Unseen Boundaries: Lost Communities

"Transforming Abandoned Quarries: Building a Thriving Community"

By

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A REPORT

Submitted in partial fulfilment of the requirements for the degree of
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AIKTC SCHOOL OF ARCHITECTURE

CERTIFICATE

This is to certify that the Design Dissertation titled Unseen boundaries: Lost communities "Transforming Abandoned Quarries: Building a Thriving Community is the bona fide work of the student Zaid Inamdar from Final Year B. Arch of AIKTC School of Architecture and was carried out in college under my guidance.

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Contents

- खोई खदान (Lost Quarries of Navi Mumbai)

4.1.7.1 LITERATURE RESEARCH PAPER

4.1.7.2 LITERATURE THEORY

4.1.8 QUARRYING SITUATION IN MAHARASHTRA

4.1.9 In Association with the Site

4.2 LITERATURE REVIEW 2 - CASE STUDIES

4.2.1 COMMUNITY CENTER, RENOVATION NANJING, CHINA

4.2.2 MANAV SADHNA, Ahmedabad

4.2.3 Jetavan Spiritual Center, Maharashtra, Nashik

4.2.4 KHAMIR CRAFT RESOURCE CENTRE , Bhuj, Gujarat

4.2.5 HUNNARSHALA FOUNDATION CAMPUS, Bhuj, Gujarat

4.2.6 Housing for Mahouts and their Elephants , Jaipur, India

4.2.7 The Eden Project Cornwall, UK

4.2.8 Lakaki Lake , Pune (quarry restoration)

4.29 The Pause (Public Restrooms)

5.0 DESIGN RESEARCH

5.1 SITE STUDY

5.2 SITE SELECTION

5.3 SITE SELECTION MATRIX

5.4 DESIGN BRIEF

6.0 AREA PROGRAM

6.1 INTENT

6.2 TENTATIVE AREA PROGRAM

LIST OF FIGURES

LIST OF TABELS

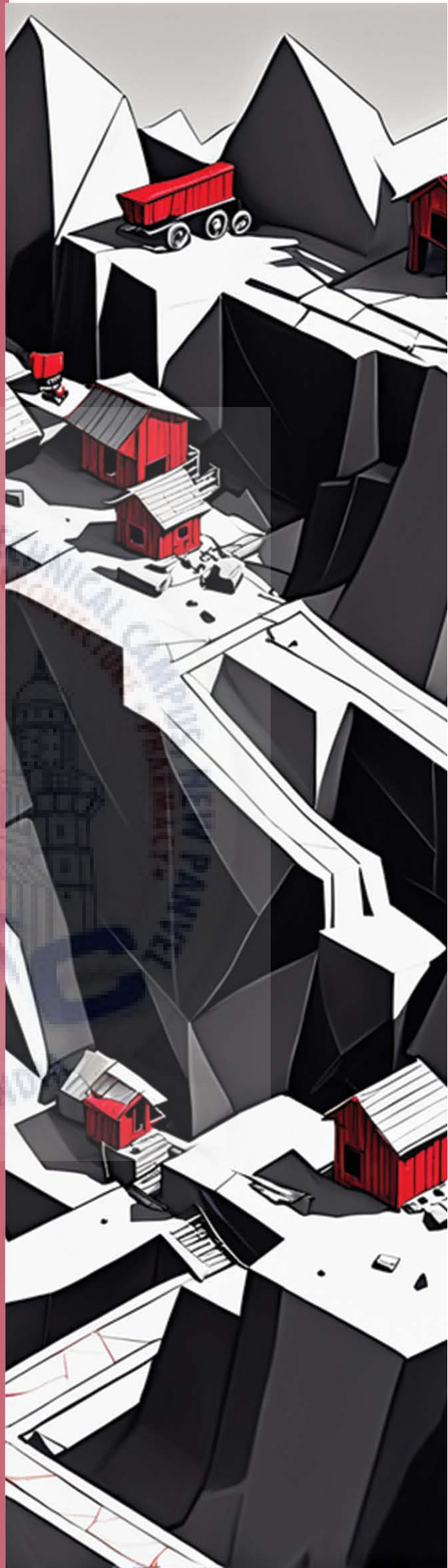
ABSTRACT

ABSTRACT

This thesis embarks on an exploratory study of the Turbhe abandoned quarry site in Mumbai, with a primary focus on addressing the complicated challenges and opportunities that have raised from decades of quarrying activities in the Turbhe-Belapur belt. These activities have had deep adverse impacts on both the local ecology and the surrounding community. The core objective of this project is to conceptualize and execute a comprehensive revitalization plan for the Turbhe quarry site, taking into careful consideration the intricate web of stakeholders that have been affected by the quarry's abandonment. The selected quarry site presents a unique advantage - its strategic location. Situated alongside a key road and in proximity to the largest slum cluster in the area, it has the potential to serve as a catalyst for positive change in a densely populated urban environment. These challenges include environmental degradation, safety hazards, and socio-economic vulnerabilities. The unfilled quarry pits have become breeding grounds for pollution and stagnant water, posing a health risk to the local community. Furthermore, the lack of anagement strategy has allowed for unauthorized waste dumping, thereby exacerbating pollution concerns. In this context, the project's area program is thoughtfully designed to mitigate these challenges and transform the Turbhe quarry site into a beacon of sustainable development. It places a significant emphasis on inclusivity, ensuring that the diverse needs of the community are addressed comprehensively. Key components of the project include the creation of employment opportunities for women and youth, the establishment of community-inclusive spaces, the provision of basic health services, and the introduction of various amenities such as public restrooms, retail stores, vocational training facilities, and communal areas. The project's vision revolves around achieving mutual benefits for all stakeholders. By reimagining the Turbhe quarry site as a thriving and sustainable community hub, this initiative aims to restore the local ecology, uplift the socio-economic conditions of the affected community, and illustrate the transformative power of responsible land management. It is a demonstration to the potential for abandoned quarry sites to evolve into resilient, vibrant, and harmonious urban spaces.

Keywords: Quarry, noise, dust, health, respiratory issues, cultural practices, social impacts.

INTRODUCTION & BACKGROUND



02

1. INTRODUCTION

Quarrying activities near the Turbhe-Belapur belt, located in the Parsik Hill Range's foothills, have had a complicated and long-lasting effect on the ecosystem and the local communities that call this area home. This procedure, which is crucial for obtaining necessary building supplies including minerals, stone, sand and gravel, has given rise to a tangle of complex problems that call for all-encompassing and long-lasting solutions.

Quarrying does not come without repercussions in terms of the ecology. This industry's essential extraction and crushing processes introduce disruptive components like noise, vibrations, and dust into the nearby ecosystems, which have a significant impact on habitats and species. Water pollution from quarrying operations exacerbates the issue by endangering aquatic life and reducing availability to clean water for locals and nearby wildlife. Environmental issues are made worse by the frequent quarrying that alters the landscape and raises the threat of landslides, erosion, and geological dangers.

Communities that are close to these quarries deal with a wide range of socioeconomic issues. Because of the cyclical nature of the quarrying business, employment there is frequently characterized by unpredictability. Residents are thus more susceptible to unemployment during economic downturns. Quarrying operations can have a negative impact on the surrounding population's respiratory health in particular because to the airborne pollutants and dust they produce. Furthermore, quarrying competes for scarce resources like water and land, increasing resource scarcity.

These problems are made worse by socioeconomic concerns. For certain communities, displacement poses a serious threat since it might result in the loss of homes and access to traditional areas. Residents' difficulties are made worse by the inadequate infrastructure development in these communities, which also restricts their access to vital services like healthcare and education.

A balanced and long-term strategy is required to address these complex problems. In order to mitigate the negative effects of quarrying, strict environmental laws are essential. These regulations must include steps to reduce dust emissions and water contamination. Getting to know local communities can help you build community benefit agreements and activities that are specifically designed to help the people who will be affected. When quarrying activities ultimately wind down, diversifying the local economy provides a lifeline and lessens dependence on the industry. In order to restore local ecosystems and lessen the long-term environmental consequences, post-extraction rehabilitation techniques for quarried terrain are essential.

To sum up, quarrying near the Turbhe-Belapur region and the Parsik Hill Range has undoubtedly benefited the ecology and the local community while simultaneously posing a variety of difficulties. In order to successfully combine the exploitation of priceless resources with the preservation of ecosystems and the welfare of the local population, a comprehensive and sustainable approach is required

.2.1 BACKGROUND STUDY

2.1.1 QUARRY MEANING

A quarry is a specific kind of mining operation where different kinds of rocks, minerals, and other geological elements are extracted from the surface of the ground. Quarries are different from underground mines, where minerals are extracted below earth, because this extraction is done by an open-pit or surface mining process. Materials for infrastructure, building, and other industrial uses are frequently found in quarries. (*dictionary.com*)

2.1.2 HISTORY AND EVALUATION

Ancient cultures had a concept of quarrying. Quarries in ancient Egypt were essential for obtaining the large stone blocks needed to build famous structures like the pyramids and temples. Similar to this, the Romans used quarries to get the materials they needed for canals, houses, and roadways. Quarrying techniques have developed throughout the years along with technological developments, making it possible for materials to be extracted, transported, and processed more effectively. Methods of extracting stone and other materials from quarries have changed since the first quarries were mined in the Aswan area of Egypt. The earliest quarries were mined with hammers, picks, and chisels made of stone or metals such as bronze and iron. Communities without stone structures continue to have quarries. The Lakota people of the Midwest of the United States and Canada did not mine stone to erect structures like monuments or homes. They quarried for stones to build calumets, or ceremonial smoking pipes, at a location in Pipestone National Monument in the U.S. state of Minnesota. Calumets (a long-stemmed, ornamented tobacco pipe used by North American Indians on ceremonial occasions, especially in token of peace.) which are structures composed of the metamorphic rock or pipestone, were crucial for forging enduring treaties or agreements between social groupings.(national geographic, *Quarry* 2023)

2.1.3 TYPES OF QUARRIES & ITS USE

A. STONE QUARRY

Stones like marble, granite, limestone, and sandstone are extracted in enormous blocks at quarries known as "dimension stone." The extracted stone is appropriate for architectural elements, sculptures, and monuments since it can be precisely carved and sculpted.

B. GRAVEL & SAND QUARRY

Gravel and sand quarries are devoted to harvesting coarse materials, which are necessary for construction projects. These materials are employed in the creation of concrete, the construction of roads, and other basic buildings.

C. CLAY & SHALE QUARRY

Clay and shale are extracted from these quarries specifically for use in the manufacture of ceramics, bricks, tiles, and pottery.

D. LIMESTONE QUARRY

Since limestone is a crucial component in the creation of cement, limestone quarries provide materials for the industry. Limestone is additionally utilized in the steel industry as a flux to remove impurities during the manufacturing of iron and steel.

E. GYPSUM QUARRY

Gypsum is a mineral that is produced in gypsum quarries and is used to make plaster, drywall, and other building supplies.

F. SLATE QUARRY

Slate quarries produce metamorphic rock that is prized for its toughness, resistance to deterioration, and appealing appearance. Roofing, flooring, and aesthetic uses for slate are common.

(Figure 1, stone quarry,*DSGA website*)

(Figure 2, gravel & sand quarry, *Extractive industries , UK*)

(Figure 3 clay & shale quarry)

(Figure 4 , limestone quarry)

(Figure5, gypsum quarry)

(Figure 6, slate quarry)

Raw materials are sized down and graded to maintain consistency in order to fulfil the specified Particle Size Distribution (PSD) criteria of the end-users specifications. Crushing and screening are the typical methods for doing this. The choice of the appropriate crusher type will be influenced by a number of variables, including geology, raw material, productivity, and end-user requirements. In order to maximize the productivity of secondary crushers, raw feed is often reduced using a jaw crusher as a "primary crusher". When reducing raw material to a size and gradation appropriate for screening or further crushing, a compression crusher is frequently employed as a "secondary and tertiary crusher". In order to attain a desired fraction of the materials introduced, screening is the process of mechanically grading items. (INSTITUTE OF QUARRYING AUSTRALIA, *What is quarrying?*)

2.1.4 ABANDONED QUARRIES AND ITS IMPACT ON ENVIORMENT & BIODIVERSITY

Quarries affect their surroundings. They relocate animals from the region and move vast amounts of soil and vegetation. Rarely do abandoned quarries leave behind enough soil to support new growth. Some closed quarries may overflow and form man-made lakes. Numerous of these lakes are deep and clean, making them safe swimming spots for both humans and some aquatic creatures like frogs and birds. However, occasionally, mining equipment is left on the bottom of lakes formed by closed quarries, making them dangerous for swimming. In abandoned quarries, toxic pollutants exposed during mining operations may also leach into the water supply. Because quarries are occasionally excavated below the water table, they are vulnerable to floods. If the water table of a region is reached by an abandoned quarry, toxic chemicals may leak into the groundwater. Quarries that have been abandoned can potentially be used as landfills. (national geographic, *Quarry* 2023)

Most of the terrestrial biosphere has been altered by human populations and land use to become anthropogenic biomes (anthromes), which has led to the emergence of a number of novel ecological patterns and processes. Spatially explicit global estimates of human populations and their use of land were analyzed throughout the Holocene for their potential to induce irreversible novel transformation of the terrestrial biosphere in order to determine whether these factors have directly altered the terrestrial biosphere to the extent necessary to indicate that the Earth system has entered a new geological epoch. Since more than 8000 years ago, humans have significantly altered the terrestrial

environment. The majority of the terrestrial biosphere, however, has just recently been changed into intensively exploited anthromes with an abundance of unique anthropogenic ecological processes. The current global extent, duration, type, and intensity of human transformation of ecosystems have already irreversibly altered the terrestrial biosphere to levels sufficient to leave an obvious geological record that differs significantly from that of the recent past or any prior period, even were human populations to decline significantly or use of land become significantly more efficient. Whether the manmade biosphere will endure and develop is still up in the air. (C. Ellis, *Anthropogenic transformation of the terrestrial biosphere* ... 2011)

2.1.5 ABANDONED QUARRIES INFLUENCING THROUGH LANDFORMS

Quarries that have been abandoned are significant environmental components with both regional and global significance. We can refer to the excavated holes that are left behind after mining solid rock minerals as having their own "landscape" because they are characterized by a variety of traits. Quarries have fascinating morphological shapes, which makes them distinctive landmarks. They frequently have good localization and are in close proximity to major cities or communication hubs. Additionally, as a result of quick natural succession processes, old mining trenches turn into priceless natural habitats for a variety of plant and animal species, but they can also serve as prospective sites for the disposal of urban and industrial trash. It is vital to note that these locations have local cultural values and could be a major draw for tourists. Through the creation of new attractions based on changes brought about by excavation, their usage by tourist routes may help to strengthen the tourism business and increase the appeal of the local tourism sector. As a result, newly formed landscape shapes may appear as a result of the mining of rock minerals and turn into an appealing aspect of the surrounding terrain that draws tourists. However, arguments against reclamation and management of the sites frequently center on such landscape formations and the shifting societal preferences. The question is the possibility of evaluating the attractiveness of abandoned quarry landscapes and their use for tourism while taking into consideration regional historical and environmental assets. (Baczyńska et al., *The landscape attractiveness of abandoned quarries - geoheritage* 2017)

2.1.6 ABANDONED QUARRIES INFLUENCING THE CULTURAL AND SOCIAL VALUES

A community's opinions, actions, and attitudes can be shaped by abandoned quarries in a variety of ways. These consequences are frequently linked to the physical alterations caused by quarrying operations and the subsequent cessation of those operations. Abandoned quarries can have the following effects on societal values:

1. **Appearance and Identity**: The existence of abandoned quarries may have an adverse effect on an area's appearance, thereby changing the community's identity. Residents' perceptions of their surroundings and their sense of local pride may be impacted by the scars left by excavation and the presence of abandoned pits.

2. **Leisure Possibilities**: For communities, abandoned quarries that develop into artificial lakes might offer distinctive leisure possibilities. These bodies of water may develop into desirable locations for boating, fishing, and other outdoor pursuits, promoting leisure and a sense of community.

3. **Safety and Community Well-Being**: People's choices regarding recreational activities, outdoor exploration, and children's play might be impacted by safety worries related with abandoned quarries. The community's sense of wellbeing can be enhanced by making these spaces safe.

4. **Economic Considerations**: Communities' economies may be impacted by the reclamation and repurposing of abandoned quarries. Local economies and property values can increase if these locations are successfully turned into parks, recreation areas, or other useful areas.

5. **Cultural and Heritage Perspectives**: For a community, abandoned quarries may be significant in terms of culture or heritage, particularly if they had a significant impact on local history, industry, or creativity. Cultural identity can be strengthened by recognizing and keeping certain cultural elements.

Quarries that have been abandoned may influence how a community's residents feel and perceive certain issues. They have an impact on how things appear, what people do for entertainment, how safe they feel, and how much they care about the environment. People may converse more about maintaining the property, recalling the history, and deciding what to do with the area when there are nearby abandoned quarries. This teaches us how to balance our wants with protecting the environment. In general, abandoned quarries educate us about the interactions between people and the environment and how we can improve both.

2.1.7 REVITALISATION OF SUCH ABANDONED QUARRIES & ITS BENEFITS

Materials are extracted from the earth in quarries, which are particular locations. Throughout history, people have utilized quarries in a variety of ways. These locations have occasionally been used again for different purposes when the digging is finished. In the past, quarries were recycled for useful purposes. Because we now care more about the environment, we also consider how to use quarries in a way that benefits the ecosystem. Let's look at some historical examples to better grasp this. Old quarries have occasionally been used for burials and other purposes. Rome is a renowned example, where disused quarries were converted into catacombs, or underground cemeteries. Similar to the catacombs in Via Appia(Latin name for Appian Way a heritage site), these ones were built using abandoned stone quarries as places to bury the dead, hold religious rituals, and avoid danger. They sometimes just made sure that these ancient quarries were secure, while other times they painted over them. Rome's Priscilla catacombs provide as a good illustration of this. They began to view quarries differently in Rome during the Renaissance. Quarries were converted into parks and gardens. The "landscape approach" is a way of thinking about quarries and the area around them. In summary, quarries have been utilized repeatedly throughout history for a variety of purposes. They were employed for practical purposes like festivals and funerals. During the Renaissance, they were also turned into stunning gardens. (Talento et al., *Quarries: From abandoned to renewed places* 2020)

Reclaiming urban quarries—that is, rehabilitating and reusing them for purposes other than their original ones—offers numerous advantages to the environment and the communities in the area. The following are some major benefits of restoring urban quarries:

1. **Environmental Restoration**: Reclaiming quarries involves restoring the ecology and surrounding area that were harmed by mining operations. The reintroduction of wildlife and the improvement of soil quality are all benefits of the restoration process. It benefits the local environment's general wellbeing.

2. **Improved Aesthetics**: In urban areas, abandoned quarries are frequently eyesores that detract from the landscape's aesthetic attractiveness. Reclaiming quarries enables the transformation of these sterile areas into lovely green spaces, improving the general attractiveness of the neighbourhood.

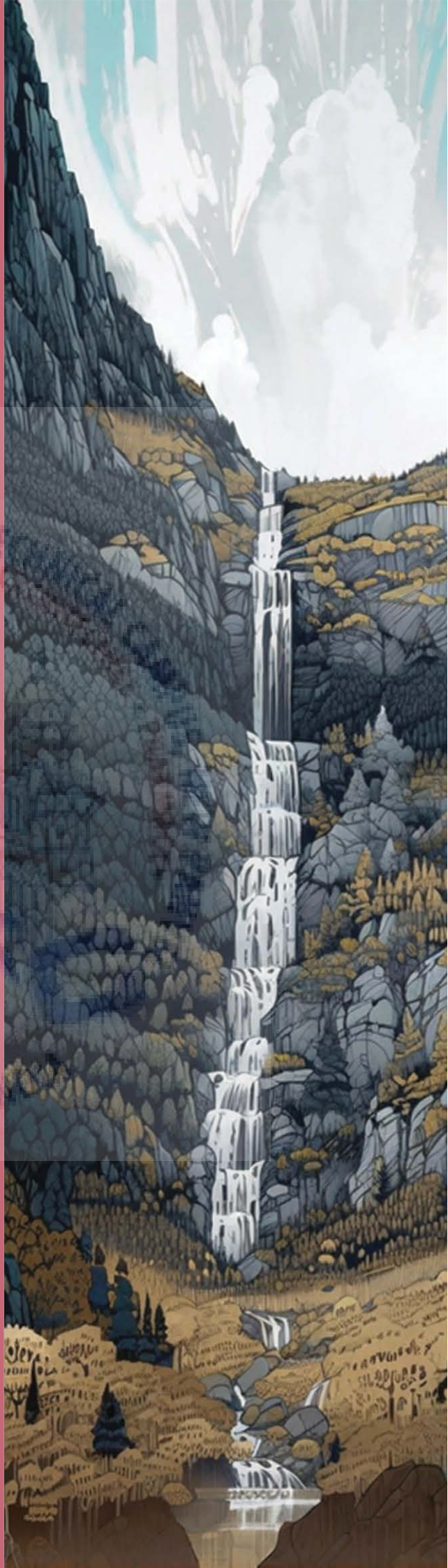
3**. Recreational Possibilities**: Reclaimed quarries can be transformed into outdoor leisure areas including playgrounds, parks, and hiking paths. This offers people useful locations where they can engage in outdoor activities, connect with nature, and enhance their general well-being.

4. **Community Engagement**: Reclaimed quarries can become focal points for the neighbourhood, encouraging inhabitants to feel connected and involved. Public spaces and gathering places promote social interaction and community development.

5. **Economic Benefits**: By bringing in tourists, businesses, and locals, reclaimed quarries can boost the local economy. They could develop into locations for ecotourism, events, and outdoor leisure, enhancing nearby companies and creating more jobs.

6. **Reclaiming quarries**: is consistent with the ideals of responsible development and sustainable land usage. Reclamation ensures that the facility serves a role that benefits the community rather than being left idle or neglected.

HYPOTHESIS,AIM & OBJECTIVE



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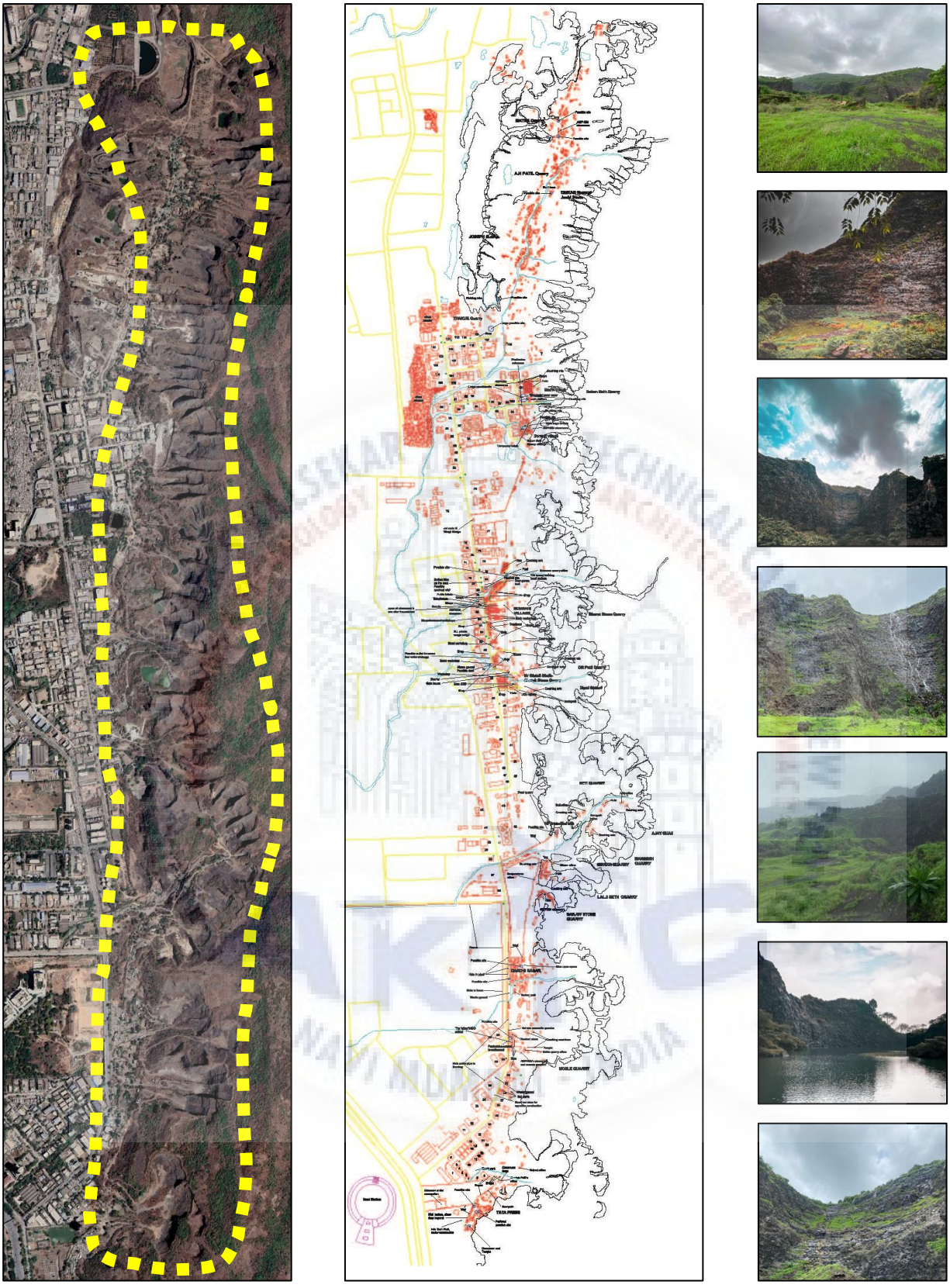


(Figure 7, Research study area abandoned quarries stretch)

2.2 HYPOTHESIS

The development of community-driven, sustainable spaces in the former quarries behind the Nerul-Turbhe industrial district offers a special chance to improve the general welfare of the neighbourhood. Implementing a range of community-focused initiatives and programs that have the potential to greatly benefit the locals is one important part of this transition.

Programs for skill development have a lot of potential in this area. People can learn new skills that are immediately applicable to the developing opportunities in the repurposed quarries by creating vocational training and educational initiatives suited to the specific requirements of the community. These programs enable the local workforce to actively participate in and contribute to the redevelopment of the quarries, whether it be through training in sustainable agriculture, eco-tourism, hospitality, or handcraft.

One practical method to raise the economic security and general standard of living in the neighbourhood is to turn some of the abandoned quarries into fertile agriculture. Using agricultural projects like aquaculture, organic farming, and community gardens, locals can not only create a sustainable source of income but also guarantee their food security. In addition to boosting the local economy, this encourages good eating habits and lessens dependency on outside food sources, improving the general health of the neighbourhood.

Additionally, eco-tourism efforts can profit from the repurposed quarries' natural beauty to draw tourists and generate more job opportunities. These programs may include tours, outdoor activities, and cultural events that not only boost the local economy but also help people feel proud of and invested in their community.

In conclusion, the conversion of these quarries is an opportunity to revitalise the neighbourhood by creating job opportunities, enhancing food security, and encouraging better living. The citizens of the Nerul-Turbhe industrial area can have a sustainable and prosperous future thanks to community-cantered programs.

2.3.1AIM

To study and transform the abandoned quarries at Thane -Belapur belt into vibrant, inclusive spaces that foster social interaction, economic growth, and improved quality of life for the local community.

2.3.2OBJECTIVES

- Investigate the historical and ecological value of the abandoned quarries at the foothills of Thane -Belapur belt to guide their adaptive reuse proposal.
- Existing settlement Understanding.
- Assess the local community's existing skills and competencies in order to locate possible career opportunities inside the reshaped locations.

- Analyse successful adaptive reuse case studies to obtain an understanding applicable to the Thane -Belapur belt setting.
- To Create a detailed assessment of the quarrying activity' health impact and propose solutions to improve community well-being
- Evaluate different methods of funding and collaborations to help with the adaptive reuse project's implementation.
- Investigate architectural and landscape design approaches for building inclusive and accessible environments in reclaimed quarries.
- Investigate the possibility of eco-tourism and leisure activities generating additional revenue for the local community.
- Examine the neighbourhood's social dynamics to ensure that the converted quarries promote beneficial social connections and community cohesion.
- Examine prospective educational and vocational training programs that correspond to career prospects offered by the adaptive reuse project

2.3.3 METHODOLOGY

- Examine existing research papers and publications on adaptive reuse and abandoned quarry projects.
- Topographical Study, Analyse the physical features and limitations of the quarry sites through GIS mapping
- Interviewing the NGO named ARPHEN to understand their view as well as identifying stakeholders and sponsors.
- Construct a timeline of quarrying activities and their effects on the community.
- Analyse the local community's demographic composition.
- Legal and Regulatory Analysis: Study relevant laws and regulations that may impact the project.
- News Articles and Media Analysis: Review media coverage related to the quarries and their impacts.
- Case studies on adaptive reuse of quarries(national & international).
- Conducting interviews with residents and stakeholders in the community.

- •Studying scientific research papers to understand various measures taken Studying the norms and policies for the adaptive reuse of quarries.

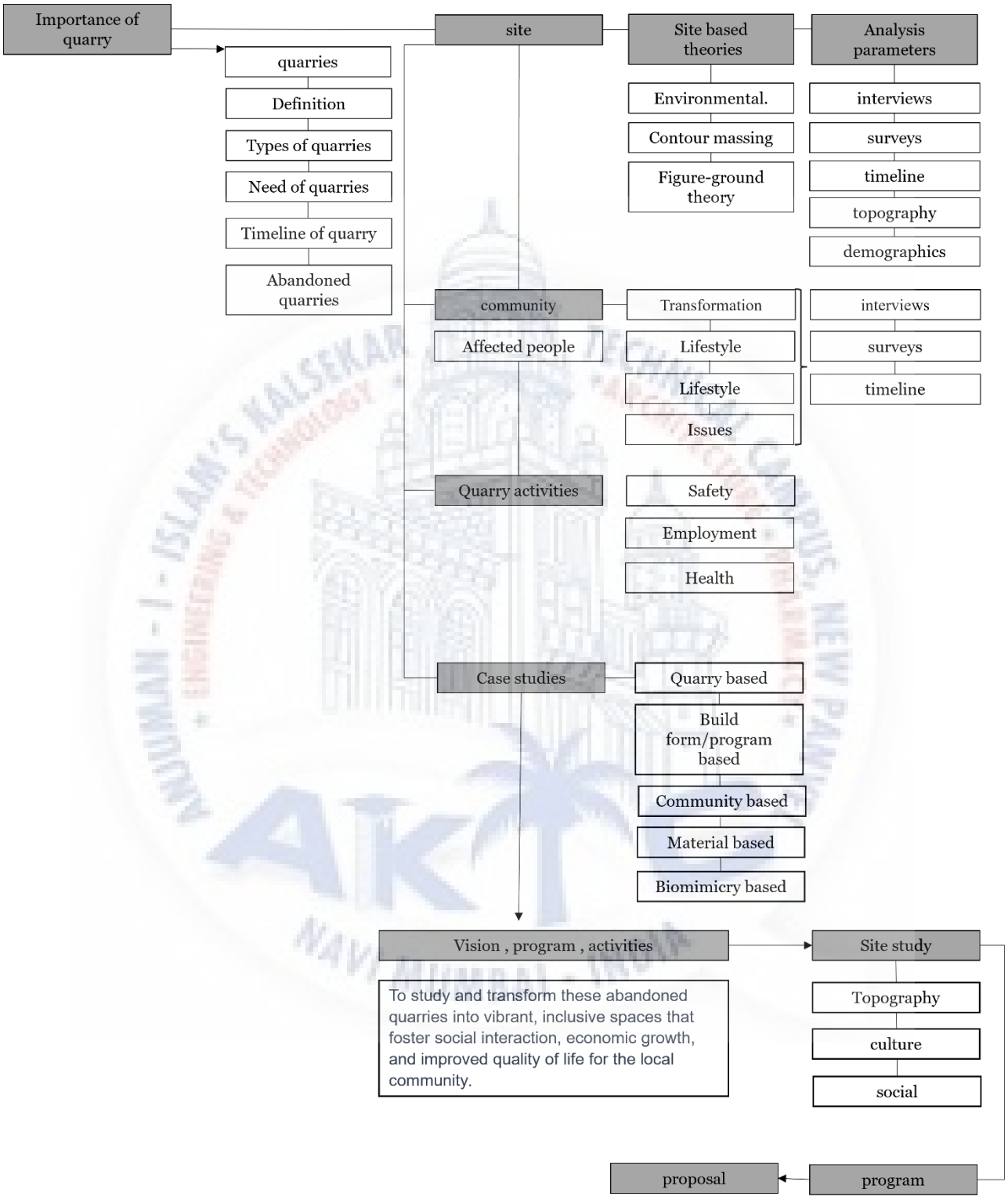
2.3.4 CONSTRAINTS/LIMITATIONS

- The research analysis and major study will be specific to the Turbhe -Nerul region.
- The implementation of the research will be site-specific and may not be implied everywhere.
- Repurposing options may be impacted by difficult site circumstances and accessibility.
- The design and development process might be impacted by regulatory and legal constraints.
- The types of activities permitted may be restricted by zoning and land use rules.

2.3.5 SCOPE OF WORK

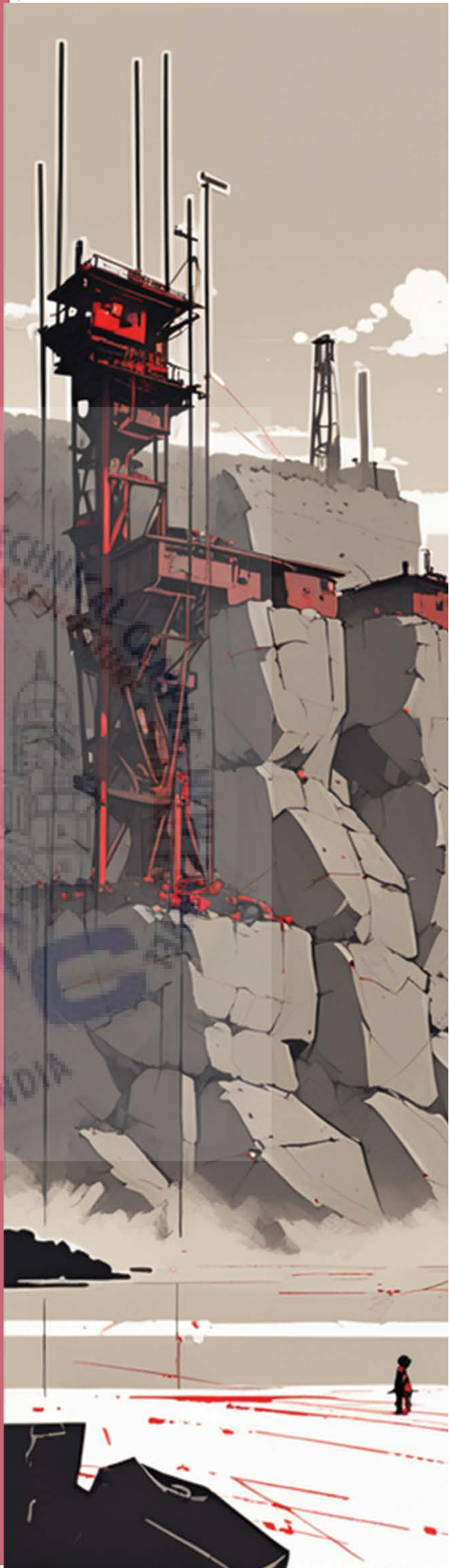
- Assess the villages' existing socioeconomic situation and identify specific employment challenges.
- Assess the health effects of quarrying activities and provide alternative remedies.
- Identify prospective collaboration options with government agencies, non-governmental organizations, and corporate organizations to support and expand the adaptive reuse project.

3.0 Methodology



(Figure 8, Research methodology)

LITERATURE REVIEW 1



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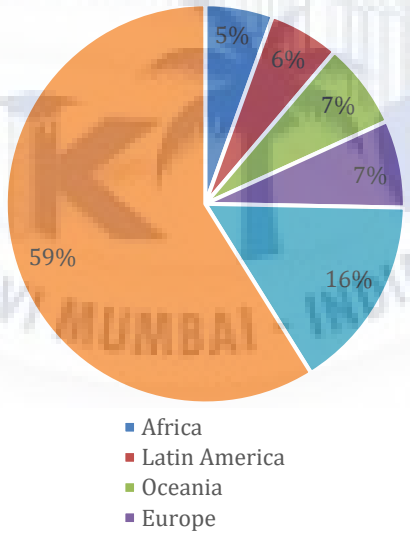
4.1 LITERATURE REVIEW:

4.1.2 GLOBAL MINING AND QUARRYING SCENARIO

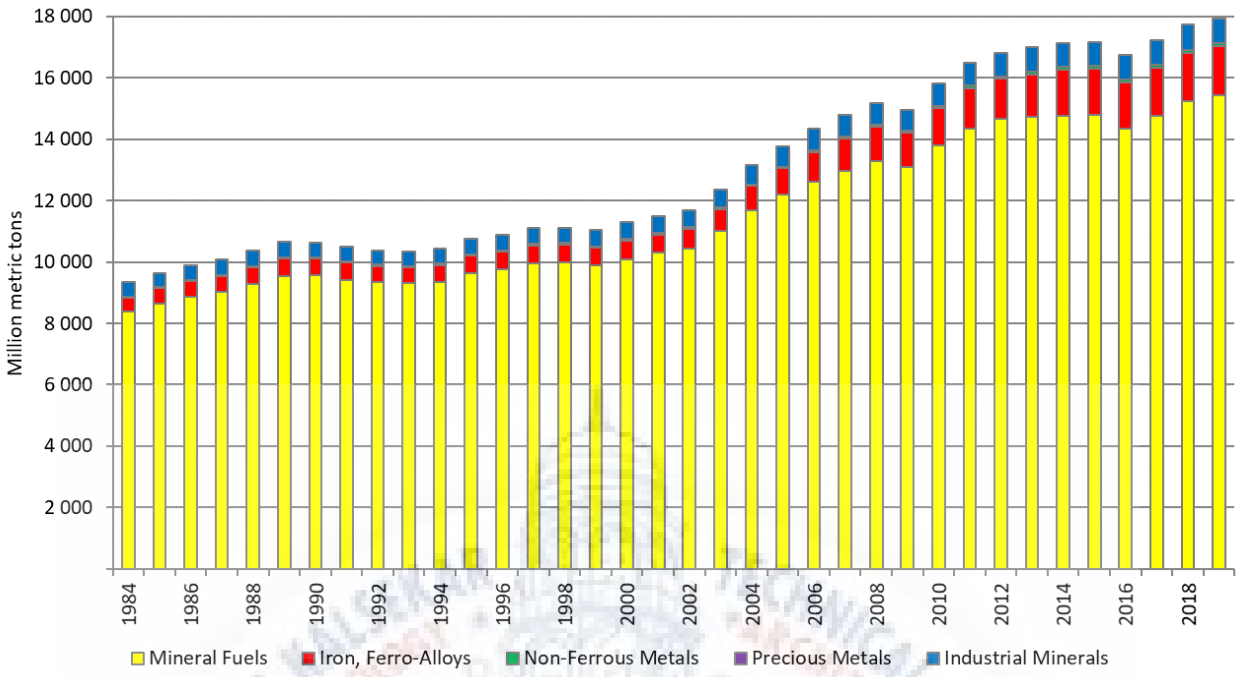
A detailed analysis of the world's mineral resources is provided in the World Mining Data report for 2021, which covers categories such iron and Ferro-alloy metals, non-ferrous metals, precious metals, industrial minerals, and mineral fuels. It emphasises how crucial it is to provide a reliable supply of mineral raw resources within fair market constraints for an economy that runs smoothly. The research emphasises the significance of implementing novel approaches, such as circular economy concepts, to guarantee long-term resource availability.

Iron and Ferro-alloy metals, non-ferrous metals, precious metals, industrial minerals, and mineral fuels are the topics covered in the report's five main sections. In order to meet the needs of expanding populations, it emphasises the importance of sustainable and balanced management of mineral resources. These resources, which come from both mined materials and produced goods, have economic value. The classification of producer nations into developed, developing, and least developed groupings as well as regional affiliations is described in the paper.

