

HOSPITAL FOR COMMUNICABLE DISEASES

THESIS

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Architecture degree

By

**Gowtham.S
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**DEPARTMENT OF ARCHITECTURE
SCHOOL OF BUILDING AND
ENVIRONMENT**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

**Accredited with Grade "A" by NAAC
JEPPIAAR NAGAR, RAJIV GANDHI SALAI,
CHENNAI - 600 119**

2021



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DEPARTMENT OF ARCHITECTURE

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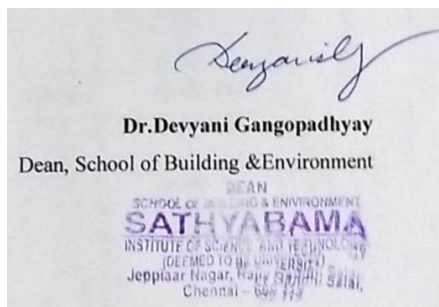
This is to certify that this thesis Report is the bonafide work of **Gowtham.S (3621028)** who carried out the Dissertation entitled "**Hospital for communicable diseases**" under our supervision from 2021.

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Submitted for Viva voce Examination held on _____

Internal Examiner

External Examiner

1.

DECLARATION

I, **Gowtham.S** hereby declare that the thesis project Report entitled "**Hospital for communicable diseases**" done by me under the guidance of **Ar.Kavitha** (Internal Guide) and **Ar.Indhumathi** (External Guide). At **Sathyabama Institute of Science and Technology** is submitted in partial fulfillment of the requirements for the award of Bachelor of Architecture Degree.

DATE:

PLACE: CHENNAI

SIGNATURE OF THE CANDIDATE

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I convey my thanks to **Dr. Devyani Gangopadhyay**, Dean and Head of the Department, **Dr.Suresh Kuppuswamy**, Design Chair of School of Building and Environment, Department of Architecture and providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my Dissertation Internal Guide **Ar.Kavitha**, Internal Review members and External Guide **Ar.Indhumathi** their guidance, suggestions and constant encouragement which paved the way for the successful completion of my dissertation works.

I wish to express my thanks to all Teaching and Non-teaching staff members of the **Department of Architecture** who were helpful in many ways for the completion of the Dissertation.

ABSTRACT

Communicable diseases are affecting public health enormously in the past and present. New, existing diseases are more likely to spread quickly due to high population so special treatment spaces are required, Architecture has helped in facing this problem in many ways and it can be more effectively used for controlling spread, by designing a special hospital considering various parameters and guidelines for treating communicable diseases. The design can help in controlling such spread within the facility and treat patients safely.

The design is considered for Chennai, the main challenges will be to segregate and separate spaces but without disturbing the connectivity of the spaces. This is one main factor that design focuses for solving this problem.

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LIST OF ABBREVIATIONS

WHO- world health organization
 ICU- intensive care unit
 BSL- bio safety level
 PPE- personal protection equipment
 HEPA- High-Efficiency Particulate Absorption/Absorber
 nCoV- Novel corona virus
 SARS- Severe Acute Respiratory Syndrome

1. INTRODUCTION

There are various types of communicable diseases existing which are caused by various pathogens. When there is a spread of new communicable diseases there is uncertainty in how rapid it spreads. If the disease is highly contagious there will be more infection and more caution is required for quarantining and treatment in spaces.

1.1 AIM

To design a communicable disease hospital that functions proficiently in controlling the spread of disease and treating the patients.

1.2 SCOPE

- The main scope of this design is to understand various communicable diseases and designing spaces to treat them.
- The hospital for communicable disease requires special planning that needs to be followed for the design.
- The segregation of the users is crucial in the design that is done in design.

