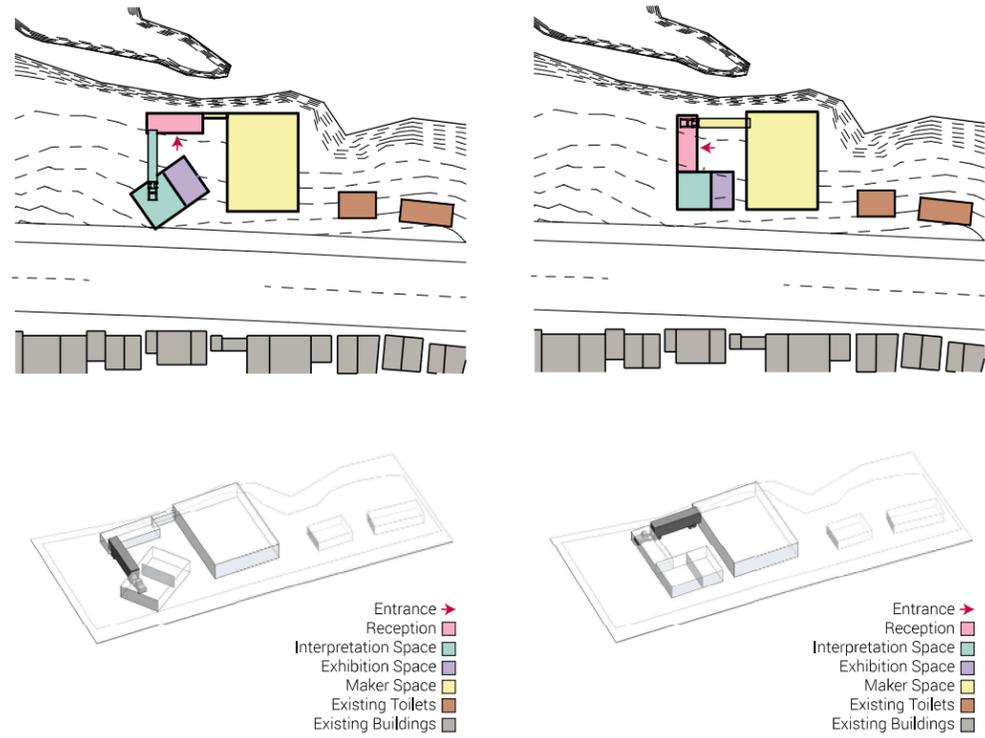


Fig.306 Massing Study

Fig.307 Massing Study

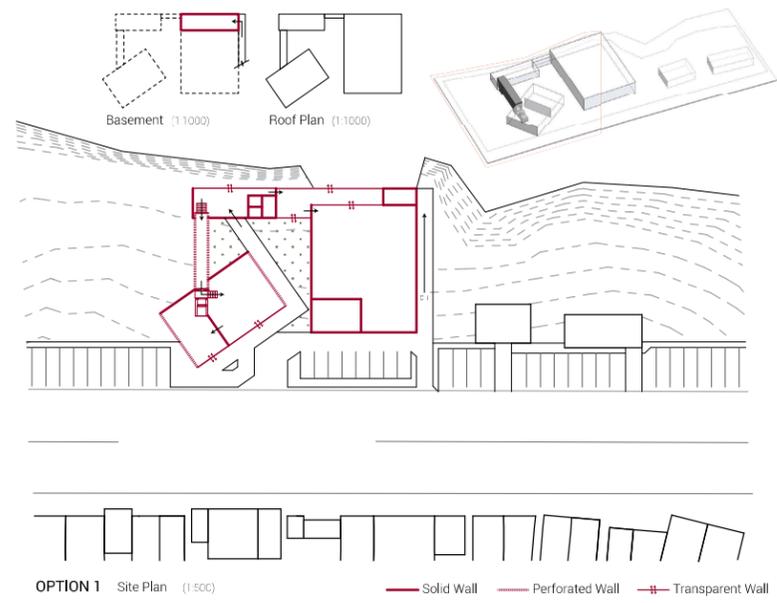


Fig.308 Design Options

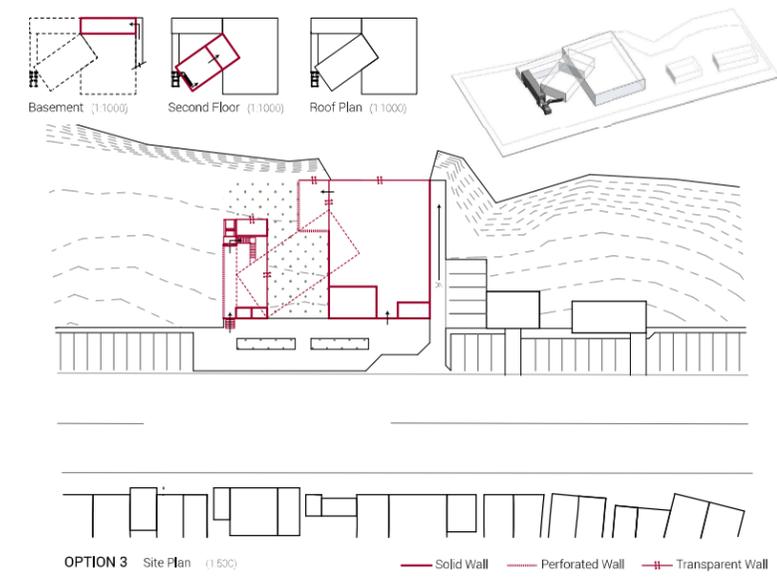


Fig.309 Design Options

3.3 SITE

As mentioned before, residents of Mumbai are afraid to go within Dharavi due to their misguided perception of the place. It is essential to locate the project site at the edge of the settlement so that people are not afraid to enter the institution.

The slum tourism often starts at the recycling unit, hence to make it the first stop of tourism, it was also essential that the design be placed near the recycling compound. And lastly, the site needed to be near a water inlet in order to design a water filtration prototype to help clean Mithi river.

The site chosen fits all three criteria. It is a mangrove preserve site where the mangroves haven't been torn apart and filled with garbage. It currently acts as a truck parking place. Due to the water inlet on one side and the recycling unit on the other, recyclers often come here to wash their materials in the river, hence further polluting the river.

The site being at the edge of Dharavi with a major road connecting BKC and the international airport on one side and downtown on the other while having two train stops at walking distance makes the site easily accessible to other people in Mumbai, who can freely come to the institute and learn about Dharavi without feeling apprehensive about going within Dharavi with the perception of it being dirty and dangerous.

By placing the design at the juxtaposition of two worlds, the project aims to merge boundaries.