According to international standards like the UNCTAD (United Nations Conference on Trade and Development) and IIASA (International Institute for Applied Systems Analysis) classifications, the development status of countries that produce minerals is categorised. Statistics, not necessarily the development stage, are used to classify nations as developed, in transition, or developing. Regions including Europe, Asia, Oceania, Africa, and the Americas are included in the data. (Reichl.C & M.Schatz, *World Mining Data 2021* 2021)

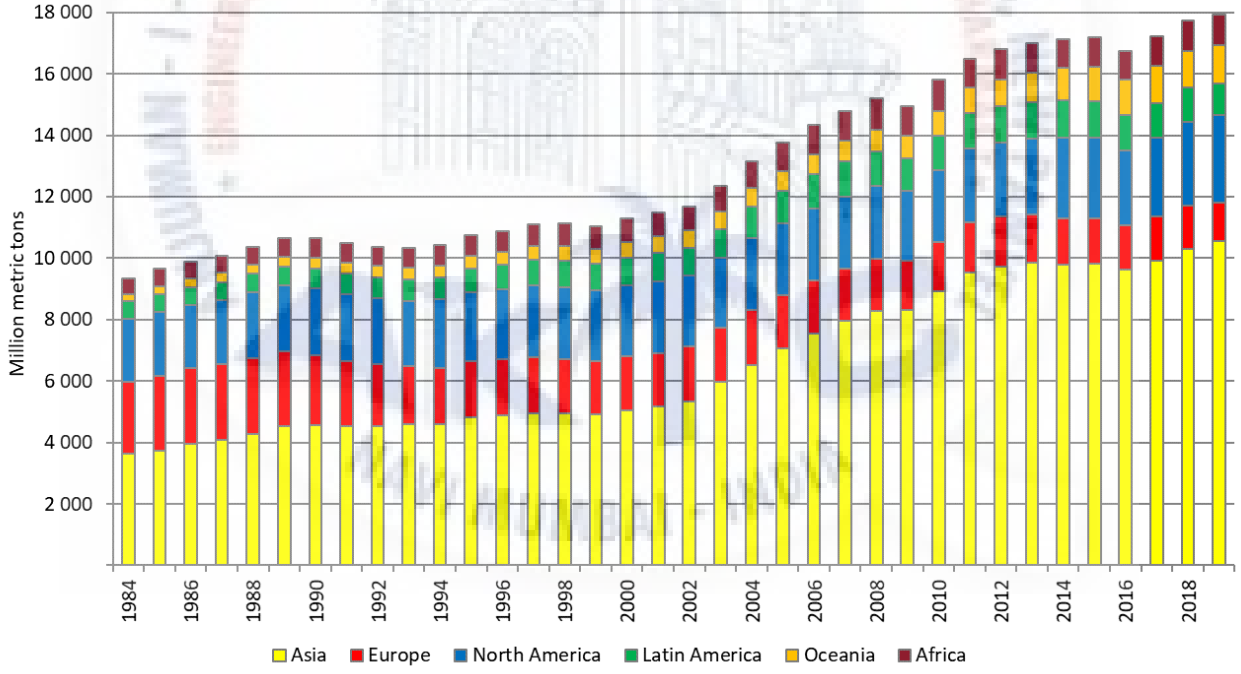


(Figure 9 , Reichl.C & M.Schatz, *World Mining Data 2021* 2021)



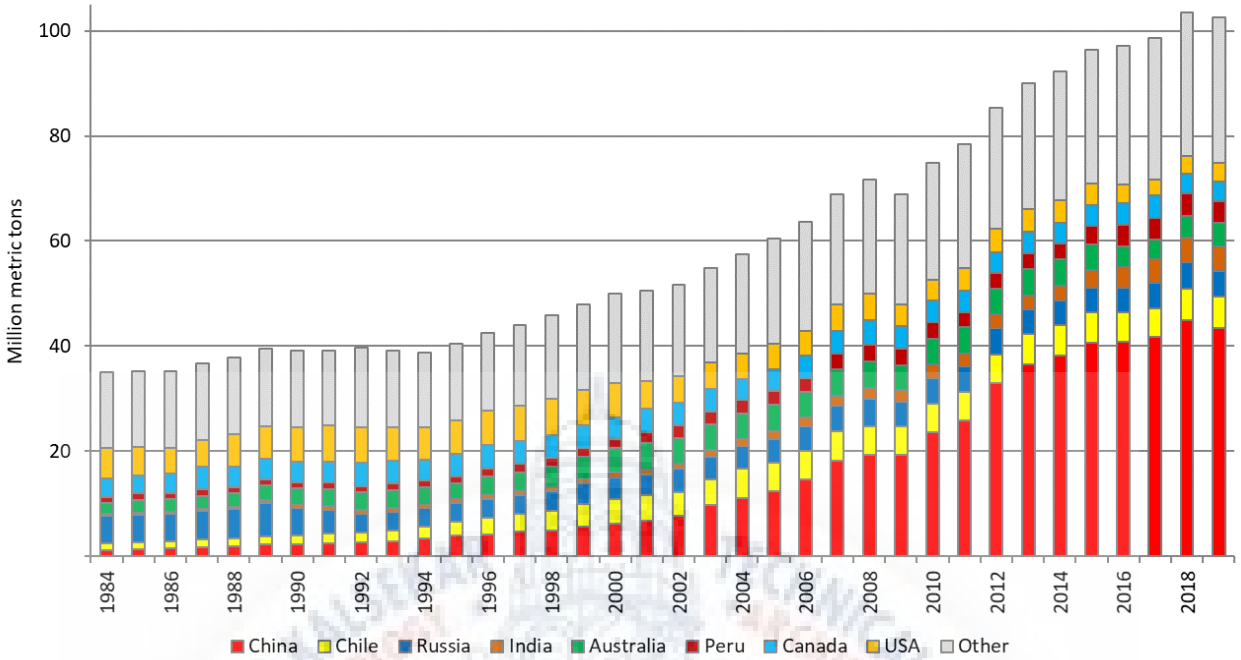
(Figure 10, World mining production 1984 - 2019 by groups of minerals

-without construction minerals, in Million meter. ton)



(Figure 11, World mining production 1984 - 2019 by continents

-without construction minerals, in Million meters. ton)



(Figure 12, World mining production 1984 - 2019 by groups of minerals: Non-Ferrous Metals by largest producer countries- in Million metre. t)

Quarrying, which involves removing precious minerals and materials from the Earth's surface, is an essential step in the mineral extraction process. Quarrying is necessary because it provides the raw materials required in manufacturing, construction, and other sectors. These materials include the aggregates needed to build infrastructure, roadways, and consumer goods, such as stone, gravel, and sand.

Asia has emerged as one of the continents with the most activity in the quarrying business, according to an analysis of activity across continents. This is a result of rapidly growing urbanisation and infrastructure in nations like China and India. In addition, there are considerable quarrying activities in Europe and North America, which are fueled by the need for new building and the upkeep of existing infrastructure.

The demand for construction materials is expected to continue to rise as a result of urbanisation and population increase around the world. Due to the industry's ability to supply crucial resources for numerous sectors, economic growth and development can be greatly attributed to it.

Benefits and Advantages of the Quarrying Industry

- Supply of Resources: Quarrying guarantees a consistent flow of the raw materials required for the construction of infrastructure and industrial growth.
- Employment: Quarrying supports local economies by generating jobs in the mining, transportation, and allied industries.
- Economic Growth: The sector's contribution to the construction industry drives economic growth and energises associated businesses.
- Local Development: Quarry operations may result in the construction of new roads and utility lines that will help the nearby towns.

Challenges and Disadvantages of the Quarrying Industry

- Quarrying may have an adverse effect on the environment by destroying forests, destroying habitats, and upsetting ecosystems, which can reduce biodiversity.
- soil Degradation: Mining operations can cause soil erosion, which can change the surrounding environment and impact agricultural regions.
- Dust emissions and sediment flow from quarries can cause air and water pollution, which is bad for the environment and for people's health.
- Safety Issues: Quarrying uses large machinery and, if not managed effectively, puts workers' safety at risk.

Global Issues Affecting Quarrying:

- Sustainability: For the quarrying sector, it can be difficult to strike a balance between resource extraction and environmental protection.
- Regulation: Strong regulatory frameworks are necessary to ensure ethical and sustainable quarrying practices.
- Innovation: Technological developments can help reduce the negative effects on the environment and increase operational effectiveness.

In conclusion, the quarrying sector significantly contributes to the global supply of necessary building materials. Although it promotes expansion and provides economic advantages, its effects on the environment and neighbouring communities must be properly monitored. In order to achieve a balance between resource extraction and environmental preservation, the industry must embrace sustainable practices, welcome technological innovation, and include stakeholders. The quarrying business is most active in Asia, Europe, and North America, therefore maintaining a focus on ethical behaviour will be crucial for the industry's long-term sustainability and beneficial effects.

4.1.3 INDIAN MINING AND QUARRYING SCENARIO

In India, the total geographical area comprises around 328 million hectares, with mining leases (excluding fuel, atomic, and minor minerals) occupying just about 0.14% of this breadth. Unfortunately, a modest 20% of this area is subject to quarrying and mining activities.

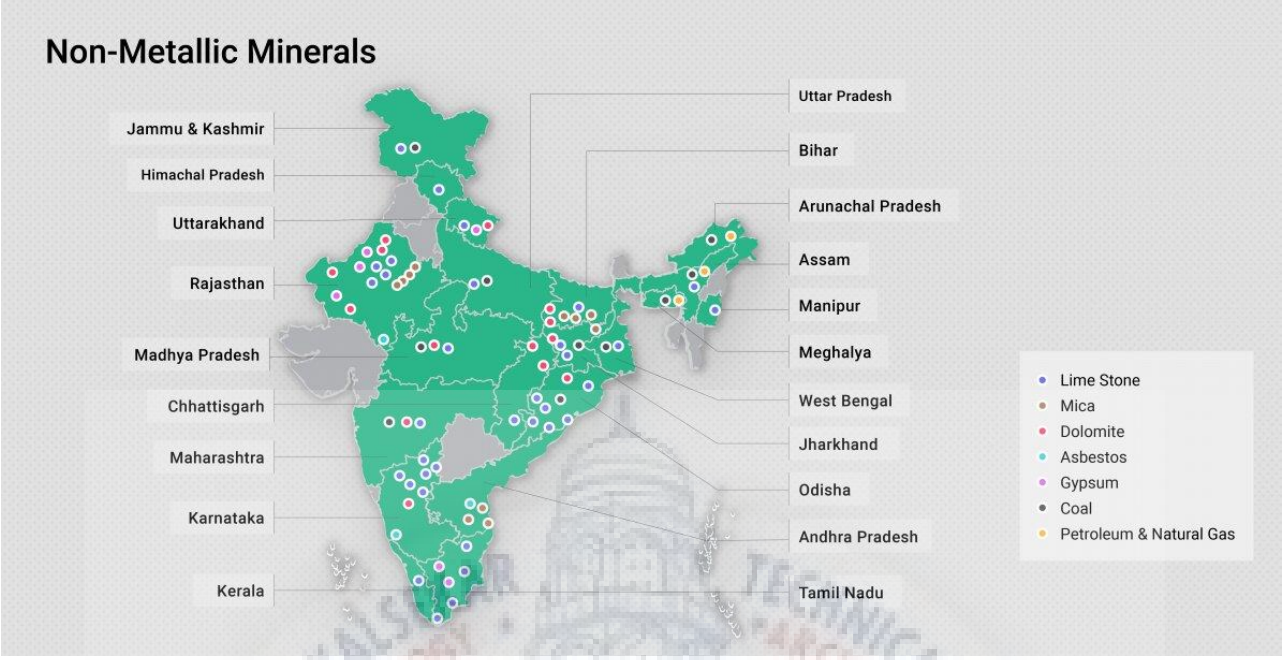
The subsoil of India is capable of considerable reserves of onshore and offshore crude oil and gas, coal, iron ore, copper, bauxite, and other valuable minerals. The country's mineral riches includes considerable quantities of iron ore, bauxite, chrome, manganese ore, rare earth minerals, and mineral salts. India's mineral diversity encompasses a diverse array of 95 minerals, covering 4 fuel minerals, 10 metallic minerals, 23 non-metallic minerals, 3 atomic minerals, and 55 minor minerals, some of which are used for construction and other industrial applications. In the fiscal year 2015-16, the country reported a total of more than 2,101 mines and quarry sites, excluding those participating in atomic and minor minerals, natural gas, and crude petroleum activities.

The quarrying and mining sector plays a key role in the Indian economy, particularly as the GDP is predicted to expand by around 7% in the future years. Sectors such as infrastructure and cars are poised to gain fresh momentum, driving greater demand for power and steel. This spike in demand is supported by the quarrying and mining sector, which supplies the raw materials required for these expanding sectors.

The cumulative value of mineral production, excluding atomic and fuel minerals, for the fiscal year 2017-18 is estimated at around $16.6 billion, representing a spectacular rise of nearly 13% compared to the previous year. Currently, the quarrying and mining sector contributes between 2.3% and 2.5% to India's GDP. The expansion of mineral output in India is emphasised by a compound annual growth rate (CAGR) of 5.72% reported between 2013-14 and 2017-18. Notably, India's standing as the world's third-largest steel producer, delivering 101.4 million tonnes of crude steel in 2017, holds the potential to offset import costs.

India enjoys a prominent position as the world's largest producer of sheet mica and ranks seventh internationally in terms of bauxite reserves, which reached around 2,908.85 million tonnes in the fiscal year 2017. The quarrying and mining sector, noted for its labour-intensive character, provides employment possibilities for both unskilled and skilled workers, largely contributing to the unskilled workforce.

Furthermore, the development of mining-based firms sets off a chain reaction that promotes growth in associated sectors and adds to the overall advancement of regions. (Drishti IAS, *Mining and Quarrying Sector in India* 2019)



(Figure 13, Drishti IAS, *Mining and Quarrying Sector in India* 2019**)**

Challenges and Concerns Faced by the Mining and Quarrying Sector in India (Drishti IAS, *Mining and Quarrying Sector in India* 2019)**:**

Displacement and Rehabilitation:

- Large-scale displacement of local communities owing to mining and quarrying activity.
- Inadequate rehabilitation measures leading to dissatisfaction and mistrust in government efforts.
- Loss of traditional lifestyles and cultural legacy, particularly among tribal populations.
- Emergence of left-wing extremism in resource-rich areas like Chhattisgarh, Jharkhand, and Odisha.

Safety Risks and Human Rights Violations:

- Safety issues for miners owing to obsolete procedures and lack of suitable safety gear.
- Mine-related accidents, such as the Kisan coal mine incident in Meghalaya and Chasnala accident near Dhanbad.
- Human rights breaches, including inadequate rehabilitation and developmental measures.
- Local protests against mining projects, as seen in Niyamgiri Hills in Odisha, POSCO project in Odisha, and Sterlite protest in Tamil Nadu.

Rathole Mining:

- Illicit practice largely observed in North-eastern locations like Meghalaya.
- Involves tiny, vertical, and horizontal tunnel drilling, sometimes just 3-4 feet high.
- Banned by the National Green Tribunal (NGT) due to its dangerous and unscientific nature.
- Commonly utilised in Meghalaya because to shallow coal seams and hard terrain.

Environmental and Health Issues:

- Environmental deterioration from mining activities like Makrana marble mining in Rajasthan and granite mining in Karnataka.
- Loss of biodiversity and damage to local heritage.
- Health hazards such as fibrosis, Pneumoconiosis, and silicosis for workers and communities.
- Water and air pollution, leading to rivers like Kopili and Damodar become acidic and unsafe for drinking.

Administrative and Regulatory Challenges:

- Arbitrary coal mining allocations prompting litigation and corruption claims.
- Delays in gaining environmental clearances owing to bureaucratic barriers.
- Judicial interventions leading to extended delays and financial losses for investors.
- Examples include Supreme Court sanctions for illicit mining without green clearances and prohibitions on projects like Vedanta in Niyamgiri Hills and illegal mining leases in Goa.

Government Initiatives:

- Introduction of star ratings for mining leases to promote sustainable development.
- Collaboration between Indian Bureau of Mines (IBM) and National Remote Sensing Centre (NRSC) for monitoring mining through satellite photography.
- Launch of the Mining Surveillance System (MSS) utilises remote sensing detection technology to combat illicit mining.
- Establishment of the District Mineral Foundation Fund (DMF) under PMKKKY to support affected communities.
- National Mineral Exploration Policy to recruit commercial exploration agencies.
- 100% FDI allowed for metal and non-metal ore exploration via automatic route, approval procedure for mining titanium-bearing minerals and ores.

4.1.4 IBM (Indian Bureau of Mines)

With a focus on promoting sustainable growth, the Indian Bureau of Mines (IBM) sees itself as a national technical regulator and development organisation for the mineral industry. Its goals include the effective regulation of the mineral industry, the development of state regulatory agencies' capacities, and the distribution of beneficial technical support to the mineral sector. IBM also wants to act as a comprehensive data hub for mining and mineral information, helping with policy development. Its goals include acting as a national technical regulator, assisting state-level regulatory improvements, encouraging the development of the mineral industry using cutting-edge methods, and assisting the government in a variety of mineral-related topics.

The Indian Bureau of Mines (IBM) is engaged in numerous critical duties, functioning as an essential entity in the management and growth of the mineral industry:

- IBM collects, organizes, and maintains a comprehensive database covering exploration, prospecting, mining, and minerals across the country. This material is made broadly accessible through publishing and distribution.
- As the National Technical Regulator for the mining sector, IBM sets norms, procedures, and systems to aid state governments, operating as the first level of regulatory control.
- IBM works on boosting capacities in both regulatory and developmental areas at both the central and state levels. This effort is targeted towards ensuring efficient and effective management of the sector.
- IBM fosters institutional coordination among multiple stakeholders, including national and state governments, the mineral industry, research institutes, and academia. This collaborative strategy strives to proactively address industrial concerns.
- The encouragement of research related to practical issues of the industry is a major aspect of IBM's involvement. It functions as a bridge between research institutions and the industry, helping the application of research ideas to real-world industry needs.
- IBM offers technical consultation services, leveraging its experience to assist players within the mineral sector.
- IBM works as an advisor to the government on all topics connected to the mineral business. Its findings contribute to the formation of policies and decisions. (*Indian Bureau of Mines - IBM* 2019)

1. Mines and Minerals Development and Regulation
2. Maryland Council for Dispute Resolution
3. The National Mineral Exploration Trust

4.1.5 IBM RULES & REGULATIONS

In accordance with a number of laws and regulations, the Indian Bureau of Mines (IBM) performs a variety of tasks within the mining industry:

1. Through a National Mineral Information Repository, IBM is responsible for gathering, compiling, and disseminating comprehensive information on exploration, prospecting, mines, and minerals.

2. In its capacity as the National Technical Regulator, IBM develops policies, protocols, and systems to direct state governments in adhering to mining regulations set forth in the Minerals (Other Than Atomic and Hydrocarbon Energy Mineral) Concession Rules 2016 and the Mineral Conservation and Development Rules 2017.

3. In accordance with the MMDR Act of 1957, IBM strengthens capacities at the federal and state levels for regulatory and developmental activities within the mining sector.

4. In compliance with applicable legislation, IBM enables institutional cooperation between the federal and state governments, the mineral sector, research institutes, and other stakeholders to proactively address industry concerns.

5. IBM supports the industry's practical applications and is governed by Section 10 of the Environment Protection Act of 1986, which encourages practical research that fills the gap between research institutes and industrial needs.

6. In accordance with the MMDR Act of 1957, Rule 45 of the Minerals (Other Than Atomic and Hydrocarbon Energy Mineral) Concession Rules of 2016 and Rule 45 of the Minerals (Other Than Atomic and Hydrocarbon Energy Mineral) Conservation Rules of 2017, IBM provides technical consulting services to stakeholders in the mineral sector.

7. As permitted by the pertinent legal framework, IBM takes part in international efforts aimed at regulating and developing the mineral sector.

8. In accordance with the MMDR Act of 1957, IBM serves as an advisory body to the government and offers opinions on issues pertaining to the mining industry.

9. IBM engages in necessary actions in geology, mining, mineral beneficiation, and environmental elements as required by developments and the field's shifting terrain. This is done in response to the industrial dynamics that are changing.

10. IBM is essential to ensure that Mining Plans are implemented, reviewed, and modified in accordance with the MCDR 2017 and the Minerals (Other Than Atomic and Hydrocarbon Energy Mineral) Concession Rules 2016 as applicable.

11. In accordance with the MMDR Act of 1957 and the MCDR of 2017, the organisation carries out inspections, gives approvals, and oversees compliance with mining legislation, Mine Closure Plans, and ceasing operations.

12. IBM works with State Governments to stop illicit mining activities by reporting infractions and keeping track of quarterly returns. This is done in accordance with the MMDR Act of 1957.

13. Within the parameters of NMET as outlined by the MMDR Act of 1957, IBM actively contributes to mineral conservation plans and advancements in exploration.

14. IBM makes ensuring the sector's expansion fits with national objectives by administering the framework for sustainable mining development in accordance with Section 20A (2) of the MMDR Act 1957 and Rule 35 of the MCDR 2017.

15. In compliance with the Mineral (Auction) Rules, 2015, IBM continues to disclose the Average Sale Price (ASP) of significant minerals, providing essential data for determining mineral value and ad-valorem royalty assessments.

16. In accordance with the Offshore Areas Mineral (Development and Regulation) Act of 2002 and the Offshore Areas Mineral Concession Rules of 2006, the organisation issues mineral concessions and regulates offshore mining operations. (*Indian Bureau of Mines - IBM* 2019)

4.1.6 INSPIRATIONS FOR THE STUDY

Anil Avchat book प्रश्न आणि प्रश्न

In the book "**प्रश्न आणि प्रश्न" (Questions and Questions)** written by Anil Avchat, the chapter titled "खदान" (Quarry) stands out as a poignant exploration of critical issues. Within this chapter, Avchat reflects on his personal experiences and insights, focusing especially on the practices prevailing within quarries. These practices, he notes, have far-reaching implications for both the environment and the local community.

The conflict of quarries providing jobs for the community while also having a negative impact on the environment is explored in Avchat's story. The author emphasizes how unmanaged quarry activities can cause ecological deterioration and negatively affect the well-being of the nearby population. The author exhibits a strong concern for the environment. Anil Avchat expresses a sincere sense of obligation through his comments to advance sustainable practises in quarry operations. He emphasizes with passion the precarious condition in which communities are temporarily supported by jobs associated to quarries, only to be left jobless once these operations cease. This fact supports Avchat's request for thoughtful analysis of the long-term effects of quarrying. The author's words emphasise how urgent it is to develop quarrying strategies that are both environmentally responsible and put community welfare first. The words of Avchat strike a chord with a call to promote behaviours that guarantee the continued coexistence of environment and society. His account emanates a feeling of accountability as he pushes for the adoption of moral quarrying methods to ensure a more just and environmentally responsible future.

(Figure 14, Anil Avchat book प्रश्न आणि प्रश्न)

Breaking Away (1979)

In the coming-of-age movie "Breaking Away," from 1979, a group of adolescent friends in a tiny Indiana town are the main characters. The main character of the film is Dave, a recent high school graduate who struggles to define his sense of purpose. at the movie, Dave's passion in professional cycling inspires him to train at a nearby limestone quarry. The quarry has a key role in the movie, acting as a backdrop that represents Dave's struggles and his journey. These episodes in the quarry demonstrate his steadfastness, devotion, and desire to defy the norms of his working-class neighbourhood. The quarry transforms into a setting for self-discovery, personal development, and strong friendship as Dave and his buddies get ready for an important bicycle event. The quarry backdrop is skilfully used in the movie to highlight the characters' ambitions and the socioeconomic difficulties in the town. "Breaking Away" deftly examines themes of identity, friendship, and the pursuit of individual interests within a larger framework through the inclusion of the quarry.

(Figure 15 ,breaking away movie)

Blood Diamond

The story of a diamond smuggler, a fisherman, and a journalist are intertwined in the suspenseful 2006 thriller "Blood Diamond" against the backdrop of Sierra Leone's civil conflict. The movie depicts conflict diamonds' role in financing armed conflicts and the resulting human suffering by delving into their murky realm. The film examines the moral difficulties and bloodshed associated with the diamond trade via the adventures of the individuals. The phrase "blood diamond" refers to gemstones that are mined in conflict areas and then used to support insurgencies. The story of the movie emphasises the moral ramifications of diamond consumption and tries to spread awareness about ethical sourcing and how one's decisions might affect international conflicts.

(Figure 16,Blood Diamond)

खोई खदान (Lost Quarries of Navi Mumbai)

(Figure 17, खोई खदान , Charles Correa Foundation)

The Charles Correa Foundation's documentary "Khoi Khadan: Lost Quarries of Navi Mumbai" explores the struggles faced by the quarrying community in Navi Mumbai, focusing on their daily lives and interconnected livelihoods. The film highlights the uncertainty surrounding basic necessities like job, housing, education, healthcare, and sanitation, as quarries close. The documentary also examines the adaptation of inhabitants to urban environments and the challenges of urbanization and economic change.

"Khoi Khadan," a film directed by Ajinkya Mishra, Alex Mohan, Amol Lalzare, Irfan Sheikh, and Mihir Patilhande, explores the personal tales behind the disappearance of quarries in Navi Mumbai as well as the complications of urbanisation and economic change. (Mishra et al., *खोई खदान (lost quarries of Navi Mumbai)* | *CCF nagari 2021* 2021)

4.1.7.1 Assessment of Quarrying Impacts Comprehensively with Futuristic Vision of Urban Landscape Post-Quarrying

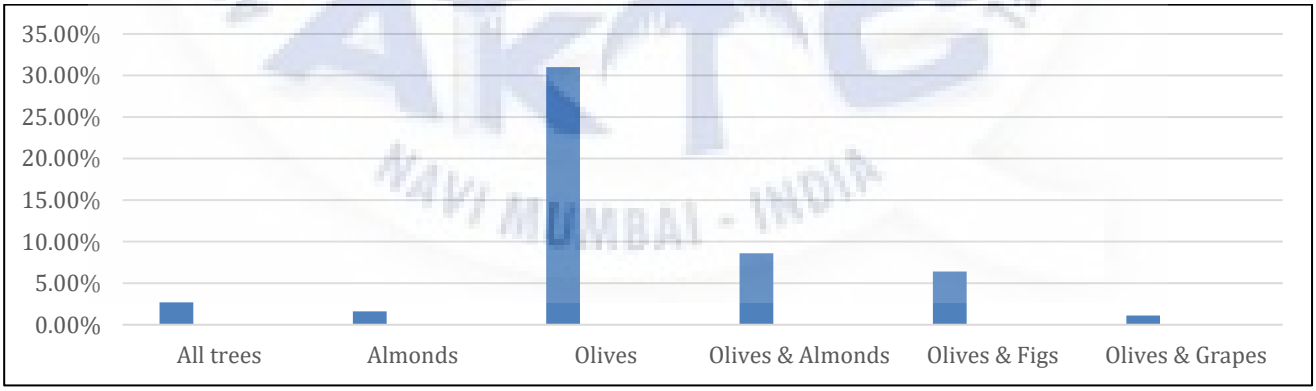
Authors: Shayma Bawatneh

Summary:

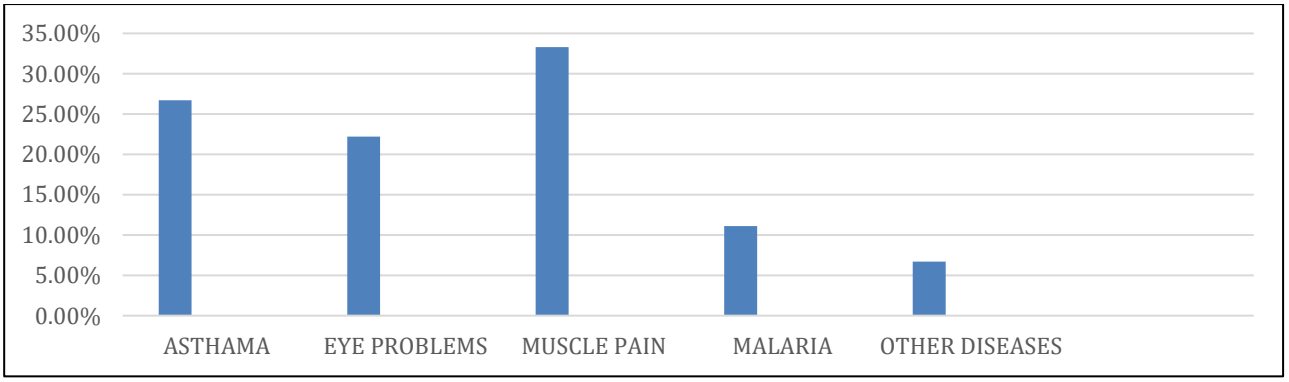
This study explores the many effects of quarrying on the environment and nearby communities with the goal of illuminating sustainable business practises for this sector. The study aims to identify both the beneficial and detrimental effects of quarrying and to provide ways for responsible practises through a thorough investigation of instances from around the world, including Hebron City, Kenya, Oman, India, and Croatia.

The report emphasises the economic value of quarrying for job creation and economic expansion but also highlights its environmental disadvantages. It demonstrates that quarrying may have a negative impact on ecosystems, water resources, air quality, and land quality. The study emphasises the significance of rigorous pre-planning to foresee and reduce potential harm in order to counteract these impacts. The research highlights how some visual characteristics of quarries can be controlled, such as by including native plants for aesthetic purposes, while others, like as pollution, call for strict regulatory measures. It encourages the adoption of sustainable practises to reduce pollution, such as routine road maintenance, the use of native plant species for rehabilitation, and recycling.

Analysing certain case studies offers insightful information. For instance, quarrying has a negative influence on agriculture and education while providing economic benefits in the West Bank. The fast expansion of quarries in Kenya is accompanied by problems with the environment and public health. The study makes actionable suggestions to improve quarrying procedures. These include cautious quarry location selection, careful post-quarry land management, afforestation to increase aesthetic appeal and biodiversity, and the 3Rs principle adoption in conjunction with technical pollution control measures. (Shayma Bawatneh, 2019)



(Figure 18 , Extinct trees due to quarrying & stone industry. Source: Sayara, 2016.)Hebron



(Figure 19, Common diseases – Mandera, Kenya.source: Ming'ate, & Mohamed, 2016.)

Findings:

The study emphasises the contradictory nature of quarrying, which contrasts its harmful effects on the environment and nearby populations with its critical role in supporting local economies through exports and jobs. The article urges governments and industry partners to implement strong environmental legislation and abide by international norms, calling for a balanced approach that prioritises sustainability. It is determined that effective waste management, good land rehabilitation, and careful quarry placement are crucial techniques to reduce negative effects. The study emphasises the importance of thorough planning and teamwork to make sure that quarrying activities are carried out in a way that is consistent with long-term ecological preservation and sustainable development goals.

4.1.7.2 PARAMETRIC STUDY ON QUARRY DUST AND BACTERIA IN CEMENT MORTAR FOR NEXT GENERATION: A REVIEW

Authors: Dr. Jayeshkumar Pitroda , Reshma Patel , Fenal Patel.

Summary:

The article evaluates the viability of using quarry dust and stone dust, waste products from quarry operations, as replacement building materials. Land fertility difficulties arise from the disposal of quarry dust, which results from quarry crushing. According to the study, adding up to 10% of quarry dust instead of natural sand improves compressive strength and workability. The addition of microorganisms also increases the durability and strength of materials.

The study explores the use of quarry dust as a binder in cement mortar, which is used in building jobs including plastering and sealing brick seams. Results show that using quarry dust in place of sand improves the strength, durability, and workability of mortar. The addition of microorganisms improves the mortar's durability, permeability, and other properties.

The potential for bacteria to make building materials resistant to alkali sulphate, freeze-thaw damage, and drying shrinkage is highlighted by prior studies. Concrete or cement mortar's compressive strength can be considerably increased by specific microorganisms.

In order to reduce carbonation rates and increase material durability, the study investigates the viability of microorganisms that encourage carbonate precipitation in building materials like concrete and mortar. The research also examines how changing the water-cement ratios and material strength by substituting quarry dust for natural sand.

Another waste product, stone dust, is also investigated for its potential use in building. Stone dust can increase the strength of concrete and mortar. For instance, increasing the amount of stone dust in cement improves the material's compressive and tensile strength. (Pitroda et al., *Assessment of quarrying impacts comprehensively with futuristic vision ...* 2017)

Findings:

The study highlights the opportunity to use quarry dust and stone dust in building materials to improve their efficiency and sustainability. Quarry dust can improve the strength and workability of construction materials by substituting for natural sand. Additional material qualities are strengthened by the addition of certain bacteria. Additionally, stone dust exhibits potential as a worthwhile substitute for fine aggregates, adding to the resilience and toughness of mortar and concrete. The study emphasises different methods for using building materials that are more effective while solving waste management issues.

4.1.8 Collectors to shutdown illegal stone quarries: Maharashtra


THE TIMES OF INDIA

Collectors to shut down illegal stone quarries: Maharashtra revenue minister Radhakrishna Vikhe Patil

(Figure 20 , Source : Times of India.)

Radhakrishna Vikhe Patil, Maharashtra's revenue minister, has ordered collectors to take action against illegal stone quarries and anybody connected to the forthcoming sand mining legislation. This policy seeks to streamline the entire sand mining process inside the state and to stop illegal mining. The finalised draught of the strategy will give citizens' interests top priority while attempting to reduce construction costs. The Maha Vikas Aghadi administration had previously implemented a programme for "manual sand mining." A quick and transparent block auction system will be included in the soon-to-be-implemented new mining legislation, coupled with cutting-edge technologies to address the issues the mining industry faces. (Nisha Nambiar , 2022)

4.1.9 In Association with the Site

4.1.9.1 Save Parsik Hills, stop fresh quarrying, NGO urges CM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THE TIMES OF INDIA

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Save Parsik Hills, stop fresh quarrying, NGO urges CM

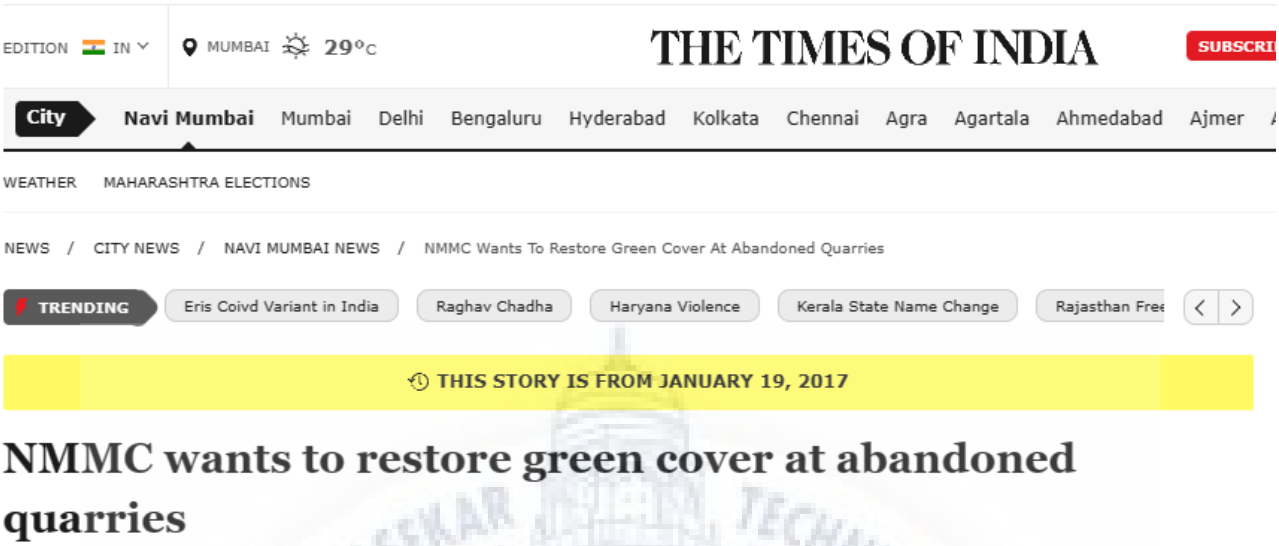
(Figure 21, Source : Times of India.)

In regards to the current quarrying operations at Parsik Hills in Navi Mumbai, the NGO "Shri Ekavira Aai Pratishthan" has voiced its concerns to Chief Minister Devendra Fadnavis. The group has brought up the Thane District Level Environment Impact Assessment Authority's choice to approve quarry blasting in the Borivli village area under the Mahape Indian Development Corporation (MIDC) zone.The quarry owner has been granted permission to carry out blasting operations in this area, especially in a location where continual blasting has had a considerable negative impact on the landscape. The NGO's head, Nandakumar Pawar, has expressed his concern that the continuous quarrying operations are endangering the health of the local population in addition to upsetting the ecological balance. According to reports, these actions produced 100 times more dust than was allowed, which had a negative influence on people's health.

A campaign called #HillGayaKalGaya (No Hills, No Tomorrow) has been started by the Public Relations Council of India in response to these worries. The purpose of this campaign is to mobilise support for and increase awareness of the significance of protecting the environment and natural landscapes from damaging quarrying activities.The circumstance highlights the precarious balance between economic goals and environmental protection, sparking concerns regarding ethical quarrying procedures and their potential effects on regional ecosystems and public health.

(B B Nayak, *Save Parsik Hills, stop fresh quarrying, Ngo urges cm: Mumbai News - Times of India* 2018)

4.1.9.2 NMMC wants to restore green cover at abandoned quarries

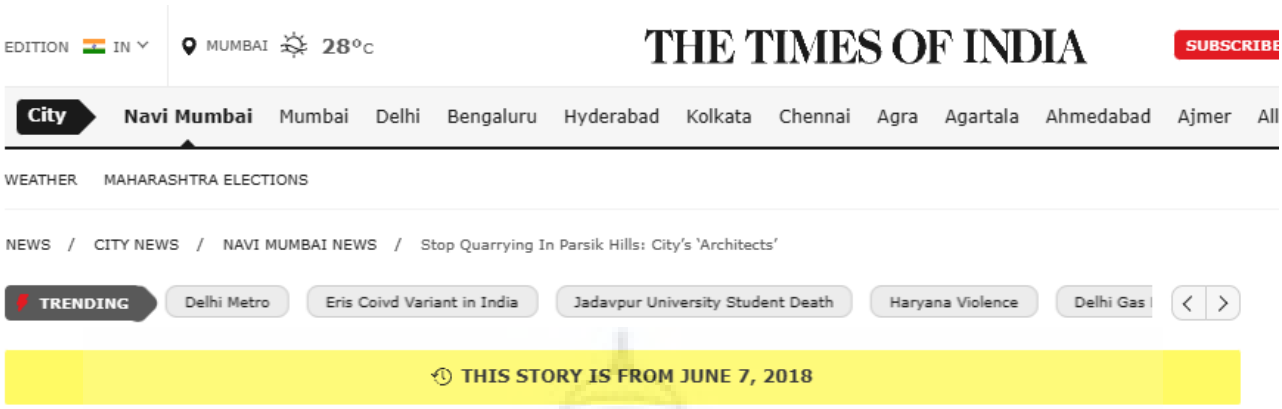


(Figure 22, Source : Times of India.)

The local government in Navi Mumbai has stepped up efforts to address issues relating to the decision made by the City and Industrial Development Corporation (Cidco). Cidco has unilaterally awarded 70 quarries under the control of the Navi Mumbai Municipal Corporation (NMMC) two extensions, each lasting three months. The NMMC has voiced its displeasure with these additions and is pushing for the transfer of control of the closed or abandoned quarries within its jurisdiction. To restore the area's vegetation, the NMMC thinks that these quarries need to be repaired and filled with soil.Despite the fact that the NMMC has authority over the quarries, Cidco decided to renew the lease for them in October 2016 and again in December until March 31, 2017. These decisions were made without consulting the NMMC. Ankush Chavan, the NMMC's second commissioner, emphasised the significance of assessing the hills' health, particularly in light of air pollution. Numerous complaints have been made to the civic council about the elevated air pollution levels brought on by suspended particulate matter, which both affects the industrial belt and residential regions.

The district mining office acknowledged that all of the hill's ground had been mined, and that additional mining would violate quarrying regulations. Civic officials discovered several violations involving the subcontracting of stone crushers as well as rules for mining and processing in addition to this one. These changes show the continued communication between local authorities to address environmental issues and guarantee compliance with rules in quarrying operations. (TNN , *NMMC wants to restore green cover at abandoned quarries: Navi Mumbai News - Times of India* 2017)

4.1.9.3 Stop quarrying in Parsik Hills: City's 'architects'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THIS STORY IS FROM JUNE 7, 2018

Stop quarrying in Parsik Hills: City's 'architects'

(Figure 23, Source : Times of India.)

Senior administrators, including the commissioner of Navi Mumbai Municipal Corporation (NMMC), leaders of several organisations including Cidco and BMC, town planners, and others have all voiced their worries with the continued quarrying activities in Parsik Hills. They emphasise how close these quarries are to neighbourhoods, raising concerns about the environment and human health. The National Green Tribunal (NGT) has requested that a thorough assessment be carried out before approving any additional lease renewal requests in response to these worries.

Ramaswamy N, NMMC Commissioner, has publicly expressed his opposition to quarrying in the city and has formally filed an affidavit to that effect. G S Gill, a former managing director of Cidco, supports mine closures and calls for an all-encompassing strategy to restore the hills under Cidco's control. Namdeo Thakur, the president of the Navi Mumbai Quarry Owners' Association, concurs with this position. Subodh Kumar, a former head of the BMC, adds his voice to the chorus by urging an immediate halt to mining activities and the restoration of native vegetation in the impacted areas.The Public Relations Council of India's Chairman, B N Kumar, has taken the initiative to start a campaign against quarrying in the Parsik Hills. With 550 e-signatures, this campaign has received a lot of support and will soon be presented to the Chief Minister for his consideration. The combined voices of these high-ranking authorities, professionals, and worried individuals highlight the expanding consensus regarding the necessity of addressing the societal and environmental effects of quarrying activities in the Parsik Hills. (tnn, *Stop quarrying in Parsik Hills: City's 'architects': Navi Mumbai News - Times of India* 2018)

4.1.9.4 Quarrying suspended in Navi Mumbai's Parsik Hill as authorities review mining lease

(Figure 24, Source: Down to earth.)

Several quarrying businesses located close to Parsik Hill in the region of Navi Mumbai have mining lease agreements that are currently being reviewed. Four additional NGOs have joined the Public Relations Council of India (PRCI) in a concerted effort to raise awareness of the environmental damage that these quarrying activities are causing and, ultimately, put a stop to them.Notably, air pollution levels near stone crushing operations have been determined to be significantly higher than permitted levels by the Maharashtra Pollution Control Board (MPCB). Deforestation, a fall in the water table, and biodiversity loss have all been brought on by the significant quarrying that has occurred along a 15-kilometer section of Parsik Hill. In order to prevent the lovely forested hills of Parsik Hill from being unnecessarily destroyed, Stalin D, director of the non-profit Vanashakti, highlights the area's potential as an ecotourism and adventure sports destination. **Due to pressure from locals and worries over pollution levels, the quarries have been dormant since May 2017**.

It's complicated because of the quarries' ownership status. These quarries were first given to locals who had donated their property to the City and Industrial Development Corporation of Maharashtra (CIDCO) for Navi Mumbai's expansion, but ownership has since shifted. The transfer of ownership is disclosed in an RTI answer acquired by Nandakumar Pawar, Director of Shri Ekvira Aai Pratishthan, and it suggests that some owners may have benefited from political patronage. According to historical occurrences, the Parsik Hills were initially awarded mining rights by the Ministry of Environment, Forests, and Climate Change for a 20-year term beginning in 2006 and ending in 2026. But CIDCO limited the lease's term to ten years, with its expiration in September 2016. The lease was renewed through March 2017, but a nearby resident filed a Public Interest Litigation (PIL) to contest the extension. Quarrying operations have been suspended since May 2017 as a result of pressure from worried neighbours and worries about pollution levels.