2. CASE STUDIES

1. GHESKIO Tuberculosis Hospital / MASS Design Group
2. GHESKIO Cholera Treatment Center / MASS Design Group
3. CD HOSPITAL (Communicable disease)
4. Butaro Hospital / MASS Design Group
5. PAIMIO SANATORIUM

2.1. GHESKIO Tuberculosis Hospital / MASS Design Group



Figure 2.1.1: top view

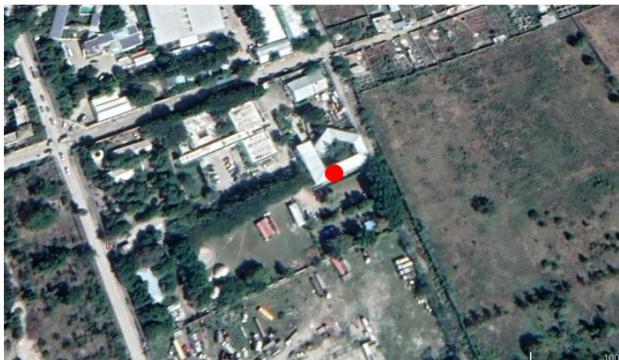


Figure 2.1.2: satellite image



Figure 2.1.3: site access & zoning

2.1.1 PROJECT DATA

Location: Port au prince, Haiti

Year: 2015

Architects: MASS design group

Area: 1400m²

No of stories: g+1

Program: pharmacy, testing, outpatient, Isolation room. Consulting

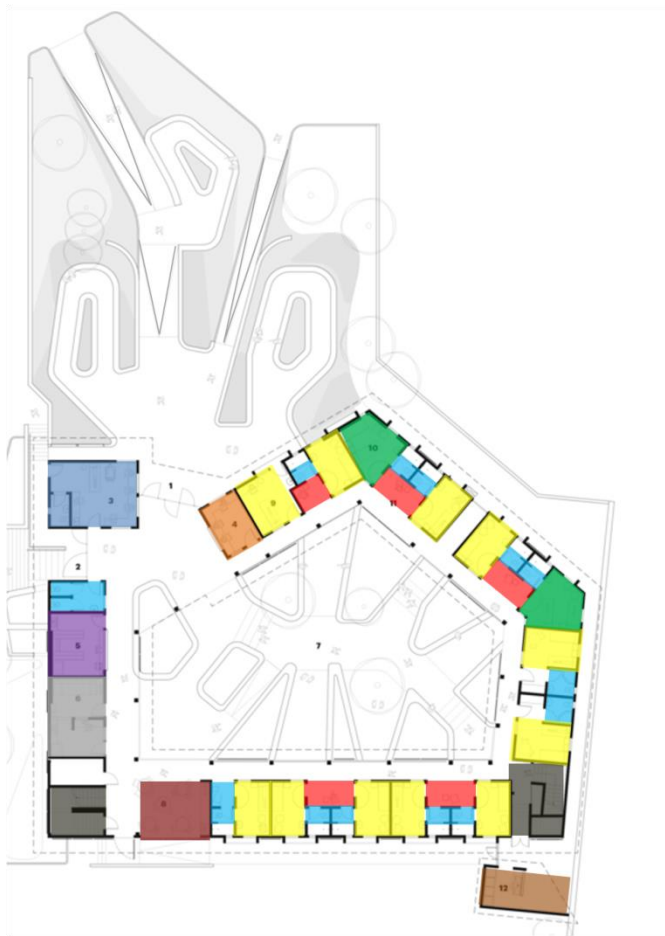


Figure 2.1.4: ground floor

Isolation room	toilets
Family isolation	X ray
Consultation	Communal hall
Outpatient	Laundry
Nursing station	
pharmacy	
stairs	