Fig.310 Existing Site



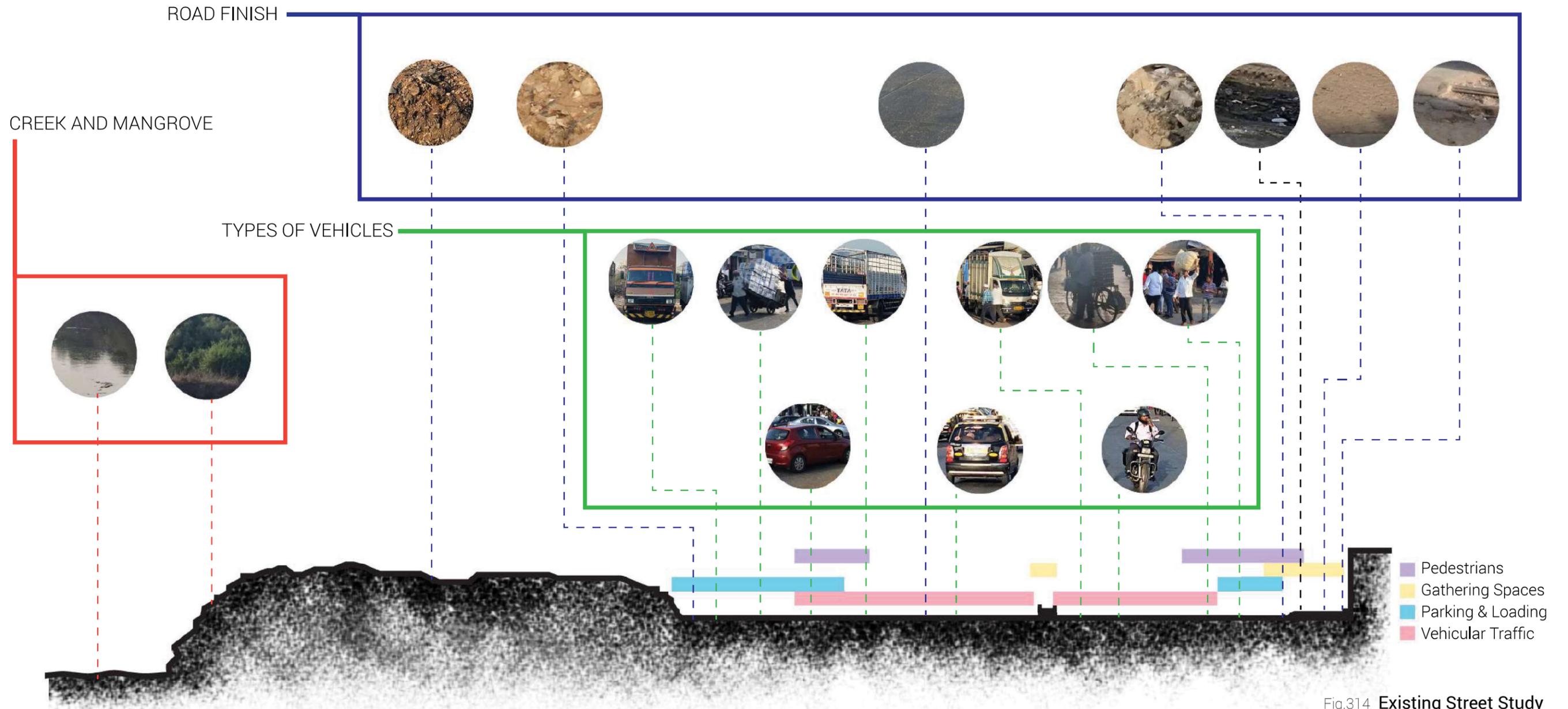


Fig.314 Existing Street Study

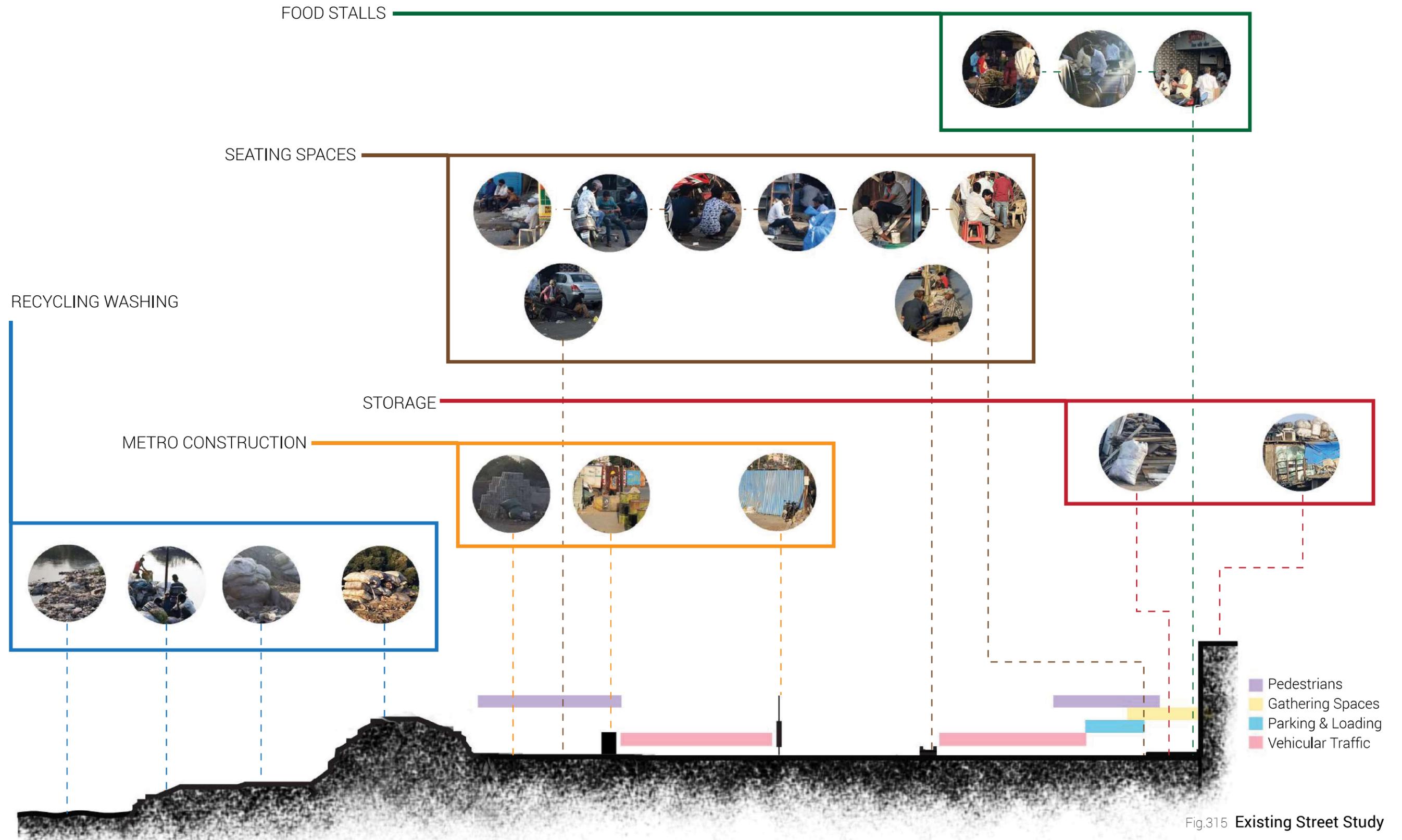


Fig.315 Existing Street Study

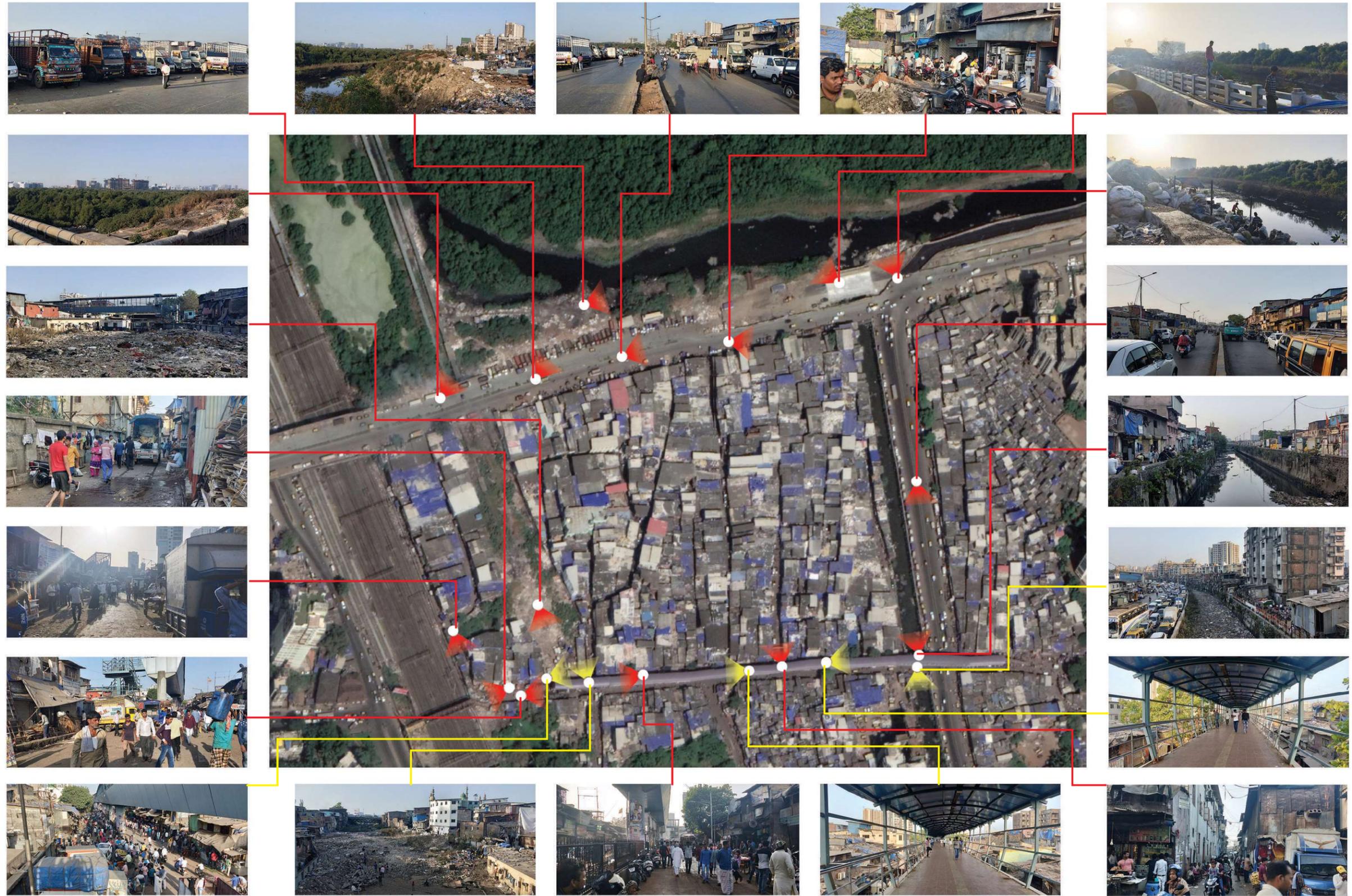


Fig.316 Context Photos

3.4 DESIGN

This project has three different programs: Interpretation Centre, Workshop and Water Filtration.

The interpretation centre educates the visitors about Dharavi and allows them to see the works exhibited by the workers. The Workshop caters to one major drawback in each industry by providing better solutions. The filtration unit is an eco-logical filtration system that acts as a prototype to cleaning the Mithi River.

Each program has its separate entrance and circulation. To symbolize current use of the existing site, i.e. truck parking; the entrance to the interpretation centre is through a truck leading the visitor to the reception area. Going up the stairs would take the visitors to the terrace with chairs and shade to sit on and relax and enjoy the hustle-bustle of Dharavi, while also having a fabulous view of the mangroves and the river, with modern office buildings in the background.

Adjacent to the terrace is the interpretation and exhibition space where the visitors would learn about Dharavi and also see some exhibits put together by the residents of Dharavi. Once in the space, the visitor could either go down to the courtyard with a water feature or exit onto the second terrace.

