

EARTHEN ECHOES - AN ECO ARCHAEOLOGICAL JOURNEY

A THESIS

Submitted in partial fulfillment of the requirements for the award of
Master of Architecture degree in Sustainable Architecture

By

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DEPARTMENT OF ARCHITECTURE
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SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)

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This is to certify that Thesis Report is the bonafide work of **ELANCHEZHIAN.T** (42890002) who carried out the Thesis entitled "**EARTHEN-ECHOES: AN ECO-ARCHAEOLOGICAL JOURNEY**" under our supervision from January 2024 to May 2024.

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I, **ELANCHEZHIYAN T** hereby declare that the Thesis Report entitled "Earthen Echoes - An Eco Archaeological Journey" done by me under the guidance of **Ar.Kavitha Suresh** (Internal Guide), **Ar.Catherine Selvaraj** (Internal Review Member) and **Ar.Krithikha Muthukrishnan** (External Guide) at Sathyabama Institute of Science and Technology is submitted in partial fulfillment of the requirements for the award of Master of Architecture degree in Sustainable Architecture.

DATE: 18-05-2024

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ELANCHEZHIAN T

THESIS SYNOPSIS

Earthen Echoes: An Eco-Archaeological Journey

Situated in the ancient landscape of Kilanamandi, Thiruvannamalai, Earthen Echoes is an evocative archaeological museum dedicated to the rich heritage of Tamil Nadu. This site, hailing from the Megalithic age, stands as a testament to the profound historical and cultural narratives that have shaped the Tamil people. Recognized as a significant archaeological site, Kilanamandi offers a unique window into the past, revealing the sophisticated craftsmanship, societal structures, and daily lives of its ancient inhabitants.

Earthen Echoes will transform this historically rich site into a vibrant museum, seamlessly integrating the natural beauty of the area with the cultural artifacts unearthed here. The museum aims to preserve and showcase a myriad of relics, from intricately carved stones to tools and pottery, each piece narrating the story of the Tamil people's ingenuity and resilience.

Visitors will embark on an eco-archaeological journey, exploring thematic exhibits that illustrate various aspects of Megalithic life. The interactive displays and multimedia installations will provide an immersive experience, allowing guests to witness the evolution of ancient Tamil society. Outdoor trails will guide visitors through the actual archaeological site, where reconstructed megaliths and guided tours will bring the past to life.

Earthen Echoes is not merely a museum but a sanctuary for education and preservation, fostering a deeper understanding and appreciation of Tamil Nadu's archaeological heritage. It aspires to become a beacon of cultural pride, connecting the present with the echoes of the past, and ensuring that the legacy of the Tamil people continues to inspire future generations.

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INTRODUCTION

1.1 INTRODUCTION

Heritage tourism as “traveling to experience the places, artifacts, and activities that authentically represent the stories and people of the past and present. It includes cultural, historic and natural resources”

Architecture that is classed as historically important is most often perceived and consequently treated as an expression of the past due to its existence through ages, it's been a vital source of reference for making of relate and indeed may historic building that we admire exist now only because of a series of reactive processes.

1.2 NEED OF THE PROJECT

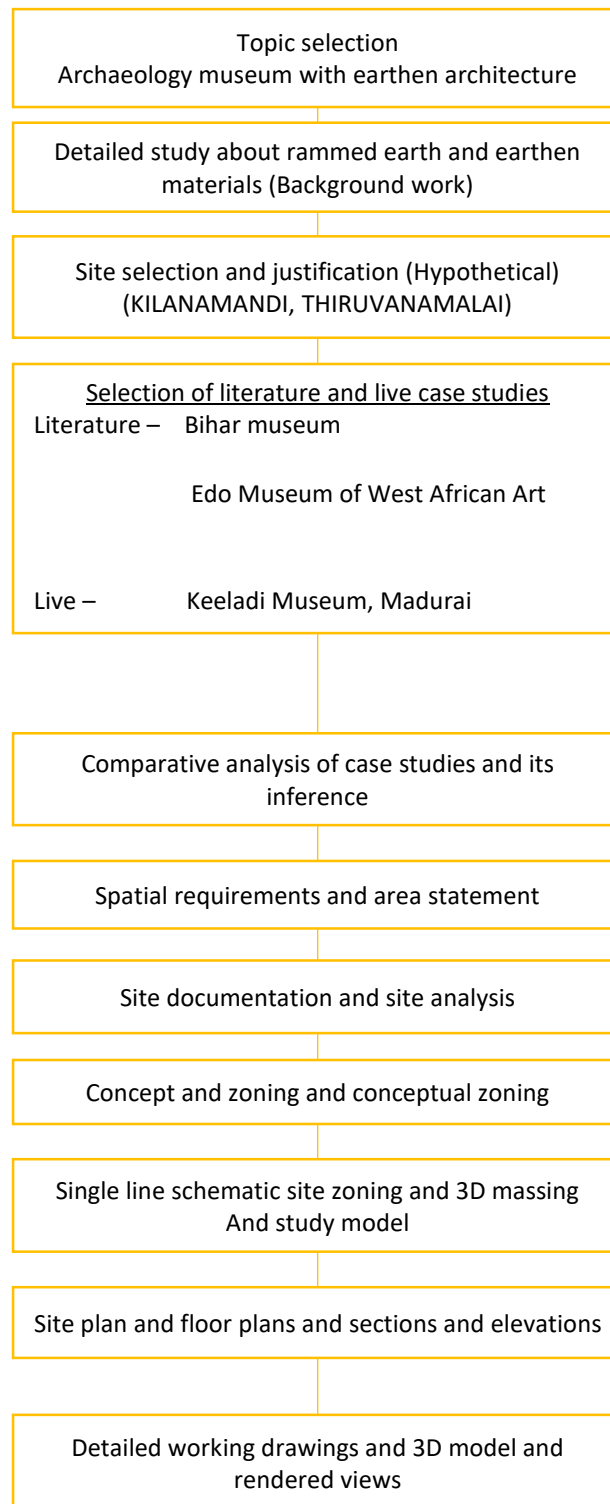
The historical and archaeological museum is considered a socio-cultural institution that fulfills the mission of preserving, broadcasting, and interpreting historical and cultural memory. Based on the properties of historical and cultural memory defined by the author, the functions of museums are established, which ensure its preservation, transition, and interpretation.

1.3 AIM AND OBJECTIVE

TO DESIGN AN ECO-LIVING AND ENERGY EFFICIENT ARCHAEOLOGY MUSEUM WITH AVAILABLE SITE MATERIAL.

- i) TO UNDERSTAND THE IMPORTANCE OF EARTHEN ARCHITECTURE AND REUSE OF NATURAL MATERIAL WITH SOCIAL AND CULTURAL ASPECTS.
- ii) TO ANALYSE THE DESIGN STRATEGIES THAT ENHANCES ECO-FRIENDLY AND ENERGY EFFICIENCY THROUGH CASE STUDIES.
- iii) TO IMPLEMENT THE STRATEGIES ON ECO-LIVING MUSEUM THAT IMPROVES COMFORT AND EFFICIENCY OF THE BUILDING.