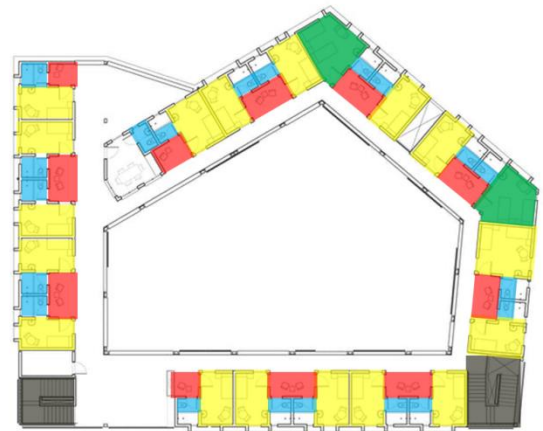


Figure 2.1.5: first floor

Cutting down heat gain



Figure 2.1.6: courtyard & corridor

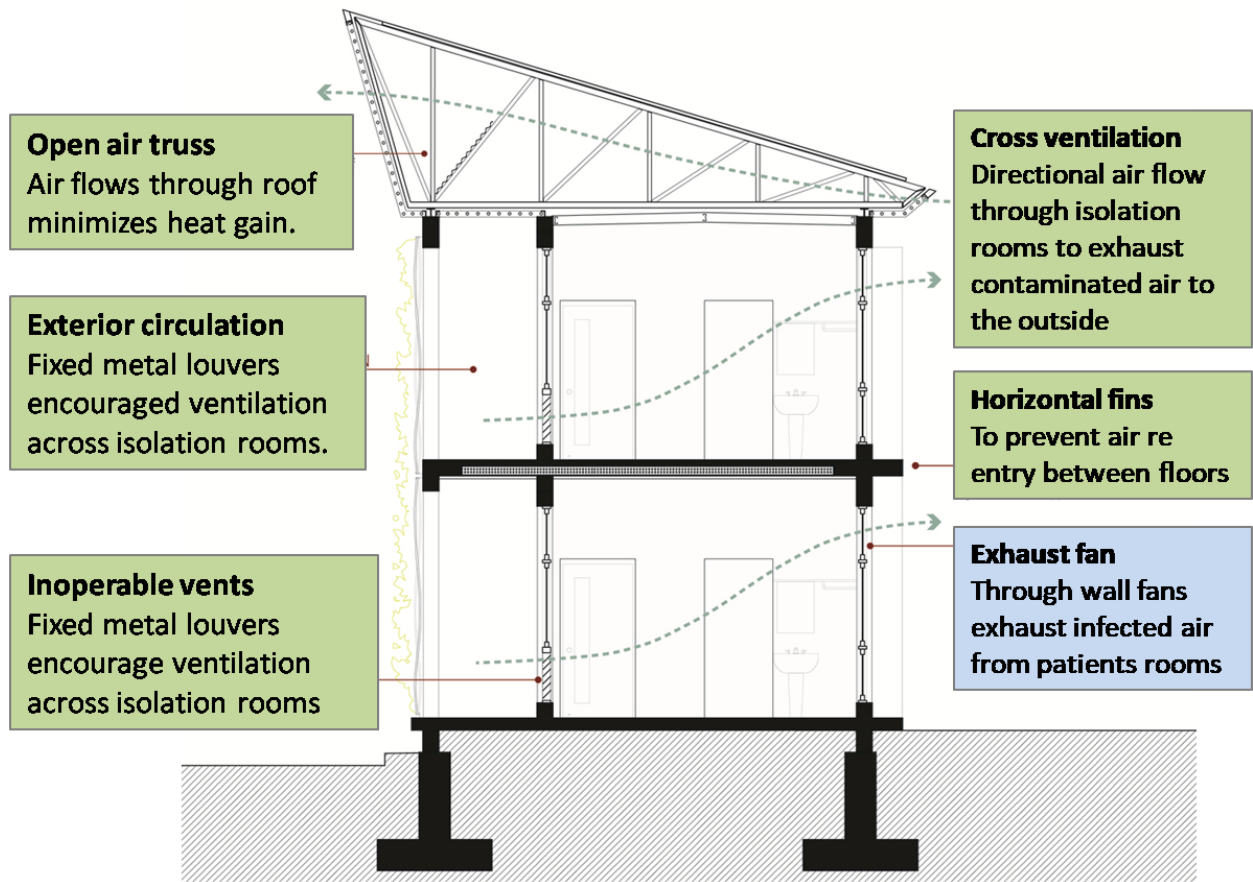


Figure 2.1.7: passive design strategy

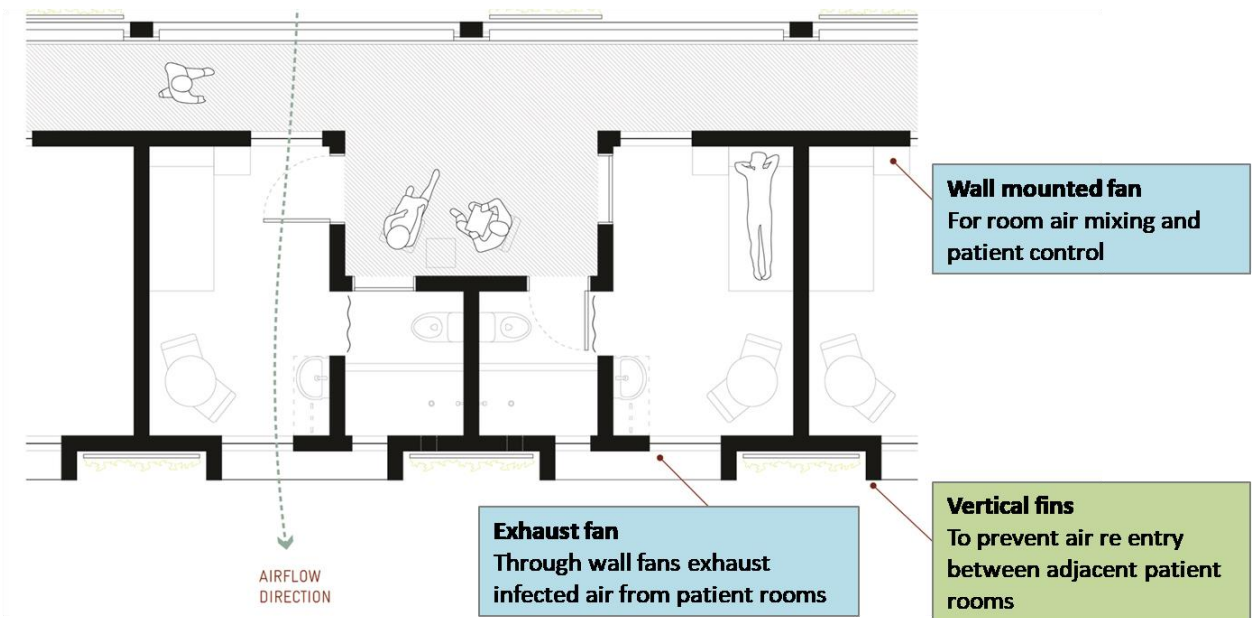