Due to the second terrace being a part of the workshop, a couple of steps leading to a different plane acts as a security buffer between the visitors and the workshop. The vis-

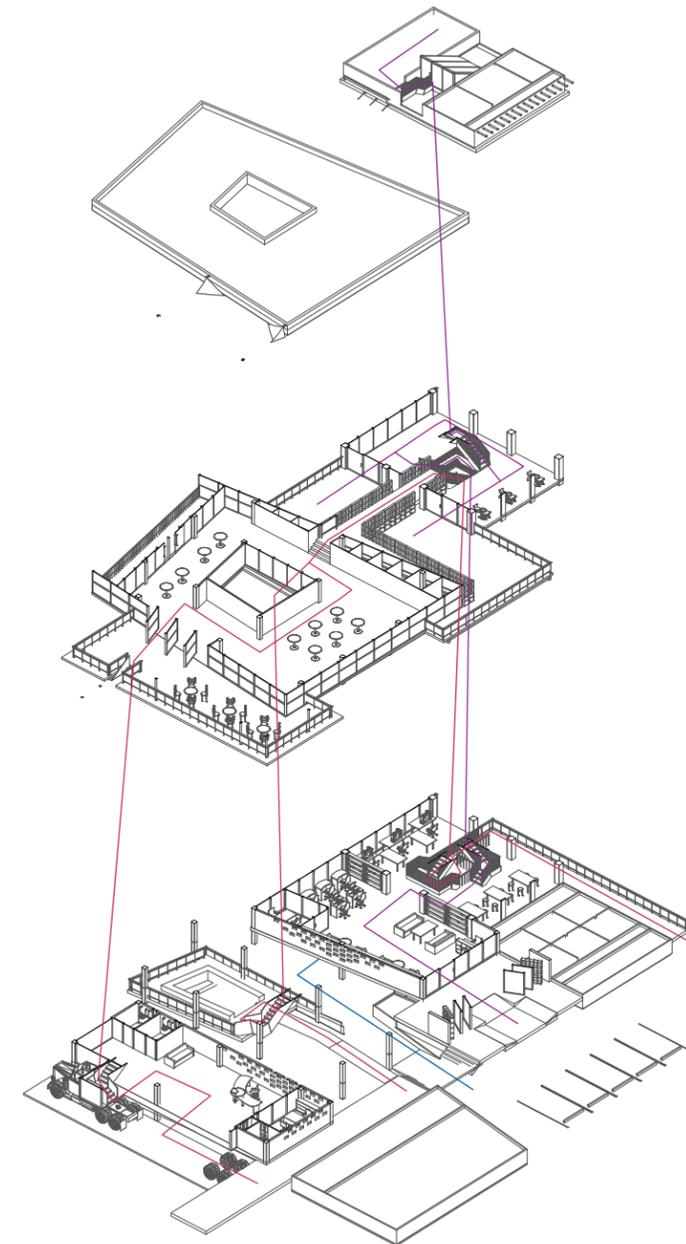


Fig.317 Circulation Diagram

itors can choose to follow the raised platform leading into the workshop where a set of stairs would lead the visitors into the main workshop level and finally leading them out.

The workshop entrance is in front of the proposed parking, making it easier to load and unload things from the workshop. The entrance has six grand panels showcasing the essence of each major industries in Dharavi. Entering the workshop would bring the workers to the reception and library where they can sign up to use the workshop.

The area adjacent to the library is divided into two parts. One caters to the textile industry, and the other is an open communal space to promote the different industries to merge and work together. A separate set of stairs leads the workers to the second floor where one half is dedicated to the leather industry while the other half is for the potters. The 'second terrace' mentioned earlier as a part of the workshop is a place for the leather workers and potters to sun and air dry their products.