1.4 METHODOLOGY



CHAPTER 2

LITERATURE CASE STUDIES

2.1 BIHAR MUSEUM – PATNA

Architects: Maki and Associates, Japan &
Opolis, Mumbai.
Principal Architect: Fumihiko Maki.
Site Area: 5.6 Hectares
Built up area: 25410 m².
Building Footprint- 37% (2.07 hectares)
Completion Year: October 2017
Climate- Composite

2.1.1 SPACIAL ANALYSIS:

The Bihar Museum creates an engaging and appropriately-scaled response to a prominent site and an ambitious, multi-faceted museum program.

The Museum houses a rich variety of treasures from the region, and includes event and education spaces that nurture a newfound sense of pride and connection to Bihar's storied history.

Location



Fig 2.1: Location



Fig 2.2: Exterior View

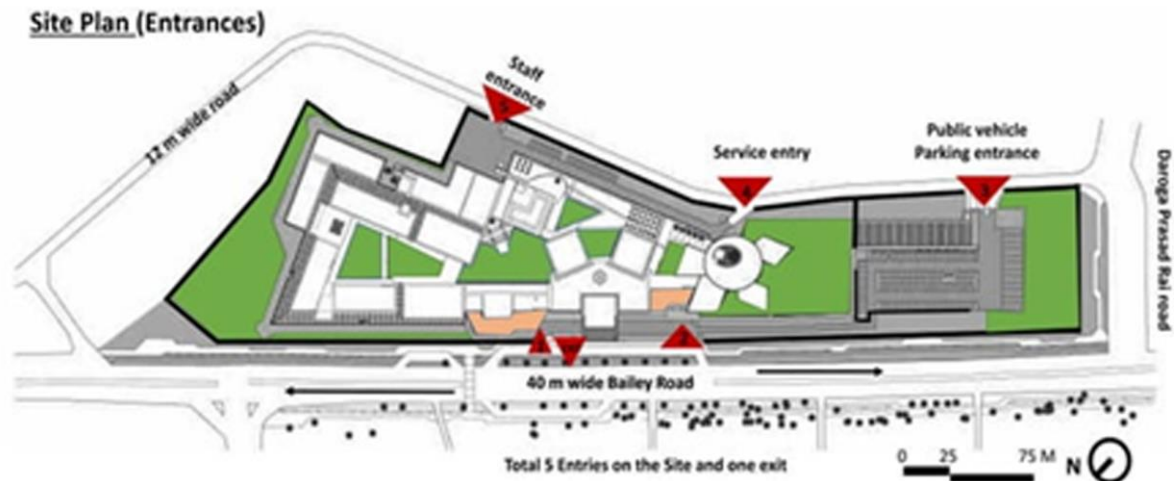


Fig 2.3: Plan of Museum

Floor plans of the building



Fig 2.3(a): Floor Plan

2. Multiple Courtyards

- 7 courtyards in the cultural center, allows daylight into the whole Bihar museum building.
- Courtyards are well landscaped and visually connected with the corridors of the Bihar museum .



Fig 2.3(b): Courtyard Plan

2.1.2 MATERIAL ANALYSIS

Sustainable Site Planning:

- Out of 423 existing mature trees, 165 mature trees were preserved and in addition compensatory plantation of 774 trees was done on site.
- Site was screened with 3m high barricading; wheel washing facility was provided for vehicles entering the site and water was sprinkled on site to control dust pollution.
- 1,680m³ top soil was preserved within the site and reused for landscaping.

Water Management:

- Reduction of 60.5% from the GRIHA base case has been demonstrated in building water demand by installing water efficient fixtures.
- Reduction of 62.5 % from the GRIHA base case has been demonstrated in the landscape water demand.
- Gunny bags/hessian cloth were used for curing of columns and ponding technique was used for curing of slabs.

Energy efficiency techniques used in the building

- Vertical fins in the administrative building to cut down the sun's radiation.
- Courtyard effect.
- Green Roof in those areas where staffs do their job.
- Extruded polystyrene Insulation in the wall.
- Use fly ash bricks (65% fly ash component in the brick)
- 50 cm thick brick masonry wall.
- Cladding on the building surfaces



Vertical fins for sun shading



Green Roof



Courtyard

Fig 2.4: Energy Efficiency

2.2 Edo Museum of West African Art

The Edo Museum of Western Art design by Adjaye Associates plans on revitalizing and incorporating the surviving remains of the walls, moats and gates of the historic city, seen throughout the modern city today.

This project will look at new ways of engaging local communities, through workshops, publications, talks and digital content, reconnecting local people with their history and highlighting the significance of the history of the Kingdom of Benin, one of the most important and powerful pre-colonial states of West Africa.



Fig 2.5 : SITE VIEW

2.2.1 SPACIAL ANALYSIS:

The preliminary design concept, one might believe this is a traditional museum but, really, what we are proposing is an undoing of the objectification that has happened in the West through full reconstruction.

Applying our research into Benin's extraordinary ruins, the city's orthogonal walls and its courtyard networks, the museum design reconstructs the inhabitation of these forms as pavilions that enable the re-contextualization of artefacts.

Decoupling from the Western museum model, the EMOWAA will perform as a reteaching tool – a place for recalling lost collective memories of the past to instil an understanding of the magnitude and importance of these civilizations and cultures.



Fig 2.5(a),(b): Plan of Edo Museum



2.3.2 MATERIAL ANALYSIS:

Surveys of the museum site and the wider surroundings to understand the sub-surface remains better and to help target excavations, will be a part of the archaeological works.

The museum project will also retain any evidence of historic buildings that may be found during excavation of the site, in their original position to become part of the of the Museum.



Fig 2.6 : Sectional view of the museum



Fig 2.7 : view of the museum

2.3 KEELADI Museum, Madurai

SITE LOCATION – Keeladi, Madurai

SITE AREA – 2 Acre

CLIMATE – HOT AND DRY



Fig 2.8 : View of the Museum

The historical site of Keeladi, where the modern state of the art museum stands in Sivaganga district, now serves as a popular attraction for tourist and history buffs.

The spacious and picturesque museum, which contains a treasure trove of artifacts and displays of ancient history dating back to the Sangam Age, bustles with a vibrant crowd of visitors from various locations.

The virtual museum holds a replica of Chettinad architecture and boasts of six galleries titled 'Agrarian and Water Management', 'Ceramic Industries', 'Weaving and Beads', 'Sea Trade', 'Pastime' and 'Lifestyle.' The galleries showed artifacts found in four excavation sites, including Keeladi, Konthagai, Agaram and Manalur.