Figure 2.1.8: passive design strategy

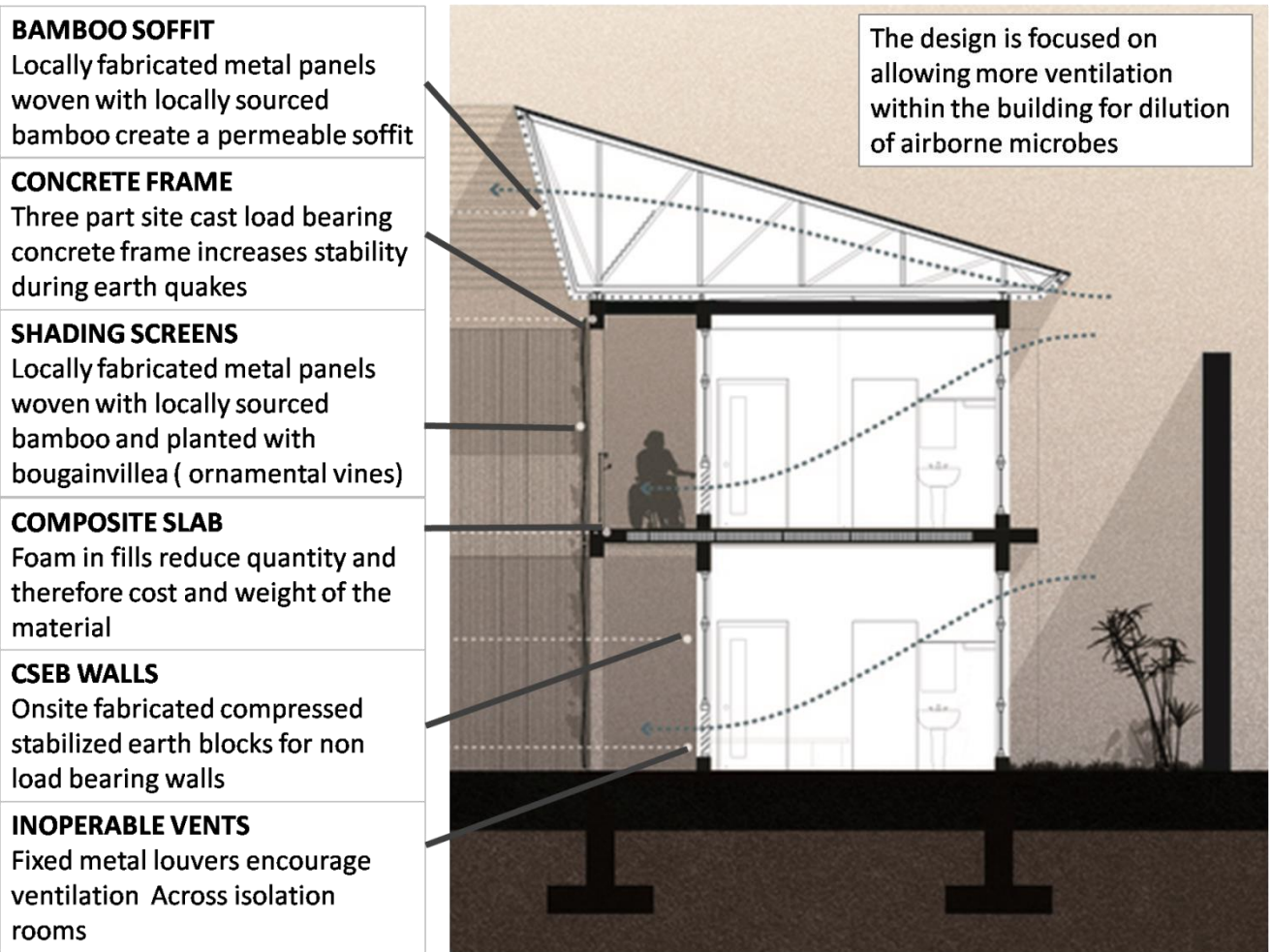


Figure 2.1.9: materials

2.1.3 AESTHETICS



Figure 2.1.10: views

2.2 GHESKIO Cholera Treatment Center / MASS Design Group



Figure 2.2.1: view

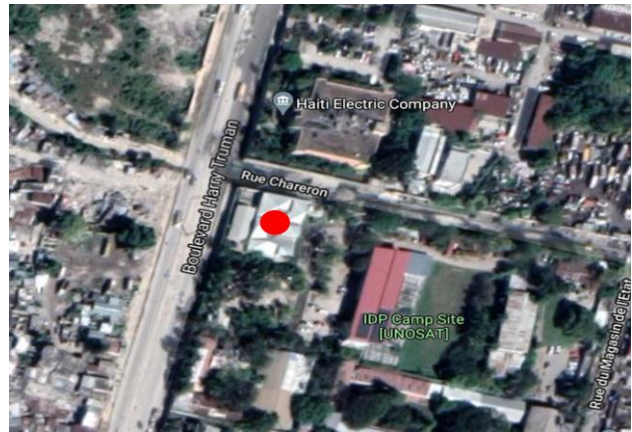


Figure 2.2.2: satellite image of site

2.2.1 PROJECT DATA

Location: PORT-AU-PRINCE, HAITI

Year: 2015

Architects: MASS design group

Build up area: 693 sq.mts

Program: cholera treatment for men, women, children, admin, observation, water management.