4.1.9.4 CIDCO Prefeasibility report of the Thane- Belapur belt quarries

According to the MoEF Notification dated **September 14, 2006**, the Pre-Feasibility Report for the CIDCO Stone Quarries in Navi Mumbai has been thoroughly produced. The Thane District of Maharashtra project, spread across five villages, focuses on open-cast quarrying for the extraction of Stone/Murrum metal in various sizes. Stone is a perfect building material because it is available in this location and has the compact black **Stone/Murrum characteristics**.On **March 17, 1970, CIDCO**, a renowned town planning organisation in India, was founded with the goal of building a self-sufficient metropolis next to Mumbai across Thane Creek. CIDCO has broadened its focus throughout time to include a variety of endeavours, such as project management, consulting, and urban development.

Location/Village	Survey No	Area in Ha
1. Pawane Village	163	21.23
2. Bonsari Village	203	30.81
3. Shirvane Village	323/A	18.59
4. Turbhe Village	387	47.74
5. Kukshet Village	183	19.70
	TOTAL	**138.07**

(Table 1, land acquired from the villagers.)

The quarrying project aims to harvest Stone, a minor mineral, from CIDCO Stone Quarries, a complex of five settlements and 138.07 hectares of forested land. These quarries, which belong to Category A, are jointly run by Project Affected Persons (PAPs). The project itself falls under Category A as well.The importance of the programme is emphasised on both a regional and a national level. Being a Category A project, its success depends on an Environmental Management Plan (EMP) that is organised efficiently and is customised for the particular area in question. Maharashtra places a high value on stone/murrum metal as a fundamental building resource that has influenced both civilisation and industrialisation. The project, which employs the **opencast** technology and aims for an average annual production of 6-7 million tonnes.

The mining lease area is geographically located according to latitude and corresponds to portions of Survey of India Toposheet No. 47 E/4. The project summary covers the specifics of the project's nature, setting, and workflow. Rich stone reserves may be found on the site, making it a fantastic building resource. (*Cidco Stone Quarries, Navi Mumbai - environmentclearance.nic.in* 2016)

(Figure 25, location of quarries.)

The initiative protects against the formation of solid waste or liquid effluent with a focus on sustainable practices. The site analysis takes connectivity, land use, and land ownership into account. The CIDCO Stone Quarries in Navi Mumbai, which span 138.07 hectares, are recognized as reserved forest land. A variety of land uses, including agricultural, non-agricultural, forest, aquatic bodies, and eco-sensitive areas, have developed over time. Given that there are no neighboring national parks or wildlife sanctuaries within a 15 km radius, the project has a negligible impact on the environment. Existing infrastructure consists of well-established quarrying enterprises and associated road systems that connect quarries to village roads and national highways. (*Cidco Stone Quarries, Navi Mumbai - environmentclearance.nic.in* 2016)

Sr. No	Particulars	Area
1	Stone quarries area	84.14 Ha
2	Crusher and Allied works, temporary labour shed and offices etc.	32.20 Ha
3	Approach Road	21.73 Ha
	Total	138.07 Ha

(Table 2, land acquired from the quarry project.)

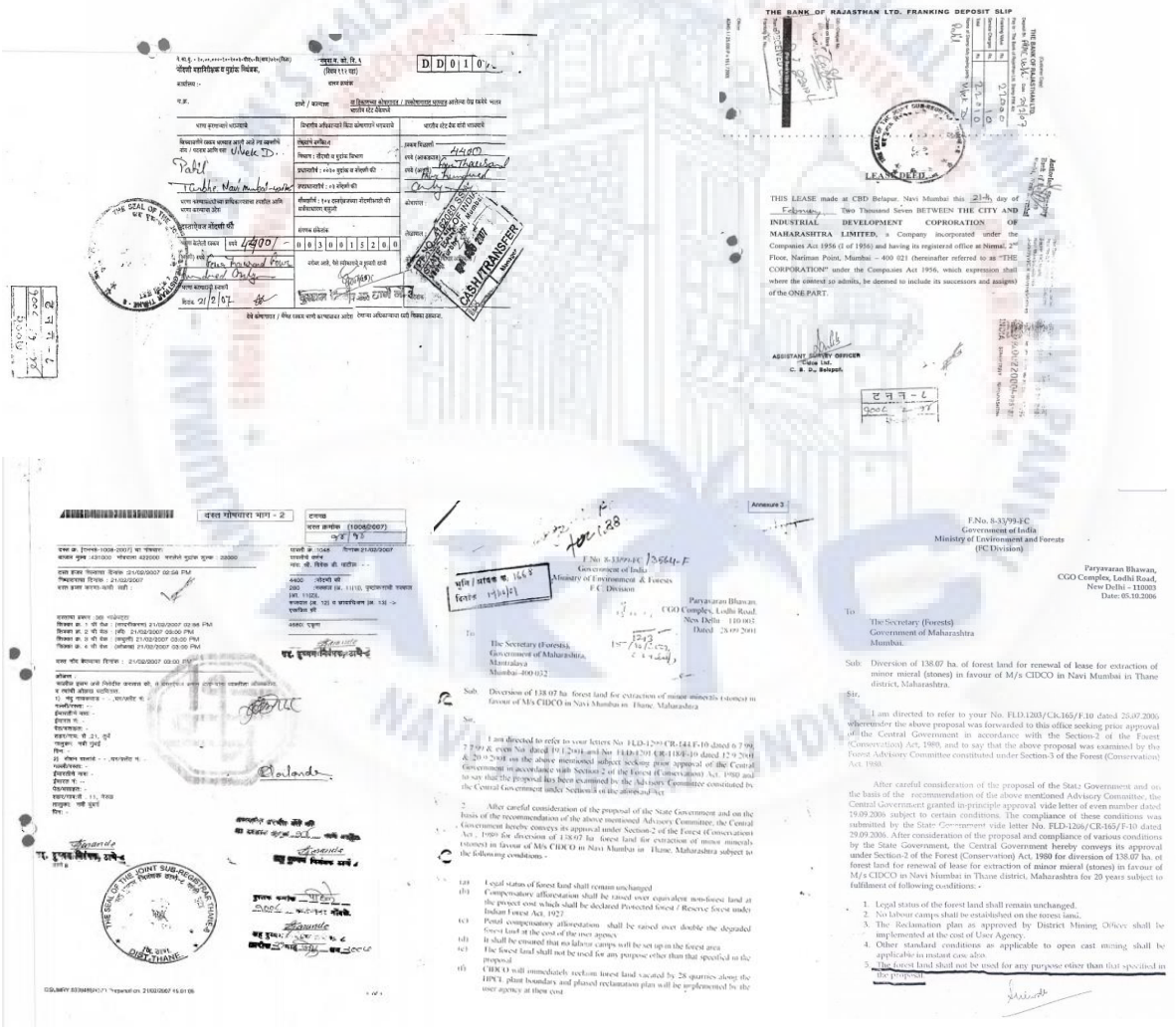
Turbhe MIDC, **Kukshet village, Nala Vasai Creek**, and the reserved forest area SQ inside the protected forest are a few of the quarry development locations that have been targeted. An expected expenditure of **Rs. 50 to 60 lakhs for each quarry development** and stone crusher setup supports the project's financial sustainability. It involves activities like crushing, screening, and truck-based road transportation.

Sr. No.	FEATURES	DETAILS	DISTANCE
1.	Village (Nearest)	Kukshet	1.3 km (W)
2.	Creek, Nala	Vasai creek	4.5 km (W)
		Bava Malang	6 km.(E)
3.	Reserved Forest	Forest area	SQ within Reserved Forest
	Protected Forest	-	-
4.	National Highway	NH 4	2.0 (E)
5.	Industries	MIDC Area	400m (W)
6.	Thermal Power Plant	None	-
7.	Mines	Various stone quarries	Adjacent
8.	Railway Line	Nerul Railway	1.62 km (W)
9.	Archeological Monument	None	-
10.	National Park	None	-
11.	Wildlife / Bird Sanctuary	None	-
12.	Interstate Boundary	None	-

(Table 3, area study, no National Park, Wild life Sanctuary in 15 Km radius of the project)

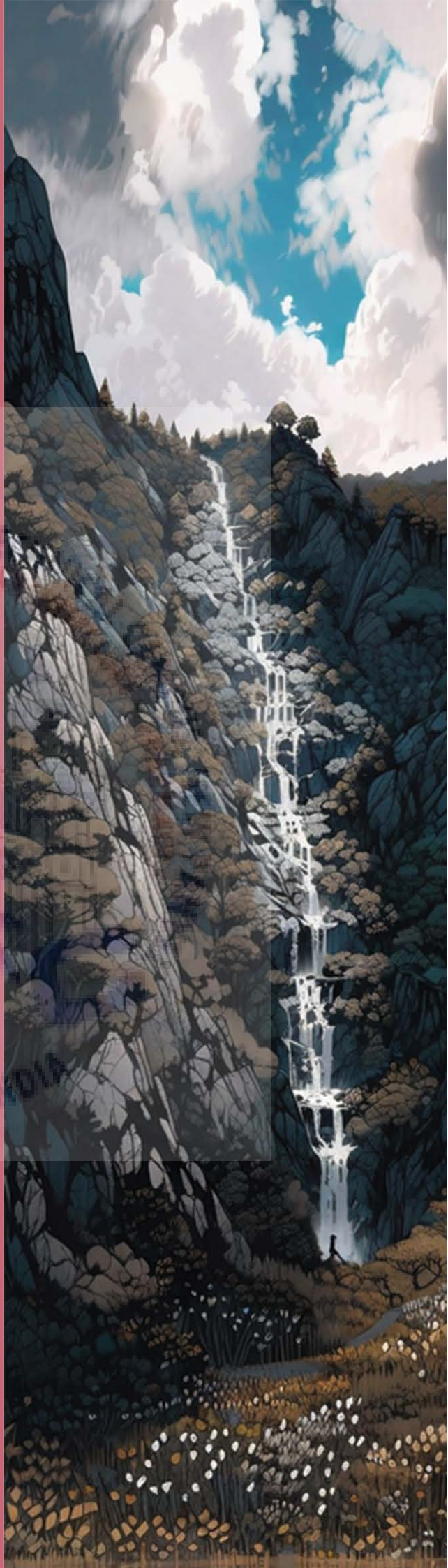
The project's proximity to adjacent villages **like Kukshet, Pawane, Shirvane, Turbhe, and Bonsari** reflects its semi-urban nature. The workforce will be mostly made up of local workers, who will come from nearby towns and states. Roads for the movement of materials and workplace amenities are among the necessary infrastructure that will be built. The provision of drinking water, canteens, restrooms, and other amenities is covered. Infrastructure for solid waste generation, industrial waste management, sewage systems, and drinking water management will all be integrated.

The initiative prioritises **rehabilitation and resettlement**, making sure that those who are impacted, such as those who have been evicted from their homes and lands as well as landless labourers, are well compensated. The effort incorporates project timetables, cost estimates, and analyses of economic viability while adhering to regulatory requirements. The initiative seeks to produce financial and social benefits with a heavy emphasis on helping the local population, including tribal people. The effort aims to promote change by closely connecting with the interests of the neighbourhood and adjacent communities.



(Figure 26, official documents of lease and environmental clearance)

LITERATURE REVIEW 2
-CASE STUDIES



05

4.2 LITERATURE REVIEW (Case Study):

4.2.1 COMMUNITY CENTER, RENOVATION NANJING, CHINA

Architecture Firm : AESEU Architectural Technology and Art Studio

Project Area : 4,950 square meters

Project Year : Completed in 2019

Design Team : Led by Jiajun Wang and Wei Wu

Client : Nanjing Lishui Industrial Investment Holding Group Co., Ltd.

Location : Situated in Nanjing, China

(Figure 27, images of the project)

PROJECT BACKGROUND

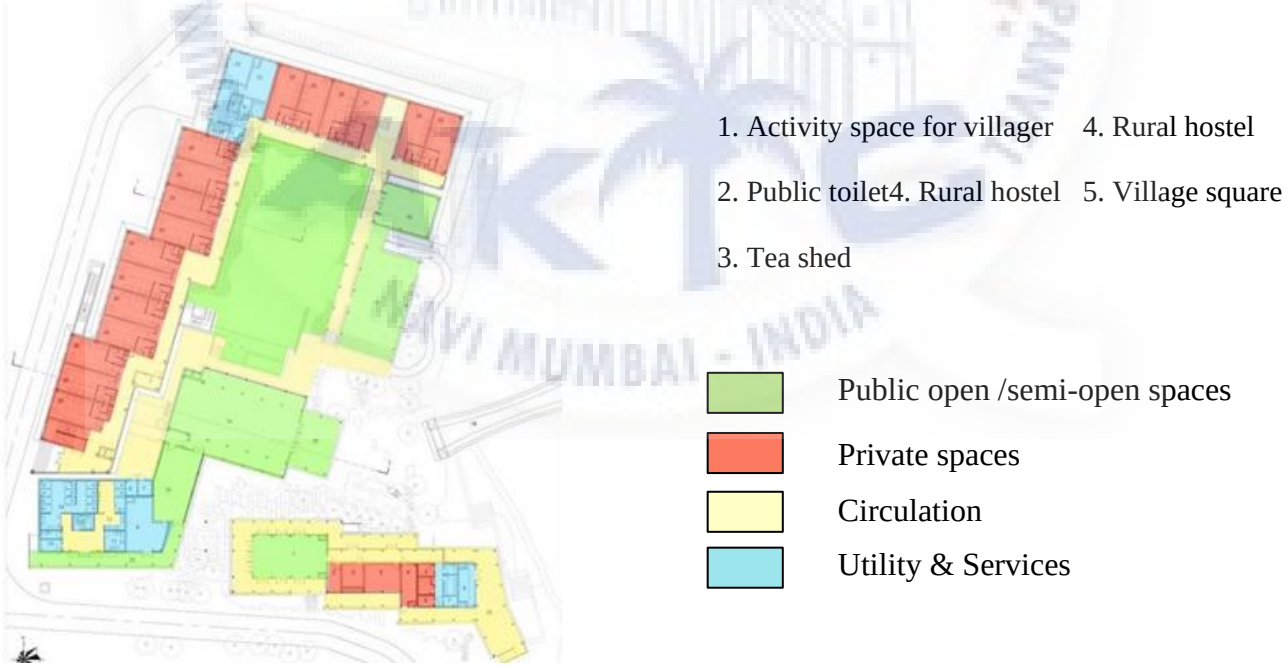
Approximately 60 KM separate Lixiang Village from Nanjing City. It is a modest community next to a mountain.

Due to its blueberry planting industry and particular historical culture, Li Xiang has become a renowned tourist destination. The village's basic public utilities, however, were unable to keep up with the increased demand for tourist services. In order to construct a new village alley that runs through the core of the village and combines the function of tourism services, catering, historical displays, cultural and artistic exhibitions, and sales, the ATA design team renovated some of the hamlet's abandoned houses in 2016. Many indigenous people have been drawn back to their communities to run hotels and homestays and sell agricultural items because of the commercial prospects presented by the tourists in the village. (Chen, *Lixiang Village Public Space / AESEU Architectural Technology and Art Studio* 2021)

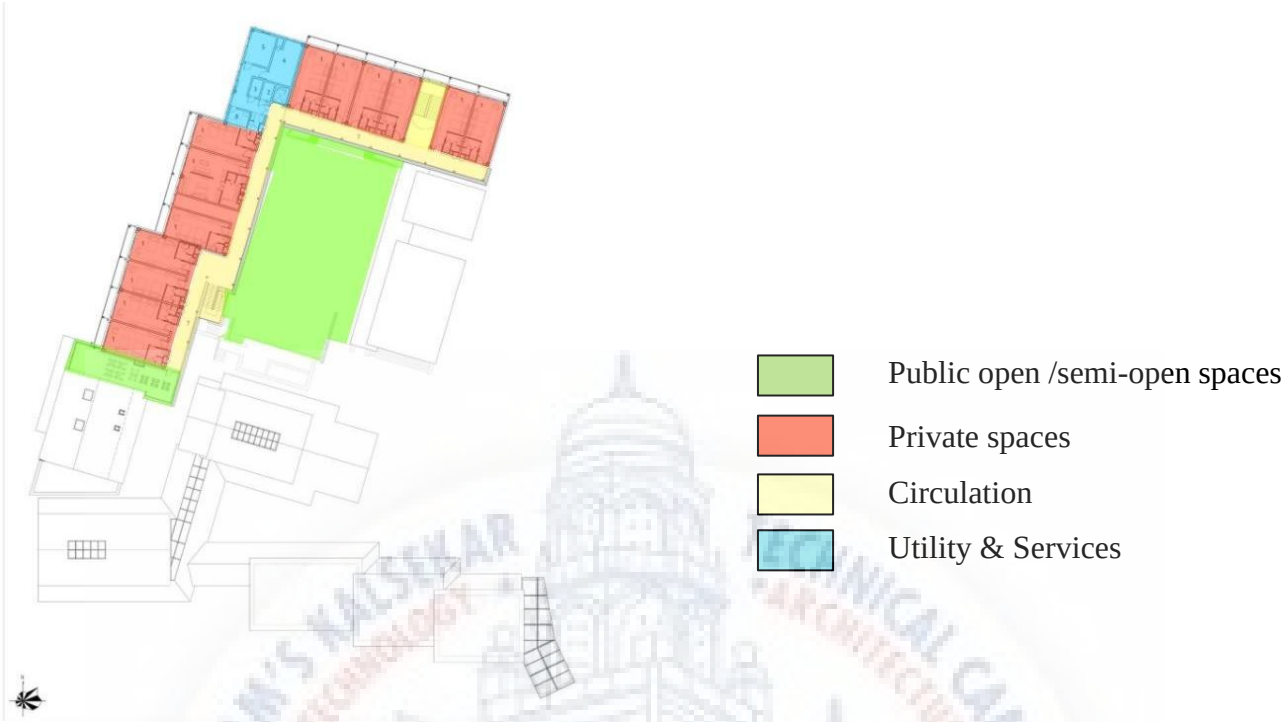
BUILT AND UNBUILT SPACES

(Figure 28, master plan/newly built & renovated parts)

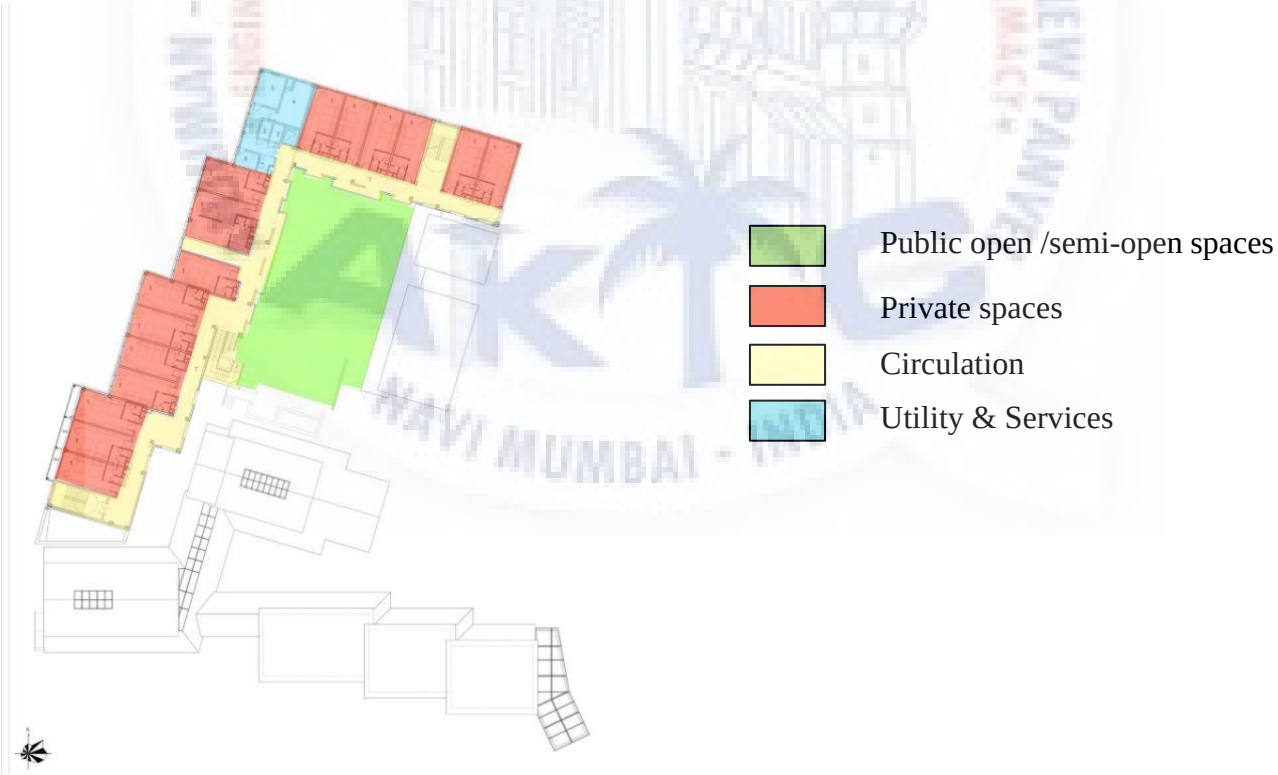
PROGRAM



(Figure 29, first floor plan)

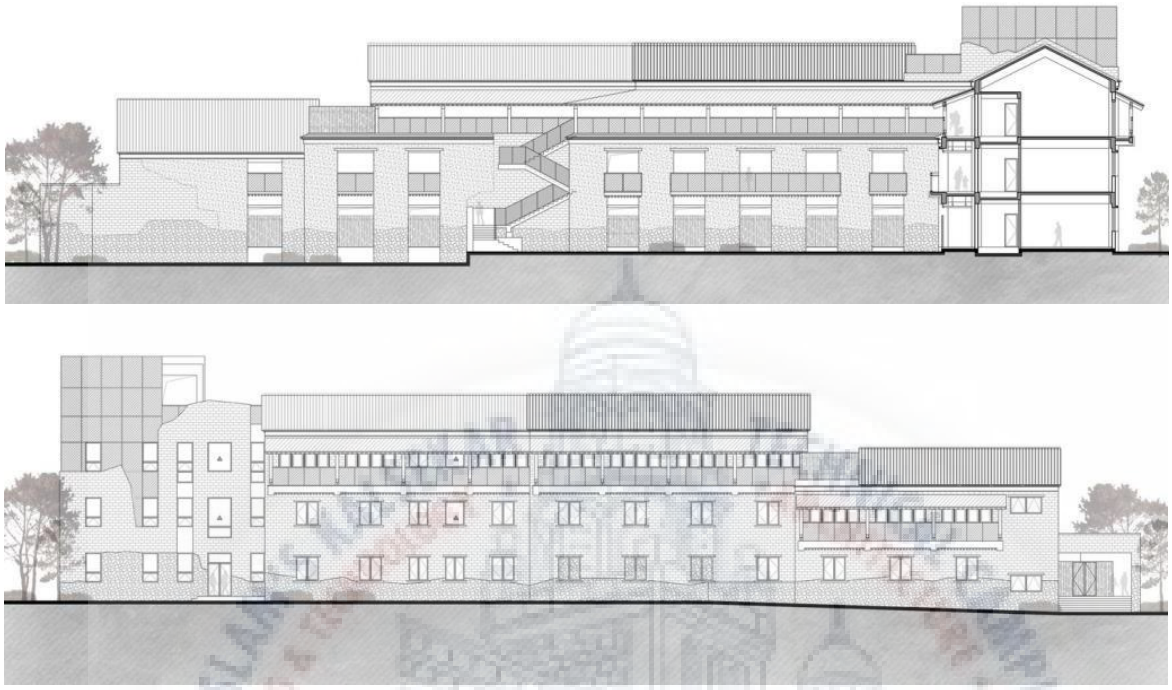


(Figure 30, second floor plan)

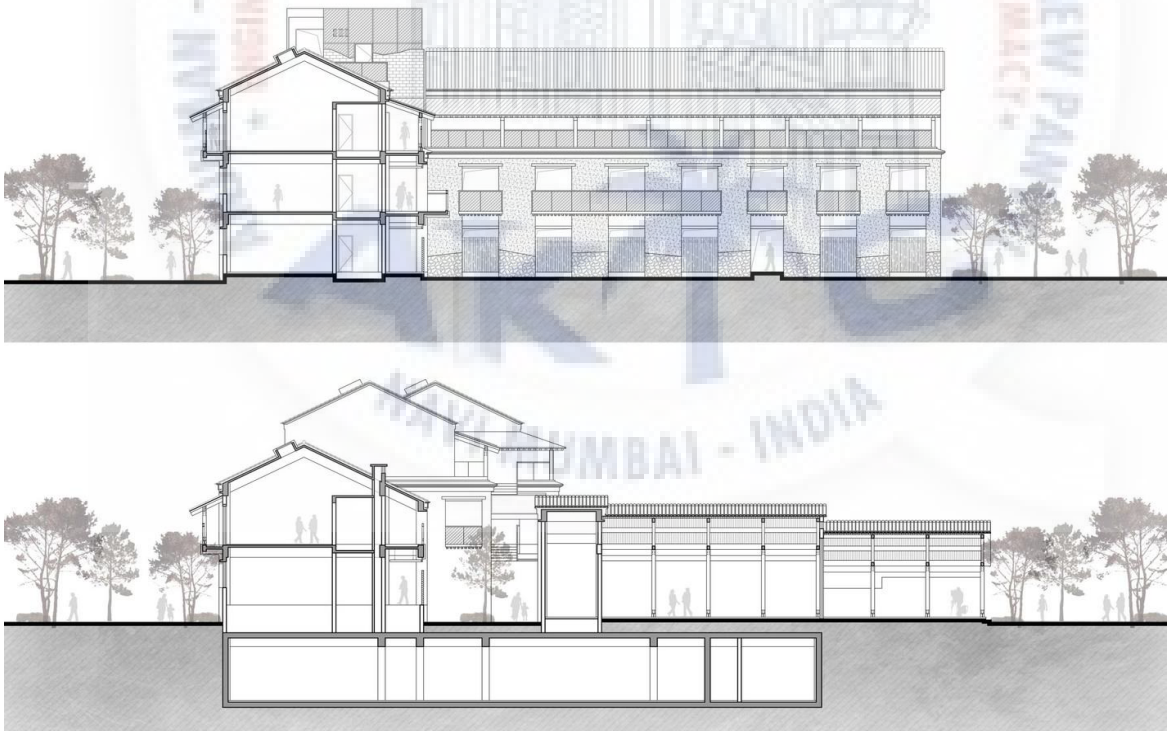


(Figure 31, third floor plan)

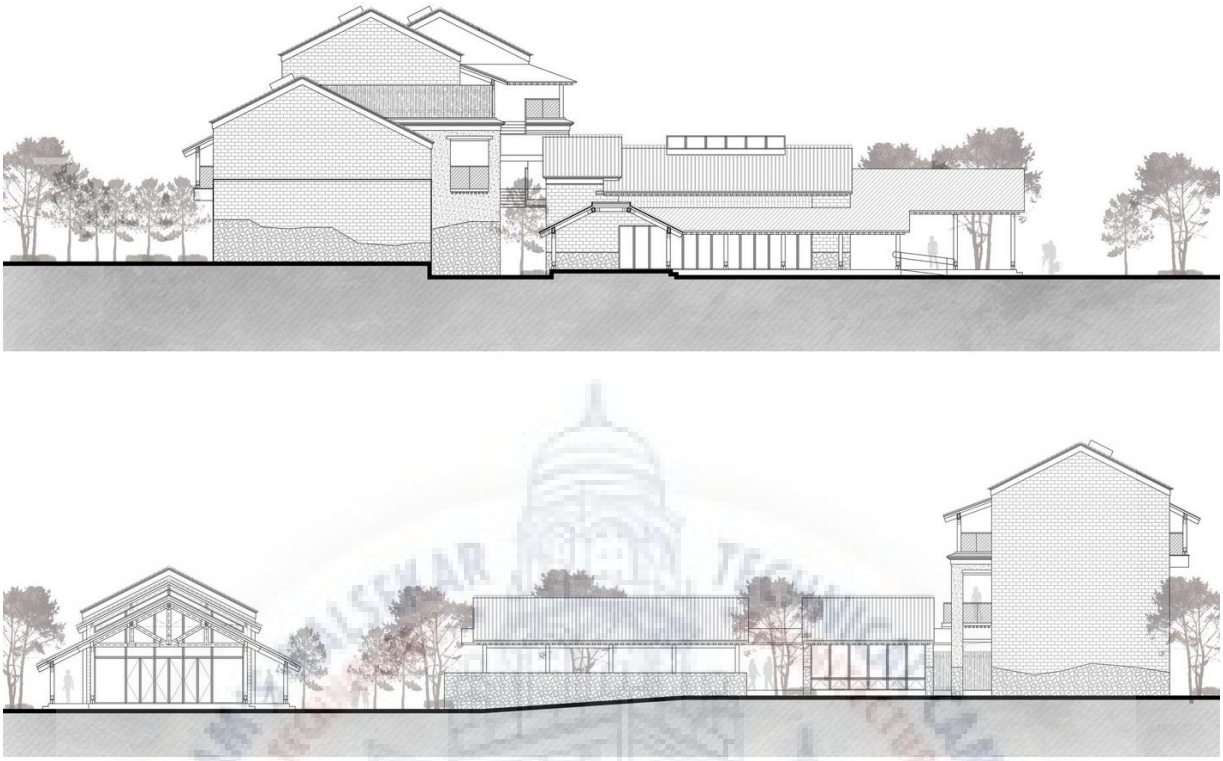
DETAILS



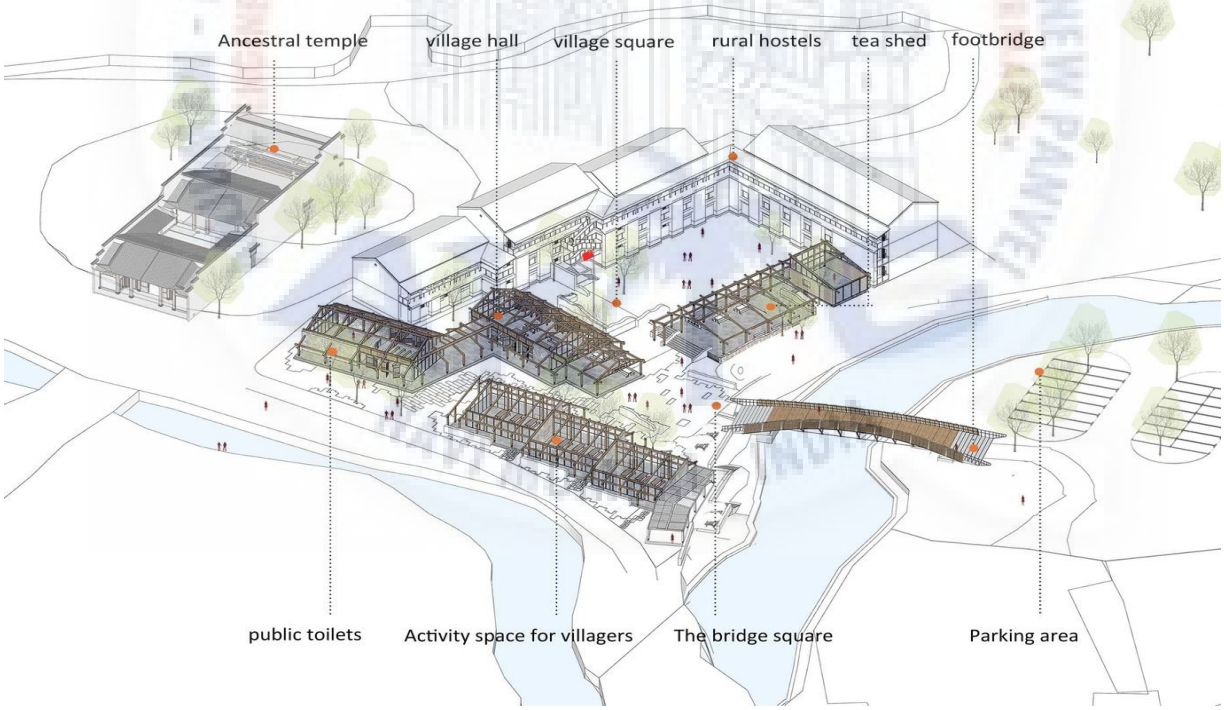
(Figure 32, elevations)



(Figure 33, sections)



(Figure 34, elevations)



(Figure 35, isometric identifying different spaces)

(Figure 36, exploded isometric explain materials & images of spaces)

1. Entrance Plaza: The project's focal point, this area honors the memories of the first village committee, where locals used to congregate. It has tall metasequoia trees and acts as a hub for gathering for both locals and visitors. People can interact with nature and one another in this inviting and open area.

2. Bridgeheads and Tree-Covered Areas: At the village's entry, these semi-outdoor areas offer a welcoming backdrop for a variety of activities. People can unwind, converse, and watch passersby. These areas act as a kind of nostalgic "village entrance" for visitors, letting them take in the charm of the town as soon as they enter.

3. Small Public Buildings: These structures, which are situated at the entry, house necessary amenities including restrooms, help offices, public restrooms, and more. They provide places for a variety of uses while being built to foster connections between tourists and locals.

4. Rural Hostel: This structure mixes visitor lodging with areas for community events. It has guest rooms, a courtyard, a pergola, a multipurpose room, and a restaurant that also serves as a canteen for the countryside. Thanks to the design, villagers and visitors are encouraged to interact and share local traditionspracticesmodernize.

5. Bamboo is used in village construction, demonstrating China's commitment to sustainability. The initiative uses contemporary technology and prefabrication to improve the quality of rural houses while promoting low-carbon and ecologically responsible building practises.

6. Rural Revitalization: The project shows how rural refurbishment may modernise small towns while keeping their environment and culture. It seamlessly combines routine village activities with visitor sightseeing opportunities in a brand-new rural public area.

CONCLUSION

Strengths:

- Encourages tranquilly and ties throughout the community.
- Draws guests with a distinctive village experience.

Weaknesses:

- Overcrowding results from a lack of space.
- Usability is constrained by certain restrictions.

Opportunities:

- Increase the variety of your activities.
- Use beautiful views to draw people in.

Threats:

- The functional challenge of crowding.

Inferences:

The settlement is successfully assimilated into society as a whole through the program. Lack of room could prevent the project from reaching its full potential and usability. Making the most of picturesque vistas can improve the project's appeal and attract more visitors.

4.2.2 MANAV SADHNA, Ahmedabad

Architecture Firm : Yatin Pandya

Site Area : 1100 sq.mts

Built-up Area : 515 Sq.mts.

Total Cost : Rs. 31 Lakh with Landscape and Interiors

Project Year : Completed in 2005

Location : Gandhi Ashram, Hridaya Kunj, Ahmedabad

(Figure 37, images of the project)

PROJECT BACKGROUND

Aim:By understanding that every person has a god within of them (Manav), serving the impoverished transforms into adoration (sadhna).

Objective: The initiative of Manav Sadhna focuses on three main areas: delivering inexpensive housing options, fostering economic empowerment, and producing a non-polluting environment. The project was born out of three years of hands-on investigation into the process of turning municipal garbage into useful building materials.

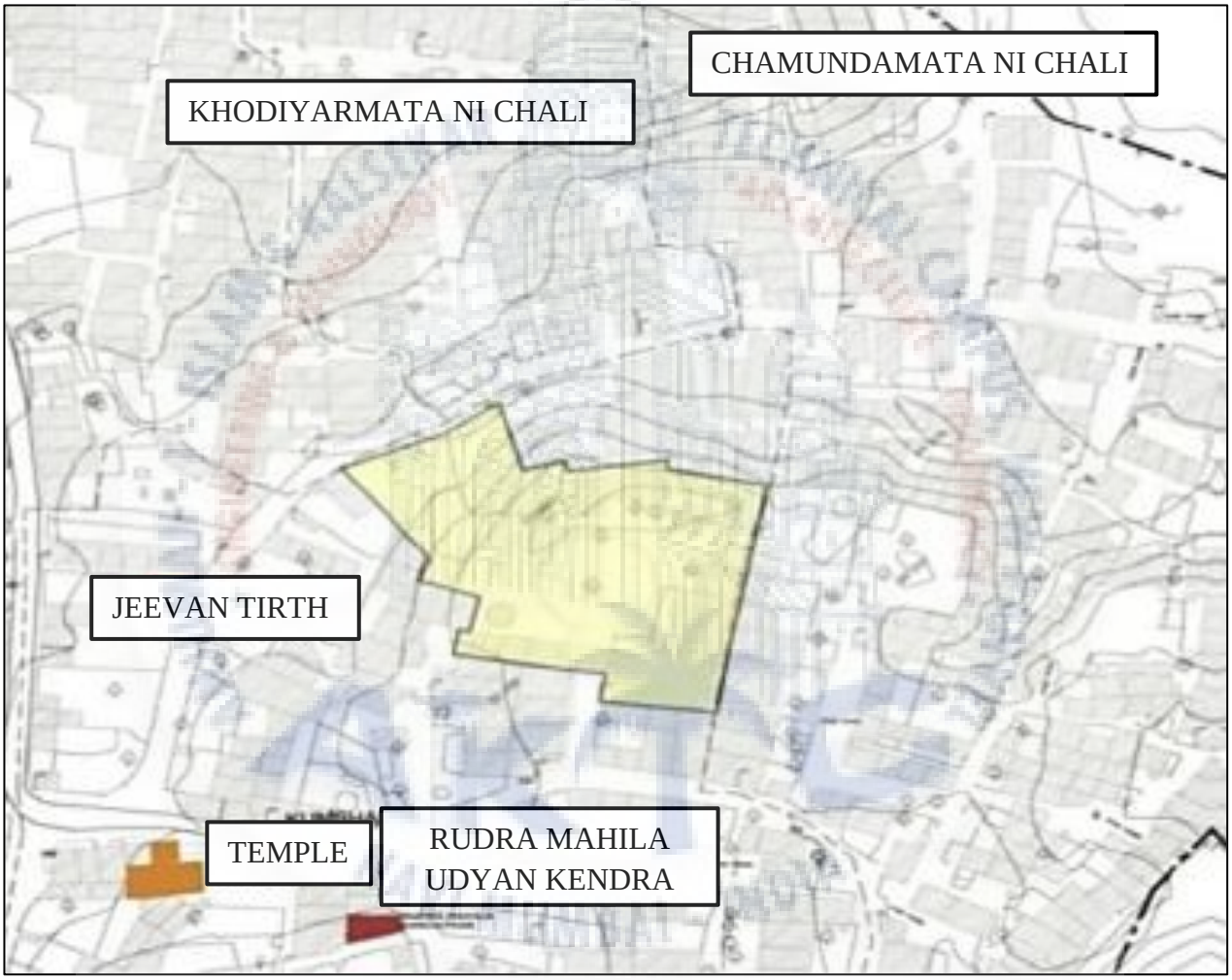
Innovation: Using basic hand tools and nearby resources, the team created innovative building components out of scrap materials. It highlights how construction may be a source of income, strengthening economically underprivileged areas and supplying options for inexpensive homes.

Multi-Activity Centre: The Manav Sadhna Activity Centre, which doubles as a school, gym, health centre, and community gathering place, is essential to the project.

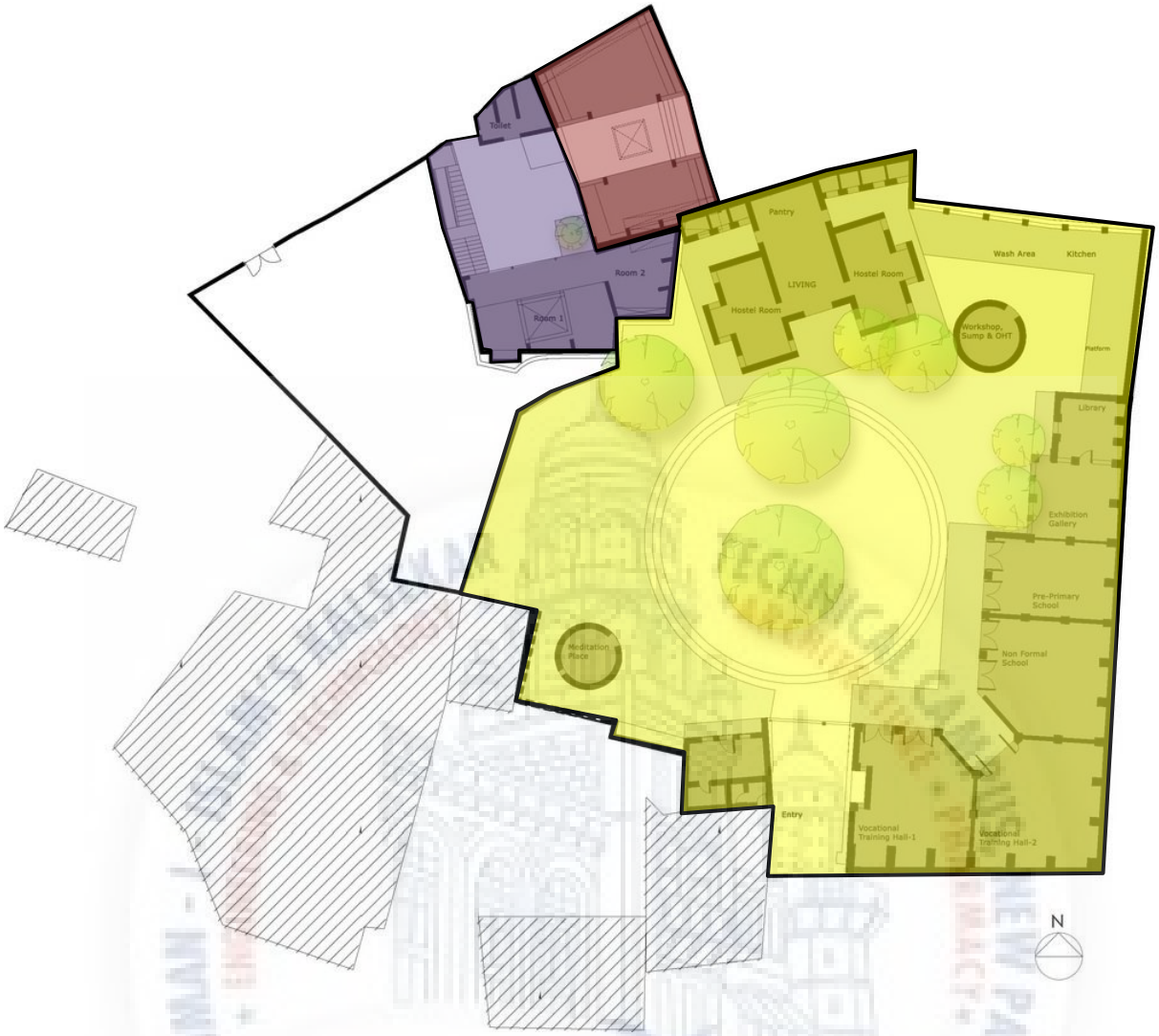
Recycling of Waste: The project recycles a variety of waste materials into new building materials such as walling, flooring, roofing and fenestrations.