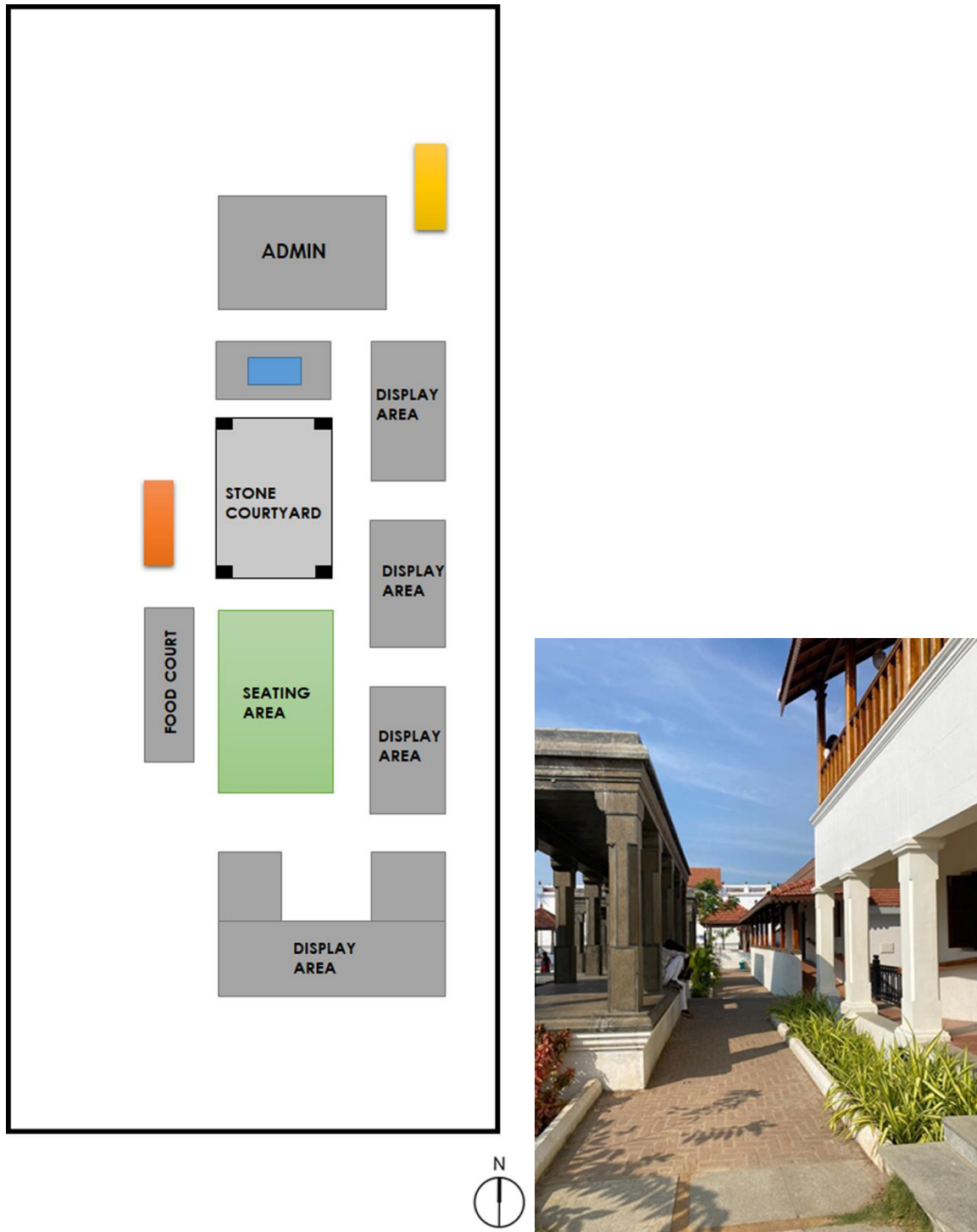


Fig 2.9 : Plan of the Museum

The museum, designed in ancient style with red tiled roofs 'Athangudi' famed tiles floors and natural wood carved handrails, houses exhibits reflecting the areas' past and highlights information about important archaeological sites in the state, journey of excavations in Keeladi, Vaigai river basin iron industry in Sangam Age, scientific analysis of iron objects, utensils and their utilities and trade during Sangam era.



Fig 2.10 : View of the Museum



Fig 2.11 : View of the Museum

CHAPTER 3

DATA COLLECTION AND STANDARDS

3.1 MUD MATERIALS:

Living in an earth full of resources, one of the most abundantly found is mud.

Mud is not only used as a rural or traditional material but has grown about as one of the most ecological approach to modern design.

Man must realize the importance of mud, and make the most of its abundance on this planet.

As people in the cities consider mud as a traditional material with many limitations, this in turn affects the thinking of the rural class.

Mud is a material so easy to mold and adapt to various situations or regions.

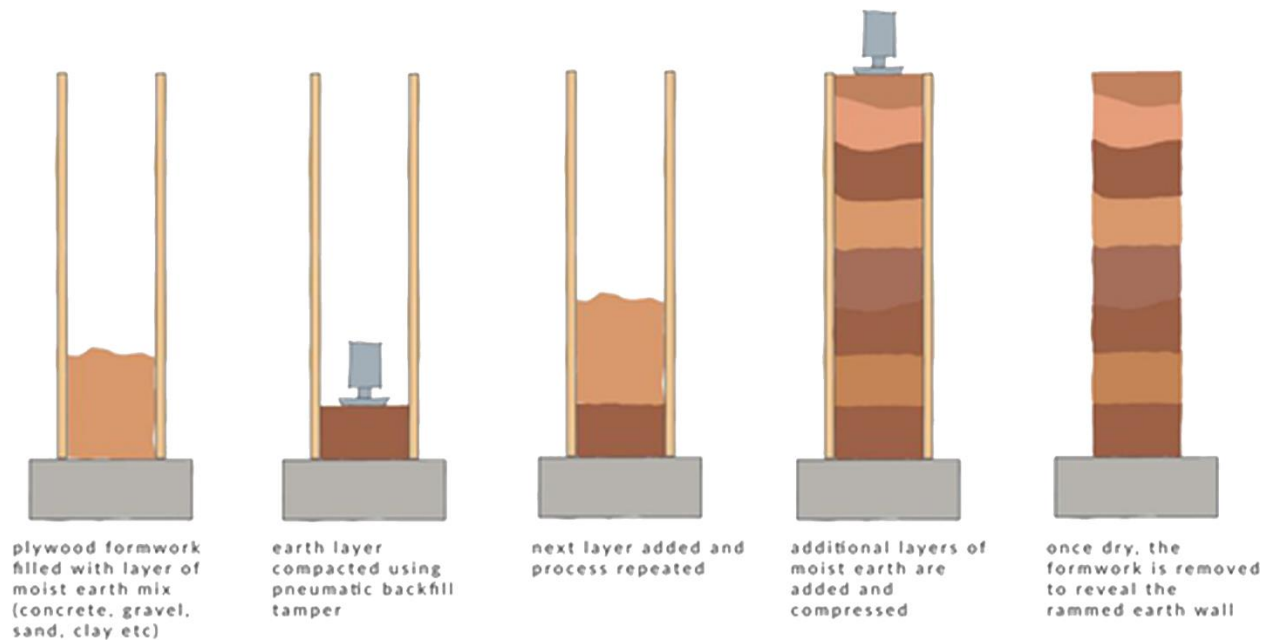


Fig 3.1 : Section of rammed earth

Rammed earth is one of the oldest methods of constructing walls and still holds great potential for modern earth construction.

One aspect of this potential is the gift of its colors and layers, which become visible as the formworks are removed, revealing a layered character.

As a process that involves the layer-by-layer compression of gravel, sand, silt, and clay, its resulting appearance is a horizontal stratification of earth tones, material content, and curing procedures.

This colorful appearance of rammed earth walls can be controlled and explored through patterns, texture, pigmentation, and natural clay colors, offering an opportunity to push its boundaries within architecture.



Fig 3.2 : Construction of rammed earth

Auroville is one of those few places in the India that has made optimum use of the mud that is locally available and has invented various new techniques in the field of architecture using mud.