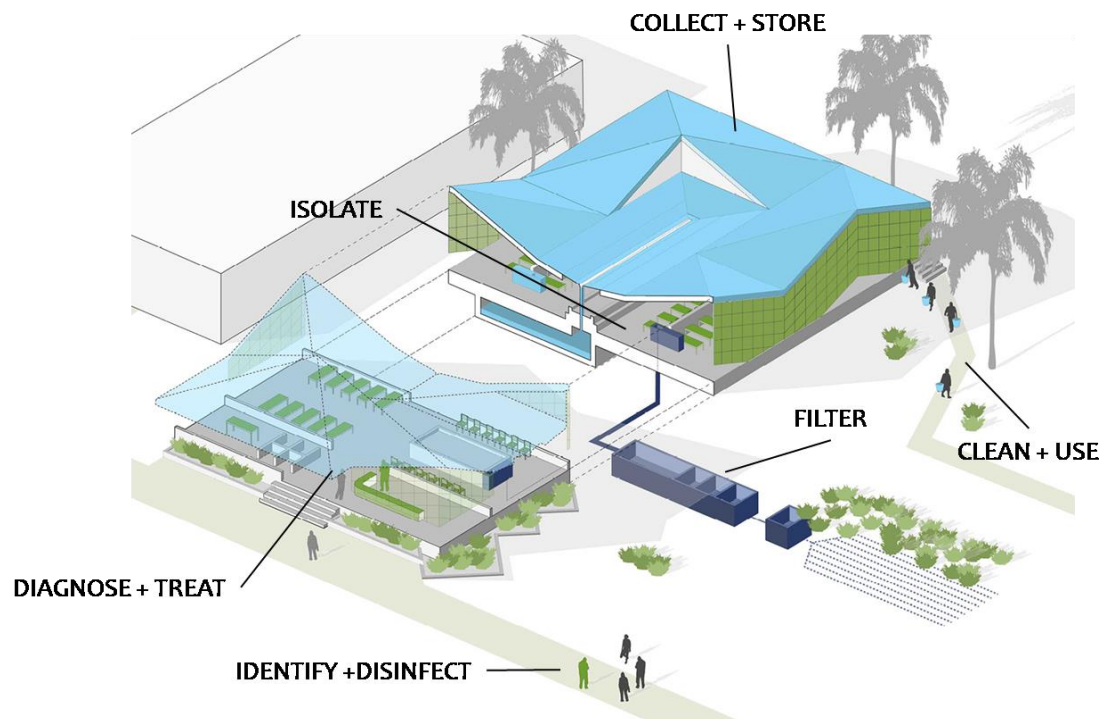
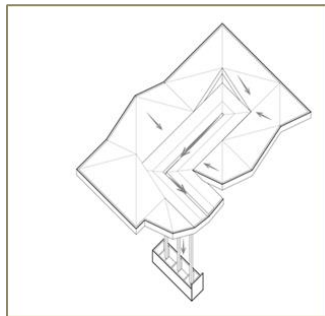


Figure 2.2.3: 3d design

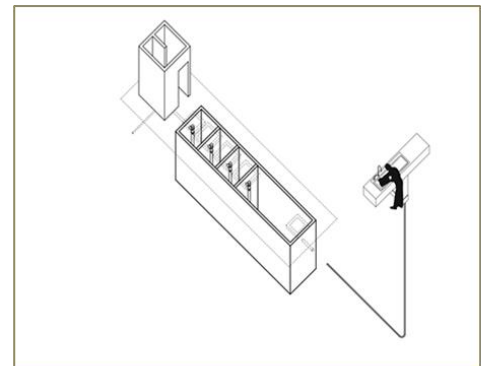
2.2.2 ABOUT

- The GHESKIO Cholera Treatment Center was designed for the purpose of providing permanent solution for treatment of cholera
- The design brief was to design a simple and revolutionary.
- The structure treats patients, collects rain water, manages waste water in site
- Solves the problem of water scarcity
- The center has the capacity to treat more than 250,000 gallons of sewage a year, helping reduce the area's water-table contamination.