The potters also occupy half of level three where they would fire up the kilns in order to finish their products. In order to avoid heating the floor below, there is a buffer between the kiln and the floor. The buffer includes an air gap below a wet sand bed. The sand acts as a step to water purification to the project.

The third entrance is for the recyclers to go to the lowest level; i.e. at the water level where there is a separate place for them to wash their recyclables. The proposed washing would prevent the river from polluting further. The water

for this area would be pulled in from the river, and after exiting the washing area, the water would go through a series of living machines for purification before going back in the river. The idea is that this project acts as a prototype for Mithi river rejuvenation and can potentially be placed as different amenities at a certain interval throughout the river.

The construction materials used for this project are the materials seen in the fabric of Dharavi. Brick, wood panels and corrugated metal sheets that are often used as building materials in Dharavi, are used as facades for the design. The floors are in-situ concrete, and the structure is supported by concrete beams and columns. The stairs and railings throughout the project is built out of perforated metal panels.

Since Mumbai is always hot and humid, the openings in bricks, perforations in metal sheets and openable wood panels create a constant airflow in the building. The water flow in and around the building acts as a way for evaporative cooling, reducing the need for artificial air conditioning. Various massing decisions including the idea of a courtyard is inspired by the current massing and functioning of Dharavi.

This project aims to prove that a gradual, non-imposive redevelopment is the way to go ahead with the ever-growing problem of informal housing. In order to save Dharavi, a place that is an entire city within a city, the first step is to create awareness among people and start merging boundaries.

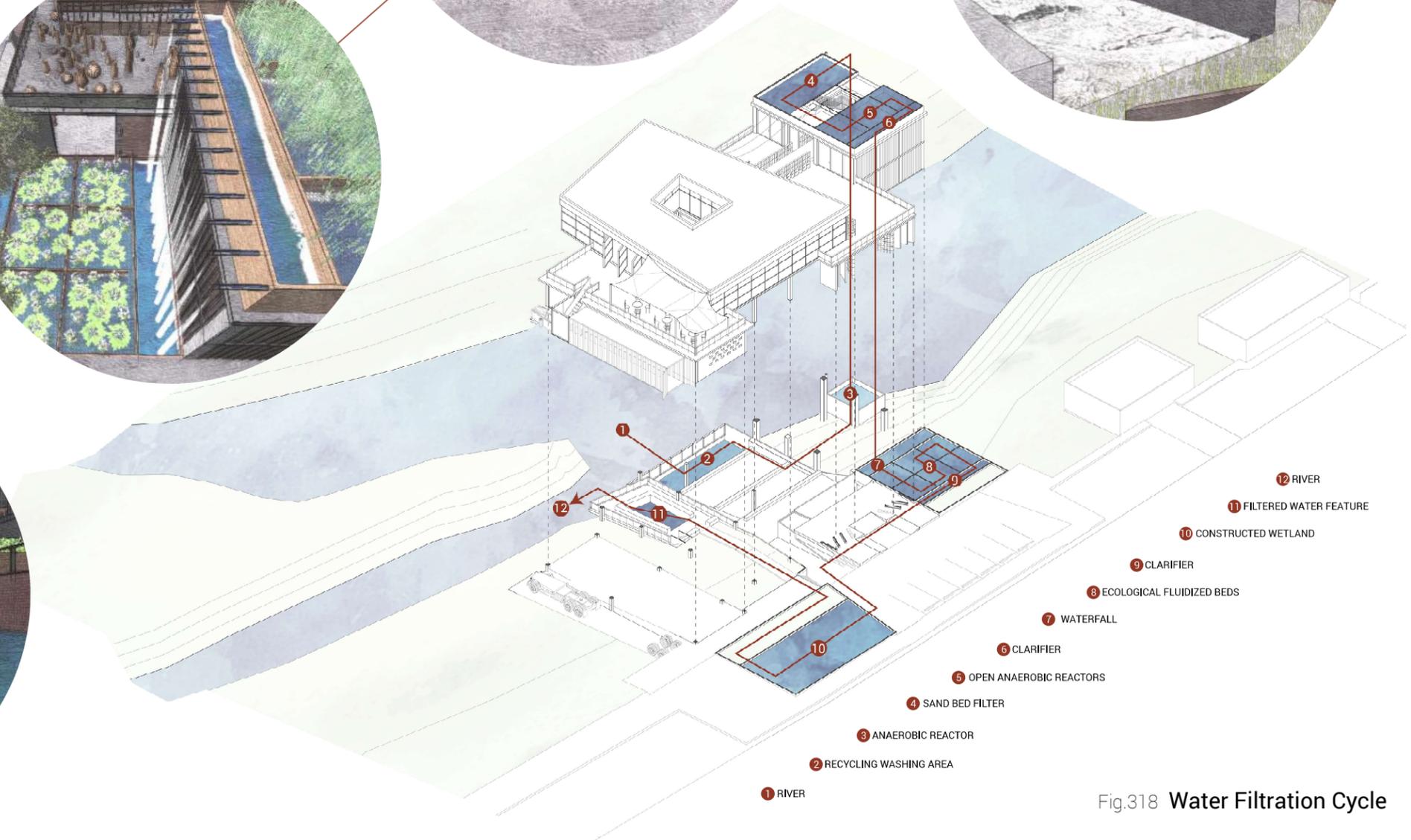
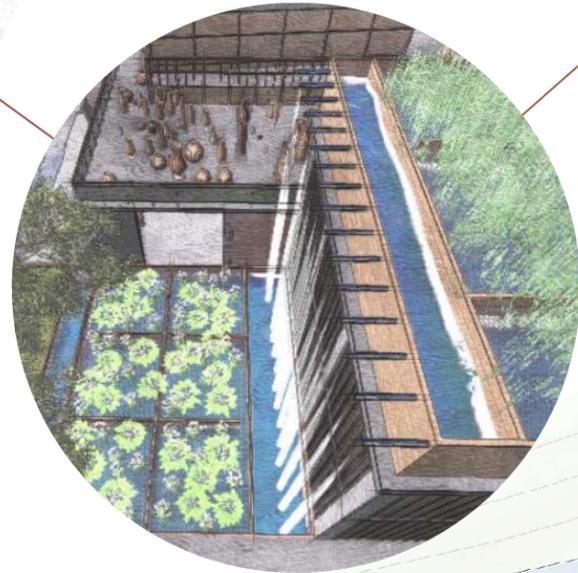