Mud requires knowledge to build but it is a material that is ignored too, due to less knowledge about the material.

No other walling system offers the same “humble majesty” of these walls (as described by a recent client). In an era of rising concern for our environmental future, rammed earth walling can offer low embodied energy, very high thermal mass and with ISE, our insulated external wall system, high R value as well.

CHAPTER 4

SITE STUDY AND ANALYSIS

4.1 SITE STUDY:

Kilnamandi ($12^{\circ}22'36.11''\text{N}$ $79^{\circ}31'24.56''\text{E}$) is a small village located in Vandavasi taluk of Tiruvannamalai district in Tamil Nadu, India. The village is located 65 km northeast of the district headquarters, 18 km southwest of Vandavasi, and 23 km northeast of Gingee. The Iron Age megalithic graveyard ($12^{\circ}23'18.6''\text{N}$, $79^{\circ}29'45.9''\text{E}$) is located 3.27 km northwest of the present Kilnamandi village.

Kilnamandi village is in Tiruvannamalai district which is one of the northern districts of Tamil Nadu with Vellore, part of Chengalpattu, and South Arcot districts as northern, southern, and western boundaries (MSME, 2020).

The topography of Tiruvannamalai is almost plain sloping from west to east. It is mostly comprised of plain lands except for the Eastern Ghats in the north-western part of the district and small hills in Polur and Chengam taluks. Palar, Cheyyar, and Pennaiyar are the rivers running through this district.



Fig 4.1(a): Tamilnadu state map



Fig 4.1(b): Kilnamandi village map

4.2 SITE JUSTIFICATION AND FEASIBILITY:

This site came to the notice of the Tamil Nadu State Department of Archaeology through a proposal submitted by S Balamurugan, Secretary of Thiruvannamalai Center for Historical Research (TCHR). Based on this proposal, a systematic exploration was carried out at this site by the State Department of Archaeology, which led to the excavation of the site in 2023.

Iron tools, carnelian beads and offering pots unearthed at Kilnamandi near Vandavasi

Archaeologists say the findings indicate the existence of human settlements dating back to the later phase of the Iron Age at the site. The excavation was launched in April and is being done on a one acre plot within the 55-acre site as part of the initial phase

June 04, 2023 08:32 pm | Updated 08:39 pm (IST) - THIRUVANNAMALAI

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Archaeologists from the Tamil Nadu State Department of Archaeology working at the dig site at Kilnamandi in Tiruvannamalai. | Photo Credit: Special arrangement



Fig 4.2(a),(b): Site view

4.3 SITE ANALYSIS:

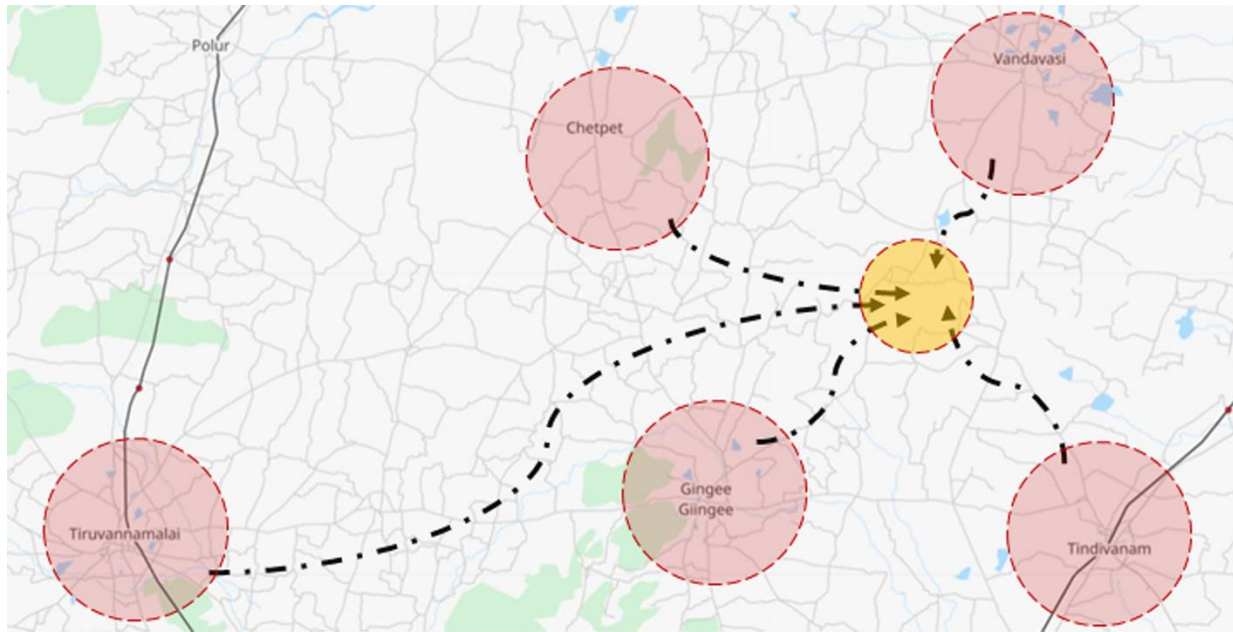
4.3.1 Neighborhood Context:

The village is located 65 km northeast of the district headquarters, 18 km southwest of Vandavasi, and 23 km northeast of Gingee.

The Iron Age megalithic graveyard (12°23'18.6" N, 79°29'45.9" E) is located 3.27 km northwest of the present Kilnamandi village

They are seasonal in nature and there is no perennial river in the district (MSME, 2020). Geologically Tiruvannamalai District mainly comprises rocks of the Archaean age.

The type of rocks found in the district are Charnockite, Granitic gneiss, Epidote Hornblende Gneiss, Amphibolite, Pyroxenite, Dunite, Migmatites, Banded Magnetite Quartzite, Shale, and Clay.



GINGEE FORT

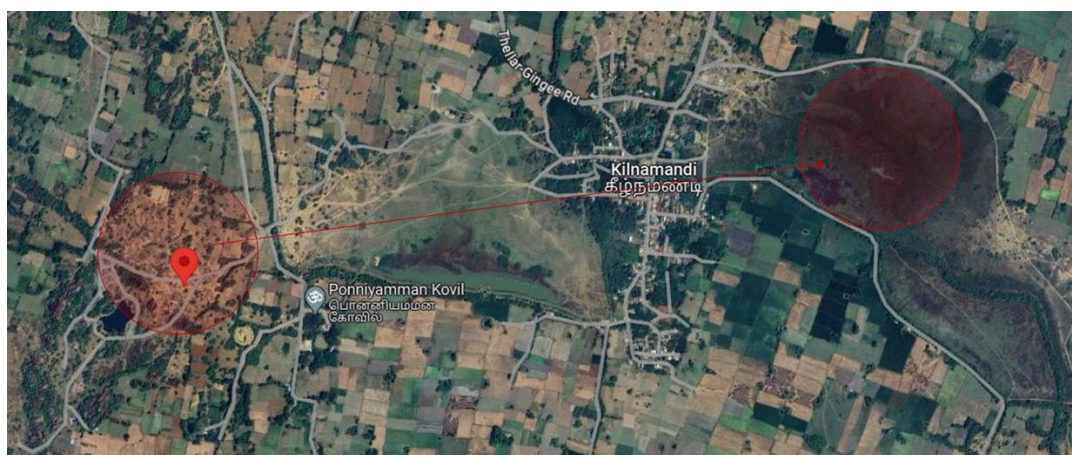


THIRUVANAMALAI



VANDAVASI

Fig 4.3 : Site Surrounding



Excavation site is located 1.2 km from the proposed site

The burials here are spread over an area of 55 acres of barren land in which 12 burials have been selected for excavation in the typological aspect and the quadrant method was implied for excavation.