Positive outcomes include employment possibilities for locals, recognition at the national and international levels, and other positive indications and spin-offs.

User Response: The community has embraced the project, resulting in the opening of more centres and the adoption of comparable architectural features in residences, promoting sustainability within the settlement. (Future, *Manav Sadhna by Yatin Pandya* 2022)



(Figure 38, site plan with neighbourhood context)



(Figure 39, Execution phases)

CONSTRUCTION :

1.Filler Slab With Glass Bottles

2.With Plastic Bottles And Bricks

3.Stone Slab

4.Cement Board With Clay Tile Cover

5.Pipe Truss With G.I. Sheet.

Wall Techniques:

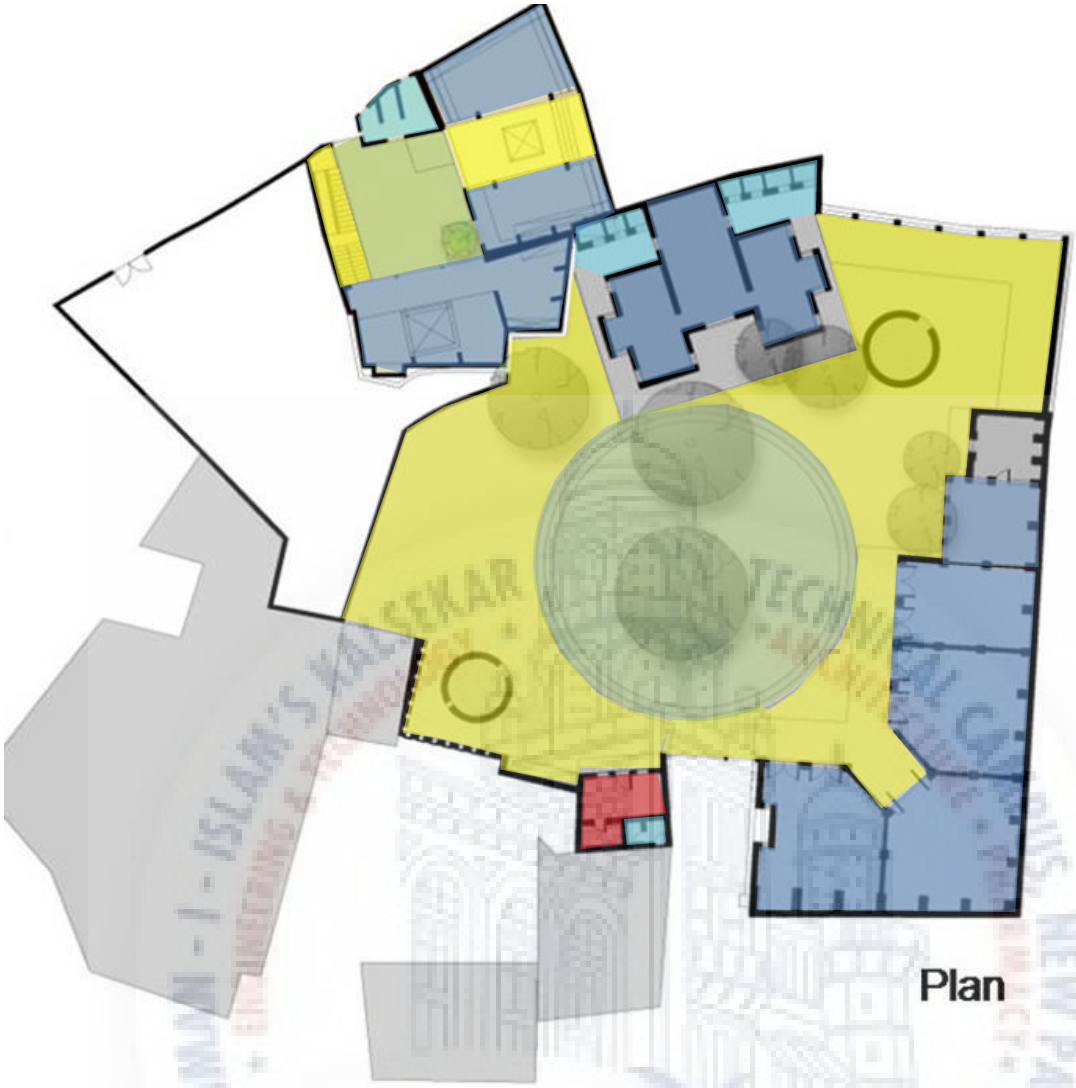
1.Cement Bonded Fly ash Bricks

2.Mould Compressed Bricks

3.Stabilized Soil Blocks

4.Recycled Glass, plastic Bottles

5.Vegetable Crate Wood Paneling.

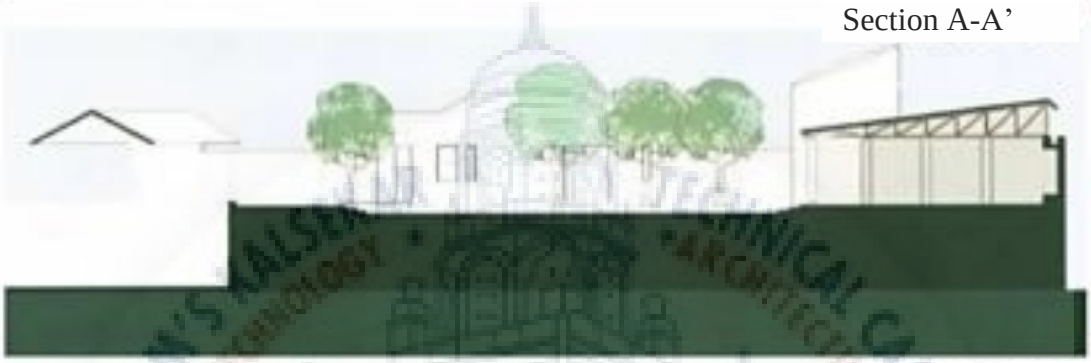


(Figure 40, area program)

- Public open /semi-open spaces
- Private spaces
- Circulation
- Utility & Services
- Public spaces

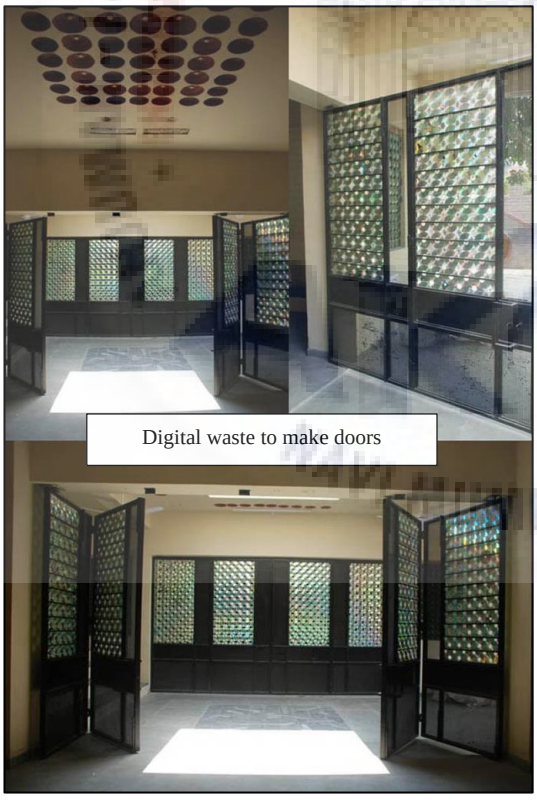
DETAILS

Section A-A’

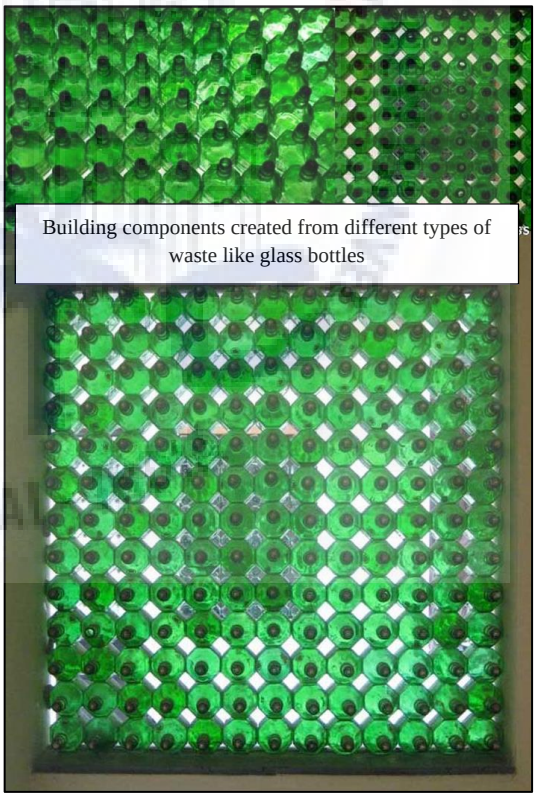


Section B-B’

(Figure 41, section)



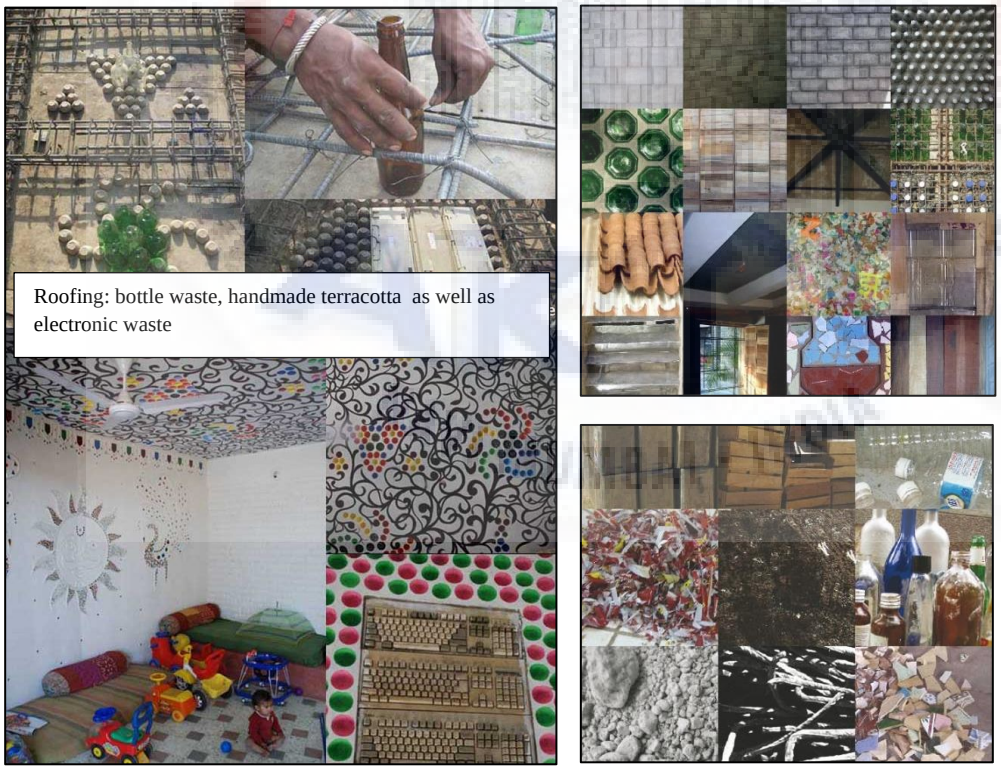
Digital waste to make doors



Building components created from different types of waste like glass bottles

(Figure 42, doors made out of digital waste & glass bottle walls)

(Figure 43, reuse of material)



MATERIALS

- Steel frame
- Bicycle parts
- Resin
- Cobalt
- Glass fiber mat
- Plastic bottle
- Fly ash
- Water sludge
- Cement, gypsum
- Lime
- River sand.

(Figure 44, filler slabs out of terracotta)

CONCLUSION

Strengths:

- Innovative Recycling: The project's creative utilisation of trash resources illustrates a sustainable approach to constructing by offering reasonably priced and environmentally friendly building materials.
- Community-Centric: The initiative is strongly rooted in the community it serves and is situated within a squatter settlement, generating a sense of ownership and social cohesiveness.
- Multi-Activity Centre: To maximise its impact, the facility's adaptable design allows for a variety of uses, including education, job training, healthcare, and community meetings.
- Economic Empowerment: The project benefits marginalised areas by generating employment opportunities for locals through construction and vocational training.

Weaknesses:

- Resource Restrictions: The project's ability to be scaled up to other regions or metropolitan contexts may be constrained by its reliance on local resources and expertise.
- Maintenance Obstacles: If continuing maintenance and community involvement are not maintained, sustainability and durability may be challenged.

Opportunities:

- Replication: The project's success can be duplicated in comparable cities with housing and waste management issues to encourage sustainable growth on a larger scale.
- Transfer of Skills: By sharing the information and abilities developed via this initiative with other communities and organisations, sustainable practises will spread.

Threats:

- External considerations: Political and economic considerations may have an impact on the project's capacity to obtain finance and resources.
- Community Dynamics: Changes in the dynamics or priorities of the community could have an impact on the project's long-term viability.

The Manav Sadhna Project is an excellent example of the possibility for all-encompassing, locally-driven solutions to serious urban problems.

4.2.3 Jetavan Spiritual Center, Maharashtra , Nashik

Architecture Firm : Sameep padora &associates

Site Area : 2015 sq.mts

Built-up Area : 311 Sq.mts.

Client : Somaiya Trust

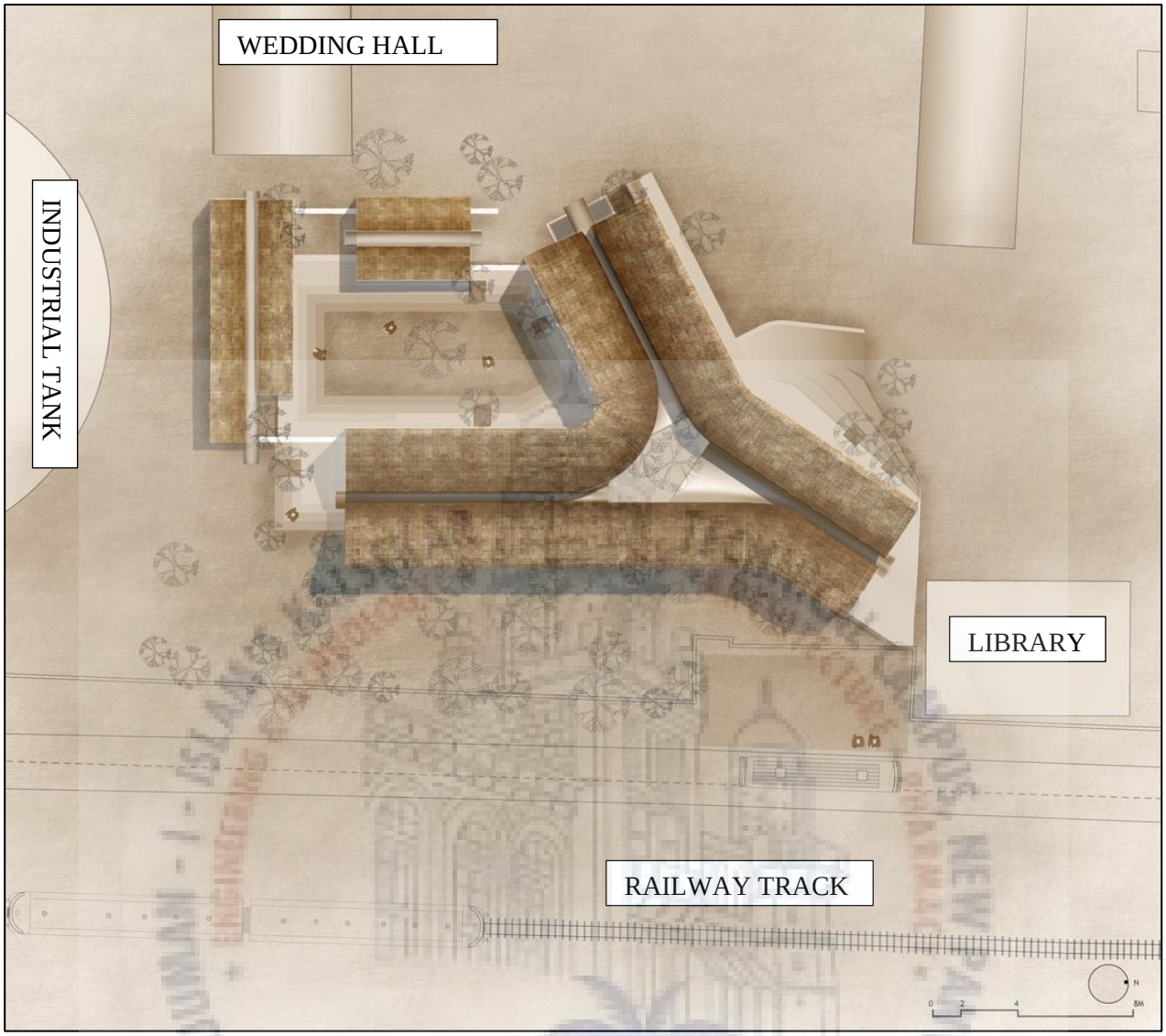
Project Year : Completed in 2016

Location : Jetavan Spiritual Center, Maharashtra , Nashik, Sakharwadi

(Figure 45 , images of the project)

PROJECT BACKGROUND

The Dalit Baudh Ambedkar Buddhist community's spiritual and skill-development center is called the Jetavan Spiritual Centre, and it is situated in the rural Indian state of Maharashtra. Samir Somaiya, the proprietor of a nearby sugar plant, donated the center, which has the name of the Jeta grove, in order to provide as a spiritual anchor for Buddhist education and thought. The center was built to protect the environment by erecting six different structures, each of which was situated with care to spare even one tree. A center valley and rising edges are used in the design to link the internal and external rooms visually. Additionally, the center makes use of environmentally friendly products such basalt stone dust, fly ash waste, recycled wood, mud rolls, clay tiles, and conventional mud and dung processes. The center blends spirituality, neighbourhood improvement, environmental protection, and sustainable building techniques, paying honor to its historical roots while providing a cutting-edge illustration of how architecture and design can improve lives while honouring the environment. It is a center for vocational and spiritual training in short a skill development community center. (*Jetvan: Sameep Padora and Associates* 2022)



(Figure 46, site plan with neighbourhood context)

MATERIALS USED

Fly ash, quarry dust, cow manure, and mud rolls fashioned from used gunny bags set on old ship's timber rafters were used to construct Jetavan's walls, floor, and ceiling. The building was constructed with the assistance of craftsmen from Hunarshala in Kutch; Godavari Biorefineries, the flagship company of the Somaiya Group, donated land; and funding came from both domestic and international contributors. (Rojas, *Jetavan spiritual center / sameep padora & associates* 2021)

PROGRAM

(Figure 47, area program)

Public open /semi-open spaces

Private spaces

Circulation

Utility & Services

Public spaces

KEY SPACES

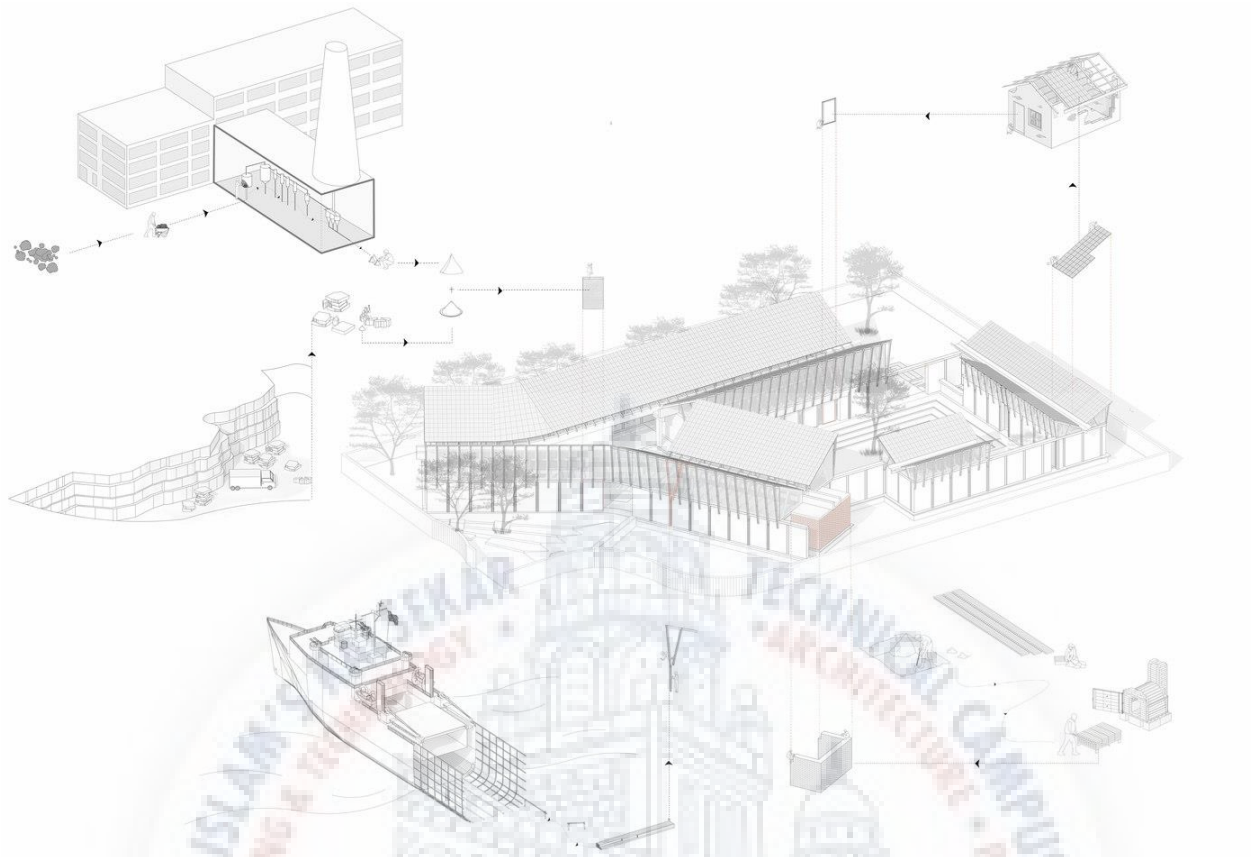
- Admin-25 sq m
- Pantry – 5 sq m
- Store room sq m
- Restrooms(men)-10 sq m
- Restrooms(women)-10 sq m
- Prayer hall-90 sq m
- Wokshop-105 sq m
- Guestroom -16.5 sq m
- Guest bathroom-5 sq m

DETAILS

(Figure 48, section)

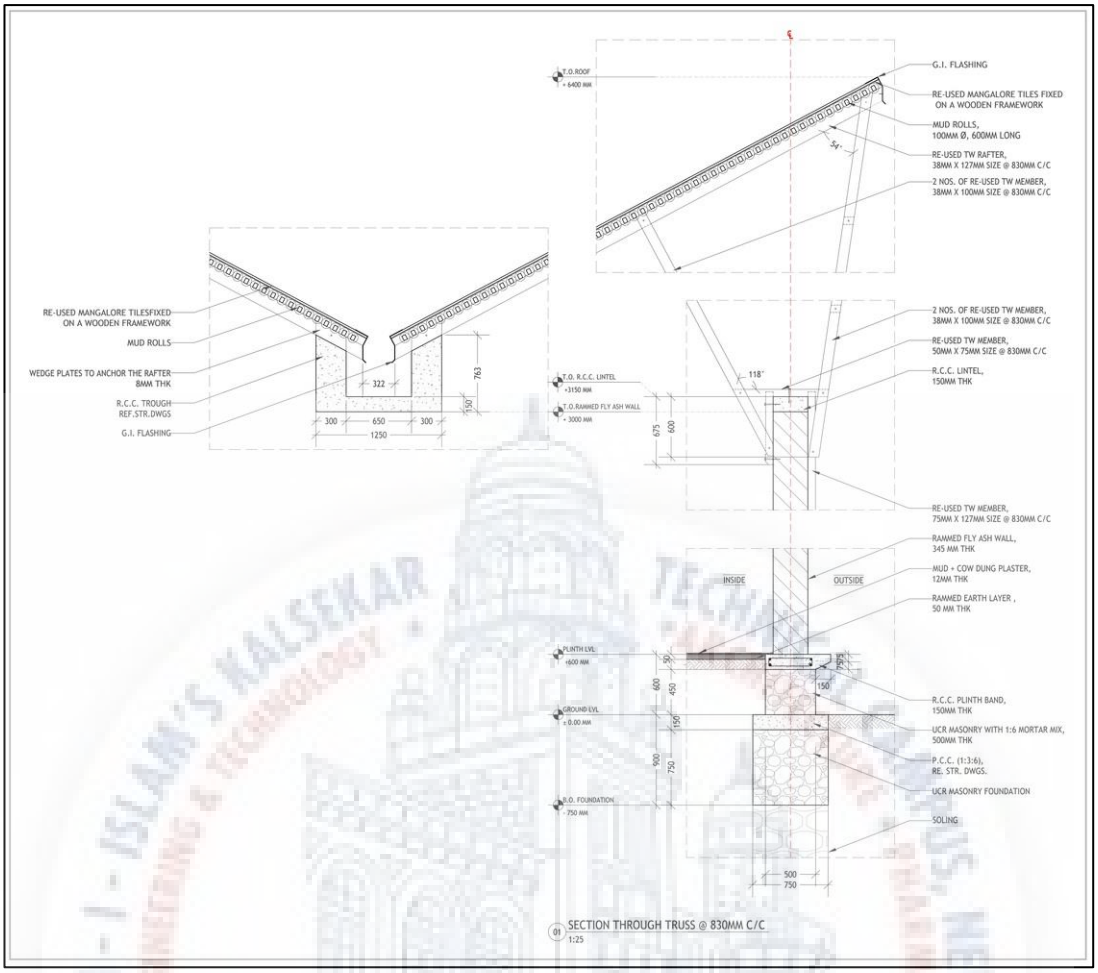
(Figure 49, section)

(Figure 50, light and ventilation)



(Figure 51, isometric explaining different strategies)

Cow dung is used to finish all of the floors. This is a typical practise in rural Maharashtrian households and is thought to offer cooling and antibacterial benefits. Given the caste dynamics that have characterised Jetavana's history, where the lowest castes would undoubtedly have had limited resources for self-expression, I believe this option to be dubious. Sparse finishing, a lack of glazing, and cracked cow dung appear to be in opposition to current goals of people from oppressed castes who are looking for an equitable place in civil society.Such materials are indicative of a top-down strategy that prioritises the needs of the architect and client over the evolving desires of a changing community.All community members will be able to learn academics, vocational subjects, health, and spirituality at the Jetavan Centre. It will serve as an addition to the three schools that Somaiya Vidyavihar currently operates nearby.



(Figure 52, part section detail)

KEY SPACES

- Admin-25 sq m
- Pantry – 5 sq m
- Store room sq m
- Restrooms(men)-10 sq m
- Restrooms(women)-10 sq m
- Prayer hall-90 sq m
- Wokshop-105 sq m
- Guestroom -16.5 sq m
- Guest bathroom-5 sq m

(Figure 53, site plan with neighbourhood context)

CONCLUSION

Strengths:

- Jetavan has great spiritual and cultural significance because it helps the locals stay connected to their ancestors.
- Environmental Commitment: It is dedicated to protecting the environment and is a leader in environmentally friendly architecture.
- Community Empowerment: It gives the community economic and social clout by providing skill development.

Weaknesses:

- Dependency on Resources: Constricted by the scalability and accessibility of nearby resources.
- Limited Outreach: Its remote location can make it harder to contact people.

Opportunities:

- Jetavana can serve as a paradigm for environmentally friendly architecture in the area.
- Engagement in the Community: It can increase outreach to a larger audience.

Threats:

- Threats to the environment, such as deforestation, may interfere with the organization's commitment to the environment.
- Socioeconomic Factors: Changes in the economy may have an effect on community benefits.

The Jetavan Spiritual Centre in rural Maharashtra, India, is a beautiful example of how history, spirituality, community growth, and sustainability can all coexist in perfect harmony. It serves as a shelter for the Dalit Baudh Ambedkar Buddhist community's spirituality and a resource for skill development. It is named after the Jeta grove and was kindly provided by Samir Somaiya.

4.2.4 KHAMIR CRAFT RESOURCE CENTRE , Bhuj, Gujarat

Architecture Firm : Neelkanth Chhaya

Site Area : 8093.71 sq.mts

Built-up Area : 2500 Sq.mts.

Client : Nehru foundation for development

Project Year : Completed in 2017

Location : Kutch,Gujarat

(Figure 54 , images of the project)

PROJECT BACKGROUND

In Kukma, India, the Khamir Craft Resource Centre was founded in 2005 in response to the severe earthquake that rocked the area in 2001. The centre strives to advance and maintain Kutch's craft industry, cultural ecology, and history. In order to construct the centre within a delicate ecological context while respecting the surrounding physical landscape, architect Neelkanth Chhaya worked in tandem with the Hunnarshala Foundation. The 2200 square metre center's architecture blends with the surrounding nature to represent the ethnography of Kutch and its environs. The centre reflects the local lighting quality by utilising regional supplies and building methods. The structures have sturdy plinths and rammed earth walls with obvious layers of craftsmanship. By facilitating economic assistance and knowledge preservation for a variety of craft forms, the institution acts as an oasis for craftspeople. Workspaces in the form of "otlas," safe locations for the storage of supplies and tools, as well as areas for product development and research, are all included in the design. A contemporary, functional space that honours and celebrates the town without romanticising it is exemplified by the center's unique architectural gestures, which emphasise simplicity and colourful dynamics. The Khamir Craft Resource Centre is a monument to the resiliency of communities and the transformational potential of architecture, representing a journey of recovery and revitalization. (Chhaya, *Site visit: Khamir Craft Resource Centre* 2020)

Users

- The musicians who practise their music

- The artists and craftspeople who practise their profession

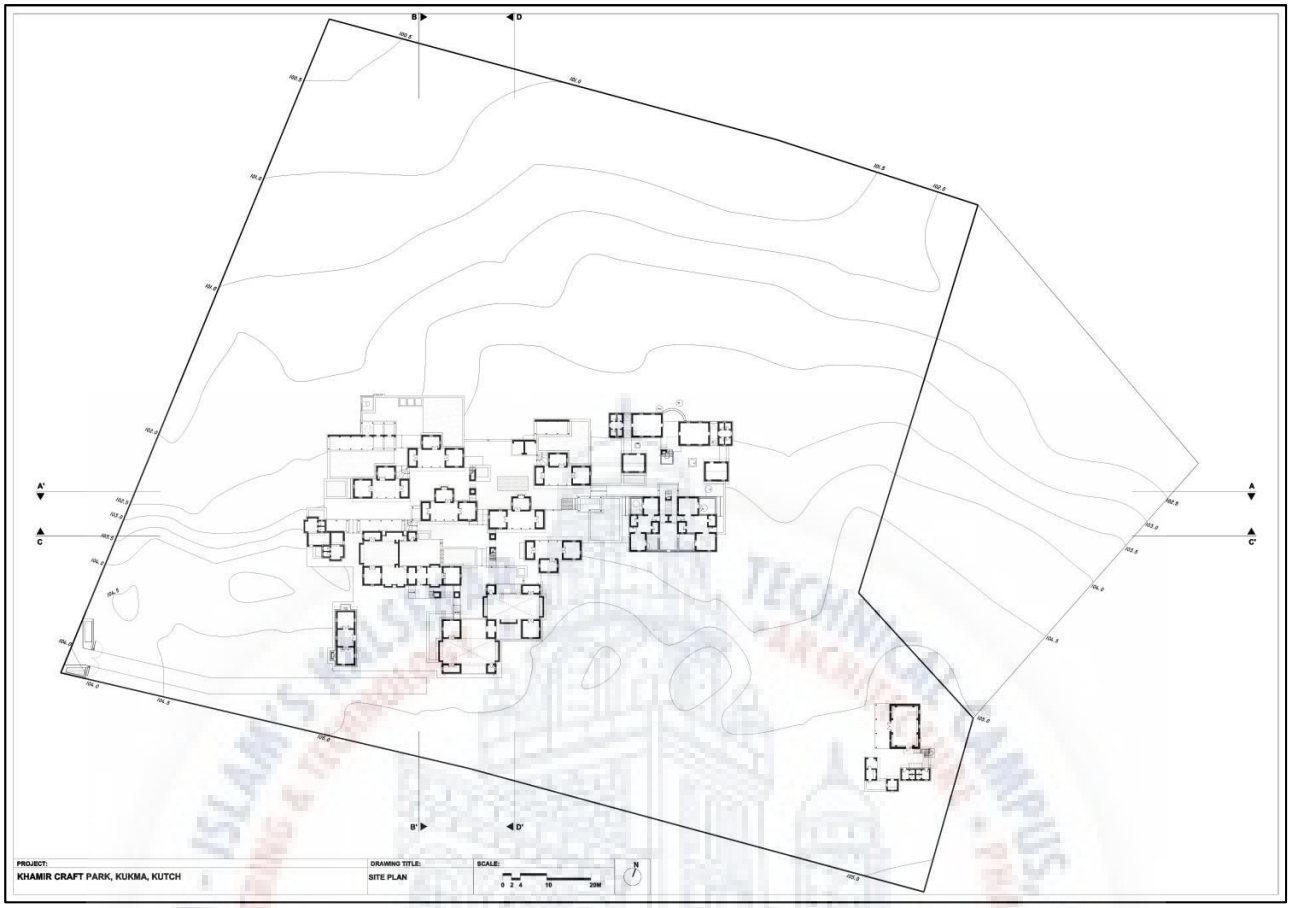
- The designers who have an interest in handicrafts

- Locals and national and international institutions working together

- Tourists discovering the area and learning from the craftspeople

(Figure 55 , location plan)

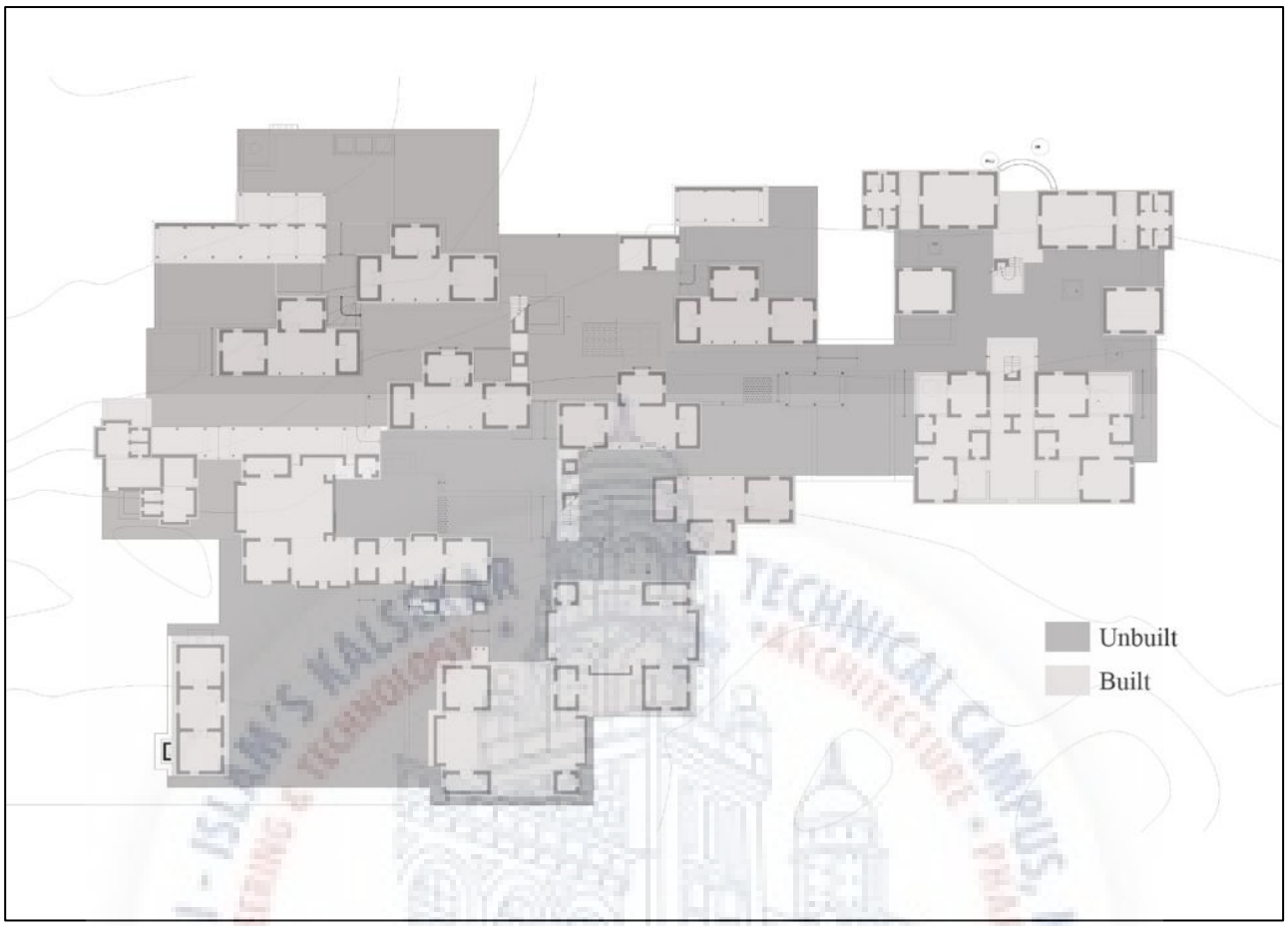
(Figure 56 , construction of earth walls , wattle and daub panels & transition space)



(Figure 57 , site master plan)

As the structures ascend higher, the architecture deviates from the norm with a contemporary, lightweight steel construction that creates a spacious area above the sturdy walls. The roof is replaced by a steel structure that holds up a double-layered roof covered in baked clay Mangalore tiles. One of the major breakthroughs that the project saw was the installation of wattle and daub panels as infills between timber and steel frames thanks to a partnership with the Hunnarshala Foundation.

The Khamir Crafts Resource Centre, a haven for artisans, is an architectural representation of a carefully considered economic model to promote, sustain, and foster the knowledge of the various craft forms by promoting exchanges. The workspaces are constructed as "otlas" (raised plinths), which give the clusters a feeling of habitation. They are adjacent to a peaceful, secure room that is frequently used as a store for tools and raw materials, a place for research and development, or as a small show area for finished goods. Khamir's infrastructure is built to support a variety of activities, including the creation and documenting of craft processes and materials, training and skill development, sales, and marketing.



(Figure 58 , Built & unbuilt)

MATERIALS

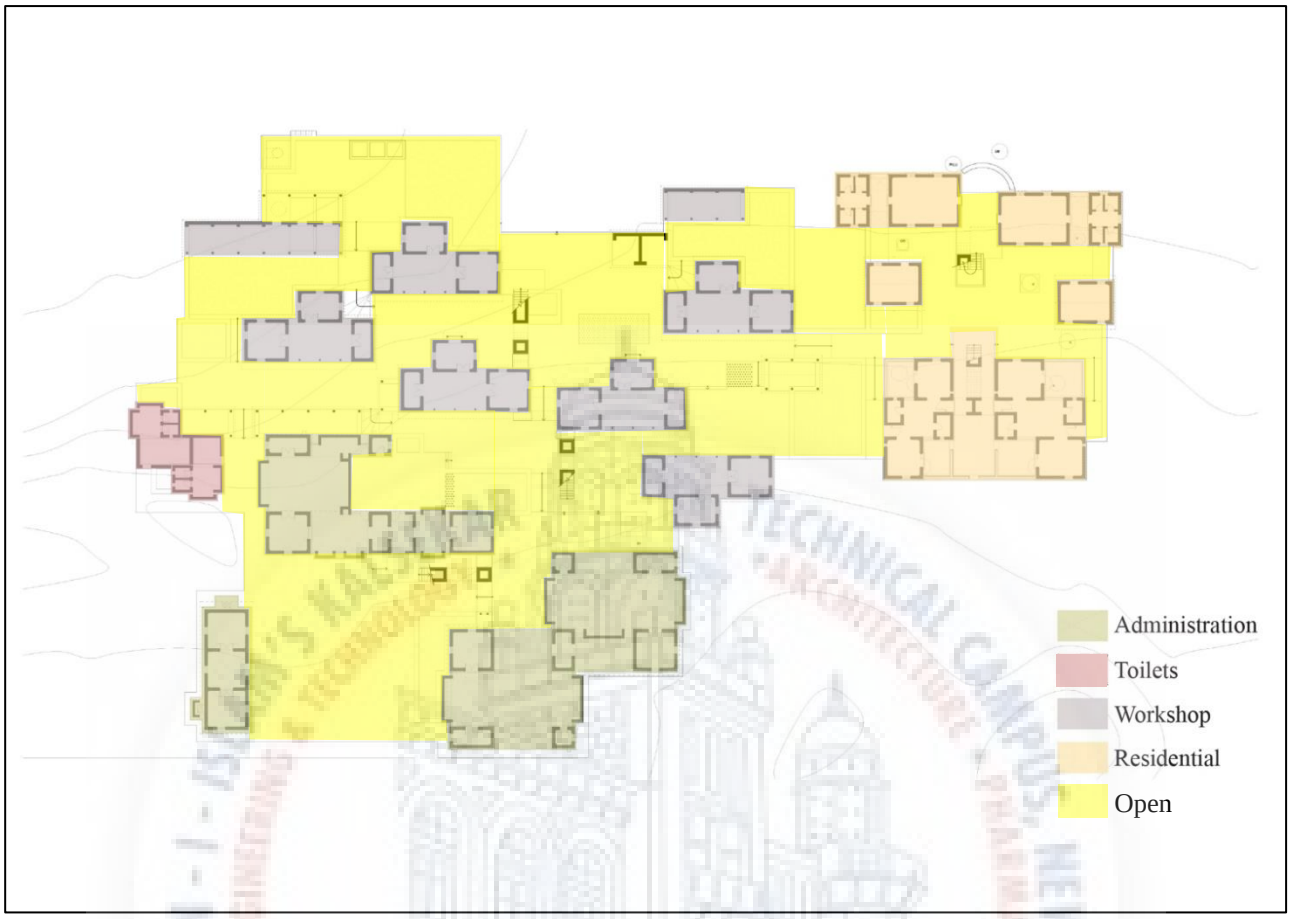
It combines columnar and planar architecture. The basic framework is made up of columns and walls. It incorporates the ideas of simplicity and pattern.