Fig.318 Water Filtration Cycle

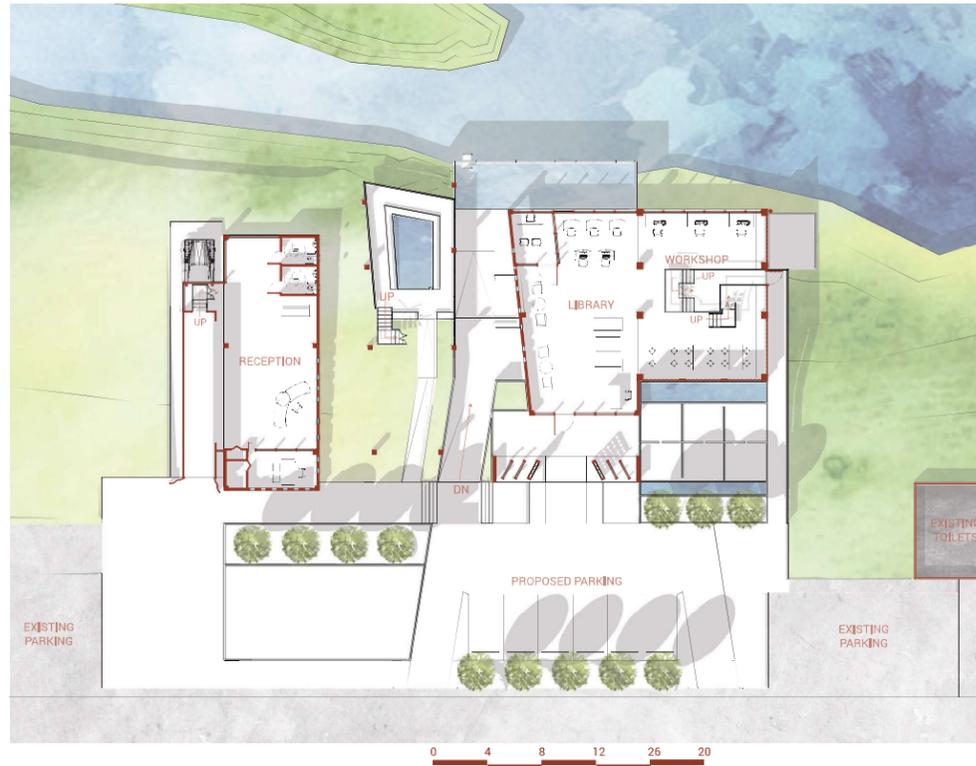


Fig.319 Main Floor Plan



Fig.321 Below Grade Plan

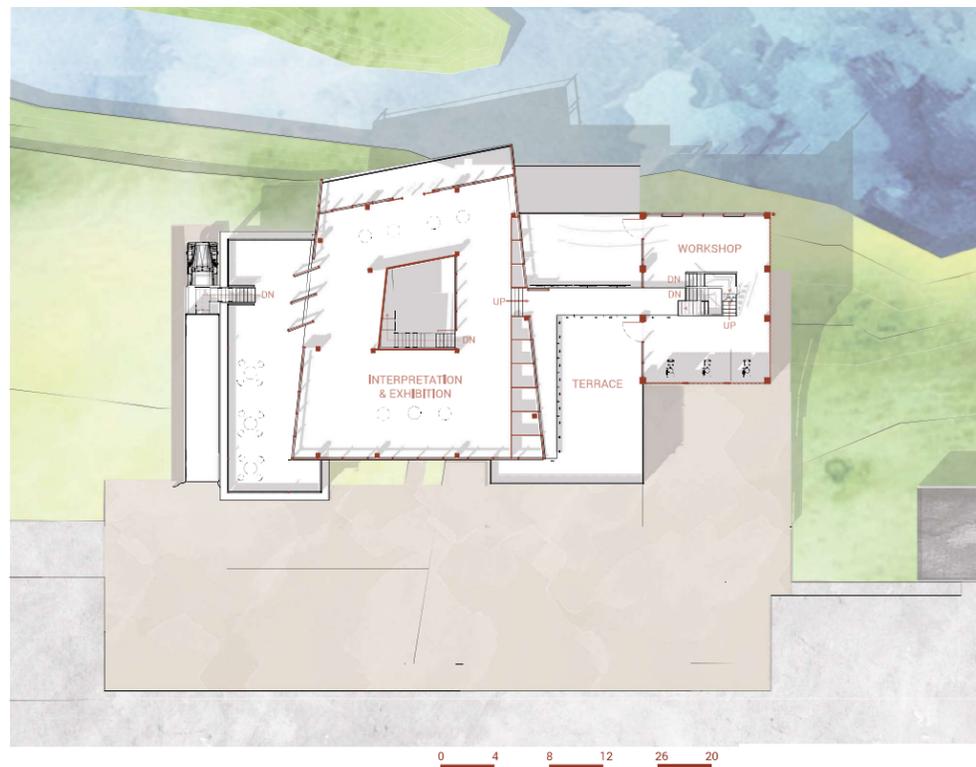


Fig.320 Second Floor Plan



Fig.322 Roof Plan



Fig.323 Section A



Fig.324 Section B



Fig.325 Section C



Fig.326 Bird's Eye View



Fig.328 From the river



Fig.327 Entrance to Visitor Centre



Fig.329 Entrance to Workshop



Fig.330 Entrance Panel Representing Each Industry



Fig.332 Water Feature



Fig.331 Recycling Washing Area



Fig.333 Visitor Reception

CONCLUSION

With the world's population on a constant rise, migration has certainly played a huge factor in people moving to megacities in search of a better life. This migration has contributed directly to the boom in informal settlements in such megacities.

Different governments have tried various redevelopment strategies over the years, from complete demolition of such communities to other more subtle less violent and more inclusive strategies.

As Mike Davis says in his book Planet of Slums, "Not all urban poor, to be sure, live in slums, nor are all slum dwellers poor." Rio-De-Janeiro and Medellin have recognized this and have taken steps to gradually and positively redevelop their informal settlements in a non-imposing manner and Mumbai needs to do the same.

The changes need to be gradual and non imposing. They need to cater to improve and upgrade the lives of the residents living in these communities. It is important to bridge the gap between the rich and the poor and a positive redelopment is the key to solving that problem.

Coming with a solution to Dharavi's threat of redevelopment was a big challenge of this project. From trying to propose a prototype unit that can be used in redevelopment to proposing an urban scheme to concentrating on street upgradation to trying to propose a filteration unit, this project has jumped through a lot of hoops.

This project aims to prove that a gradual, non-imposive redevelopment is the way to go ahead with the ever-growing problem of informal housing. In order to save Dharavi, a place that is an entire city within a city, the first step is to create awareness among people and start merging boundaries.

The interpretation center is aimed at being one of the first steps towards showing the government as well as the world of the poten-

tial within Dharavi. I anticipate that as more people become aware of the economic conditions and political conditions here, the more resistance they would be against the government's efforts to bring down such a thriving community which is home to a lot of families. The interpretation center would also look to encourage investment into various sectors of small industries that operate within Dharavi. This has the potential to slowly upgrade the amenities and standard of living here and with the right investment by the state government here, just like in Rio and Medellin, we could see a huge improvement in what Dharavi is.

This project also acts as a water filtration prototype to clean the now polluted river. The idea is to have several of such filtration areas across the river, hence rejuvenating the river. The prototype not only cleans the river but also act as an amenity to the city.

One of the strategies to bring people to visit the institution is by creating public awareness. Creating mobile exhibitions and showcasing them around the city. 'Kala Ghoda Art Festival' is one of the annual festivals in downtown that exhibits various installations that is viewed by thousands of people. The idea is to present a unique piece of work that portrays the Essence of Dharavi as a means to attract people to the site. This is a concept that can be a reality. My next step after this thesis would be to co-ordinate with people of Dharavi and plan an instillation in next year's Kala Ghoda Art Festival.

I do not believe all slum dwellers are poor, and this project should be seen a stand against the government's methods of redevelopment and show them that there are better ways to go about it. However, the question remains, will Dharavi be an example to the rest of the world, in proving that high-rise is not the only to solve the city's density problems? The world does not need more building blocks, it needs more Dharavi.

LETTER OF COPYRIGHT PERMISSION FOSTER + PARTNER

9/11/2019

Mail - tanvi.kundliwal@uwaterloo.ca

RE: Permission to use an image for Masters Thesis

Katy Harris <kharris@FosterandPartners.com>

Tue 9/10/2019 4:46 AM

To: Tanvi Amarsingh Kundliwal <tanvi.kundliwal@uwaterloo.ca>;

Cc: Zoe Fields <zfields@FosterandPartners.com>;

Dear Tanvi

Yes that is fine to use the image as long as you credit it Foster + Partners. If you would like further information on our proposals for Dharavi let me know.