There are more than 50 graves covering 55 acres of barren land. This site came to the notice of the Tamil Nadu State Department of Archaeology Based on this proposal, a systematic exploration was carried out at this site by the State Department of Archaeology, which led to the excavation of the site in 2023.

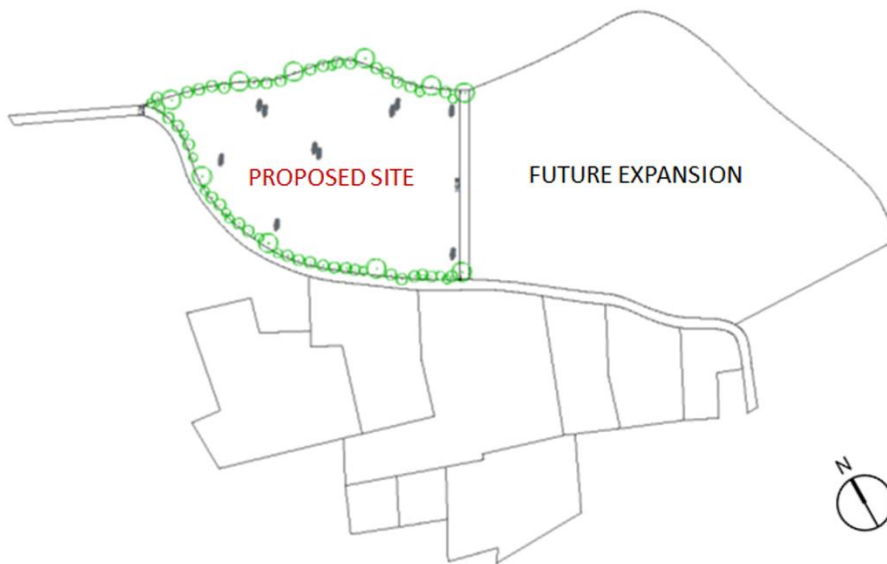


Fig 4.4 : Site detail



Fig 4.5 : Site photos



Fig 4.5(a): Site analysis plan

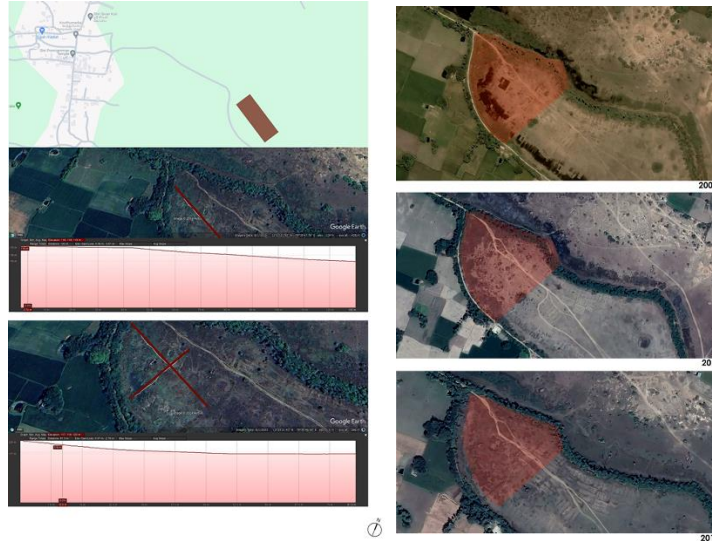


Fig 4.5(b): Site section

4.3.6 Climate of Tiruvanamalai:

The climate of the district is tropical. It is very hot during April to June. The rainfall in the district for the year 2005-2006 was 1388.3 mm as against the normal rainfall of 1046.60mm.

The district receives good rainfall through Southwest monsoon. Generally, Semi-arid climatic condition prevails without any sharp variation in the district.