The complex consists mostly of three kinds. Residential, administrative, and workshop areas. Except for the restrooms and a portion of administration, all the forms are repetitious. Open spaces that serve as circulation and workshop areas make up 70% of the total area. These places host the majority of activities, as opposed to the built-up areas. The Surrounding is organised by the void, which is required for it to function. Allows air and light to pass through the passage.

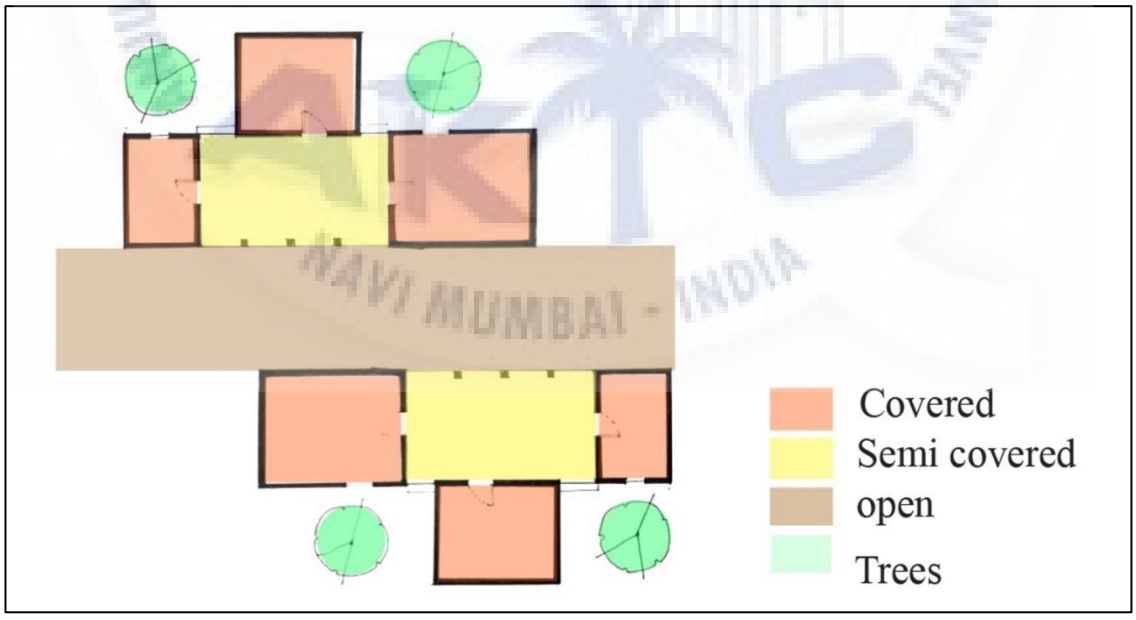
Wattle and daub panels were used in the construction of the first-floor walls of this craft facility. In this building technique, horizontal twigs and branches are interlaced between vertical wooden poles, or wattles. The term "daub" refers to a mixture of substances including wet soil, clay, sand, lime, animal manure, and dry grass.

- easy construction
- extremely durable
- Lower maintenance costs

PROGRAM



(Figure 59, area program)



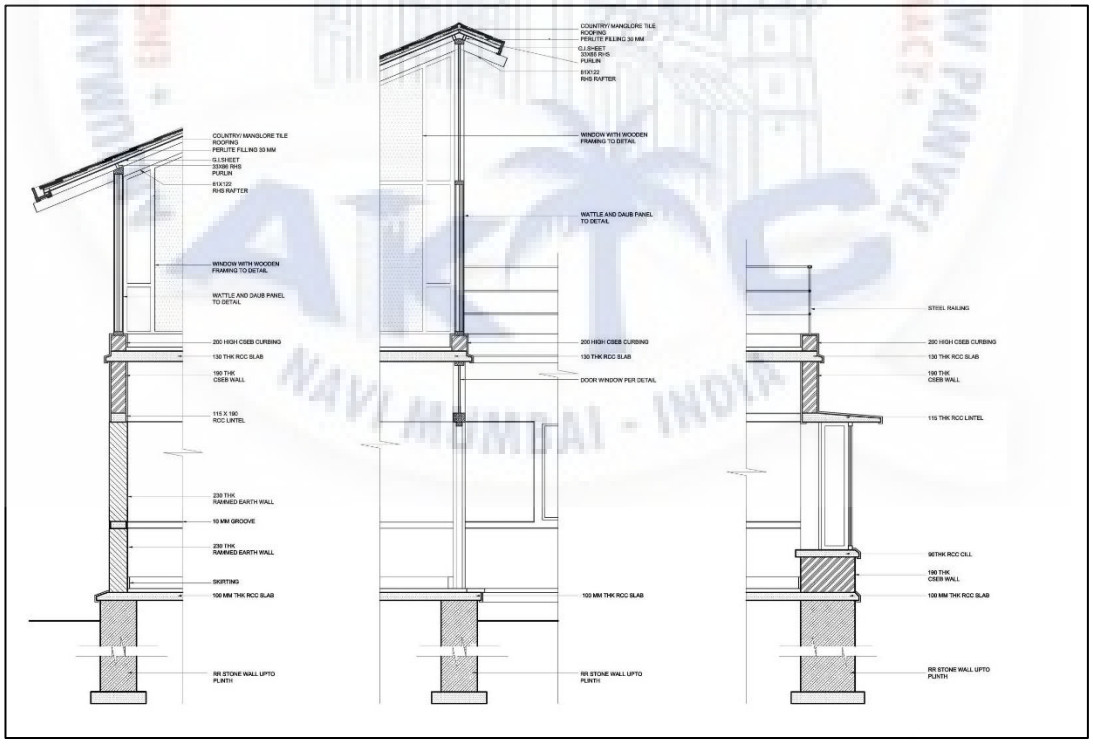
(Figure 60, area program)

Space and area requirement

S.NO.	SPACES	NO. OF USERS	AREA (Sq. M.)	FUNCTION OF THE SPACES
1.	Reception and Exhibition	130	130	Outlet of products made at Khamir
2.	Museum Archive	130	100	Collection and display of products
3.	Administration	10	50	Managing the centre
4.	Bell	15	82	Conducting workshops, attached office And storage
5.	Pottery	30	115	Conducting workshops, attached office And storage
6.	Block Printing	30	100	Conducting workshops, attached office and storage
7.	Weaving	40	100	Conducting workshops, attached office And storage
8.	Training	35	115	Conference and teaching
9.	Leather/Laquer	30	90	Conducting workshops, attached office And storage
10.	Tie and Dye	25	72	Conducting workshops, attached office And storage
11.	Guest House	20	156	Accommodation facility for guests
12.	Cafe	12	36	Food
13.	Store		100	Storage of finished products for selling
14.	Toilets		100	
	Total Area		1506	

(Table 4 , area program)

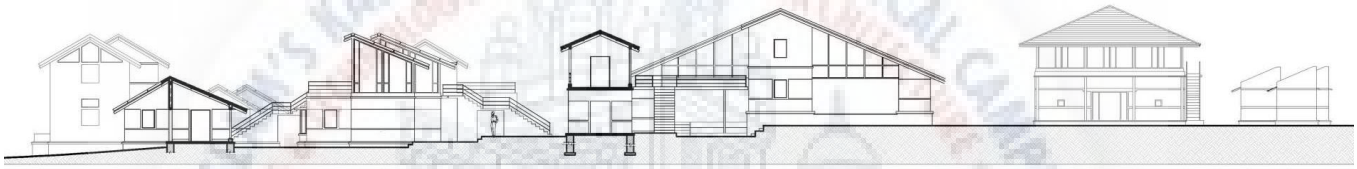
DETAILS



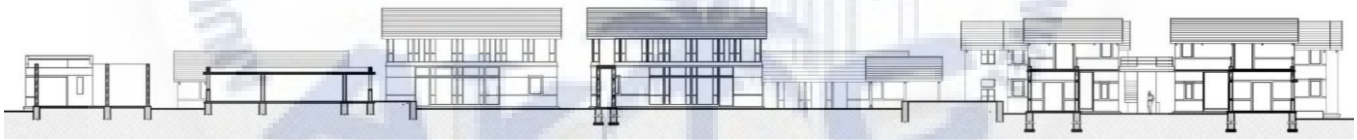
(Figure 61,part section details ,Chhaya, 2020)

DETAILS

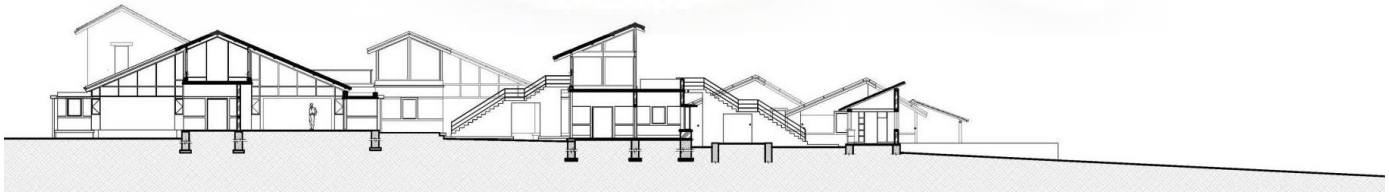
(Figure 62, section A-A')



(Figure 63, section B-B')



(Figure 64, section C-C')



(Figure 65, section D-D')

CONCLUSION

Strengths:

- Cultural Preservation: Khamir maintains Kutch's rich legacy through conserving traditional knowledge and skills.
- Innovation and Resilience: The ability of people to bounce back from a disastrous earthquake is demonstrated by their inventiveness in architecture.
- Environmental Integration: The center respects regional spatial rules while integrating with its ecological surroundings.

Weaknesses:

- Resource Dependency: Reliance on local resources may prevent resources from being scaled and made available.
- Limited Outreach: Its remote location can make it harder to contact people.

Opportunities:

- Khamir can serve as a model for sustainable architecture and cultural preservation in the area.
- Engagement in the Community: Increasing outreach may have a greater impact.

Threats:

- Environmental Challenges: Modifications to the delicate ecology could have an impact on long-term viability.
- Economic factors: The community's potential to gain from the centre may be impacted by changes in the economy.

After the Kutch earthquake in 2001, the Khamir Craft Resource Centre was founded to preserve traditional crafts and cultural heritage utilising materials and methods from the area. In order to promote cultural identity and environmental harmony, architect Neelkanth Chhaya worked with the Hunnarshala Foundation to blend the campus with rural surroundings. Through skill development and marketing assistance, it empowers craftspeople.

4.2.5 HUNNARSHALA FOUNDATION CAMPUS, Bhuj, Gujarat

Architecture Firm : Hunarshala foundation

Built-up Area : 226 Sq.mts.

Project Year : Completed in 2008

Location : Kutch,Gujarat

(Figure 66, images of the project)

PROJECT BACKGROUND

The Hunnarshala Foundation is an Indian NGO that focuses on community empowerment, artisan training, and promoting traditional building systems, particularly earth-based construction techniques. It was established after the 2001 earthquake in Kutch, India, which led to a need for habitat reconstruction. The foundation aims to empower communities to rebuild their habitats resiliently and sustainably, collaborating with skilled artisans to infuse innovative approaches with traditional building techniques. The foundation emphasizes empowering artisan entrepreneurs and promoting community-led planning and reconstruction within the construction sector. The foundation's approach involves a community-driven process, involving local builders, artisans, and residents to devise reconstruction methods rooted in indigenous knowledge. The foundation promotes energy-efficient technologies and materials, and advocates for waste recycling. The Hunnarshala campus showcases sustainable architecture, incorporating earth technologies, roofing techniques, and sustainable practices. (Future, *Hunarshala campus by Hunarshala Foundation* 2021)

PROGRAM

(Figure 67, area program)

Public open /semi-open spaces

Private spaces

Circulation

Utility & Services

Public spaces

PROGRAM

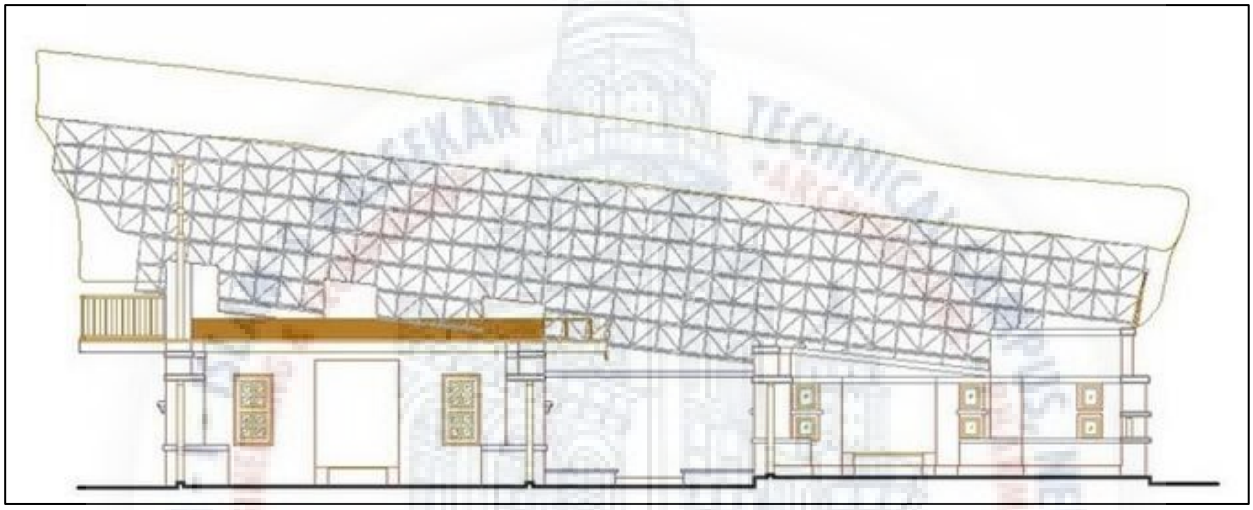
1. Ozari workshop
2. Artisan's working space
3. Store
4. Carpentry workshop
5. Pantry
6. Toilet
7. Karigarshala
8. Structural laboratory
9. Environmental Laboratory
10. Research and development
11. Project Management
12. Foyer
13. Design Studio
14. Director's office
15. Reception
16. Entrance
17. Administration and accounts
18. Caretaker's shelter
19. Parking

(Figure 68, interior space & husk roof)

Sustainable materials

Promoting affordable, environmentally friendly building materials and infrastructure that use locally relevant aesthetics and inputs is one of the organization's main goals. The company's studies have resulted in the use of industrial waste, including the addition of levigated (washed) clay to rammed-earth building and the attachment of thin strips of salvaged shipwood to create doorframes, window frames, and structural floors. Most innovative methods and materials are thoroughly examined in the lab of the Hunnarshala foundation in Bhuj. The foundation also collaborates with local authorities to develop technical standards that will be included in regional manuals for new construction.

DETAILS



(Figure 69, section)

(Figure 70, section)

Traditionally, wood was utilised for the roofing of buildings; therefore, after the earthquake, space frames were developed by simply connecting pipes together to prohibit the indiscriminate clearing of the Thor forests. The artisan company "SPAN" now offers this solution for short interim shelters following disasters in addition to classic buildings with vast spans.

Spaces - The office

Rammed earth, interlocking brick and stone are used to construct building walls, and visible seismic resistance bands serve as a constant reminder that safety is crucial in this seismically active area. Building roofs blend thatch and Mangalore tiles and hang low, both of which are supported by thin space frames. They also have the conventional wattle and daub building style, which is lime plastered and exposed.

The lecture halls

In their classrooms, frosted glass panels that simultaneously function as light sources are used in place of blackboards to convey the impression that information is enlightening.

Karigarshala

In 2011, Hunnarshala established a Karigarshala, or artisan school, where they teach carpentry and masonry to dropouts from the formal education system between the ages of 16 and 18. After a year of training, they help them secure employment as artisans.

(Figure 71, different materials used on the external facade)

CONCLUSION

Strengths:

- Communities and craftsmen are empowered for sustainable growth through community empowerment.
- Successfully revitalised conventional earthquake-resistant constructions.
- Emphasis is placed on environmentally friendly building and waste material recycling.

Weaknesses:

- Resource Dependency: Scalability is constrained by reliance on regional resources.
- Limited Reach: The impact might only be felt locally.

Opportunities:

- Regional sustainable design could be modelled after this sustainability paradigm.
- Knowledge Exchange: By extending their reach, they can broadly exchange their methods.

Threats:

- Environmental Difficulties: Modifications to the delicate ecology could affect sustainability.
- Economic factors: Community benefits may be impacted by economic changes.

The Hunnarshala Foundation, established in response to the Kutch earthquake of 2001, is a testament to resiliency and creativity. While preserving traditional crafts and sustainable building techniques, it empowers local communities and craftspeople. The organisation has revived vernacular architecture by working with regional craftsmen and builders and embracing sustainability by utilising recycled materials and green building practises. These ideas are demonstrated on their campus.

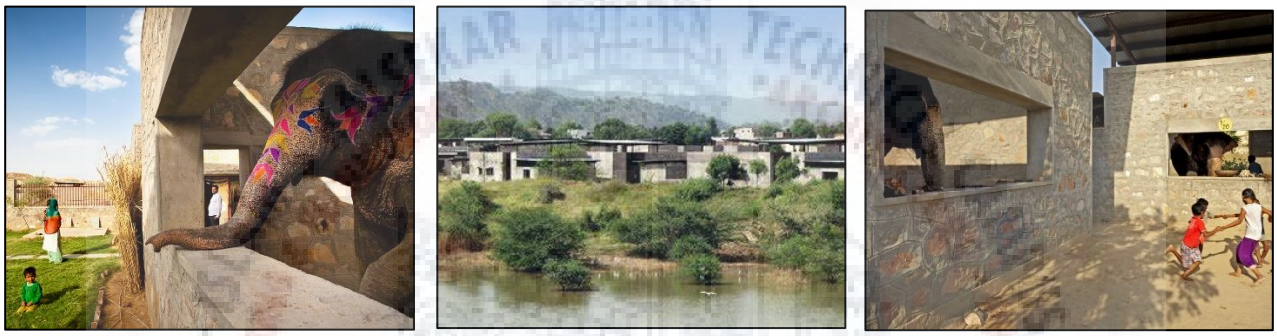
4.2.6 Housing for Mahouts and their Elephants , Jaipur, India

Architecture Firm : RMA Architects

Built-up Area(single) : 88 Sq.mts.

Project Year : Completed in 2010

Location : Jaipur , Rajasthan , India

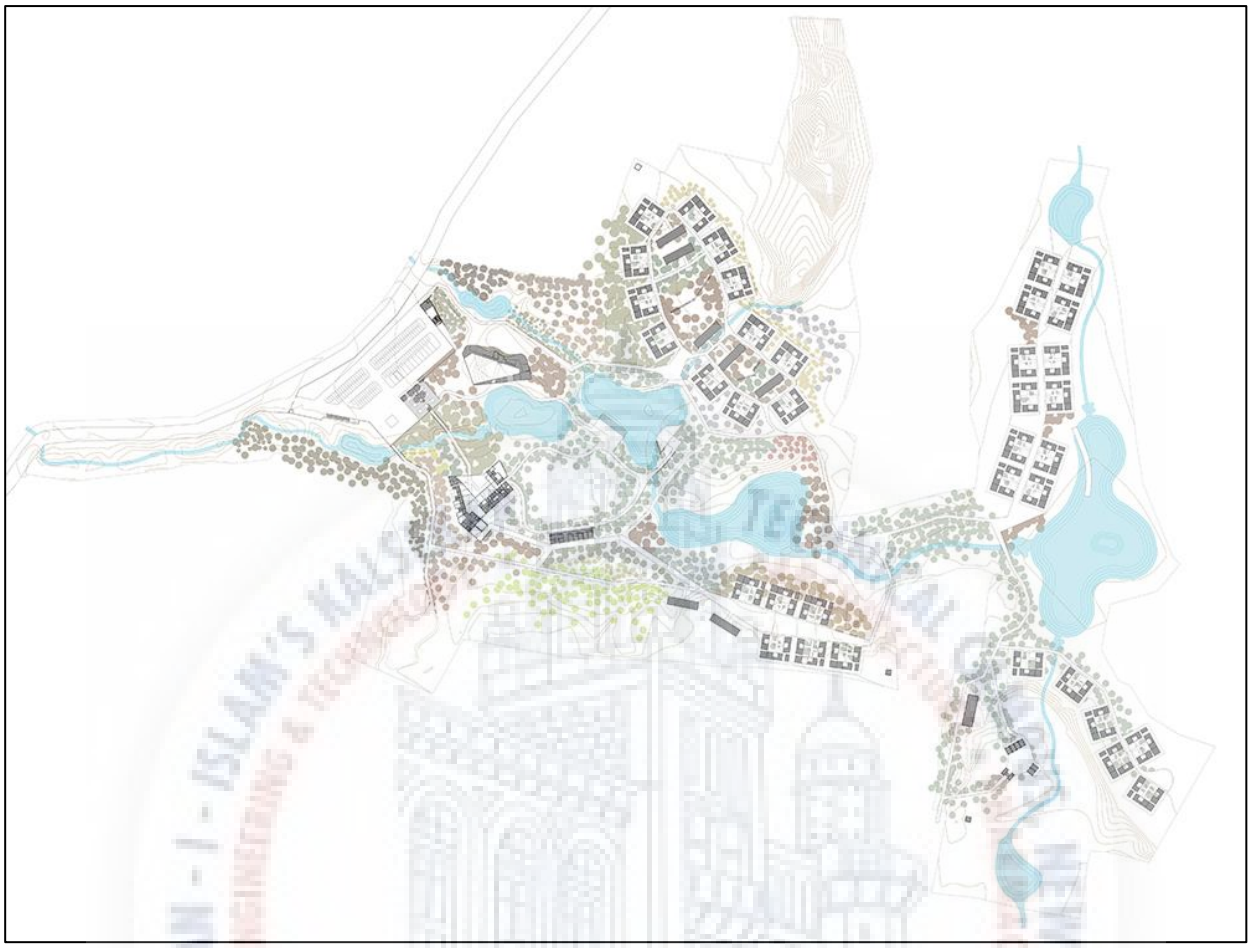


(Figure 72, images of the project)

PROJECT BACKGROUND

A housing project in Rajasthan called Hathi Gaon, popularly referred to as the Elephant Village, ensures to house 100 elephants and their mahouts. In the dry desert climate, the project's main goal is to create a sustainable and regenerative ecosystem. The first step is to structure the landscape by establishing a web of water bodies to collect rainwater runoff and turn the area into a tropical setting that resembles the habitat of elephants. The project's 10-year goal is to restore the area's ecosystem and create environments that are beneficial for both elephants and people. The project prioritizes rainwater gathering through its network of water bodies and sustainable water management. In order to establish a harmonious habitat for elephants and the surrounding natural flora and wildlife, it also emphasizes ecological restoration through the planting of native plant species along water bodies' boundaries. With the use of courtyards and pavilions, the housing units are grouped together to maximize space efficiency. In addition to being a housing development, Hathi Gaon is a bold initiative to restore Rajasthan's desert terrain while fostering peaceful cohabitation between people and elephants. (*Hathigaon (housing for elephants and their mahouts) RMA architects*)

SITE



(Figure 73, site master plan)

HOUSING UNIT

On areas of the site that are not being used for the landscape regeneration, the thans (housing units) are arranged in clusters. The 40 sqm of total land that was allotted in the budget for this primarily low-income housing project is supplemented with courtyards and pavilions. In order to foster a sense of community among the residents, the site planning used a clustering method to provide shared common space at various hierarchies.

By concentrating on the landscape and using the priceless resource of water as the central instrument around which decisions were facilitated, the difficulties of navigating the bureaucracy in a project sponsored by the Government and carried out by the equivalent of the Public Works Department were overcome. This was a humiliating experience because it was obvious that the finances prioritised the requirements of the residents and their lives, with little money spent on architecture. The goal of the design was to provide the inhabitants the freedom to gradually alter their own dwellings and appropriate them through visual and spatial alterations. (Daniel, *Housing for Mahouts and their elephants / RMA architects* 2013)

PROGRAM

(Figure 74, Area program, unit cluster)

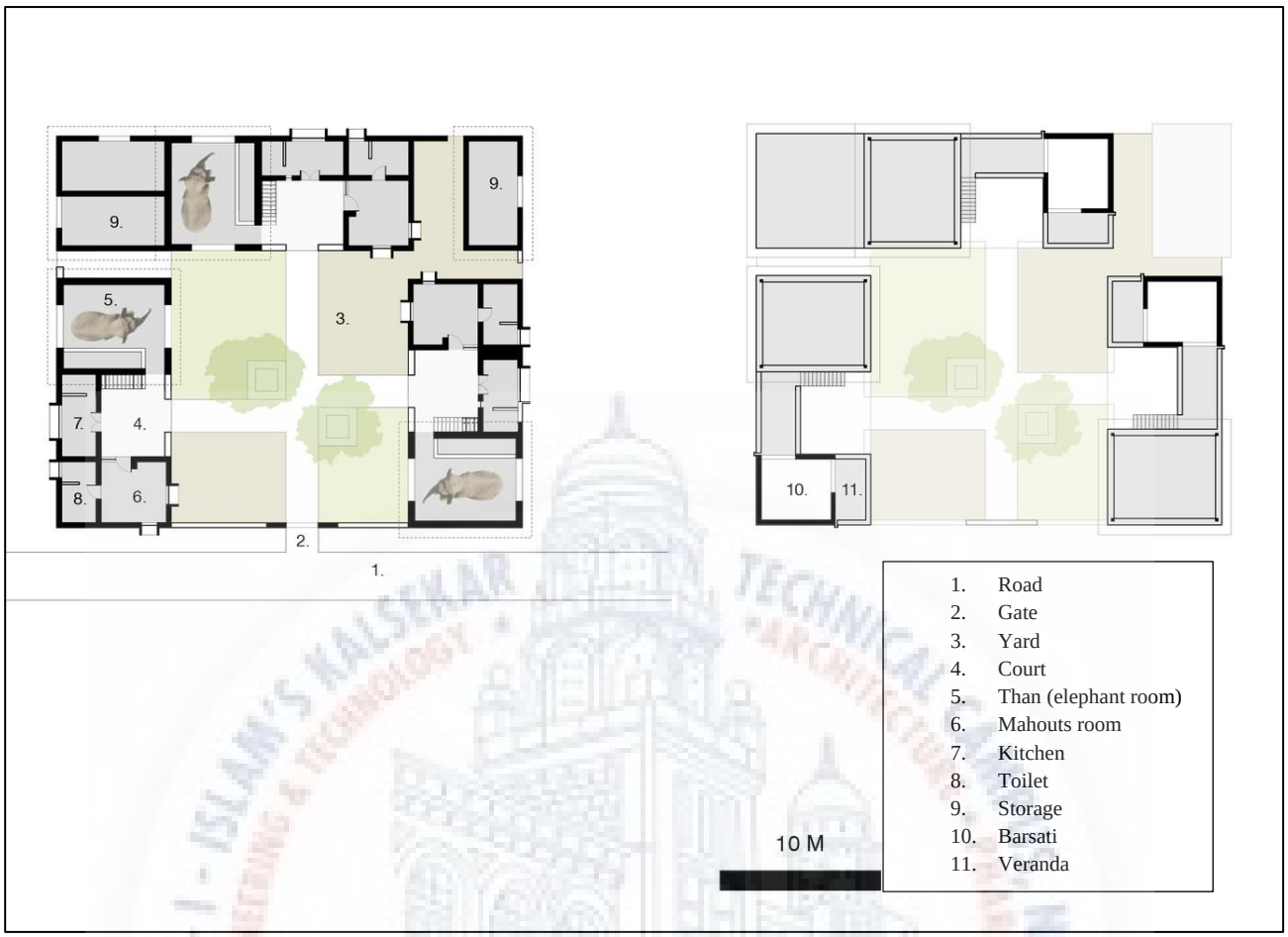
Public open /semi-open spaces

Private spaces

Circulation

Utility & Services

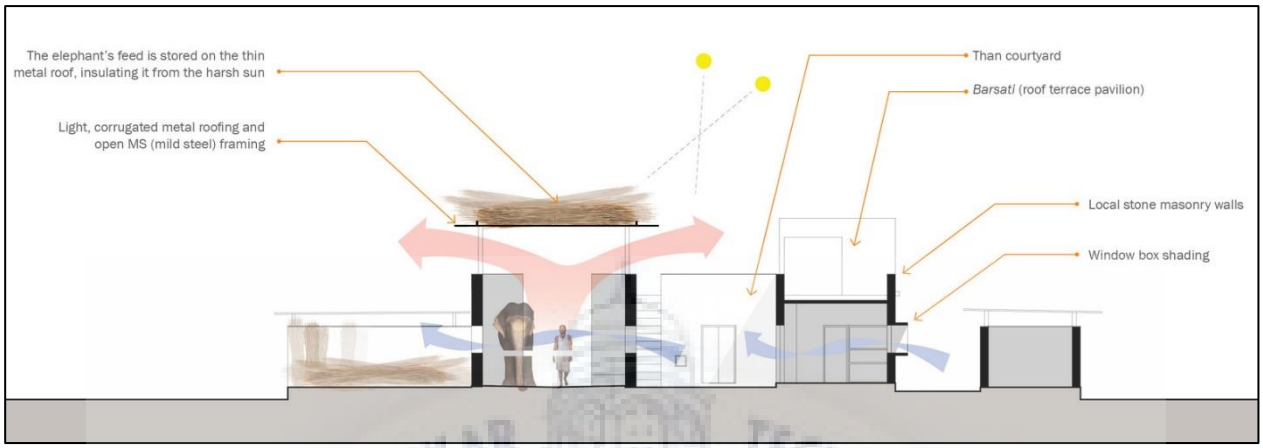
Public spaces



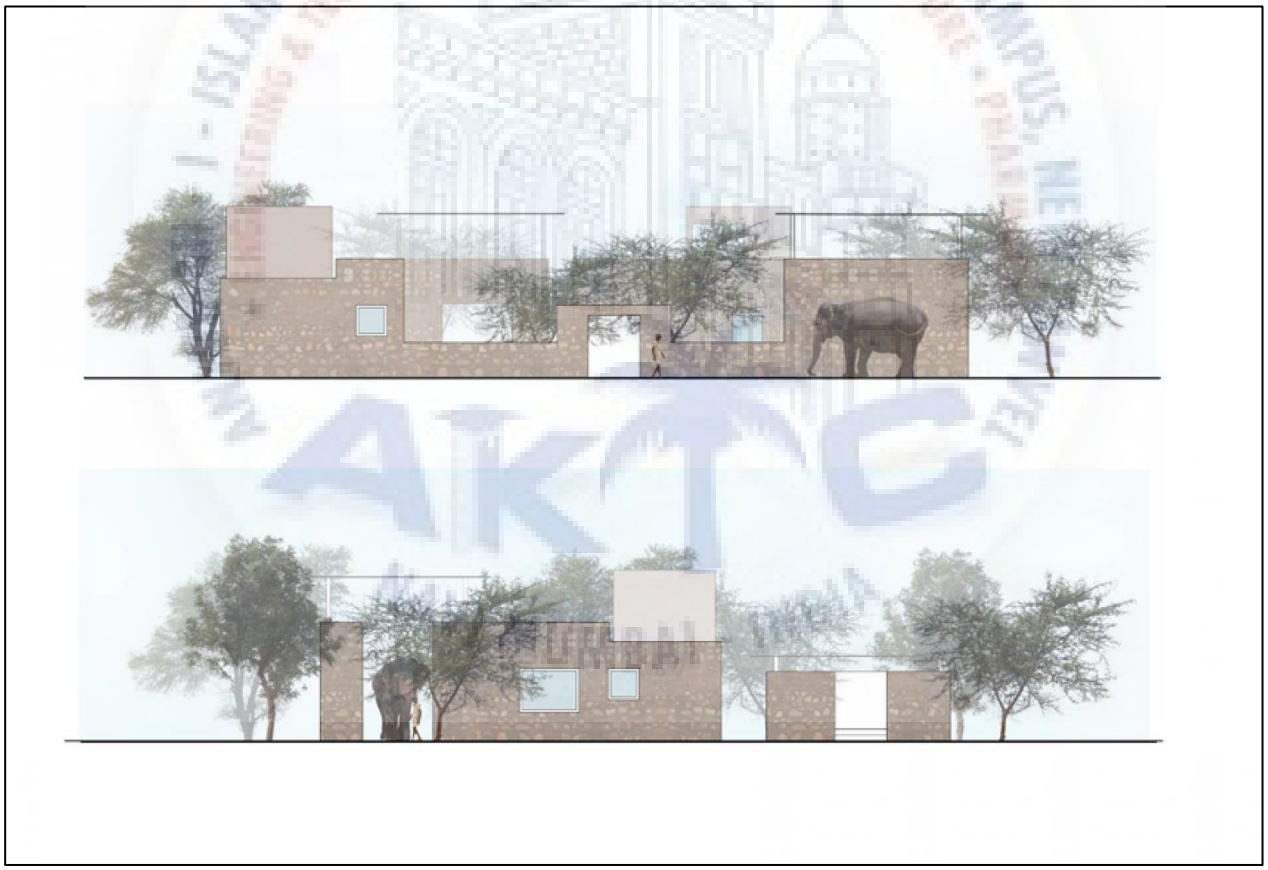
(Figure 75, unit plan)

(Figure 76, space required by an elephant)

DETAILS



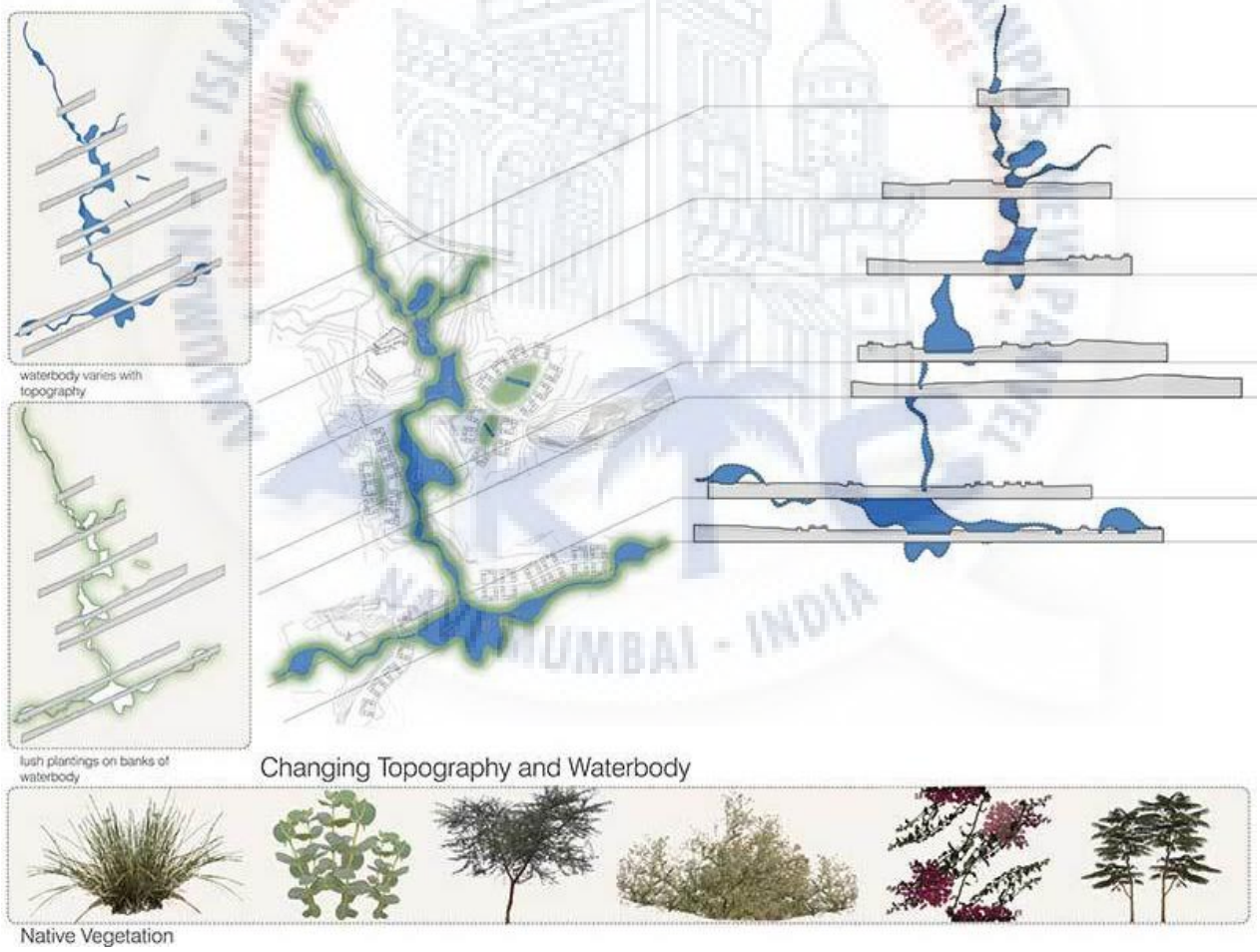
(Figure 77, section through unit showing design elements & ventilation)



(Figure 78, elevation of the unit)

TRANFORMATION OF SAND QUARRY

A sustainable design path led to the creation of Hathi Gaon, the Elephant Village, from a former sand quarry. The project's goal was to repair the site's damage from its prior use as a sand quarry. A sustainable water management system that benefits both people and elephants was established via the construction of a network of water bodies to collect rain runoff. Through the sacrosanct practise of bathing, the water sources also help to strengthen the link between mahouts and elephants. An large tree planting programme was put into place, allowing for the propagation of local species and the restoration of the ecosystem. To maximise land use while staying within budgetary limits, housing units were grouped together. The landscape and water were given top priority by the design team as major elements, giving people the freedom to alter and subsequently personalise their living spaces. The transformation of the quarry into Hathi Gaon is evidence of the effectiveness of sustainable architecture, environmental restoration, and community development in Rajasthan's arid desert climate.



(Figure 79, restoration of the quarry)

CONCLUSION

Strengths:

- Landscape regeneration and effective resource usage are highlighted in the project's sustainable design, which demonstrates a strong commitment to sustainable principles.
- Building Community: By fostering social ties and mutual support, clustered housing units encourage a sense of community among residents.
- Resource Efficiency: By using rainwater as a resource, the project exemplifies effective water resource management, which is essential in a water-scarce area.
- Ecological Restoration: Mass tree planting and the propagation of indigenous species help to restore the local ecology.
-

Weaknesses:

- Budget Restraints: A lack of funding may make it difficult to use particular design features and materials.
- Bureaucratic Difficulties: Government sponsorship and Public Works Department execution may cause delays and complexity in the bureaucratic process.

Opportunities:

- Replicability: The success of Hathi Gaon presents a chance for other dry locations experiencing ecological issues to adopt comparable sustainable designs.
- Tourism and Education: The project can act as a tourism and educational destination, promoting environmentally friendly building practises and environmental preservation.

Threats:

- Maintenance and Long-Term Sustainability: In the future, it may be difficult to maintain and preserve the water bodies and natural components.
- Changes in Climate Patterns: The success of the project may be impacted by changes in climate patterns and rainfall amounts, necessitating adaptive measures.
- Impact of tourism: Although it presents opportunities, tourism also bears the risk of misuse and environmental harm if not effectively managed.