Thanks very much
Katy

Katy Harris
Senior Partner, Head of Communications
Foster + Partners
Riverside, 22 Hester Road
London SW11 4AN
T +44 20 7738 0455
D +44 20 7943 6266
kharris@fosterandpartners.com
fosterandpartners.com

From: Tanvi Amarsingh Kundliwal <tanvi.kundliwal@uwaterloo.ca>
Sent: 08 September 2019 21:12
To: Press <press@FosterandPartners.com>
Subject: Permission to use an image for Masters Thesis

Hello,

I am a Master of Architecture Student at the University of Waterloo. My thesis project is titled "Dharavi: Merging Boundaries" and I would like to ask your permission to use the attached image in my thesis as a reference to different re-development plans proposed by different firms.

Sincerely,

Tanvi Kundliwal.

Foster + Partners Limited | Registered in England and Wales | CRN + 01644989

<https://connect.uwaterloo.ca/owa/#path=/mail/inbox>

1/1

Bibliography

- Bullivant, Lucy. 2012. *Masterplanning Futures*. Abingdon, Oxon ; New York: Routledge.
- Burdett, Richard, Deyan Sudjic, London School of Economics and Political Science., and Alfred Herrhausen Gesellschaft für Internationalen Dialog. 2011. *Living in the Endless City : The Urban Age Project by the London School of Economics and Deutsche Bank's Alfred Herrhausen Society*. London: Phaidon Press; Phaidon Press Ltd.
- Campana Joseph. 2013. *Dharavi the City Within*. Utter Pradesh, India: HarperCollins Publishers.
- Carrera, Judit and Magda Anglès. 2010. *In Favour of Public Space : Ten Years of the European Prize for Urban Public Space*. Barcelona : Barselona/Basel/New York: Published by Centre de Cultura Contemporània de Barcelona : ACTAR ; Distribution, ActarBirkhäuserD.
- Childs, Mark C., 1959-2004. *Squares : A Public Place Design Guide for Urbanists*. Albuquerque: University of New Mexico Press.
- Davis, Mike. 2006. *Planet of Slums*. London: Verso.
- Fabian Frenzel, Ko Koens, and Malte Steinbrink, eds. 2012. *Slum Tourism. Contemporary Geographies of Leisure, Tourism and Mobility*, edited by Micheal Hall. Vol. 32. London: Taylor and Francis.
- Fernández Per, Aurora. 2008. *The Public Chance : Nuevos Paisajes Urbanos = New Urban Landscapes*, edited by Javier Arpa. Vitoria-Gasteiz, Spain: a+t ediciones.
- Gaventa, Sarah. 2006. *New Public Spaces*. London: Mitchell Beazley.
- Gehl, Jan, 1936- author. 2013. *How to Study Public Life*, edited by Birgitte Svarre author. Washington, DC: Island Press.
- Gehl, Jan, 1936-. 2003. *New City Spaces*. 3rd ed. ed. Copenhagen: Danish Architectural Press.
- Goltsman, Susan M. and Daniel S. Iacofano. 2007. *The Inclusive City : Design Solutions for Buildings, Neighborhoods and Urban Spaces*. Berkeley, Calif.: MIG Communications.
- Gonzalo Lizarralde. 2015. *The Invisible Houses*. New York: Routledge Ltd.
- Hernández, Felipe, Peter Kellett, and Lea Allen. 2010. *Rethinking the Informal City. Remapping Cultural History*. Vol. 11. Oxford: Berghahn Books.
- Lizarralde, Gonzalo. 2002. *Organizational Design, Performance and Evaluation of Post-Disaster Reconstruction Projects*.
2000. *Reconstruction Management and Post-Disaster Low-Cost Housing: The Case for Social Reconstruction*. Montreal:
2011. *Stakeholder Participation and Incremental Housing in Subsidized Housing Projects in Colombia and South Africa*. Vol. 35.
- Lizarralde, Gonzalo and Mark Massyn. 2008. *Unexpected Negative Outcomes of Community Participation in Low-Cost Housing Projects in South Africa*. Vol. 32.
- McCandless, David. 2009. *The Visual Miscellaneum : A Colorful Guide to the World's most Consequential Trivia*. New York: Collins Design.
- McLeod, Ruth and Kim Mullard, eds. 2006. *Bridging the Finance Gap in Housing and Infrastructure. Urban Management Series*, edited by Nick Hall. Vol. 1. United Kingdom: Intermediate Technology Publishing Ltd.
- Mostaedi, Arian. 2002. *Urban Spaces*. Barcelona: Carles Broto & Joseph Ma Minguet.
- Mukhija, Vinit. 2017. *Squatters as Developers?: Slum Redevelopment in Mumbai* Routledge.
- Petti, Alessandro, Sandi Hilal, and Eyal Weizman. 2013. *Architecture After Revolution*. Berlin: Sternberg Press.
- Pickering, Ernest, 1893-. *Shelter for Living*. New York, J. Wiley, 1941:.
- Saunders, William S. 2006. *Urban Planning Today : A Harvard Design Magazine Reader*. Minneapolis: University of Minnesota Press.
- Sorabjee, Jehangir. 2005. *Above Bombay*. Mumbai: Eminence Designs.
- Teige, Karel, 1900-1951. 2002. *The Minimum Dwelling L'Habitation Minimum = Die Kleinstwohnung : The Housing Crisis, Housing Reform*. Cambridge, Mass. : Chicago, Ill.: MIT Press ; Graham Foundation for Advanced Studies in the Fine Arts.
- Uffelen, Chris van. 2011. *Low Price Houses*. 1st ed. ed. Salenstein]: Braun.
- UN-Habitat. 2003. *The Challenge of Slums: Global Report on Human Settlements, 2003*. London: Earthscan Publications.
- Vale, Robert (Robert James Dennis). 2009. *Time to Eat the Dog : The Real Guide to Sustainable Living*, edited by Brenda Vale. London: Thames & Hudson.
- Wagner, Fritz W., Riad G. Mahayni, and Andreas G. Piller, eds. 2015. *Transforming Distressed Global Communities*. England: Ashgate Publishing Limited.
- Weinstein, Liza, 1977-. 2014. *The Durable Slum : Dharavi and the Right to Stay Put in Globalizing Mumbai*, edited by Inc ebrary. Minneapolis: University of Minnesota Press.
- Werthmann, Christian and Jessica Bridger. 2015. *Metropolis Nonformal*. San Francisco: Applied Research + Design Publishing.
- Zukin, Sharon, Philip Kasinitz, and Xiangming Chen. 2016. *Global Cities, Local Streets*. New York: Routledge.