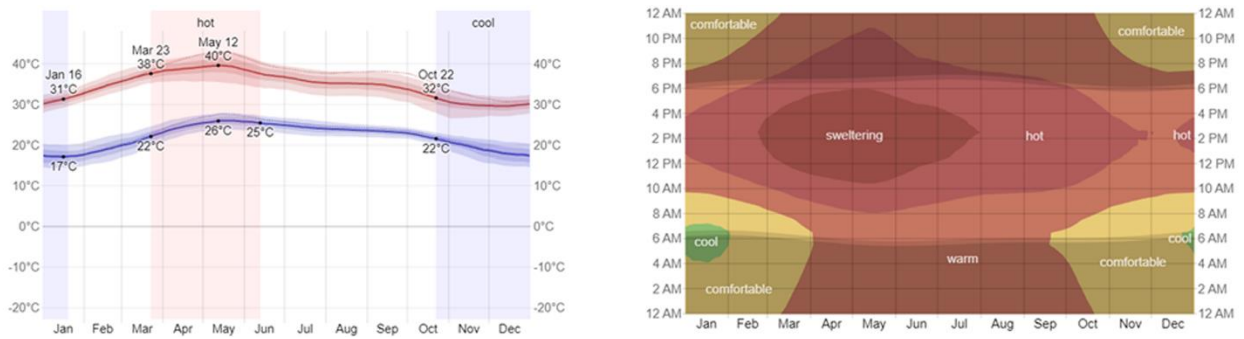


Fig 4.6 : Site Climate

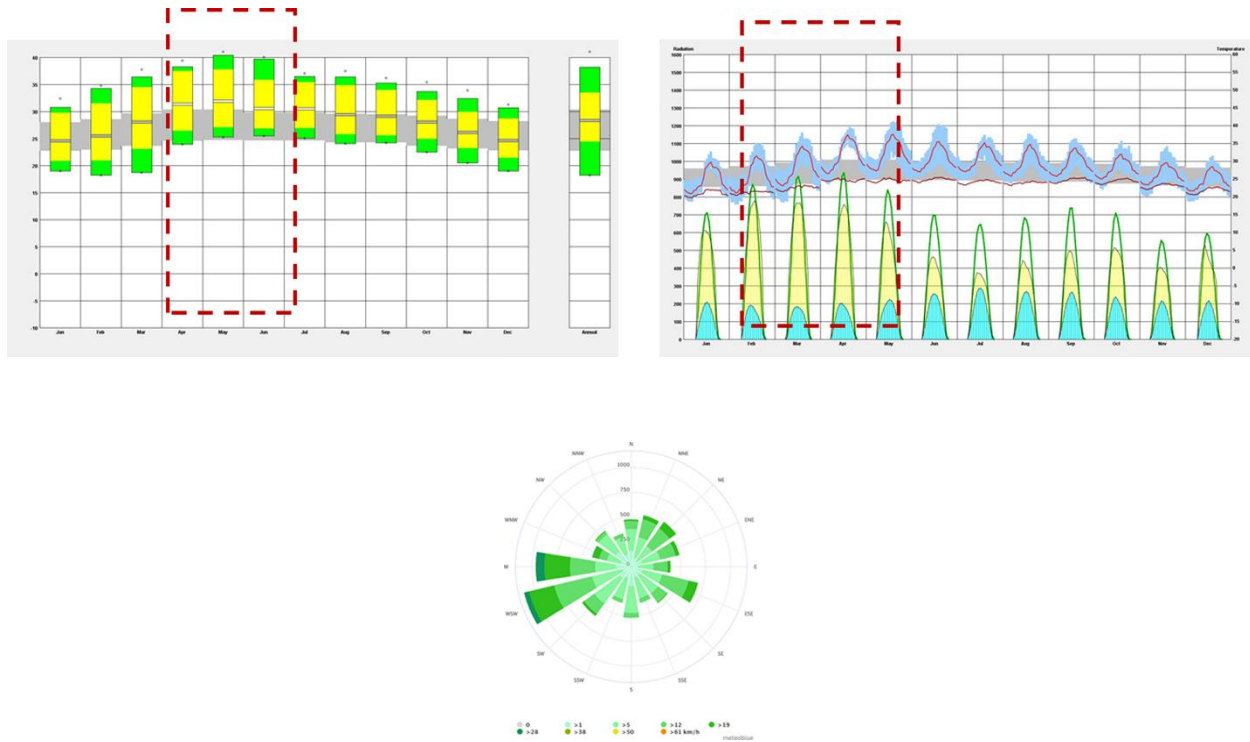


Fig 4.7: Climatic data of Tiruvannamalai

The predominant soil type is red. Red loam was found in all the taluks with more concentration in Polur Taluk. Red sand was also found in all the taluks, but predominantly in Chengam, Tiruvannamalai, and Vandavasi taluks. Different types of soil like ferruginous loamy and sandy loamy were seen extensively throughout the district and black loam was found in tank and river bed areas of Cheyyar and Vandavasi taluks.

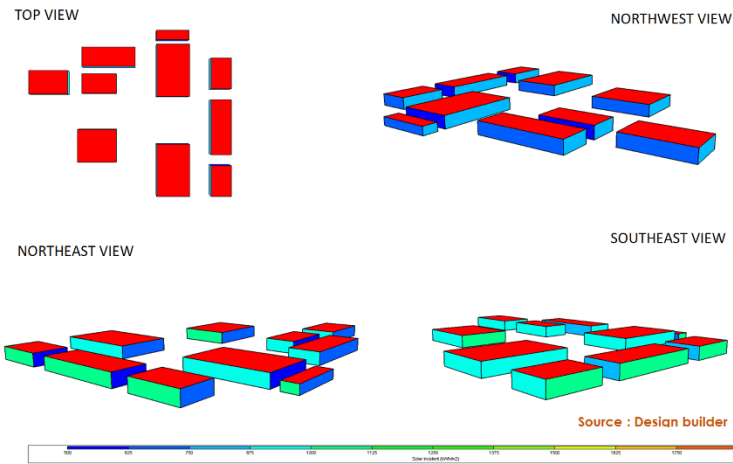
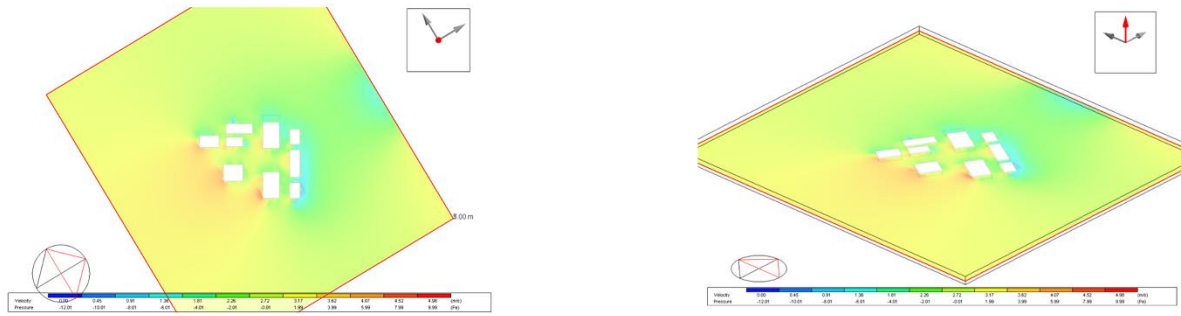
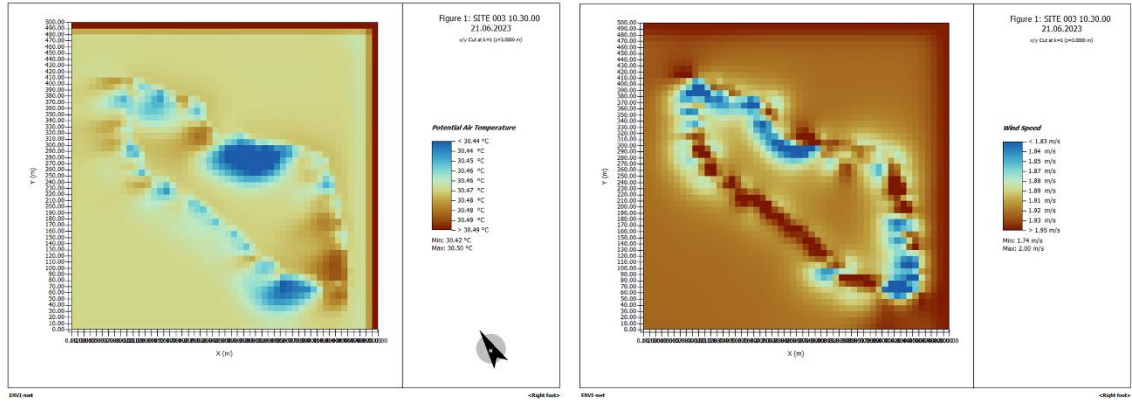


Fig 4.8 : Site Simulation

CHAPTER 5

ARCHITECTURAL DESIGN

5.2 CONCEPT

5.2.1 Strategies can be followed at site level:

(a) Orientation -

The built forms longer facades can be oriented facing the east and west directions. The east and north side orientations can have the larger window open it helps in avoiding the direct exposure to sunlight and also allows the interior to receive ample amounts of indirect natural light and help preventing solar heat gain

(b) Built form -

More scattered open and closed volumes can be planned and more open courtyards and buffer spaces can be created. The organic and curved building forms of the building leads to reduced surface volume ratios towards the East and West directions and thereby reduces the solar heat gain



Fig 5.1: Site view

(c) Mutual shading -

Mutual shading by placing and planning the building such that they share each other from the her son can help in reducing the heat gain

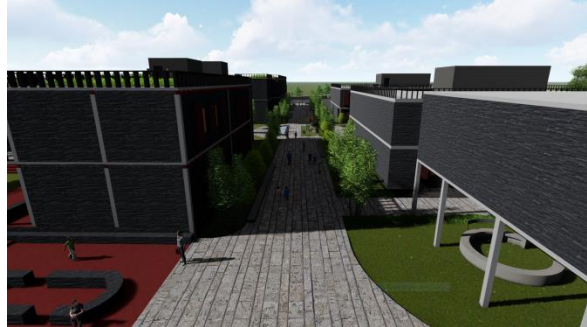


Fig 5.2: View of mutual shading of buildings

(d) Vegetation -

Vegetation and landscaping can play a major role in changing the microclimate of a site and can lower the temperature vegetation can also be used to prevent and protect INS the undesirable winds and solar radiation