The transformation of Hathi Gaon into an elephant village exemplifies the ability of eco-friendly architecture and environmental renewal in Rajasthan's harsh desert environment. By placing an emphasis on native species propagation, rainfall gathering, and landscape regeneration

4.2.7 The Eden project Cornwall, UK

Architecture Firm : Grimshaw architects

Built-up Area(single) : 15 hectares

Project Year : Completed in 2000

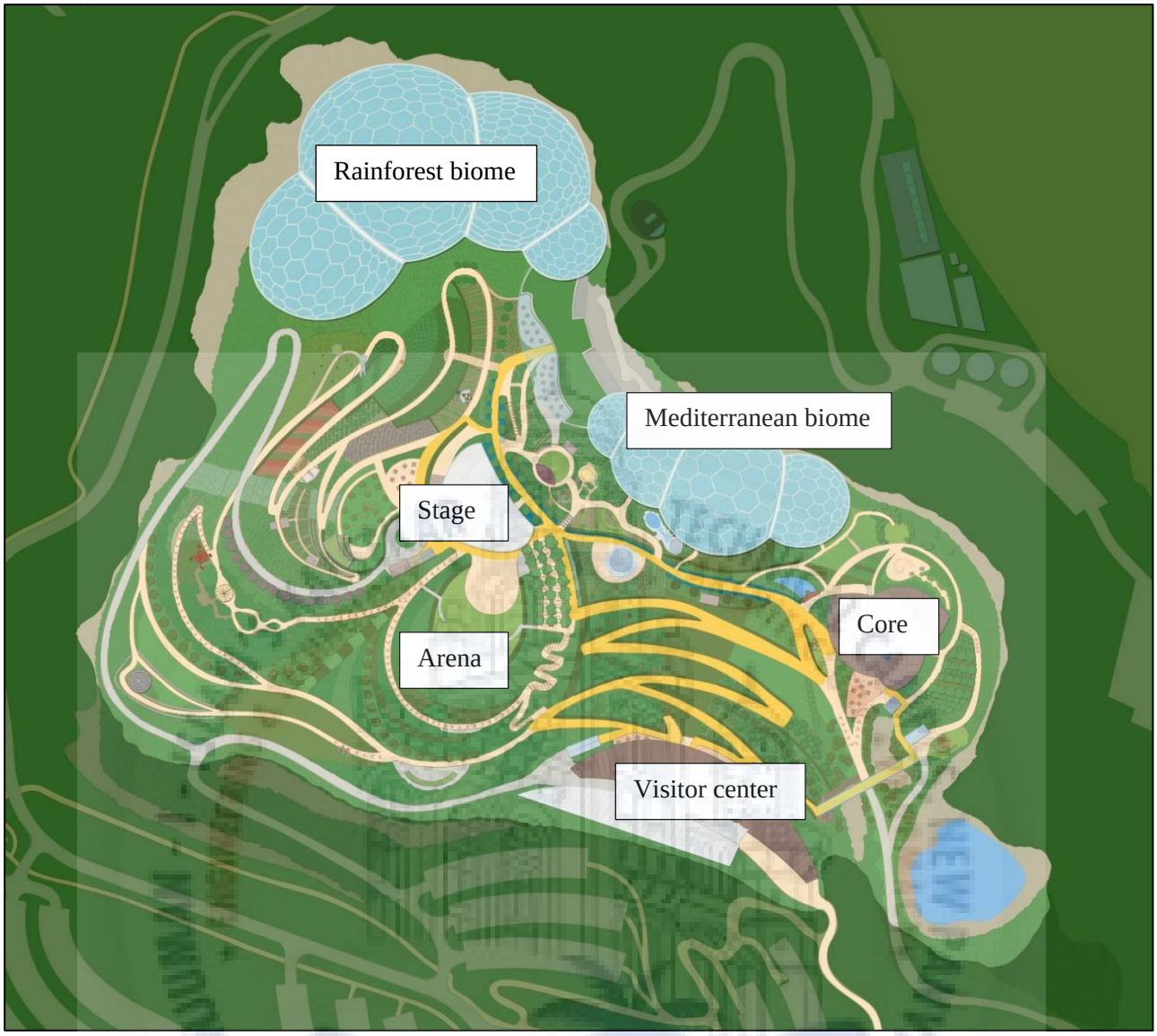
Location : St Blazey, Cornwall, England

Type : Multiple greenhouse complex

(Figure 80, images of the project)

PROJECT BACKGROUND

The Eden Project is a ground-breaking botanical garden and environmental education effort that is situated in St. Austell, Cornwall. It mixes science, art, architecture, and ecology to highlight the plant kingdom and its significance for a sustainable future. It was created by Tim Smit and Nicholas Grimshaw. In two enormous geodesic domes designed by Buckminster Fuller, the project combines cutting-edge technology to generate microclimates for the over 100,000 plants from various climate zones. The biomes provide visitors an instructive and artistically appealing experience by serving as a testament to the intricate interactions between plants and their environs. A Visitors Centre, outdoor biome, Visitors Centre, outdoor amphitheatre, and access road are all part of the project's staged development. The Eden Foundation offers a learning centre with lecture halls and exhibition areas. The project aims to promote a commitment to sustainability, build a deeper awareness of the natural world, and highlight the significance of plants and trees in creating a more resilient and environmentally conscious future.

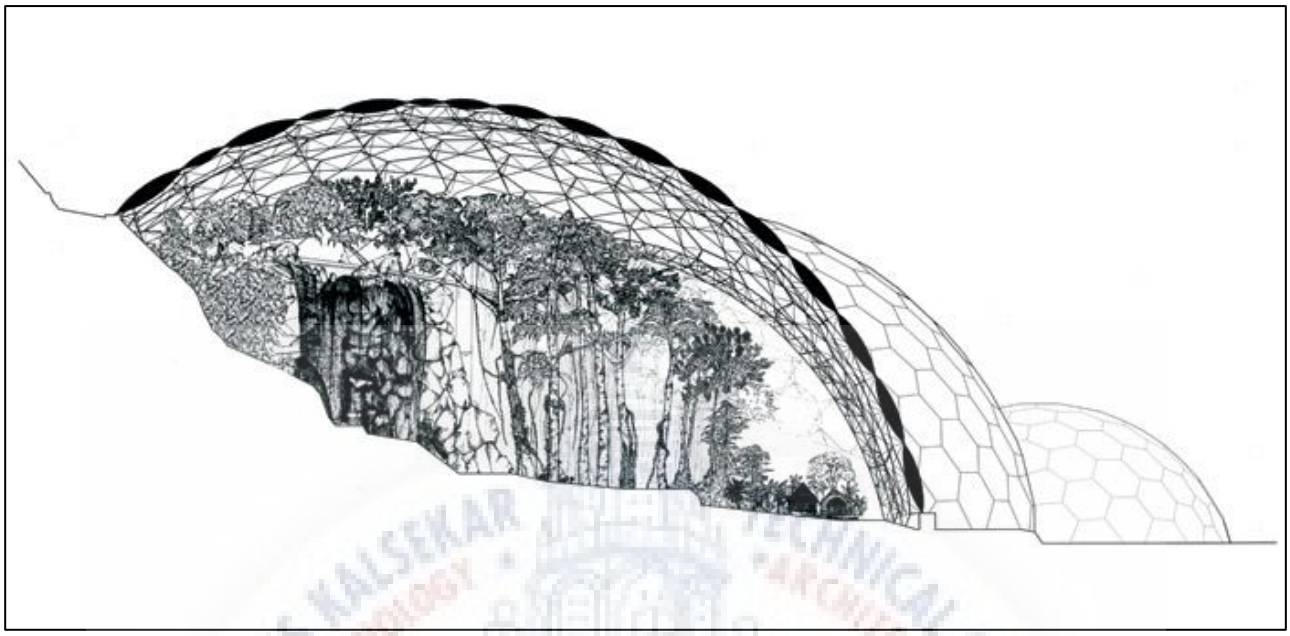


(Figure 81, masterplan)

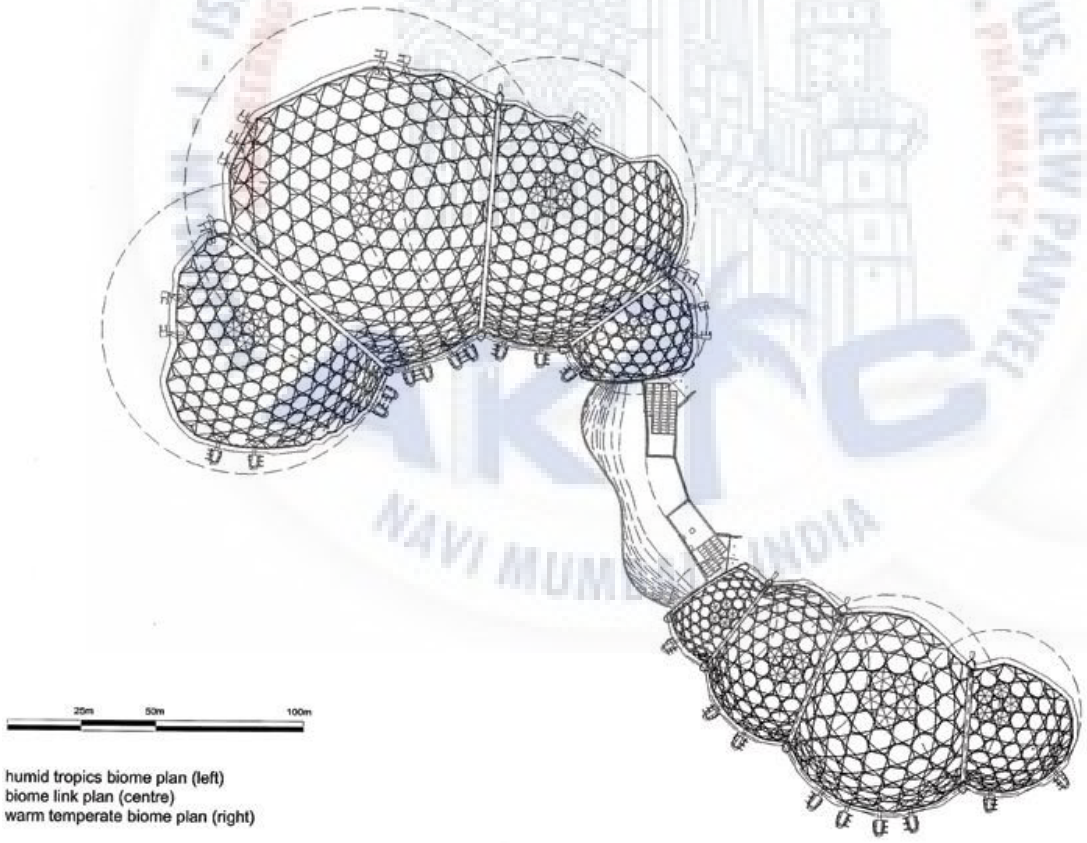
MATERIAL

Over 500 Efte (ethyl tetrafluoroethylene) panels are used to close the domes, which are made from thin layers of UV-transparent Efte film. These panels are liveable, self-healing, antistatic, recyclable, and easily reparable. They act as cameras in heated air, acting as a thermal blanket for the structure and providing better insulation than glass. The panels have an average lifespan of 20-30 years. The domes are designed to maintain high humidity levels through sustainable mechanisms, which retain the sun's heat in the rock used to construct them. 60% of the base load heating is provided by plant material. During hot summers, fresh air can be pumped into the base and top of the domes, and they can be opened for ventilation. Water is supplied to the Visitors Centre, and air is pumped into the solar panels using solar energy. The Visitor's Centre is a small structure with a grass-covered, sloping steel roof, popular in Cornwall. (*Blueprint 20/20: Grimshaw's Eden Project* 2015)

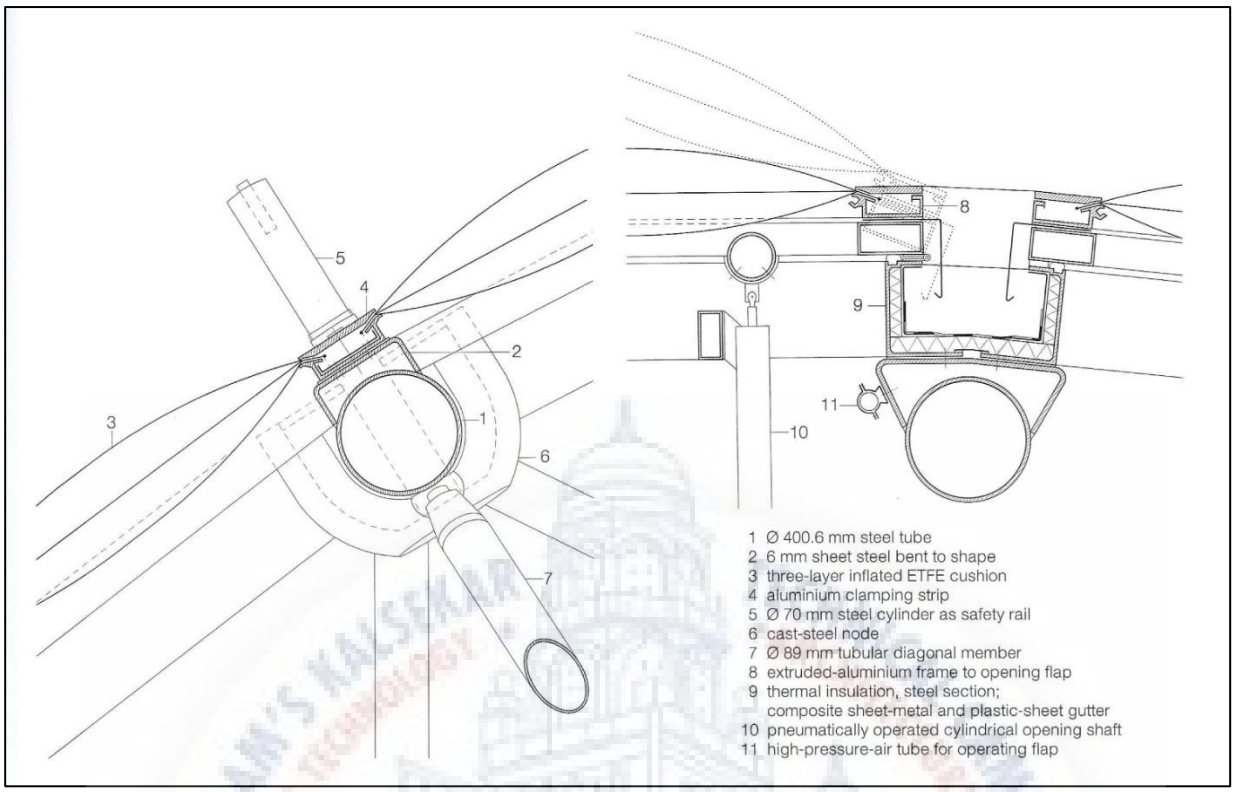
DETAILS



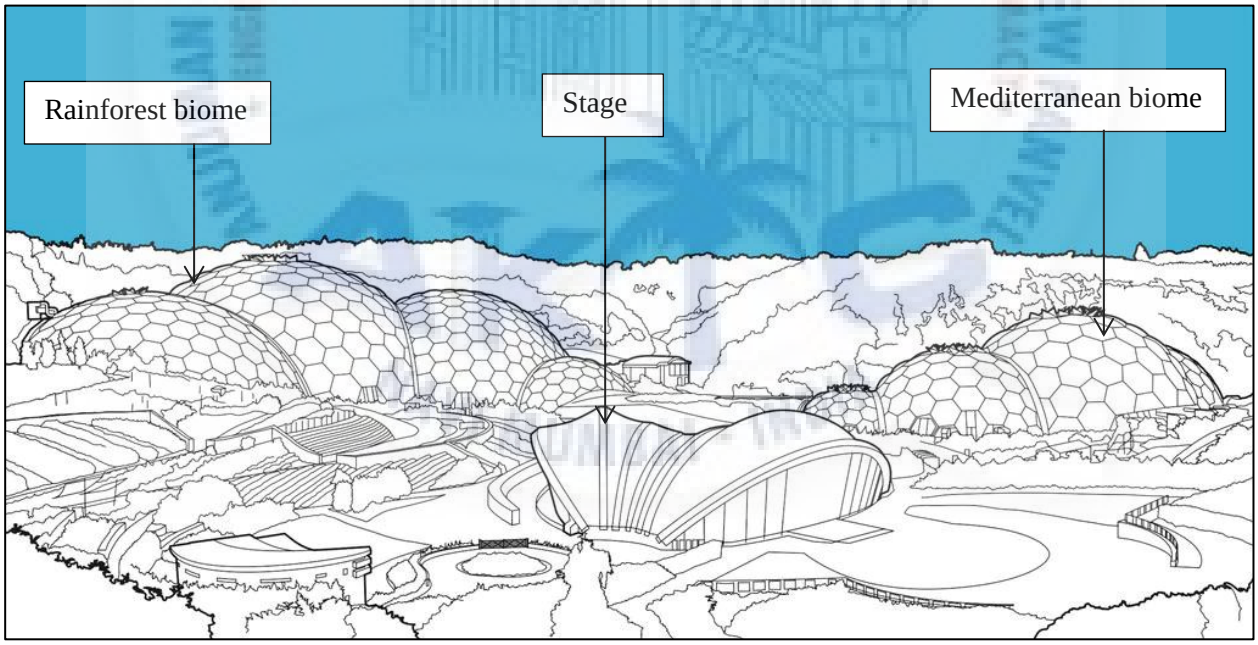
(Figure 82, part section)



(Figure 83, efte panel)



(Figure 84, joinery detail)



(Figure 85, isometric model)

CONCLUSION

Strengths:

- Innovative Design: The geodesic domes and cutting-edge technology of The Eden Project produce microclimates that permit the growing of a variety of plant species from all over the world.
- Value for Education: The project is a potent instructional tool that promotes knowledge of the value of vegetation, trees, and environmental sustainability.
- Biodiversity: The vast array of plants and trees highlights the great variety of the planet's ecosystems and highlights the need for protection.

Weaknesses:

- Maintenance Obstacles: Keeping a variety of plant species alive in regulated environments can be difficult and time-consuming.

Opportunities:

- Research and Conservation: The Eden Project can increase its involvement in plant research and conservation initiatives, assisting in the preservation of biodiversity throughout the world.
- Sustainable Technologies: The initiative can keep promoting environmentally friendly practices and technologies as a global emblem of sustainability.

Threats:

- Resource Limitations: It may be difficult to continue providing the high levels of care and education provided by the Eden Project, particularly during periods of economic hardship.

The Eden Project is a shining example of environmental innovation, biomimicry, preservation, and education. Although it has maintenance and resource issues, there are intriguing opportunities given its potential for research, environmental advocacy, and global growth. The Eden Project still serves as a source of inspiration for environmental care and good transformation as a global emblem of ecological awareness.

4.2.8 Lakaki Lake , Pune (quarry restoration)

Architecture Firm : Ravindra bhan and associates

Built-up Area(single) : 6 Acre

Project Year : Completed in 1995

Location : Model colony , Pune , Maharashtra

Type : Quarry restoration

(Figure 86, images of the project)

PROJECT BACKGROUND

Model Colony Lake, also known as Lakaki Lake, is a six-acre abandoned quarry site in Pune, India, with a rich history dating back nearly a century. The lake is a sanctuary for migratory birds, fishermen, and nature enthusiasts, and has played a crucial role in maintaining a healthy environment within its residential surroundings. The lake's unique ecological attributes, such as the presence of mosquito larvae-eating fish, have been studied by Dr. Mrs. Meera Bondre of Poona University and Prof. S.B. David. Despite potential challenges like pollution and urban development, the lake has remained resilient and contributes to a clean and healthy atmosphere.

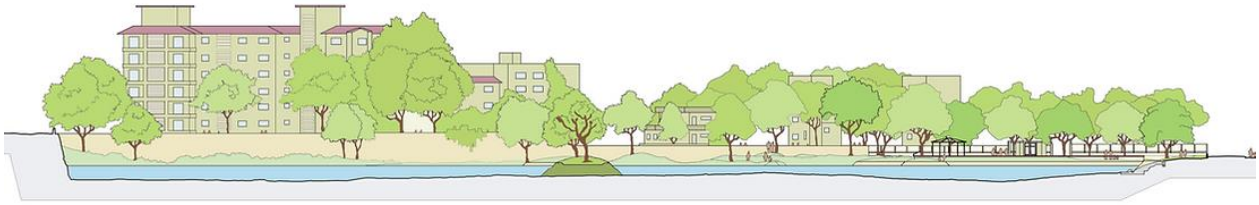
In 1985, the Pune Municipal Committee proposed converting the lake into an education complex, sparking local outrage. Dr. Salim Ali, an ornithologist, visited the lake and was impressed by the numerous birds that frequented the residential enclave. Driven by passionate leadership, organizations like WWF(world wide fund) and INTACH, a determined effort emerged to save the lake from potential extinction. The project adhered to a minimum development strategy, prioritizing the preservation of the lake's complex and sustainable ecosystem.

SITE

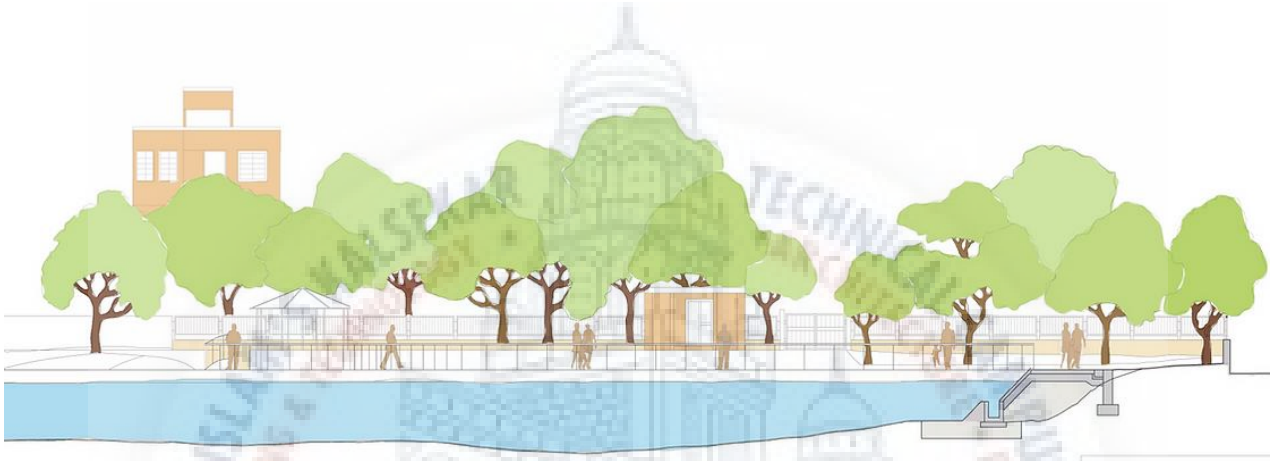
(Figure 87, master plan)

(Figure 88, toilet, pathway, guardroom, kiosk)

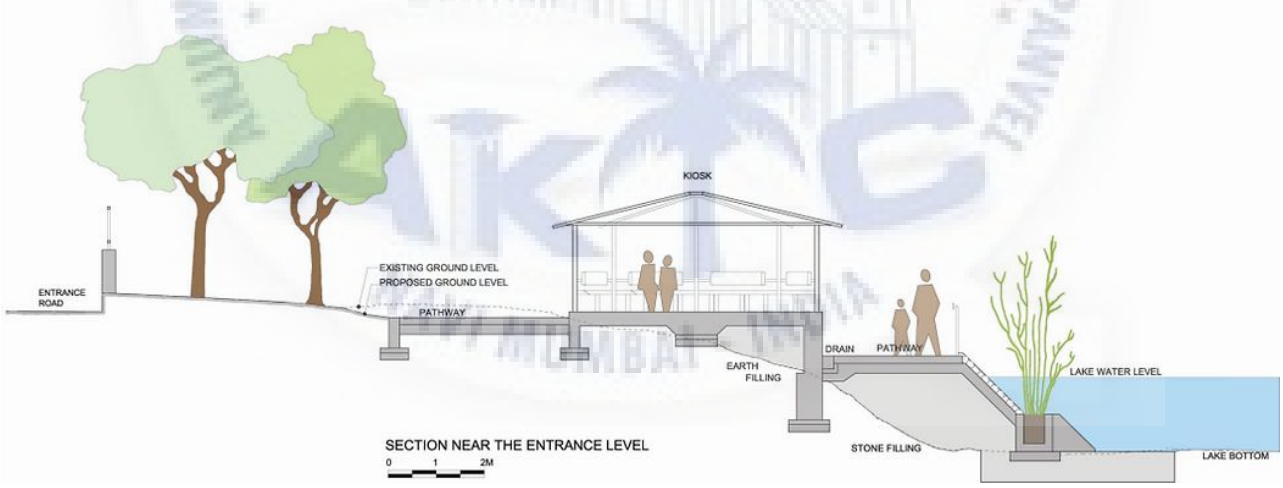
DETAILS



(Figure 89, section)



(Figure 90, sectional elevation of the lake facing the entrance)



(Figure 91, section near the entrance level)

(Figure 92, master section)

Restoration Techniques Employed at Model Colony Lake:

- Model Colony Lake in Pune underwent rehabilitation using a number of thoughtful techniques designed to maintain its delicate biological balance. Scientists and experts, including Dr. Mrs. Meera Bondre, oversaw a thorough ecological evaluation of the lake at the start of the procedure. With regard to water quality, flora, wildlife, and microclimates, this assessment shed important light on the current environment.
- The accumulation of residential trash led to eutrophication, one of the lake's biggest problems. The lake has been stocked with particular fish species to address this problem. These fish were crucial in regulating excessive nitrogen levels and reducing algal growth, which improved the water's quality. With this strategy, the issue was to be solved without upsetting the delicate biological balance of the lake.
- Water plants were also added to the ecosystem of the lake along with the addition of fish. These aquatic plants performed a variety of tasks, including nitrogen uptake, water oxygenation, and the provision of habitats and food for aquatic life.
- Minimal intervention was a cornerstone of the restoration plan. The project's strategy was determined by extensive scientific research and data analysis, with a focus on protecting the lake's natural processes and delicate biological balance, which had evolved over a long period of time.
- A slender peripheral boardwalk was added around the lake's edge to provide visitors a place to enjoy it without upsetting the lake's residents. By allowing visitors to watch wildlife and birds from a respectful distance, this promenade protected the lake's natural ecosystem. Aside from that, no artificial lights were put up on the path so as not to interfere with the birds' nocturnal habits. (*Model colony lake*)

CONCLUSION

Strengths:

- successfully restoring the environment
- maintaining the delicate balance
- community support and participation

Weaknesses:

- Potential issues in preserving ecological balance
-

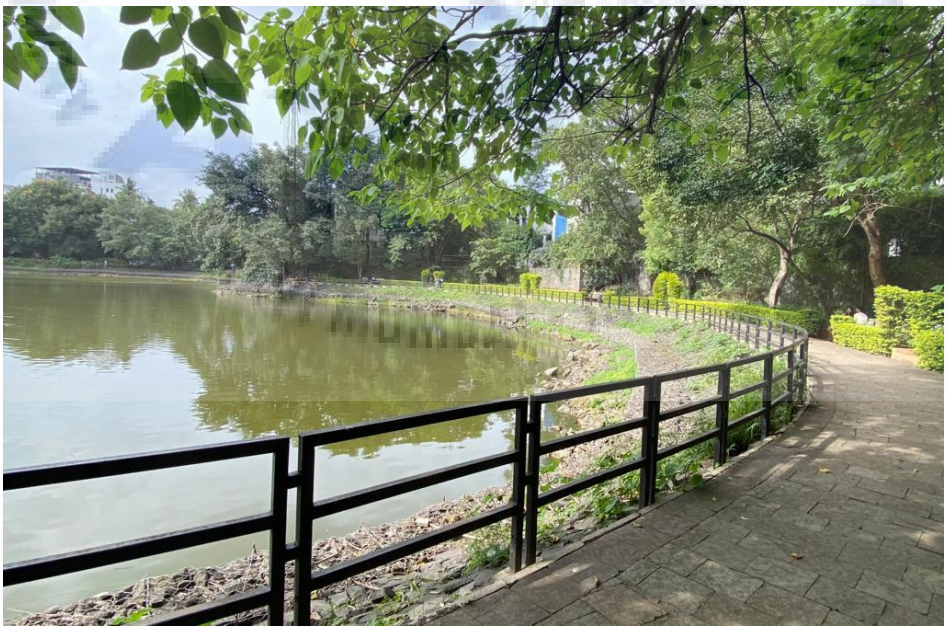
Opportunities:

- Ecological restoration model with promise in education
- continued improvement of biodiversity

Threats:

- ongoing obligations for monitoring and maintenance
- urban development's impact on the environment

The restoration of Model Colony Lake is an example of how little intervention and ecological awareness may be successful. The project's emphasis on maintaining the lake's delicate equilibrium while offering a space for visitors showcases how nature and urban life can coexist together.



(Figure 93, pathway)

4.29 The Pause (Public Restrooms)

Architecture Firm : Rohan chavan

Project Year : Completed in 2018

Location : Bombay-Goa Highway.

Type : Public Restrooms

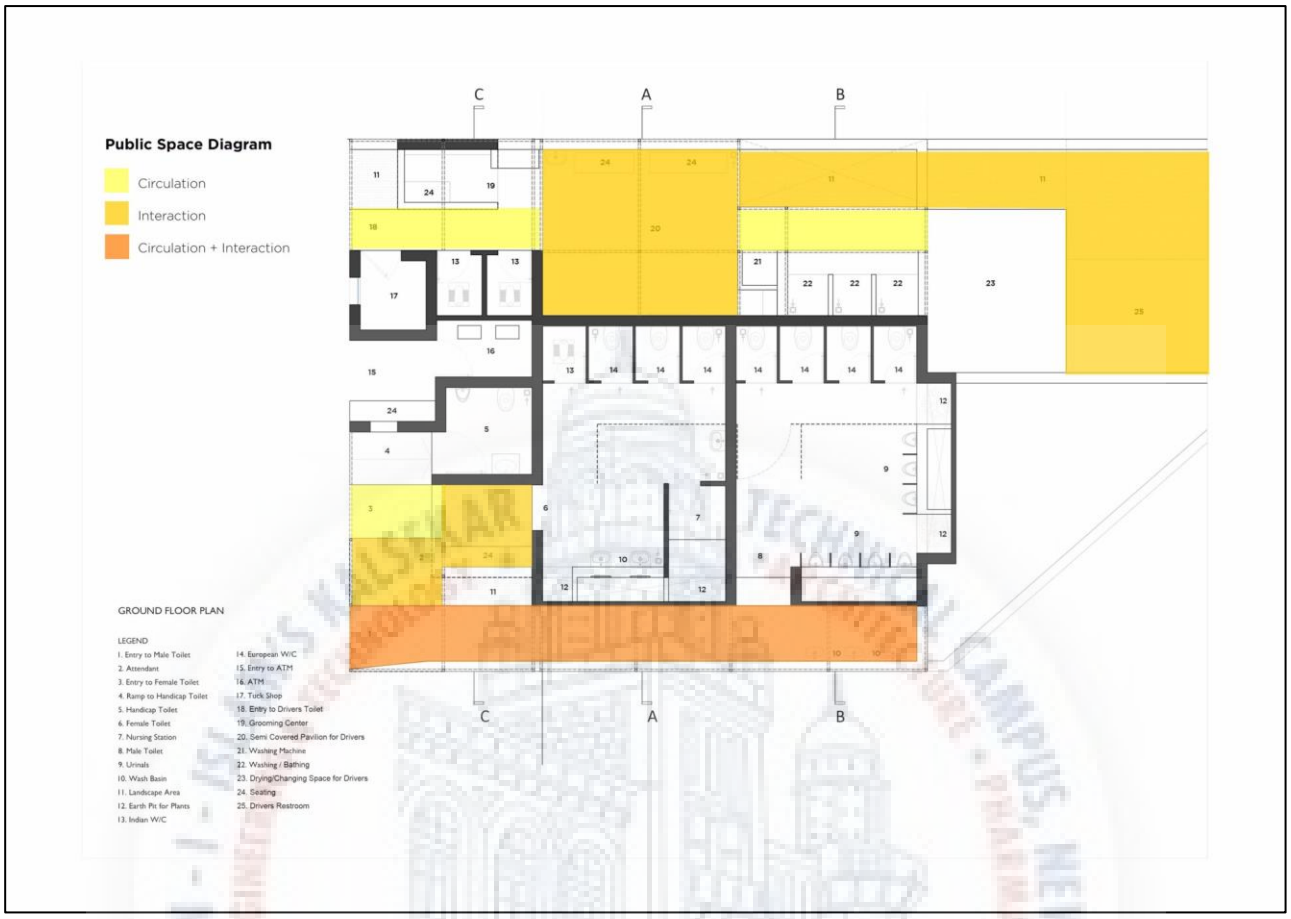
(Figure 94, images of the project)

PROJECT BACKGROUND

The Pause Campus is a unique facility designed to cater to the needs of long-distance truck drivers, offering a wide range of essential services and amenities. The campus is strategically located to ensure security, accessibility, and user comfort. It prioritizes distinct access points for different user groups, ensuring privacy and security. The campus also caters to women, senior citizens, and differently-abled individuals, creating a verandah niche at the main entry point for their convenience.

The core objective of the Pause Campus is to enhance the overall experience for long-distance truck drivers and other visitors. It offers a comprehensive array of functions and amenities, including toilets, sinks, convenience centers, hair cutting salons, pantry, shop, laundry space, vending machines, nursing station, and sanitary napkin vending machines. The central feature is the Suvidha Kendra, which functions as a convenience center for truck drivers and provides banking and transaction facilities.The campus is characterized by its use of color, drawing inspiration from London's iconic red telephone booths, post boxes, and buses. The campus's distinctive red color serves as a visual marker for passersby, enhancing the overall well-being and convenience of the trucking community and other visitors. (.co, *Pause restroom* 2021)

PROGRAM

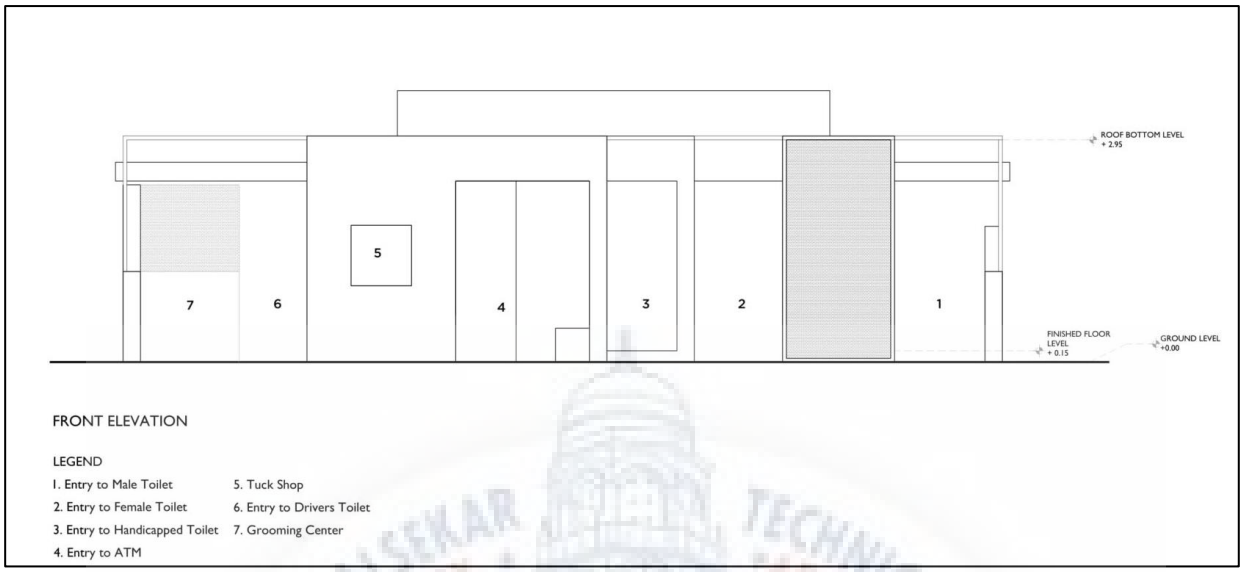


(Figure 95, area program)

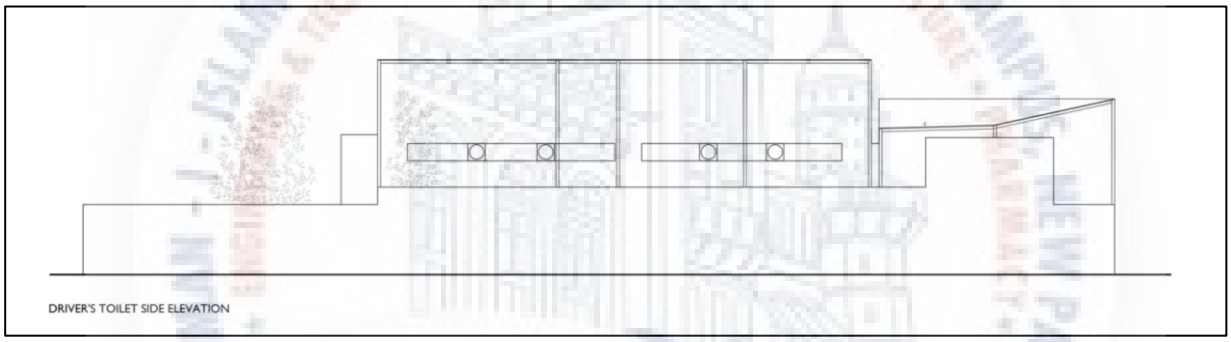
13. Entry to male toilet
14. Attendant
15. Entry to female toilet
16. Ramp to handicap toilet
17. Handicap toilet
18. Female toilets
19. Nursing station
20. Male toilet
21. Urinals
22. Washbasins
23. Landscape area
24. Earth pits for plants
25. Indian W/C

1. European W/C
2. Entry to atm
3. ATM
4. Tuck shop
5. Entry to drivers toilet
6. Grooming center
7. Semi covered pavilion
8. Washing machine
9. Washing/bathing
10. Drying/changing space
11. Seating
12. Drivers restroom

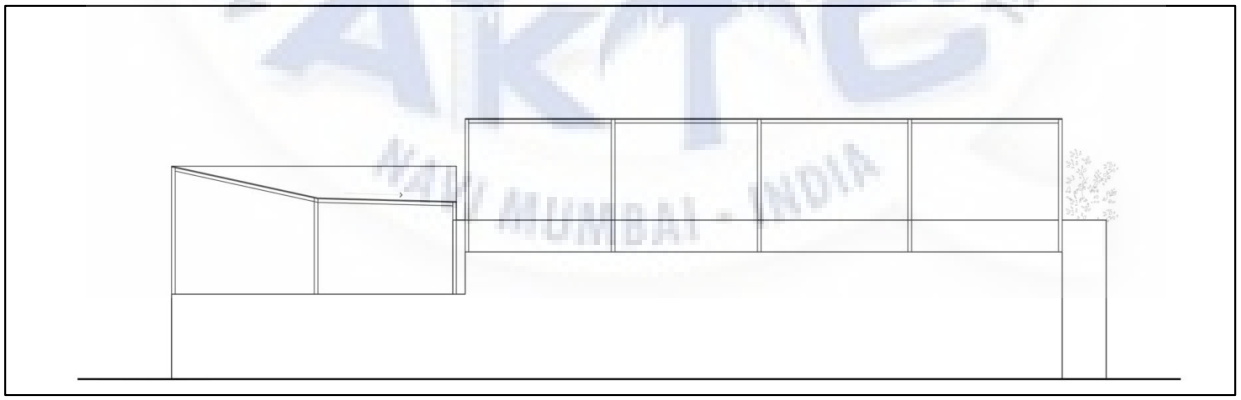
DETAILS



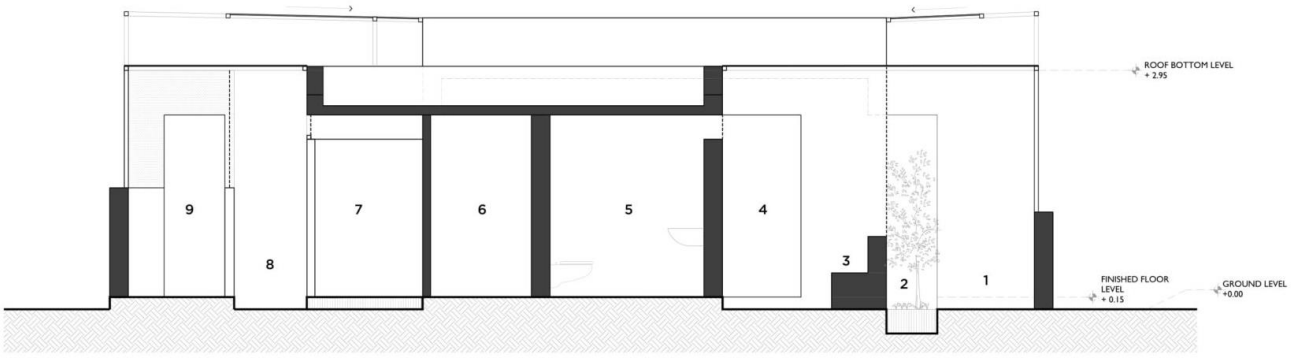
(Figure 96, front elevation)



(Figure 97, drivers toilet elevation)



(Figure 98, mens toilet elevation)

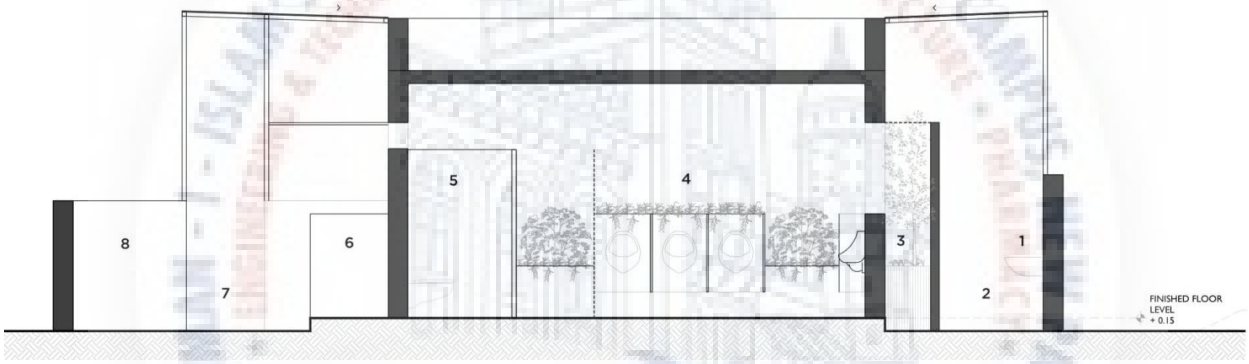


SECTION AA

LEGEND

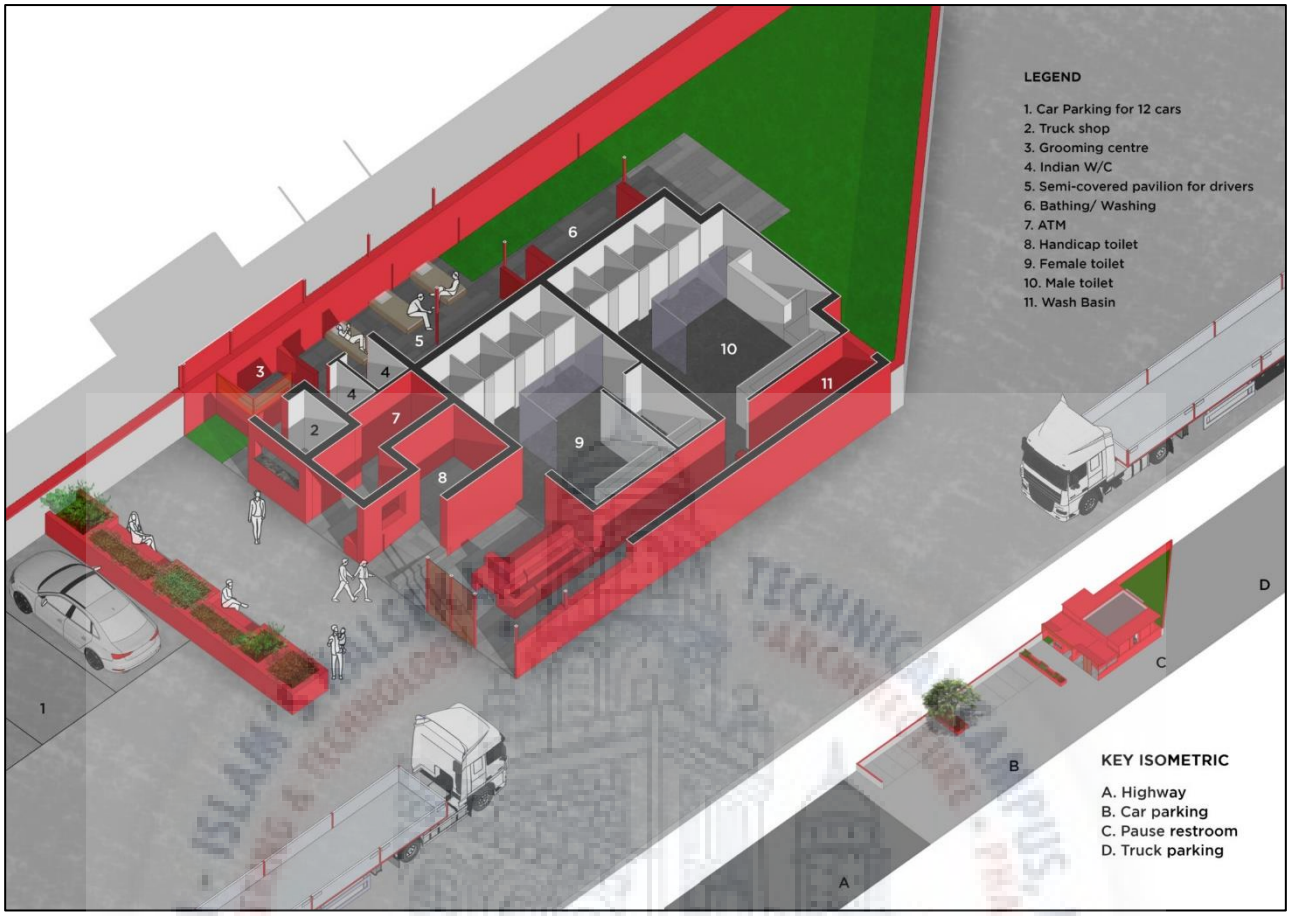
1. Entry to Male Toilet
2. Earth pit for plants
3. Seating
4. Entry to Female Toilet
5. Handicapped Toilet
6. ATM
7. Indian W/C
8. Entry to drivers Toilet
9. Grooming center

(Figure 99, section A-A')



(Figure 100, section B-B')

(Figure 101, elevation)



(Figure 102, area program)

NATURAL LIGHT AND VENTILATION

The building uses natural light and ventilation to illuminate spaces and facilitate quick drying of toilets. The exterior wall is pushed beyond the beam, creating open sky niches for plants, fixtures, and light. Light is crucial in public spaces, as it creates a safe environment for women. The verandahs vary in scale, allowing interaction between people at different scales. Materials inside the spaces are easy to maintain and robust, with weather shield paint for walls, granite slabs for flooring, and kotah stone for exterior flooring. Doors are designed based on activities, with main entry in perforated metal and solid blockboard for privacy. Communication design enhances accessibility to public utilities, with signage in two languages for easy understanding and communication. (Content@architecture.live, 2022)

(Figure 103, area program)

CONCLUSION

Strengths:

- Comprehensive Amenities: Pause Campus provides long-distance truck drivers and others with necessary facilities, improving user convenience.
- Inclusivity: Accessibility and inclusivity are given top priority in special facilities for women, elders, and people with disabilities.
- Strategic Location: The area is accessible and appeals to the intended user demographic.
- Design That Is Easy to Recognise: The campus is quickly recognised thanks to its striking red colour.