APPENDIX PRECEDENT IMAGES

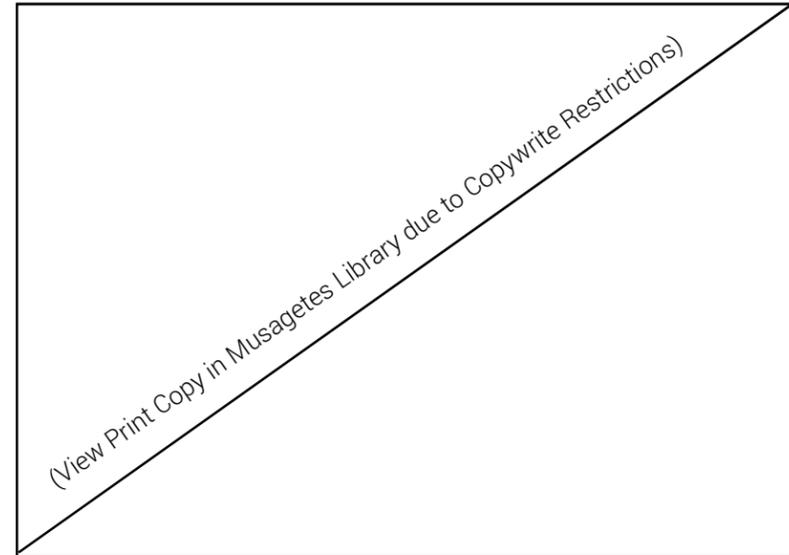


Fig.401 **Lamego Multi Purpose Pavillion | Barbosa & Guimarães (Jose, 2012 - View Print Copy)**
Used as massing inspiration

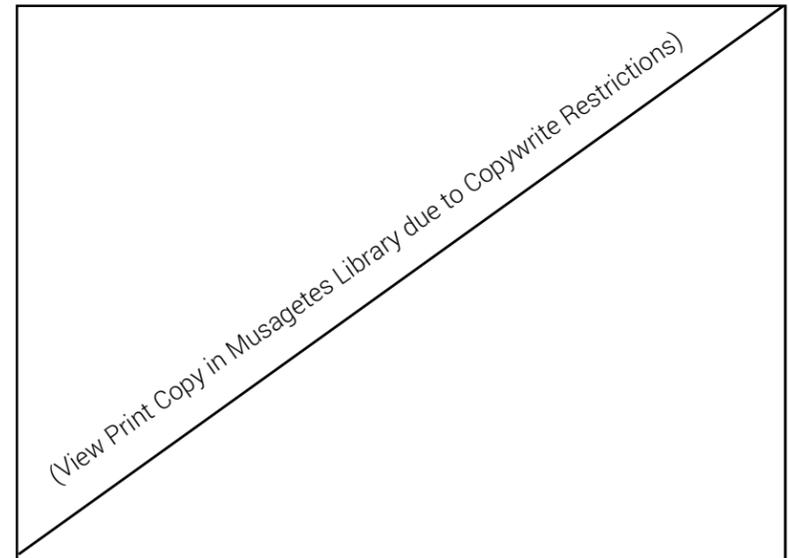


Fig.402 **Bavillion | Studio Ardete (Purnesh, 2018 - View Print Copy)**
Used as massing inspiration

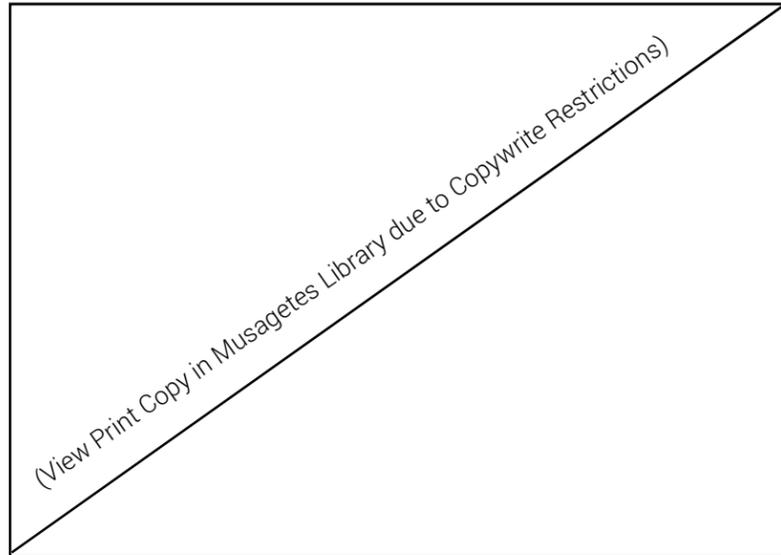


Fig.403 **Media Pavillion | Moho Arquitectos + Carlos Abadía Sánchez (Moho, 2009 - View Print Copy)**
Used as courtyard inspiration

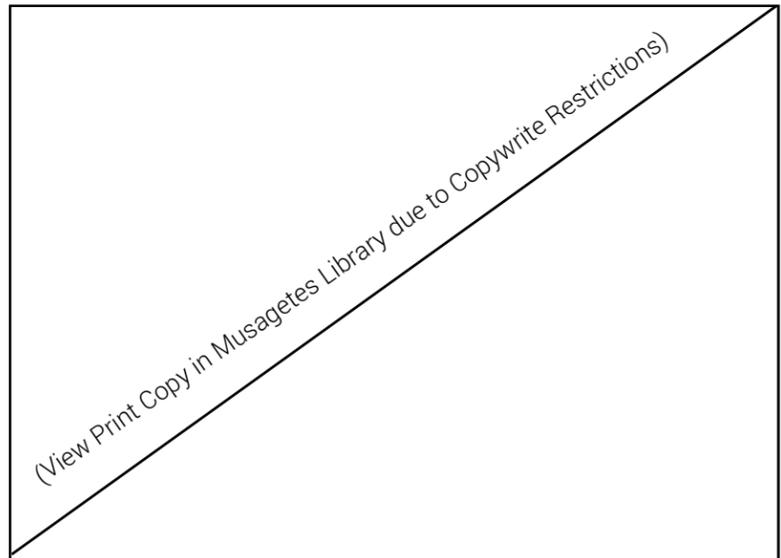


Fig.404 **Bloomberg's European HQ | Foster + Partners (Nigel, 2017 - View Print Copy)**
Used as courtyard inspiration

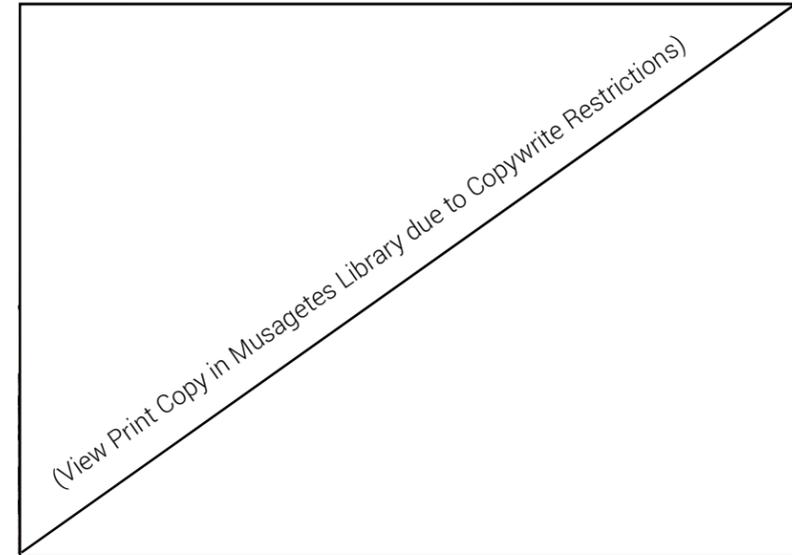


Fig.405 **Corrugated-Sheet House | Daisuke Yamashita Architects (Takeshi, 2018 - View Print Copy)**
Used as facade inspiration