(e) Wind channeling and buffer spaces -

Buffer spaces open gardens and courtyards can be provided to channel and bring in good Breeze and wind into the building



Fig 5.3: View of walkway and greenery

5.2.2 Passive design strategies:

(a) Courtyard effect –

Courtyard can be microclimate modifier and controller it helps in evaporative cooling and

increase of heat loss through ventilation. Usually open to the sky. The heat transfer that takes place within a courtyard is affected greatly by - the Airflow, thermal mass, solar radiation. Due to the incident solar radiation in the courtyard the air in it becomes warmer and rises up to replace it cool air from the ground level floors through the louvered openings of the room producing the air flow

(b) Passive air conditioning system –

Allowing natural ventilation and day lighting through proper implementation can help in achieving passive air conditioning. Techniques stack ventilation can also be implemented to avoid the use and consumption of mechanical air conditioning system

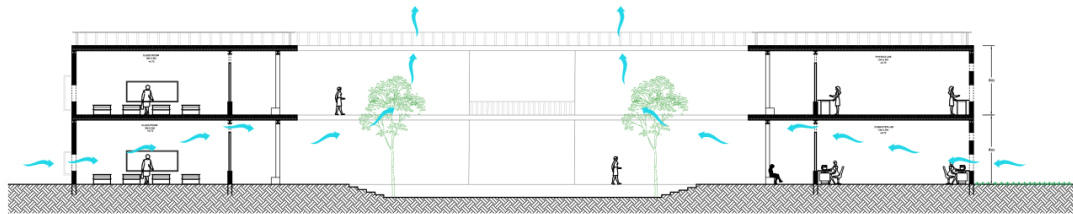


Fig 5.4: Passive air conditioning system

(c) Green roofing systems –

These are roofs covered with vegetation and soil and also functions by providing shading, insulation, evapotranspiration, and acts as thermal mass

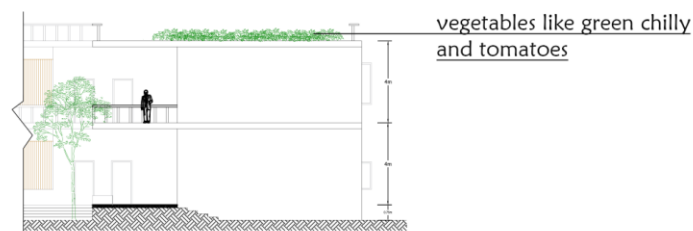


Fig 5.5: Green roofing system

5.2.3 Concepts at site level:

At the dining area outdoor dining is also designed in such a way that the people can have their lunch.



Fig 5.6 : Outdoor sitting at the dining

Each and every block is connected with a common gathering space which place a major role in the school



Fig 5.7 : Gathering spaces

5.2.4 Materials and construction techniques:

(a) Wall system -

For exterior wall the construction is with rammed earth and for interior wall have used combination of rammed earth and cob.. Lime mortar is a combination of lime + rammed earth.

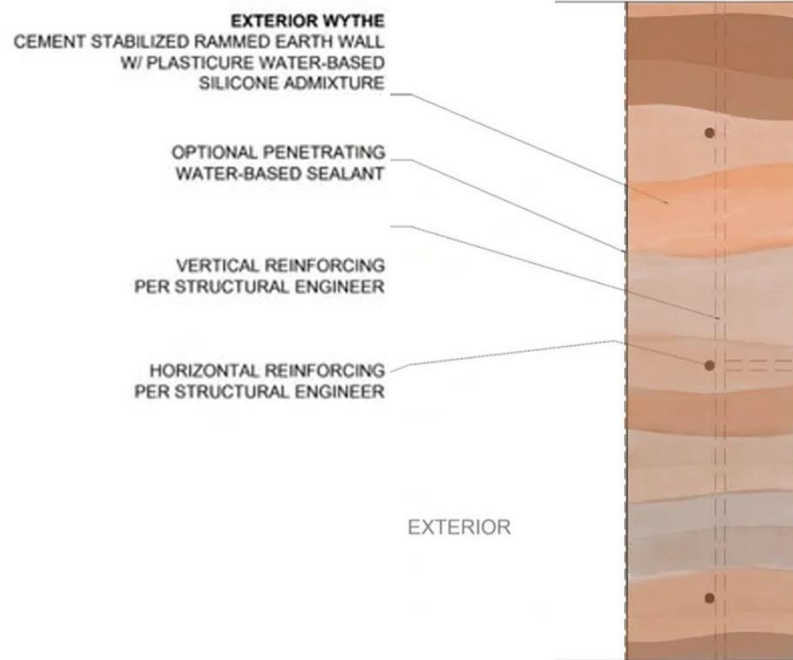


Fig 5.8 : Construction of wall system

(b) Flooring system -

For flooring have gone for red oxide flooring which will reduce the structural load and will be more economical and astatically pleasing

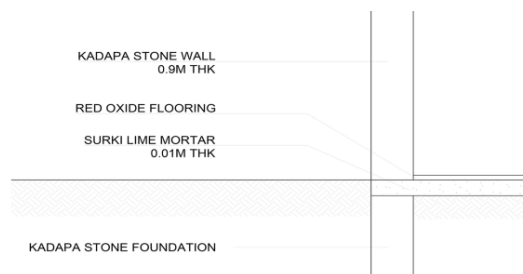


Fig 5.9 : Construction of flooring system

(c) Roof system –



Fig 5.10 : Construction of roof system

(d) Foundation –

For foundation waste granite and kadapa stone pieces can be used. The wastage is generated from the cutting of granite and kadapa stone