Weaknesses:

- Maintenance requirements: To live up to user expectations, the comprehensive amenities may need regular maintenance.

Opportunities:

- Offering instructional and awareness programmes might be helpful to users.
- Community involvement: Working with the locals and the transportation industry can improve services.
- Potential for Expansion: Think about applying the idea in different places.

Threats:

- Industry variations may have an impact on service demand due to economic factors.

The well-designed project Pause Campus caters to the requirements of other customers as well as long-distance truck drivers. Strengths include its inclusiveness, advantageous location, and recognisable design. However, taking care of maintenance issues and increasing business hours might improve customer satisfaction. Examining educational opportunities and community involvement possibilities might enhance the campus's influence even more. Pause Campus has the potential to be a useful tool and a model for similar institutions as it serves its intended audience.

COMPARISON CHART

SR .NO	CASE STUDY	STUDY CATEGORY	PROJECT TYPE	LOCATION	AREA	OBJECTIVE
1.	LIXIANG VILLAGE PUBLIC SPACE	INNOVATION IN PROGRAM COMMUNITY SPACIAL CONNECTIONS	COMMUNITY CENTRE/ RENOVATION	NANJING, CHINA	4950	REVITALIZE NANJING COMMUNITY CENTER THROUGH RENOVATION FOR ENHANCED COMMUNITY LIFE AND INCLUSIVITY.
2.	MANAV SADHNA	COMMUNITY INCLUSIVE MULTI ACTIVITY INNOVATION MATERIAL	MULTI-PURPOSE COMMUNITY CENTRE	GANDHI ASHRAM, HRIDAYA KUNJ, AHMEDABAD	515	PROMOTE AFFORDABLE HOUSING, ECONOMIC EMPOWERMENT, AND ECO-FRIENDLY ENVIRONMENT.
3.	JETAVAN SPIRITUAL CENTRE	SKILL DEVELOPMENT COMMUNITY EDUCATION MATERIAL INNOVATION	COMMUNITY SPIRITUAL & SKILL DEVELOPMENT CENTRE	SAKHARWADI, NASHIK, MAHARASHTRA	311	CREATE SUSTAINABLE SPIRITUAL SKILL DEVELOPMENT CENTER HARMONIZING ENVIRONMENT AND COMMUNITY.
4.	KHAMIR CRAFT RESOURCE CENTRE	SKILL DEVELOPMENT COMMUNITY VERNACULAR TECHNIQUES MATERIAL EMPLOYMENT	CRAFT RESOURCE AND SKILL DEVELOPMENT CENTRE	KUTCH, GUJRAT	2500	PRESERVE KUTCH CRAFT HERITAGE, ECOLOGICAL RESPECT, AND COMMUNITY ECONOMIC SUPPORT.
5.	HUNNARSHALA FOUNDATION CAMPUS	COMMUNITY EMPOWERMENT, ARTISAN TRAINING, TRADITIONAL BUILDING SYSTEM	ARTISAN SKILL DEVELOPMENT CENTRE	KUTCH, GUJRAT	226	EMPOWER COMMUNITIES WITH SUSTAINABLE HABITAT RECONSTRUCTION AND TRADITIONAL BUILDING TECHNIQUES.

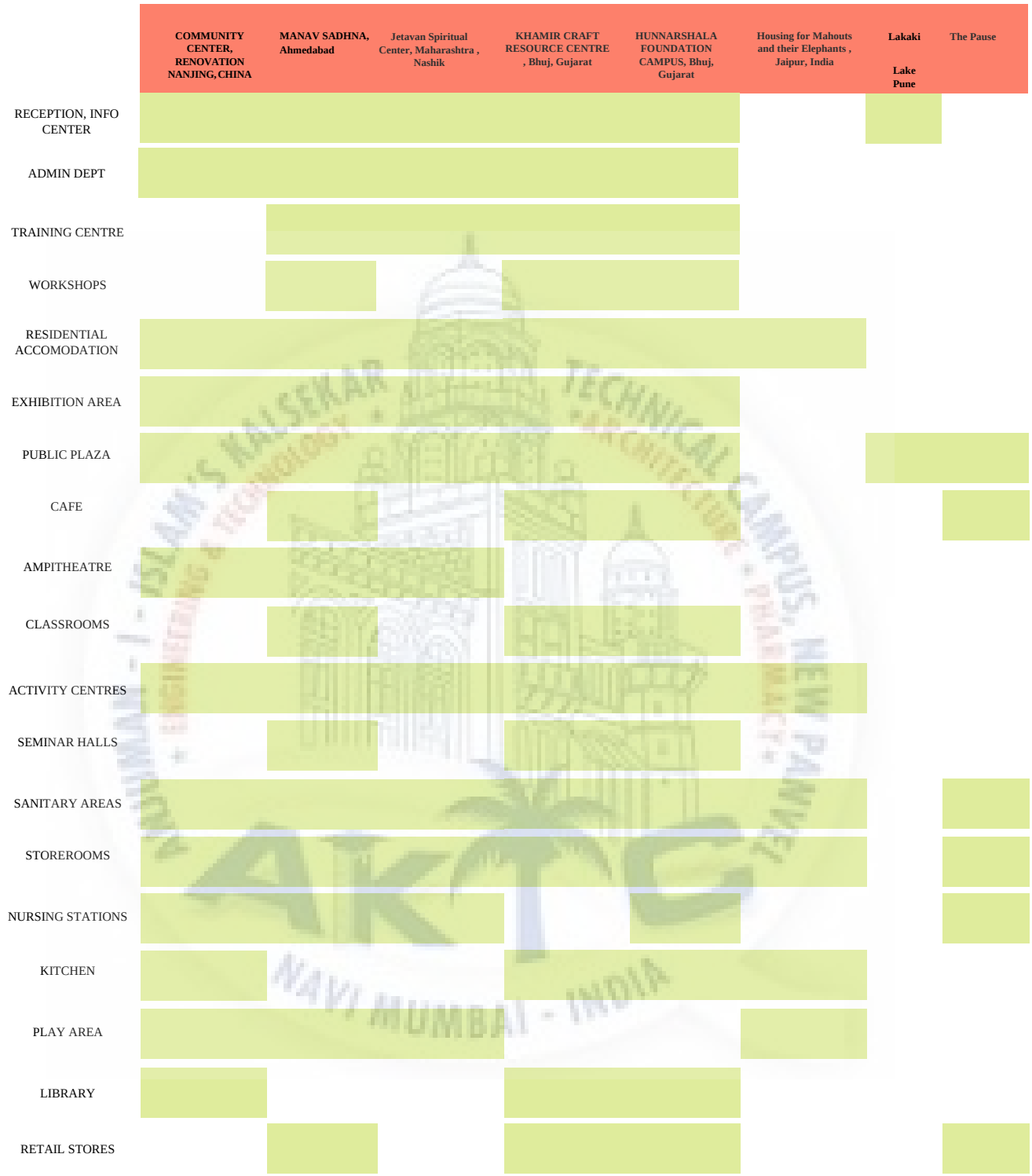
(Table 5, comparison chart)

COMPARISON CHART

SR .NO	CASE STUDY	STUDY CATEGORY	PROJECT TYPE	LOCATION	AREA	OBJECTIVE
6.	HOUSING FOR MAHOUTS AND THEIR ELEPHANTS	QUARRY RESTORATION, COMMUNITY INCLUSIVE, SUSTAINABLE, REGENERATIVE ECOSYSTEM	COMMUNITY HOUSING	JAIPUR, RAJASTHAN	88	CREATE SUSTAINABLE HABITAT FOR ELEPHANTS AND PEOPLE IN RAJASTHAN DESERT.
7.	THE EDEN PROJECT	BIOMIMICRY, QUARRY REUSE, STRUCTURAL SYSTEM	MULTIPLE GREENHOUSE COMPLEX	ST BLAZEY, CORNWALL, ENGLAND	150000	PROMOTE SUSTAINABILITY AND NATURE AWARENESS THROUGH INNOVATIVE BOTANICAL GARDENS.
8.	LAKAKI LAKE PUNE	QUARRY RESTORATION, ECOSYSTEM REVIVAL, PUBLIC SPACE	PUBLIC PARK	MODELCOLONY, PUNE, MAHARASHTRA	60000	CONSERVE AND PRESERVE THE UNIQUE ECOLOGY OF MODEL COLONY LAKE..
9.	THE PAUSE	PUBLIC RESTROOMS, PROGRAM, USER EXPERIENCE, AMENITIES	PUBLIC RESTROOMS	BOMBAY-GOA HIGHWAY		ENHANCE TRUCK DRIVER EXPERIENCE WITH COMPREHENSIVE, ACCESSIBLE AMENITIES AT PAUSE CAMPUS.

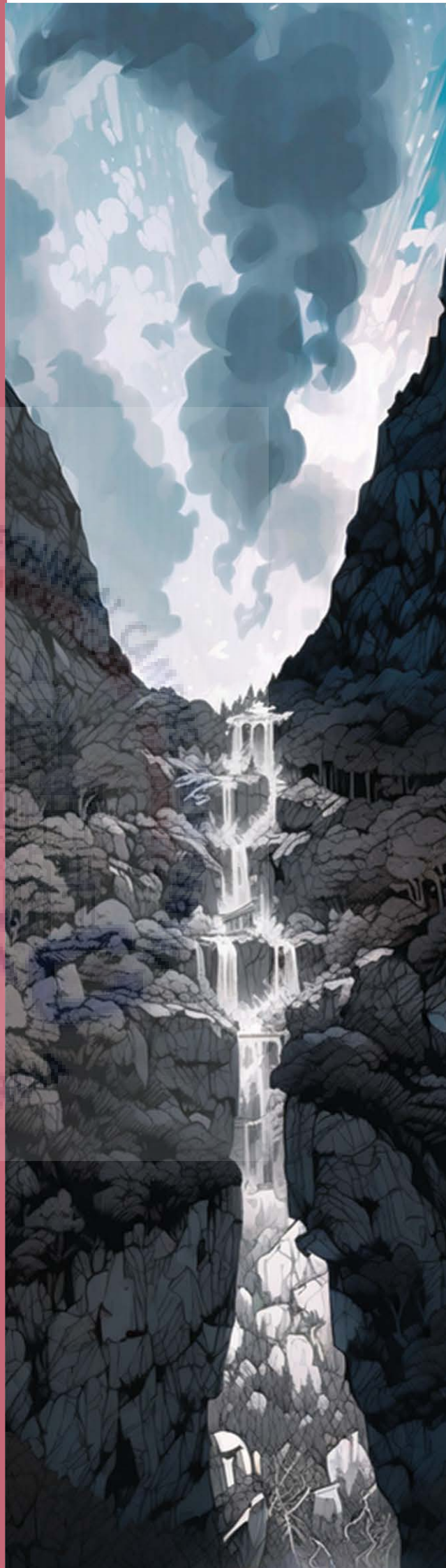
(Table 6, comparison chart)

Comparative Analysis of Case Studies:



(Table 7, comparison chart)

DESIGN RESEARCH
SITE STUDY & SELECTION



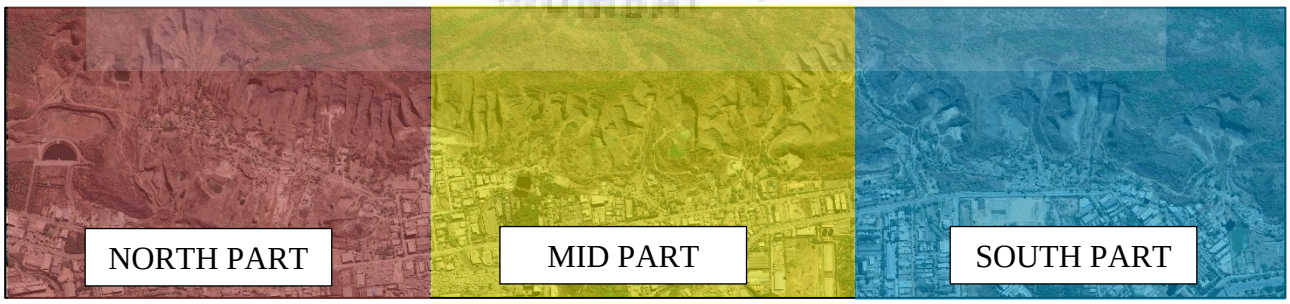
06

5.0 DESIGN RESEARCH

5.1 SITE STUDY

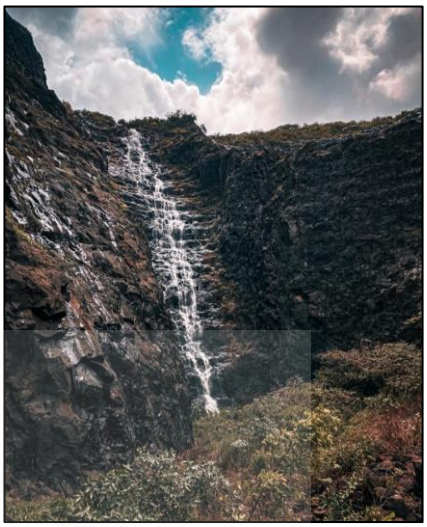
QUARRY SITE SURVEY

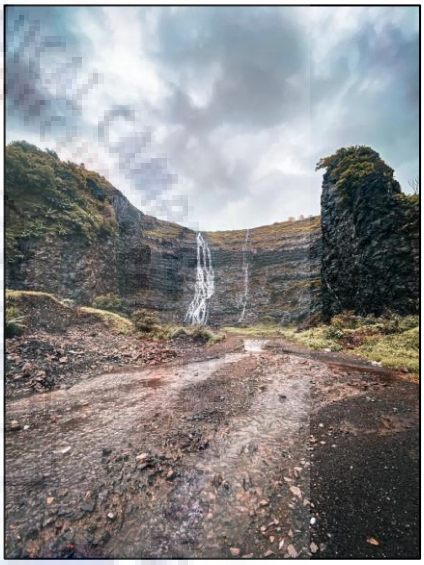
(Figure 104, location of quarries, Nerul, Navi Mumbai.)

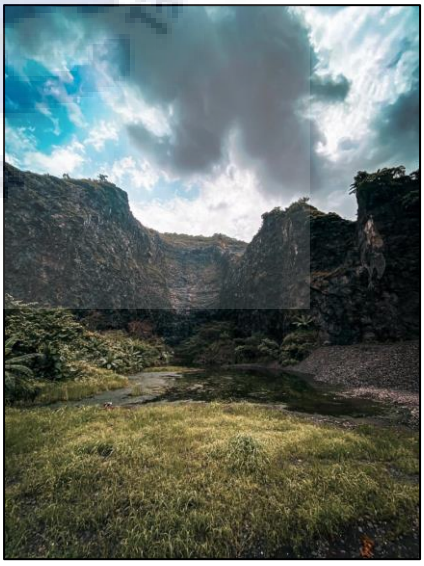


(Figure 105, 5.46 km long quarry stretch divided in three parts.)

Physical characteristics of Navi Mumbai







(Figure 106, Quarry images)

Geography

Navi Mumbai spreads over parts of two districts of Maharashtra; Thane and Raigad. The region is hilly in some parts. Parts of the region are also protected wetlands. Unlike its bigger neighbour, the city is sparsely populated. Its coordinates are 73° E; 20° N. Along the east, there are small hills running in north-south direction. The lands forms part of Konkan Region. The narrow belt of land starts at Dighe in north and ends at Kalundre in south. It is 25.60 km² in area, 20 km long and about 2.0 km wide.

Geology

The rock formation in the region is derived mainly from Deccan Basalt and also from granites and laterite. The gently sloping coastal low lands are observed in patches and are covered with moderately shallow to deep soils, mostly lateritic in nature, sometimes oxidised to yellow murrum.

Topography

To part of Western Konkan coast is a narrow coastal strip along the western part of Sahyadris. It is bound on the East side by hillocks of 50 to 200 m height and on the west side by Thane creek.

Soil

The soils of this region are highly saline in the vicinity of creeks and non-saline at other places. They are calcareous, neutral to alkaline in reaction (pH 7.5 to 8.5), clayey, with high amount of bases and have high water holding capacity (200-250 mm/m). The soils located on moderately sloping residual hills are lateritic in nature and show intensively leached surfaces. They are loamy and slight to moderately acidic (pH 5-6.5) with moderate base status (< 75%)

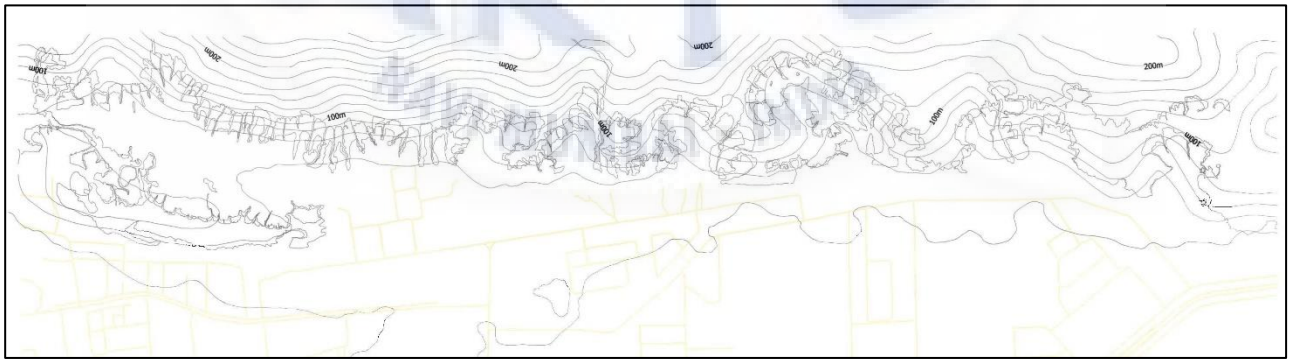
Land use

The land was used to produce paddy during rainy season. Some mango and coconut orchards and limited vegetable cultivation was also practised by locals. Those with well-irrigation facilities used to go for vegetables like ‘tur’ and beans. With increasing urbanisation, all agriculture activities in Navi Mumbai have almost ceased to exist, except in easternmost part. Fish, crabs and prawns were once common products from the creek, though the quantities were not significant. Surplus from domestic consumption was sold in Thane and Belapur markets.

Land and Ownership

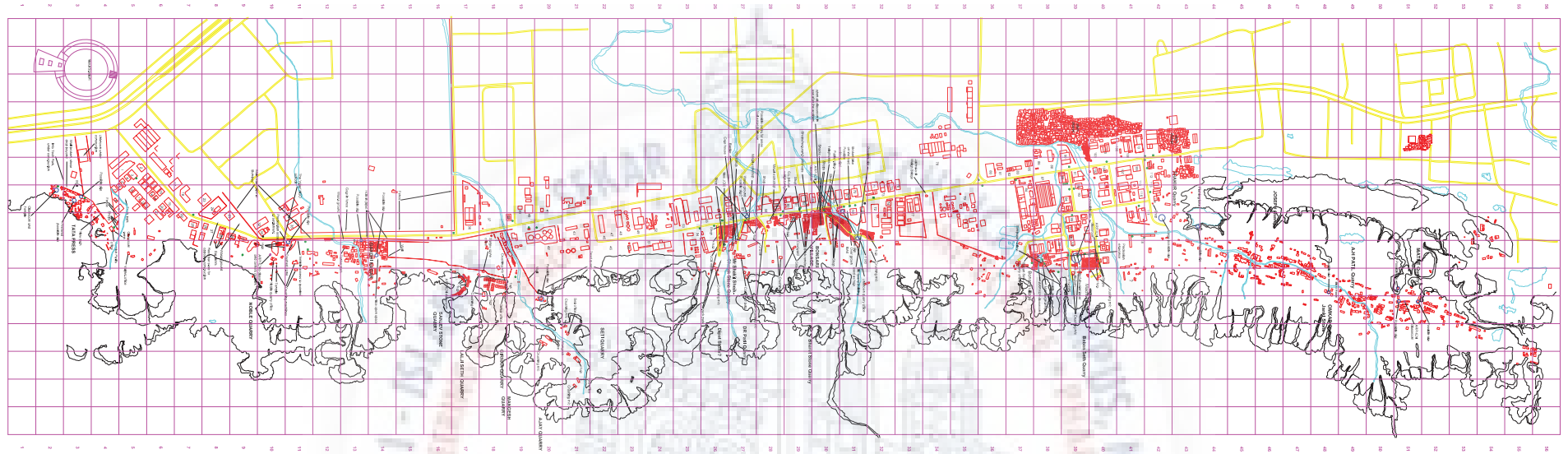
Ideally land for the proposed community buildings will be transferred into the ownership of a Trust (consisting of representatives of CIDCO, NMMC, ARPHEN, Quarry Owner's Association, community, etc) whose remit would be to maintain the building and programme of initiatives.
The following is the list of current quarry owners known BY ARPHEN.

NAME OF QUARRY OWNER	QUARRY NAME
• Ranade	• Bharat Stone
• Bhau Mahtre	• A.H Patil
• Muttu	• Muttu
• Yogesh	• Painter
• Pramod Gharat	• D.D Gharat
• Naresh Gauri	• Bharat Stone
• Dattu	• Ajay Stone
• Girish	• Jaimata Di
• Ramesh	• Ramesh Metal
• Vivek Patil	• D.R Patil
• Mangesh Awahad	• Mangesh
• Avinash Laad	• Laad
• Bharat Sir	• Janki
• Kunal	• Bharat Stone Member Mahavir
• Nilesh	• Noble
• Atul	• Noble
• Pandari Nath Patil	• Baban Seth
• Santosh	• Suresh
• Suresh	• Laxmi
• Vaijnath	• Thakur
• Parera	



(Figure 107, Contour map)

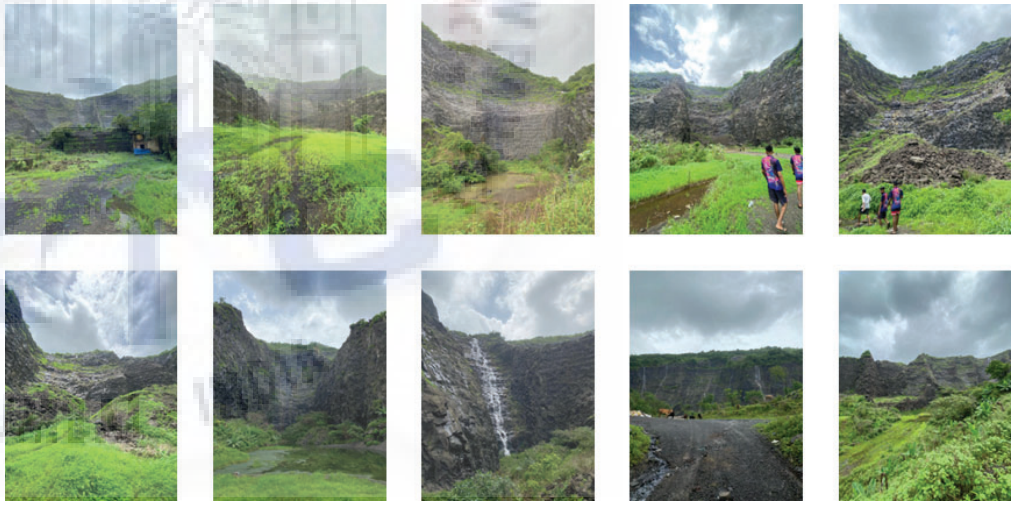
ENTIRE STRETCH SURVEY MAP OF QUARRIES



(Figure 108, Surveyed map of quarry settlements 1:15 000 ,100 m grid)

1 TATA Consultancy services
2 Metal Fab Workshop
3 Empty Plot
4 Heavy Metal Workshop*
5 Heavy Metal Workshop*
6 Heavy Metal Workshop*
7 Shreeji
8 Valpaint PVT LTD
9 Coca Cola Bottling Plant
10 Storage*
11 Metal Workshop*
12 Metal Workshop*
13 Unused
14 Kombyne Transpak PVT LTD
15 Unused Office
16 Tanker Wash*
17 For Sale
18 Furgo Survey (India) PVT LTD
19 Skoda Auto
20 FABZ
21 Under Construction
22 Unused Office
23 ABS
24 For Sale/Lease
25 TATA Coach Builders Office*
26 TATA Coach Builders*
27 Under Construction
28 Airtel
29 Un-named Factory
30 Un-named Office
31 Techno Pre Cast
32 Matheru Sons
33 Writer Relocations
34 H,A&R
35 OVIS Biosurgicals PVT LTD
36 Viking
37 Under Construction
38 Vishal Restaurant
39 Vadilal Chemicals LTD
40 Gargi Hutchines Albertas LTD
41 India Oil
42 Hindustan Petrollium
43 Hindustan Petrollium
44 Hindustan Petrollium
45 Invensys India PVT LTD
46 Truck & Tanker Park*
47 Under Construction
48 Vishal Ice Factory & Cold Storage
49 Lifex
50 HP Corp Research & Development
51 Hindustan Colas LTD
52 L&T Concrete
53 Bharax Mercantile Warehouse
54 Hincol
55 Snoval Chem
56 Black Towers*
57 Jetair PVT LTD
58 Under Construction
59 Un-named Factory
60 Un-named Factory
61 Un-named Factory
62 Condenser House*
63 Un-named Factory
64 Rei Agro LTD
65 Rei Agro LTD
66 Un-named Factory
67 Rei Agro LTD
68 Un-used factory
69 Nutech
70 J&K Coating Centre
71 Storage*
72 ABI Paint
73 Narval Industries
74 Green Fuel Solutions & CNG Repairs
75 Un-used Factory
76 Un-used Workshop
77 Esdee Paints LTD
78 Ever Ready India
79 Amines & Plasticises LTD
80 Un-used Factory
81 Un-used Factory
82 Un-used Factory
83 JD Orgochem LTD
84 Mazda Colours LTD
85 Un-named Factory
86 RB Chemicals & Agros PVT LTD
87 New Reshma Dyenia Private LTD
88 Machsons PVT LTD
89 PG Chemicals PVT LTD
90 Un-named Factory
91 Unknown Tanker Company*
92 Un-named Factory
93 Un-named Factory
94 Tal Reja Textiles PVT LTD
95 Unknown Office/Facory
96 Henkee Cal PVT LTD
97 Henkee Cal PVTLTD
98 M/S Nityanand Engg PVT LTD
99 Daksh Udydg
100 Accumay Engineering
101 White Dust Factory*
102 Satpre Chemicals LTD
103 Reshma Organic Chemicals
104 Unknown Factory
105 Sunber Alloys Co of India LTD
106 Under Construction
107 Un-used Facoy
108 Unknown Office/Factory
109 Under Construction
110 Solas Marine Industries
111 FUCHS
112 Lubricants (India) PVT LTD
113 Unused Factory
114 Turbhe Chemicals
115 Un-used Factory
116 SISCO Research Labs LTD
117 Unknown Factory
118 Roman Tarmac

Main elec tower
Sub station
Water Tank
Tap
Real Name Unknown
Accident Site
Temple



(Figure 109, Quarry images)

BUILDING TYPOLOGIES

There are four main types of building typologies within the Navi Mumbai quarry area. These cover both homes of those that work within the quarry area and the industrial environment in regards to the machines and associated buildings that make up the built landscape.
These four types are temporary, light-weight structures; semi-permanent light-weight structures; permanent heavy-weight structures and festival structures. In all these categories they can be both industrial and residential, even the festival structures as they are closely linked with the individual quarry's that commission them.

Temporary Light-Weight Structures

These structures are normally found in the residential area of the quarry i.e. where the workers of individual mines are housed by the quarry owners. They can vary from a considered bamboo frame with woven joints, the type seen in many slum clusters in India; any form of up-rights crudely lashed with some roof supports creating the basic shell, and then covered with whatever the owner can find to cover the structure, and make it water/dust proof.

(Figure 110, Temporary Light-Weight Structures)

Semi-Permanent Light-Weight Structures

The structures that fall into this group tend to be made by the quarry owners themselves for a specific propose, to house equipment for example. The standard construction of these are either steel or wood, with a high quality sheet material to enclose the space. (High quality in comparison with some other buildings within the quarry area.) But the main use of this type of building is the quarry machinery itself. The reason it is classed as semi-permanent is that these are dismantled when the quarry shuts down, or in some cases in the quarries to the north, the machinery is moved closer the face of the quarry after a period of time. The steel structures are just enclosures for the machines, the machinery itself having solid foundations.

(Figure 111, Semi-Permanent Light-Weight Structures)

Permanent Heavy-Weight Structures

The heavy-weight type of structure is basically brick, cement or rock. Brick built structures make up the more ordered areas of workers housing, quarry buildings and governmental structures that exist on site. The use of rock is perhaps the most interesting both visually and construction. For example, when building a free-standing wall, rather than a retaining wall, the vertical sides are angled in towards the top, making the wall thicker at the bottom. This gives the wall great strength considering that the construction process is compromised due to poor materials. The main reason for this is that cement is an additional expense that can not be found in quality on site. The mortar being made of particles of around 2-3mm diameter, which creates a weak joint when trying to bond hard granite with rough aggregate.

(Figure 112, Permanent heavy-weight structures)

Festival Structures

These festival structures use large lengths of quality bamboo well-laced at joints, using a course, strong rope, to create a temporary structure that is only in place for a matter of weeks at the most. The quarry owner, or community who hire on of these temporary structures usually does so for the housing of an idol, or god. In the case of those that we saw during the survey, this was for Ganesh, the god of fortune. This is a massive festival and is worshipped with great reverence, therefore an enclosure for Ganesh is required of the highest standard. The only things that differ in this type of structure are the size colour of tarp covering. Some 'temporary temples' differ from other also in the fact that they have a rock platform constructed on which the idol is seated. This is constructed out of the rock of the quarry in the manner mentioned in the heavy-weight section.

(Figure 113, Festival structures)

COMMUNITY SURVEY

Quarry Inhabitants

The people living in the quarries comprise of unskilled workers from rural areas in Maharashtra, who moved there for work. Some of them have been living there for 15-20 years. The main language is Marathi, although some people speak Hindi. The large majority of inhabitants (ca. 95%) is Hindu, while 5% are Muslim.

Living Conditions

Most people live in basic shelters provided by the quarry owners and are dependent on water trucks making daily deliveries. Thick dust was constantly used to covers the hills, cover the workers' shacks and coats the peoples' lungs (while the quarry was functional). Apart from warnings prior to blasting when the people have to vacate their homes as debris cascades down on their dwellings there are no official health and safety schemes in operation and fatal accidents sometimes occur. The heavy monsoon also causes problems.

Employment (Before quarries were closed)

Most men work in the quarries, while most women are housewives. Over the years machinery has replaced labor, and a large proportion of men have found jobs in the surrounding industrial area. According to ARPHEN, 25% of the women work in the quarries (women are not allowed to work in some quarries), 25% in the neighbouring industrial area or in Navi Mumbai (eg. as cleaners) and 25% are housewives.
Quarry Workers (mainly stone crushers) : RS 80-200(10h day/6 days per week) – Disadvantages: eyes and lung problems due to dust, 4-month period of unemployment during monsoon. Pay: dependant on skill : Minimum: RS 80 (unskilled, eg. breaking stone) Max: RS 250-300 (blasters+ drivers). Cleaners: RS900/month (spend ca. RS15 in transport per day (ca.10% of salary) Tailor: RS100/day (Tang, *Navi Mumbai Stone Quarry settlements by ARCSR* 2008)

Employment (after quarries were closed)

Now the men work in the turbhe industrial area some of them drive dumpers and trucks, while the rest work on daily wages and stand near the turbhe naka for their daily employment. While most women are housewives and also work as housemaids.

Average monthly family spending

Although the quarry owners provide the people living in the quarries with free houses and electricity (in some cases they have to pay an average RS500/month electricity bill), most quarry inhabitants live a hand-to-mouth existence. The money they earn is hardly enough to pay for food and clothes. Most children do not go to school, as they are too far away and transport is too expensive (RS5/pp in autorickshaw). On average, children start working at the age of 13, mainly as cleaners, earning ca. RS 200-300/week. The average family income is below 10,000 (data received after survey)

Education

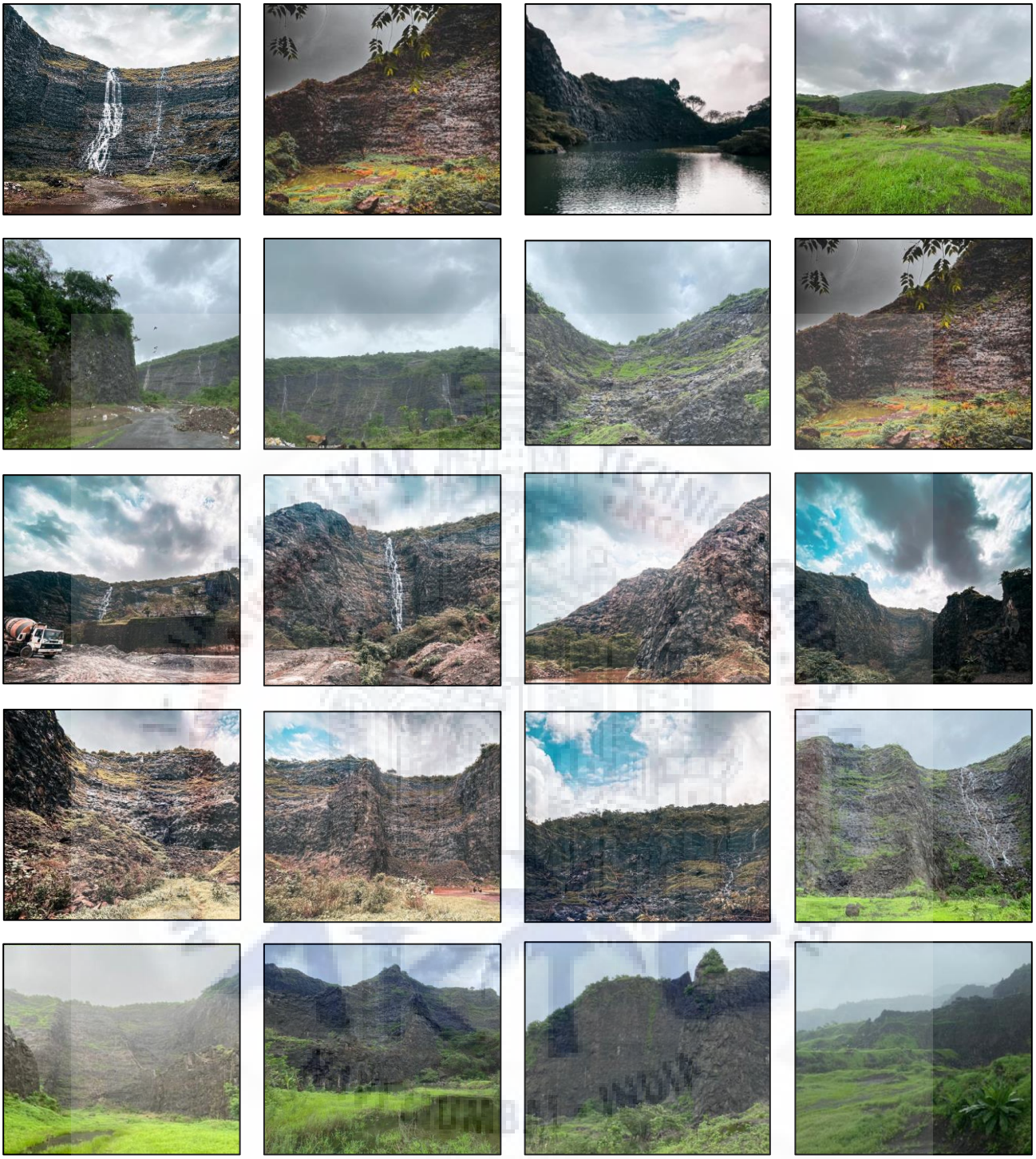
Most children stay at home playing and parents often do not understand the importance of them receiving an education. Part of ARPHEN's engagement is to help this understanding develop. The distance to schools makes this more complicated. From some quarry locations, it takes over 1hr to walk to school. Children walk on the road, where they are exposed to dangerous traffic and accidents have already occurred. On average, the school-going kids miss about 5 days of school per year due to heavy rains.

ARPHEN's Education Programme

An estimated 500-600 children living in the quarries of Navi Mumbai currently do not go to school. ARPHEN now runs 10 bridge classes for approximately 250 non-school-going children between 6 and 14 who live in the quarries, preparing them for entrance into government schools. They are learning to read and write as well as participating in games and social activities.