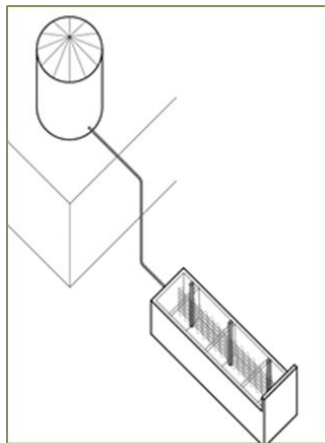
1. RAIN WATER COLLECTION SYSTEM

rain water is collected along the center of the roof and is channeled along a runnel to the north west edge, where it drains into a tank built into a planter within the building



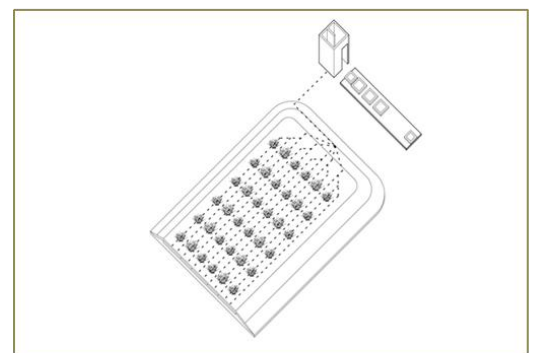
4.A.B.R (Anaerobic Baffled Reactor)

Waste water is piped from the CTC into a 4 chambered Anaerobic baffled Reactor, where the waste is broken down into biomass sludge And fertigation water to be used on the site.



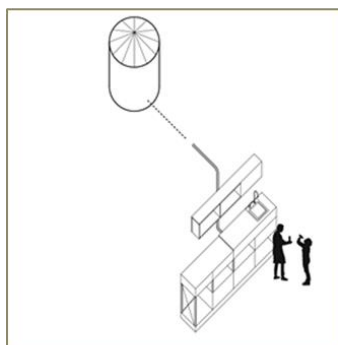
2. CICTERN

The water collected from the roof into the tank at grade is pumped to a rooftop cistern on the building adjacent of the CTC for storage, filtering and re use within the treatment center



5. LEACHING FIELD

The now treated waste water is irrigated into a leaching field adjacent to CTC where it soaks into the ground water and fertilizes plants.



3. ORS (oral rehydration solution)

The filtered rainwater from the cistern is piped back into the CTC, where it is mixed with salts to act as a rapid rehydration tool for patients.