Fig 5.11: Foundation materials

5.3 DETAILED DRAWINGS

5.3.1 Site plan:



Fig 5.12: Site plan, section and elevation



Fig 5.13 :Ground Floor plan

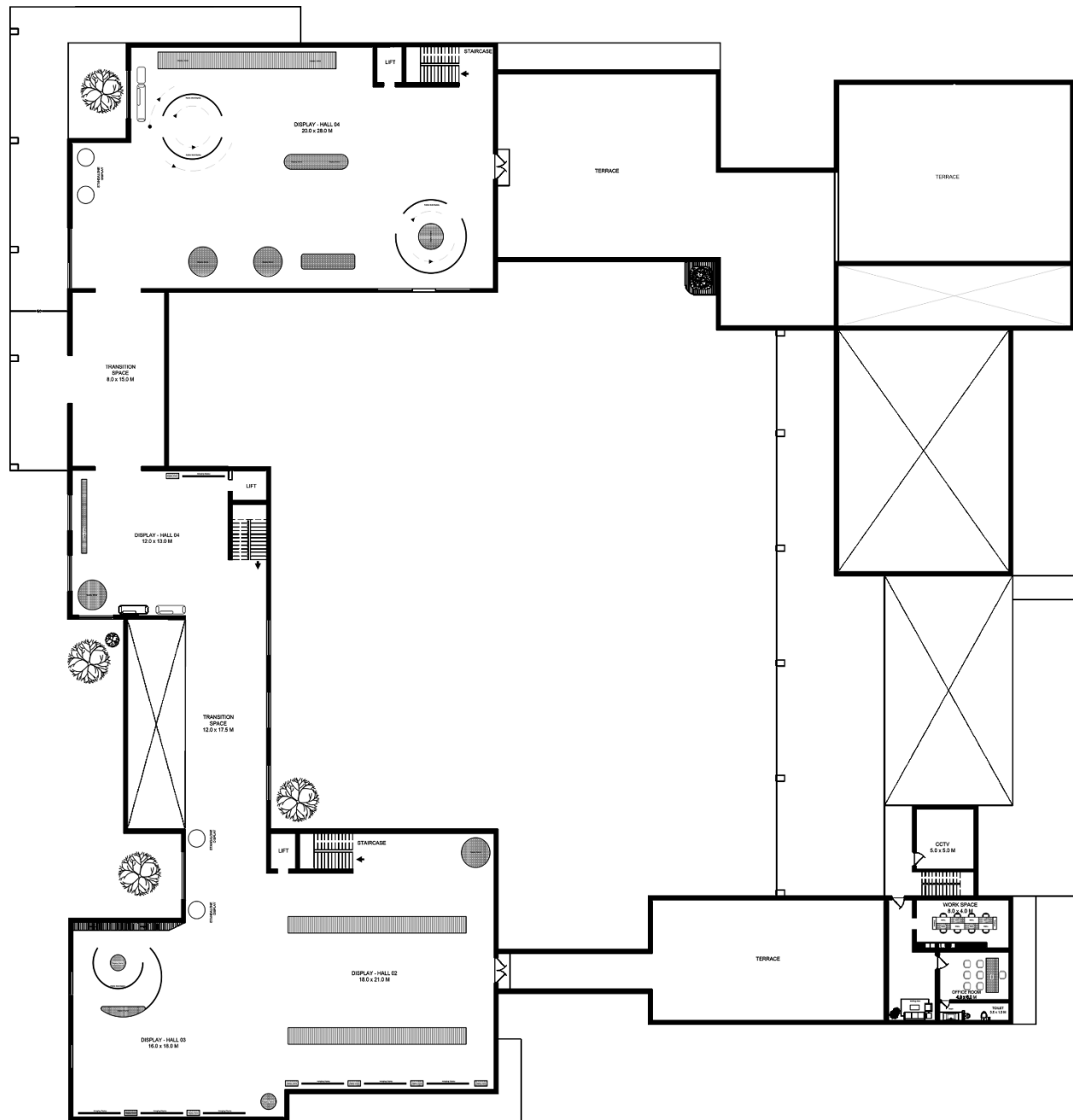


Fig 5.14 : First Floor plan

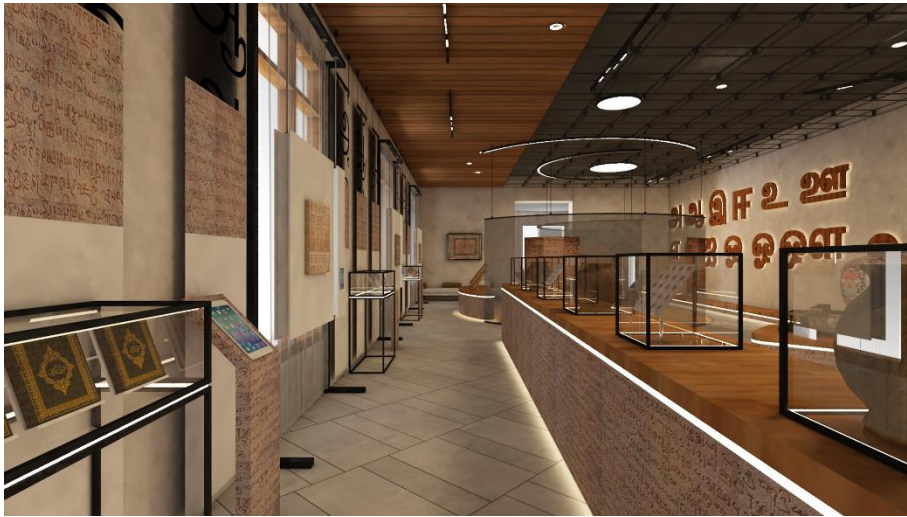
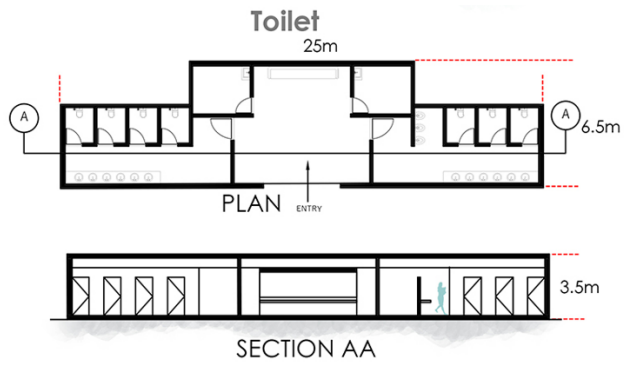


Fig 5.15 : views

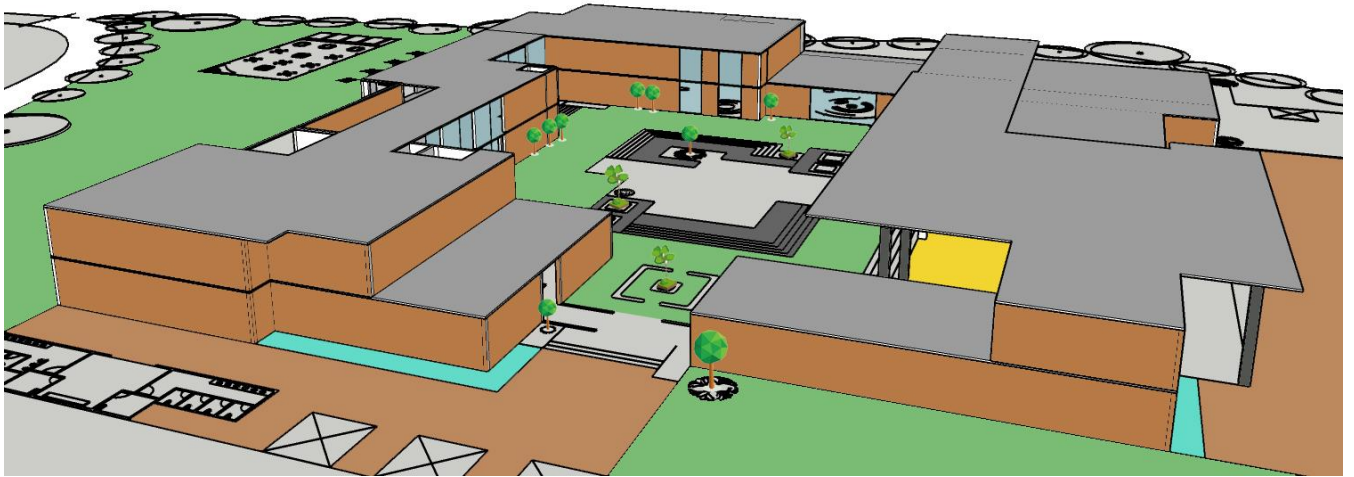


Fig 5.16 : Over all site view from the top

CHAPTER 6

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