Increasing numbers of children are now passing exams to progress to mainstream education. 120 children have passed entrance exams for government schools this year. ARPHEN is working with the communities to increase this number even more next year. Plans are to make more classes, train more teachers and link more closely with NMMC. Strong links have been made with local schools, located in Indra Nagar and Turbhe Naka, where quarry children have been accepted. ARPHEN's ultimate goal is 100% school enrolment. (Tang, *Navi Mumbai Stone Quarry settlements by ARCSR* 2008)

(Figure 114, Bridge classes)



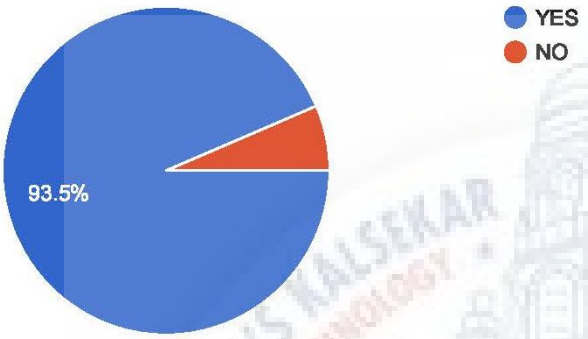
(Figure 115, 28 accessible quarries visited for the study)

Out of the 84 quarries 28 were found to be accessible for visit, proximity of the quarry is very close to the settlement and it is approximately 100-200 m from the settlement.

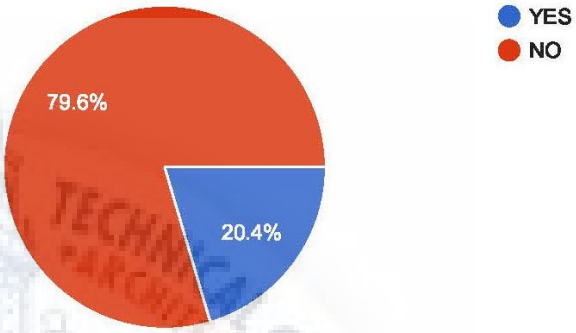
SURVEY QUESTIONS

A total of 94 community members are included in this survey of different age groups ranging from 18-60 years old.

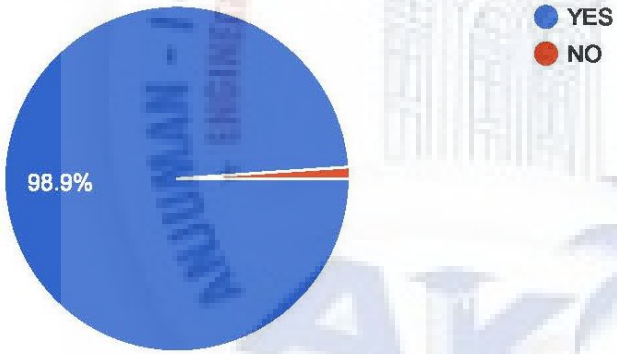
Have you or someone you know experienced any health issues like respiratory problems, skin irritations, or allergies that you suspect could be connected to the abandoned quarry site?



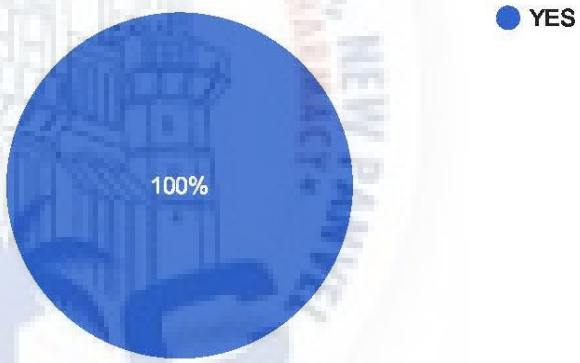
Do you feel that there are adequate safety measures in place around the abandoned quarry to prevent accidents or unauthorized access?



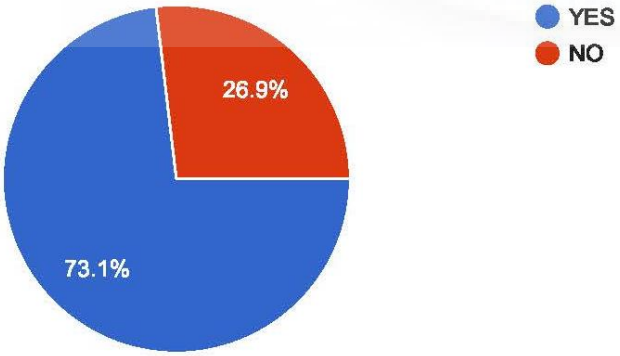
Have you observed any hygiene-related issues in the surrounding area attributed to the abandoned quarry? (e.g., waste dumping, stagnant water)



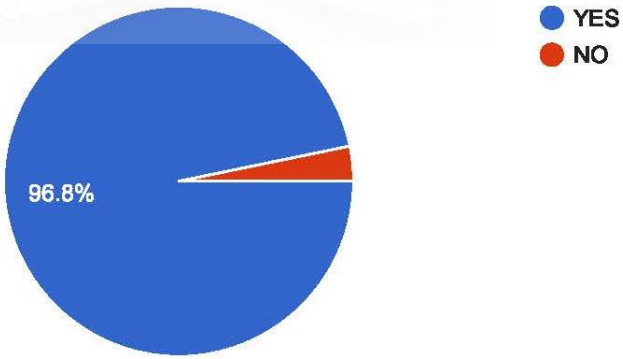
Are you worried about the potential risks posed to children or pets due to the abandoned quarry site?



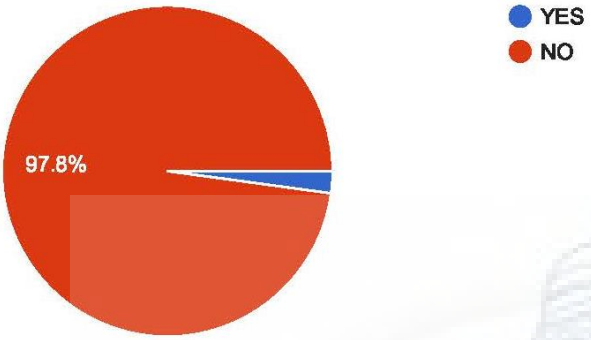
Do you have concerns about potential health hazards caused by the abandoned quarry, such as air or water pollution?



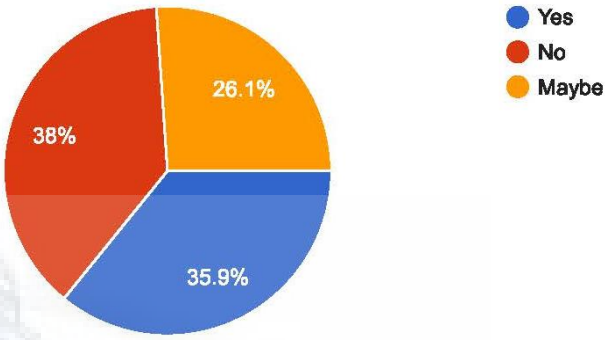
Do you believe that the presence of the abandoned quarry is negatively impacting the beauty of the area or affecting property values?



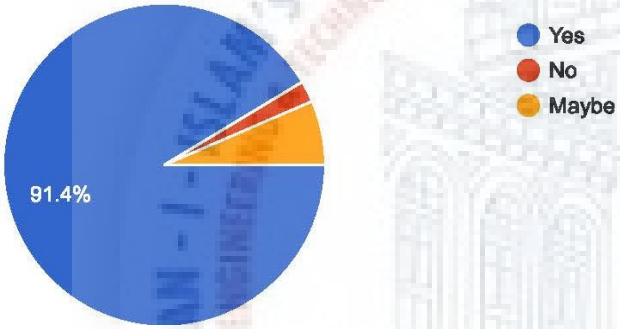
Are you aware of any initiatives or plans to rehabilitate or repurpose the abandoned quarry site?



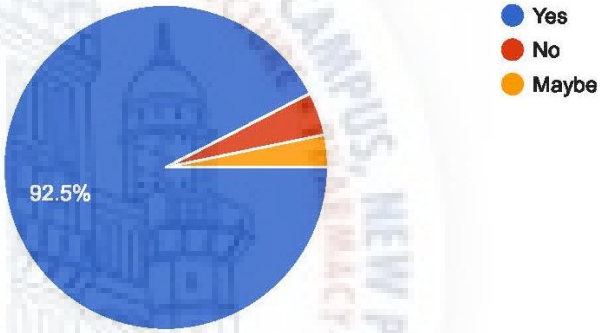
Do you encounter any difficulties accessing essential services (e.g., healthcare, schools, markets) because of the proximity to the abandoned quarry?



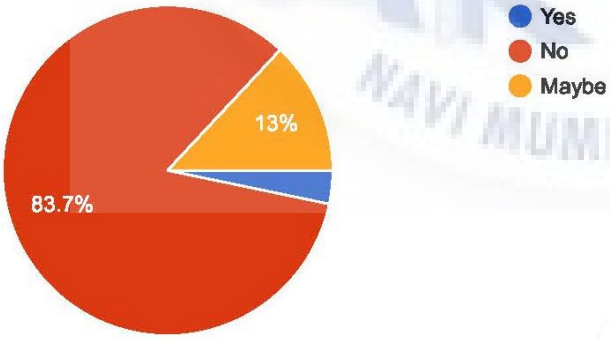
Do you face any challenges related to transportation or road access due to the abandoned quarry site's location?



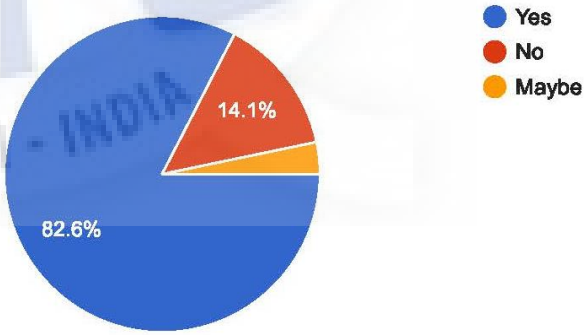
Have you or anyone in your community faced any accidents or injuries while near the abandoned quarry?



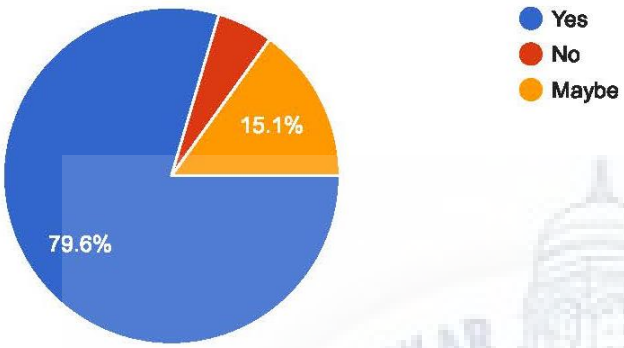
Are you satisfied with the overall cleanliness and waste management in your neighborhood?



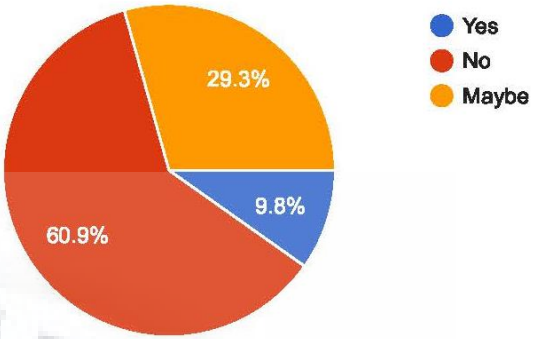
Are you aware of any property damage or structural issues in buildings caused by the quarry or its activities?



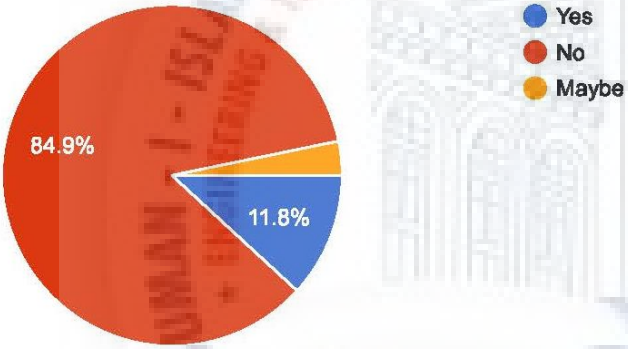
Do you feel that the presence of the abandoned quarry affects your overall quality of life in the neighborhood?



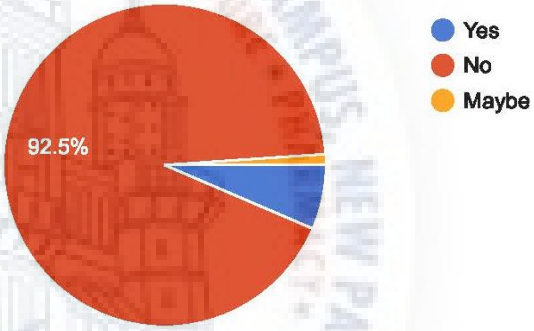
Do you have a toilet in your place of residence?



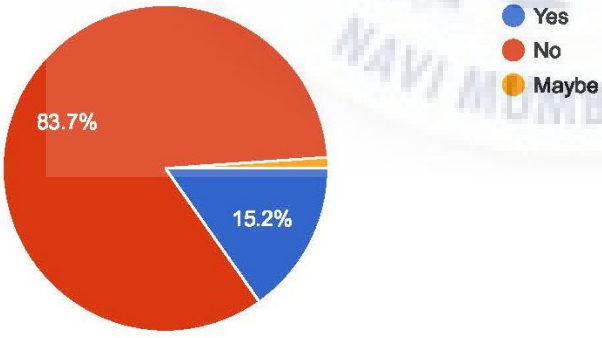
Are you able to find consistent work within the city?



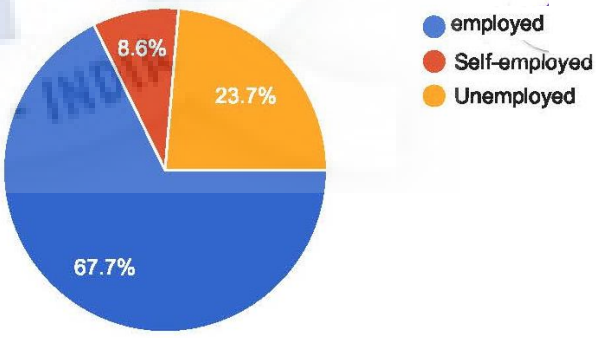
Are you satisfied with the quality of your local schools?



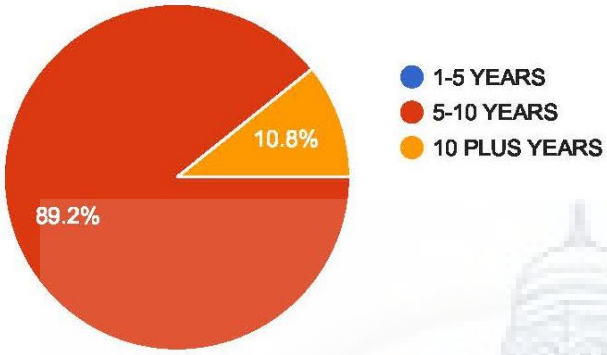
Do you have a bathing area in your place of residence?



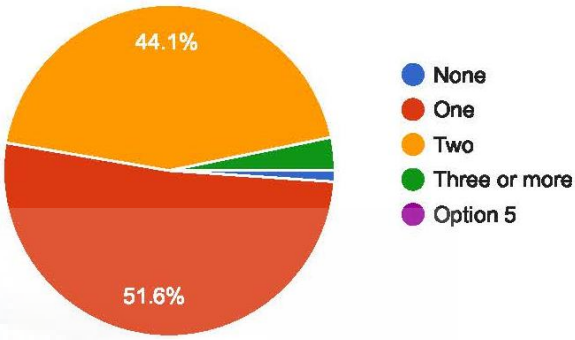
Which of the following best describes you?



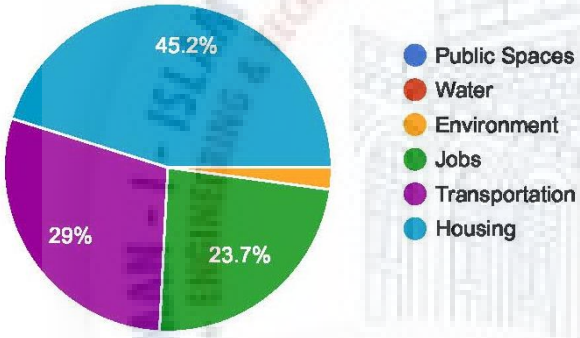
For how long have you lived in Mumbai?
Less than one year



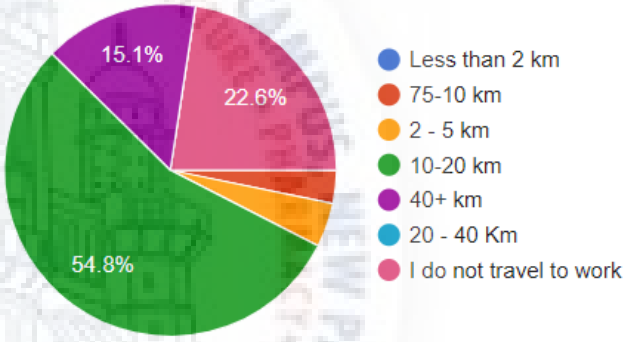
How many earning members live in your household?



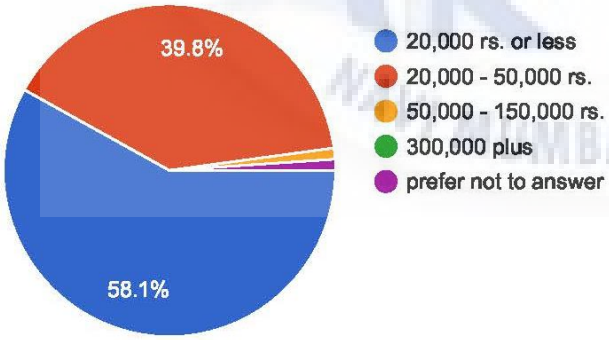
Which of the below issues is most important to you?



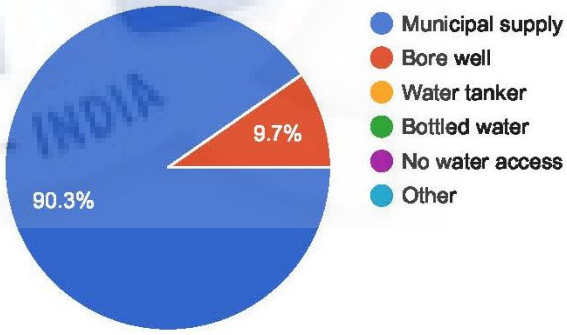
How far is your place of work from your house?



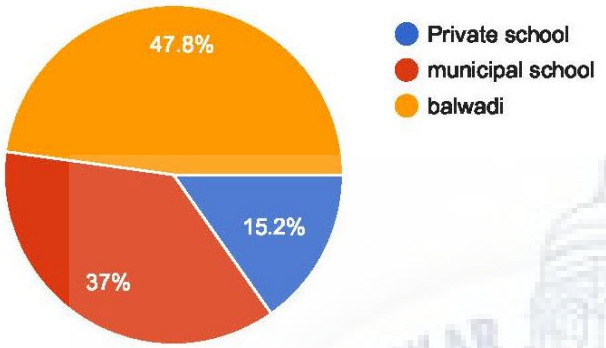
What is your household income per month?



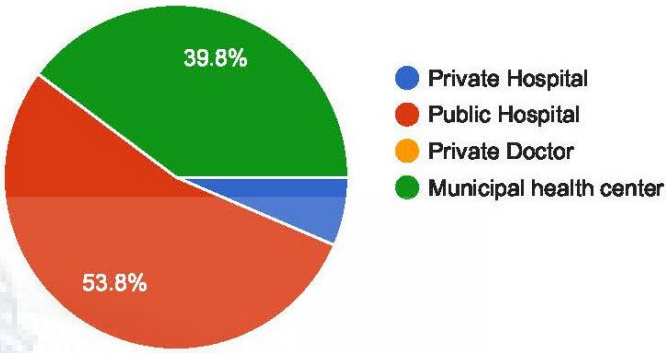
What is your primary source of water?



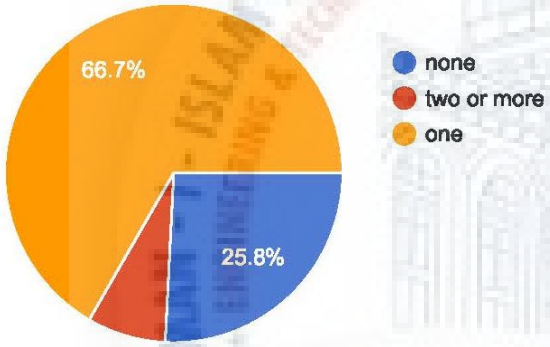
Where do the children in your family attend school?



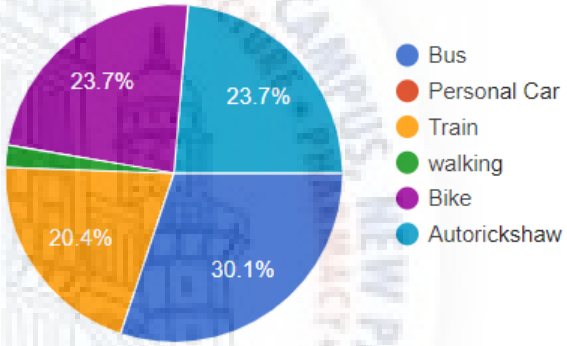
Where do you go when a family member is unwell?



How many hospitals are in your area of residence?



How do you usually travel distances within the city?

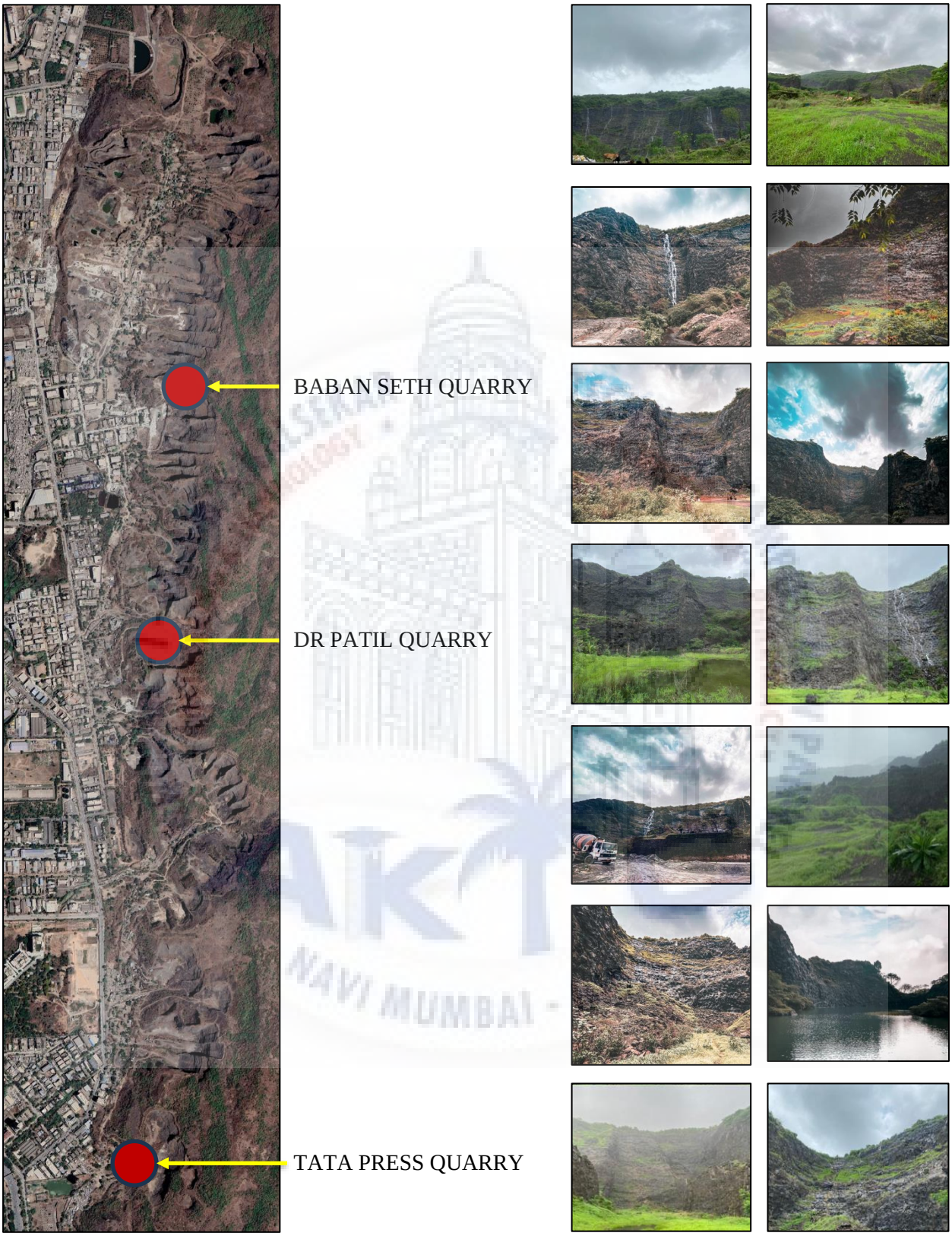


(Figure 116, All graphs have been made by the author through physical survey)

Contact: Pradeep-9594124939

The study results point to a number of important priorities for raising the area's quality of life. Among these include resolving health issues connected to the defunct quarry, better sanitation and waste management, boosting security surrounding the area, and taking into account its rehabilitation or repurposing. Additionally, it's critical to boost job development, ensure improved access to necessities like healthcare and education, and improve transportation infrastructure. Creating public places, promoting environmental preservation, and encouraging community involvement are essential elements of a comprehensive strategy to enhance inhabitants' general well-being.

5.2 SITE SELECTION



(Figure 117, Possible sites)

TATA PRESS CAMP -PROPOSAL 1

PROS

- The geology of the site is solid bedrock.
- Raised elevation allows additional natural ventilation.
- The area itself is large enough to accommodate a varied range of potential building typologies and activities.

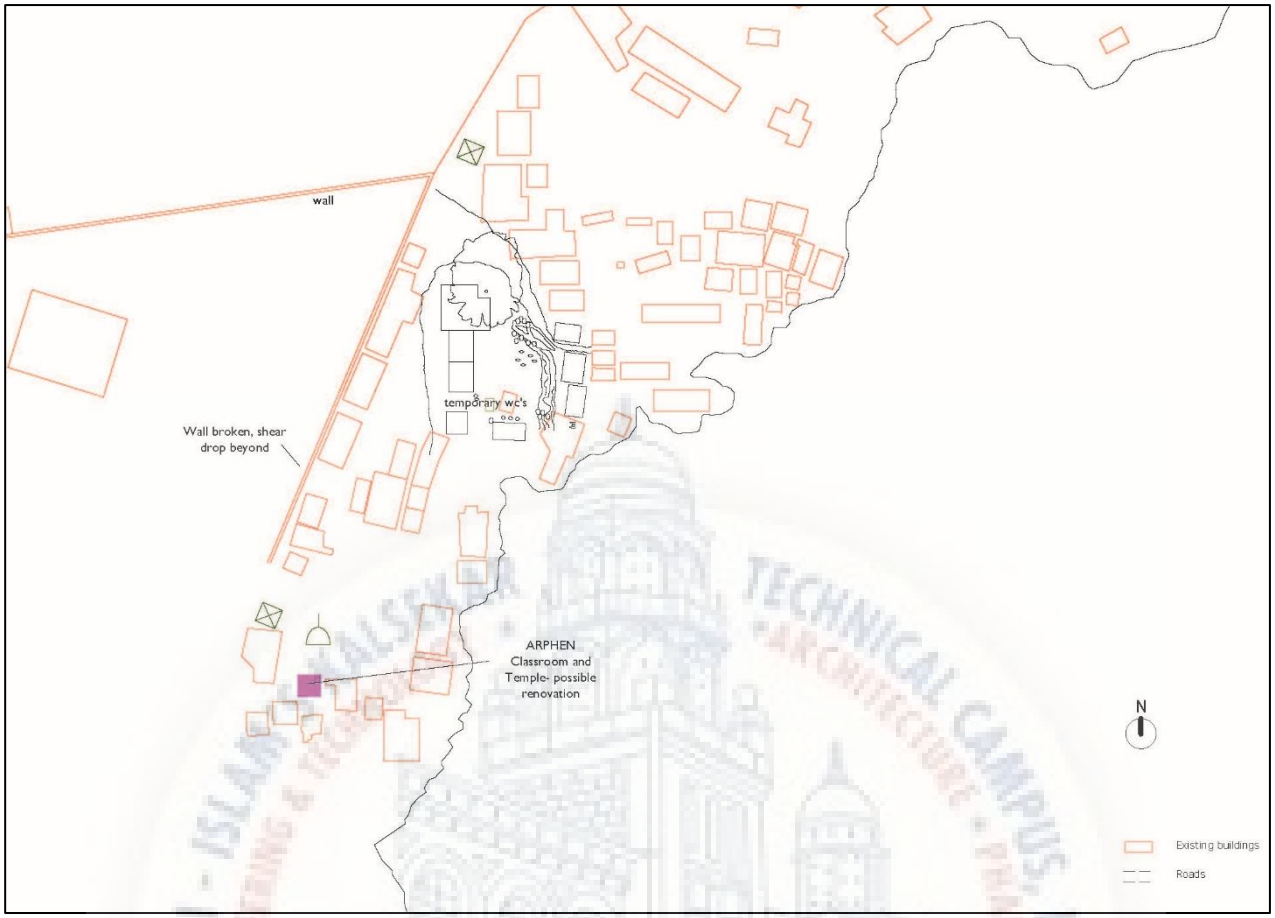
CONS

- Still regarded as the southernmost site, with the same access issues related to this.
- Difficult to convert bedrock into a suitable building platform.
- Access is difficult due to its raised elevation and narrow entrance point.
- The southernmost part of the site is a natural water runoff for monsoon rain. Additional infrastructural work would be needed to manage this.

This has the best potential site in the southern area. Strong foundations coupled with enough land to make a multi-use structure.

(Figure 118, Panoramic views of Tata Press Camp)

(Figure 119, Google Earth image)



(Figure 120, Plan of Tata press camp)

(Figure 121, Panoramic views of Tata Press Camp)

In conclusion, the selection of the abandoned quarry site for this project is based on the presence of a community of approximately 300-500 people in the area. This decision reflects a commitment to responsible development and strong community engagement. The project aims to revitalize the site while actively involving the local residents, addressing their concerns, and ensuring that the benefits extend to all members of the community. A mutually beneficial partnership and a promising future for all stakeholders are anticipated.

DR PATIL QUARRY -PROPOSAL 2

PROS

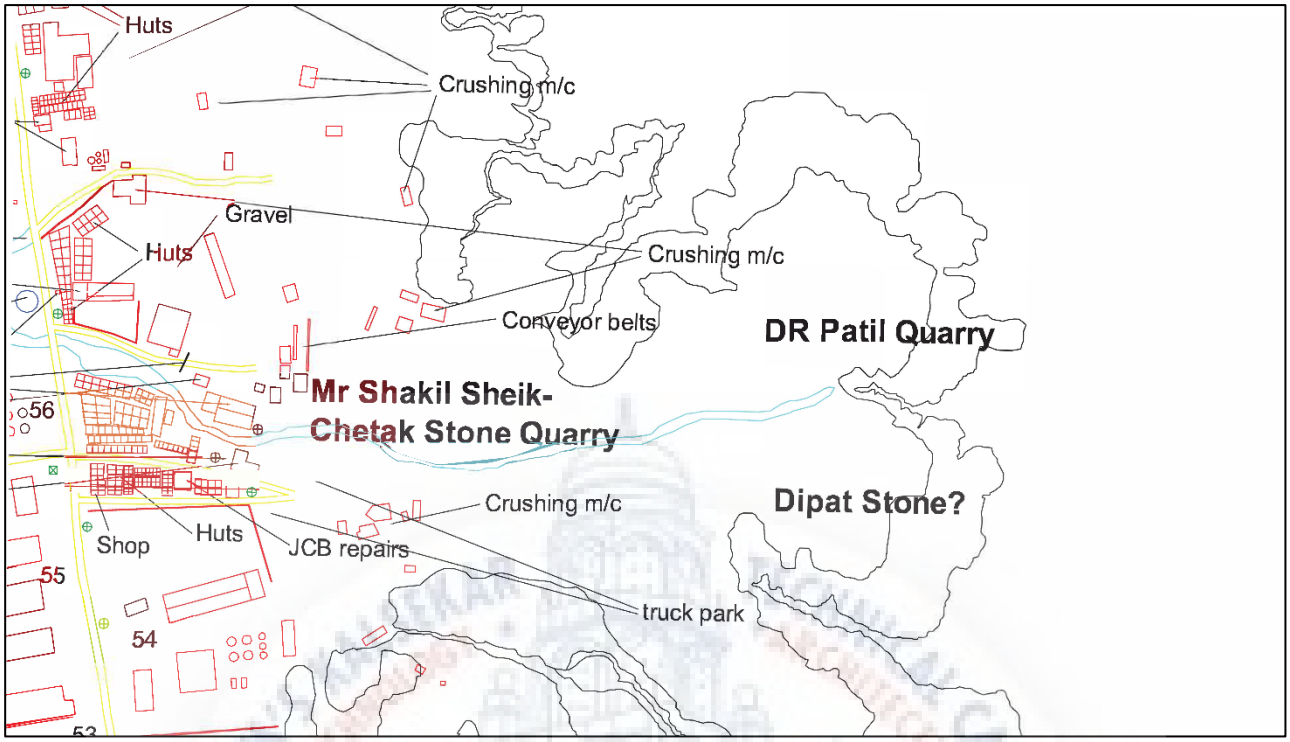
- Situated to the central part of the potential sites. Convenient to access from all but the most northern sites.
- The geology of the site is solid bedrock.
- Due to the previous usage of the land (a small quarry) the site is protected on three sides (north, east, and west) by the cuts from the quarrying, providing shelter.
- Water run off from the land above the site, falling down the north west corner, are dealt with naturally. (Water running south south west along the west side).

CONS

- The site's actual location requires access by crossing an existing RMC plant. Infrastructure development for vehicular access will be essential in this context.
- The site is remote to all apart from those that live within the site itself.
- The site in general is one of the largest of all potential sites, so it could be adapted for different uses.
- Another issue on this the lack of lighting at night and the difficulty in accessing the site.

(Figure 122, Panoramic views of Dr Patil quarry)

(Figure 123, Google Earth image)



(Figure 124, Plan of Dr Patil quarry)

(Figure 125, Dilapidated & abandoned structures)

In summary, the abandoned quarry site was selected for its strong community of approximately 300 people. This choice reflects a commitment to responsible development and community engagement. The project aims to revitalize the site, considering both the nearby RMC plant and the community's small businesses and truck drivers, ensuring mutual benefits and a promising future for all stakeholders.

BABAN SETH QUARRY -PROPOSAL 3

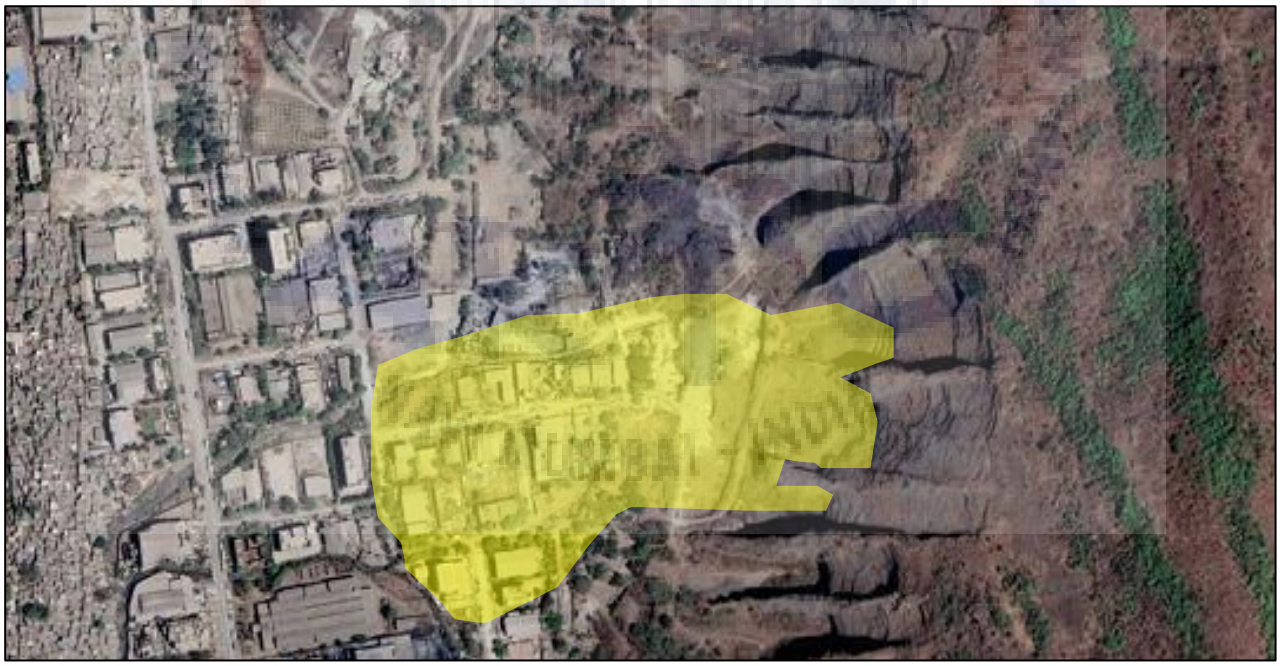
PROS

- Access is good for both pedestrians and vehicles being located by a road.
- The location of the site in terms of the quarry as a whole is good due to the proximity of the largest slum cluster.
- Although the site has two roads on its boundaries the site wouldn't mean any danger for children due to its size.
- Existing public toilets are available

CONS

- The structural viability of the water tower is unknown.
- This is one of the largest sites and has the potential to house a multi-use building with outside facilities.
- Public toilets have no water connection and are unusable.

(Figure 126, Panoramic views of Baben Seth quarry)



(Figure 127, Google Earth image)

(Figure 128, Plan of Baben Seth quarry)

In summary, the decision to opt for the abandoned quarry site for this project is rooted in the presence of a resilient community of approximately 300 people, despite challenges such as unusable toilets in the area and nearby industrial plants. This choice underscores a firm commitment to responsible development and community engagement. The project's objective is to rejuvenate the site, taking into account not only the local community but also addressing vital concerns like sanitation and coexisting with industrial facilities. By considering the unique needs of this diverse community, the project aims to create mutual benefits and a promising future for everyone involved.

5.3 SITE SELECTION MATRIX

SR.NO	CRITERIA	SITE 1	SITE 2	SITE 3
01.	Proximity to Industrial Area	✗	✓	✓
02.	Available Space	✓	✓	✓
03.	Natural Beauty	✗	✓	✓
04.	Tourist attraction	✗	✓	✗
05.	Accessibility	✗	✗	✓
06.	Local Labor Availability	✓	✓	✓
07.	Public Transportation	✓	✓	✗
08.	Infrastructure	✗	✗	✗
09.	Water and Power Availability	✗	✓	✓
10.	Water body	✗	✓	✓
11.	Cultural Amenities	✗	✓	✓
12.	Unmaintained public toilets availability	✗	✓	✓
13.	Arphen bridge classes	✓	✗	✓
14.	Recreational Opportunities in terms of landscape	✓	✓	✓
15.	Rmc plant in the vicinity	✗	✓	✓

(Table 8, Site selection matrix)

5.4 DESIGN BRIEF

To create a community welfare and vocational training centre at the Turbhe quarrying site in Mumbai. The centre should offer inclusive spaces, basic health services, and a range of amenities to cater to the diverse needs of the local community. Additionally, it should provide vocational training opportunities for women and youth. The design should emphasize accessibility and convenience for both pedestrians and vehicles, while considering the site's unique position near the largest slum cluster

AREA PROGRAM & INTENT

07

6.0 AREA PROGRAM

6.1 INTENT

Factors to be considered for the program

- Sanitation - public consciousness
- Employment for women
- Guidance for youth
- Community-inclusive spaces
- Rejuvenation of the quarry topography through the effective landscape
- Basic health services

Sanitation public consciousness-

- Public sanitation facilities
- Male and female restrooms
- Handicap washrooms
- Small retail/convenience store
- Nursing station

Employment for women

- Vocational training facilities
- Workshops
- Shops
- Classrooms
- Seminar hall
- Community Kitchen
- Sewing workshops
- Cafes

Communal areas

- Plaza spaces
- Recreational spaces
- Community Gathering
- Exhibition spaces

6.2 TENTATIVE AREA PROGRAM

AREA PROGRAM					
EMPLOYEMNT FOR WOMEN /GUIDANCE FOR THE YOUTH					
Sr .no	Space	Sub spaces	Type	User no.	Area in sq .m
1	Reception	Entrance lobby	Public		150
		Information desk			30
		Waiting area			50
2	Admin	Staff room office	private		120
		Director office			50
		Assistants cabin			20
		Meeting room			60
		Store room			30
		Staff toilet			60
3	Educational	Classrooms	Semi-Public		180
		Seminar halls			300
		Activity centres			60
4	Workshops	Waste segregation	Semi-Public		40
		Pottery			20
		Sewing machine			50
		Construction techniques			50
		Steel containers			50
5	Exhibition area	Information desk	Public		30
		Lobby			40
		Display area			200
		Store room	Private		30
SANITATION FACILITIES FOR THE COMMUNITY					
1	Sanitary area	Male toilet	Public		70
		Female toilet			70
		Handicapped w/c			4
		Restroom			50
		Retail shops			30
		Nursing station			10
		Vending machine			5
		Grooming centre			10
		Pavilion			40
		Resting space			20

(Table 9, comparison chart)

COMMUNITY SPACES					
Sr .no	Space	Sub spaces	Type	User no.	Area in sq .m
1	Public plaza		Public		300
2	Cafeteria	Kitchen	Public		150
		Dining space			50
		Toilet			60
		Semi open dining			60
		Store room	Private		20
		Reception			5
3	Amphitheatre		Public		300
LANDSCAPING					
1	Jogging track	Entrance	Public		5
		Guard room			10
		kiosk			10
		Seatings			
		Toilets			20
		Jogging track			
Total					2739

(Table 10, comparison chart)

The area program is based on the population density of the community residing in the Nerul Turbhe quarry stretch

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