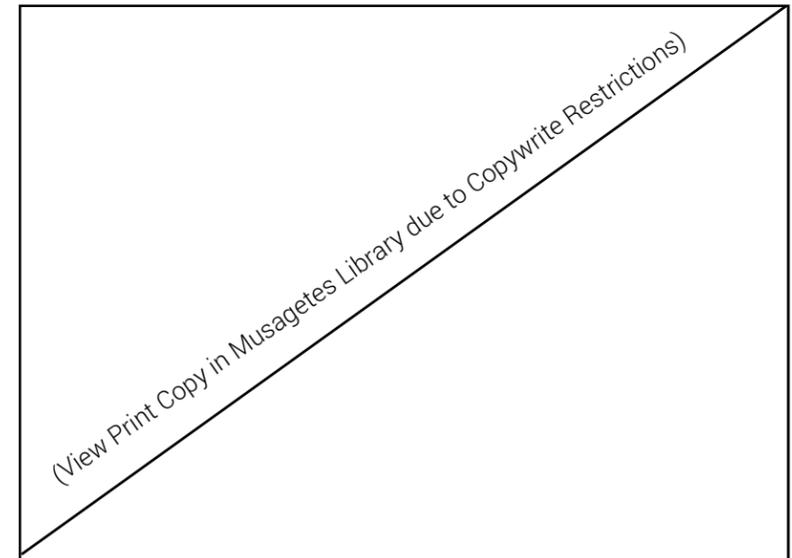


Fig.406 **Tower of Bricks | Interval Architects (Zhi, 2018 - View Print Copy)**
Used as facade inspiration

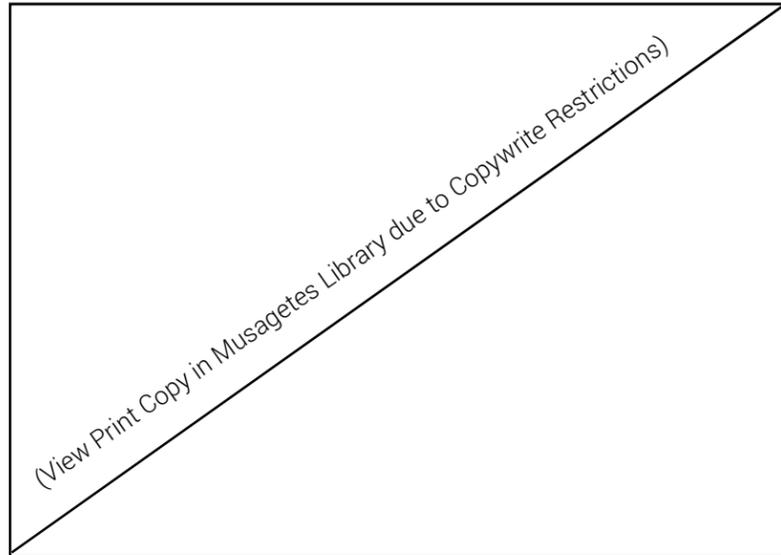


Fig.407 **Alexandra Interpretation Centre | Peter Rich Architects (Iwan, 2010 - View Print Copy)**
Used as operables inspiration

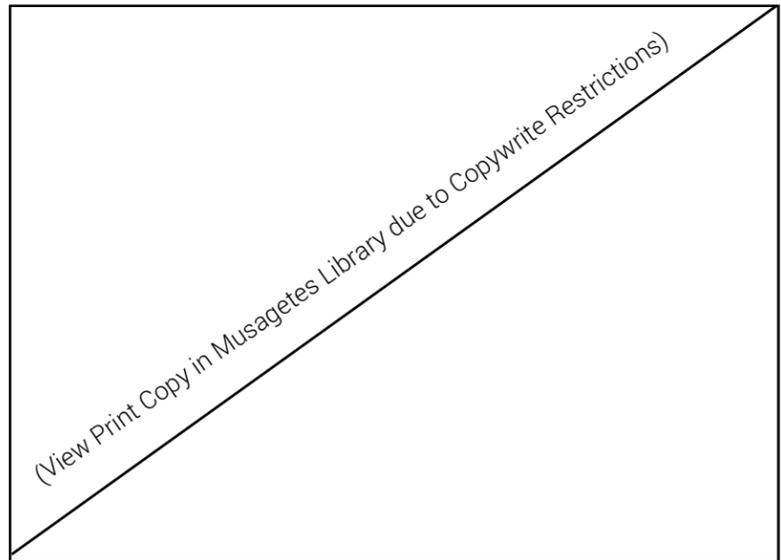


Fig.408 **Alexandra Interpretation Centre | Peter Rich Architects (Iwan, 2010 - View Print Copy)**
Used as operables inspiration

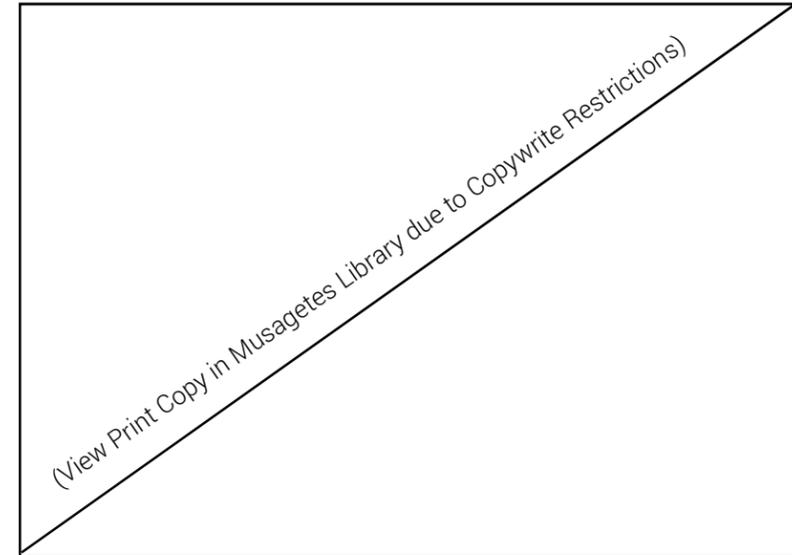


Fig.409 **Girassol Pavilion | Brasil Arquitetura (Daniel, 2019 - View Print Copy)**
Used as interior inspiration

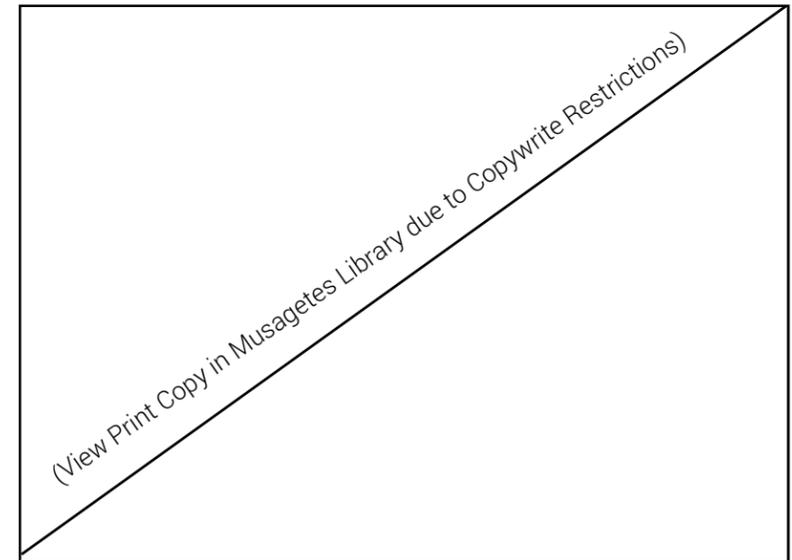


Fig.410 **Verdun Memorial Museum | Brochet-Lajus-Pueyo + Le-Conte Noiroto (Harve, 2016 - View Print Copy)**
Used as interior inspiration