Figure 2.2.4: water treatment

FACADE

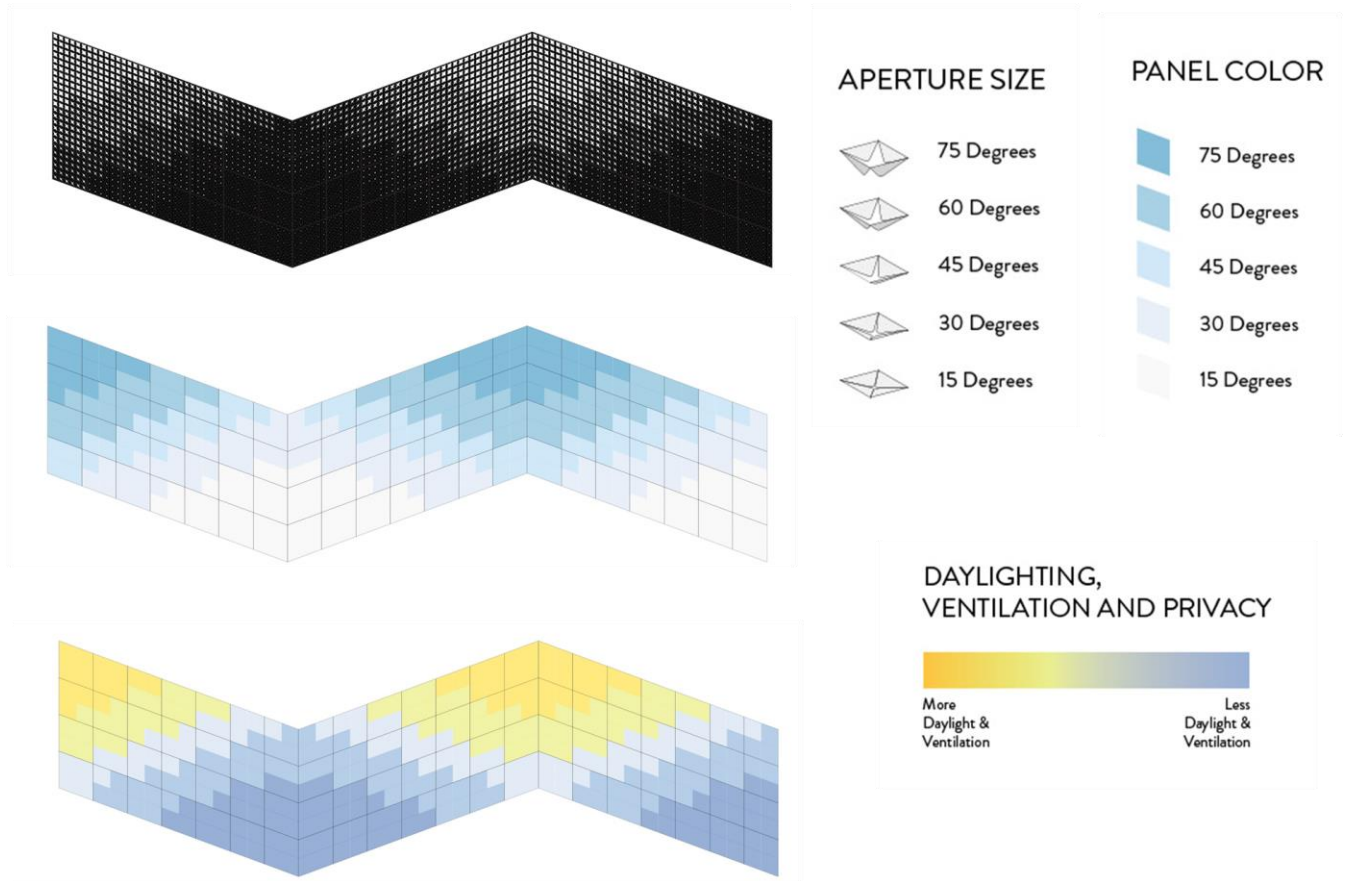


Figure 2.2.5: facade

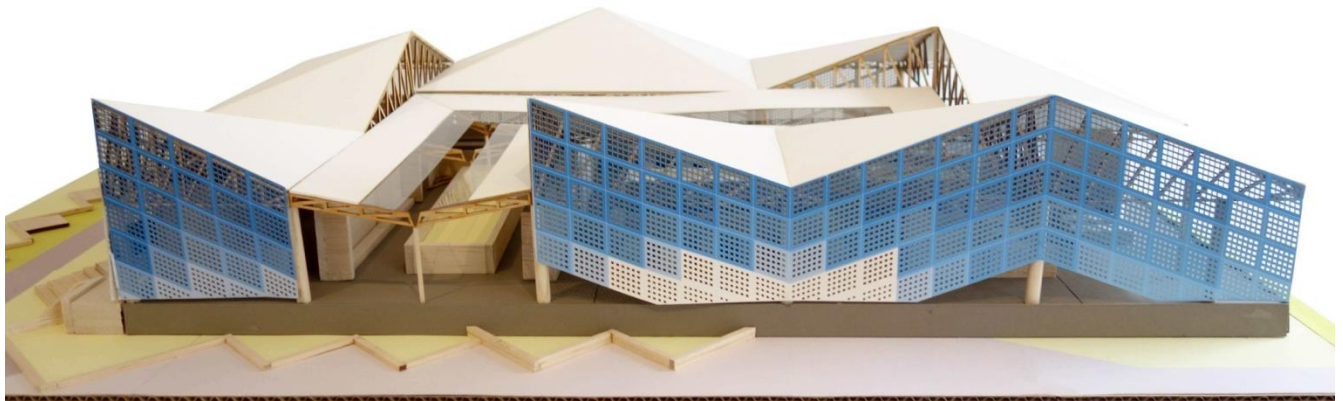


Figure 2.2.6: model

2.2.3 AESTHETICS

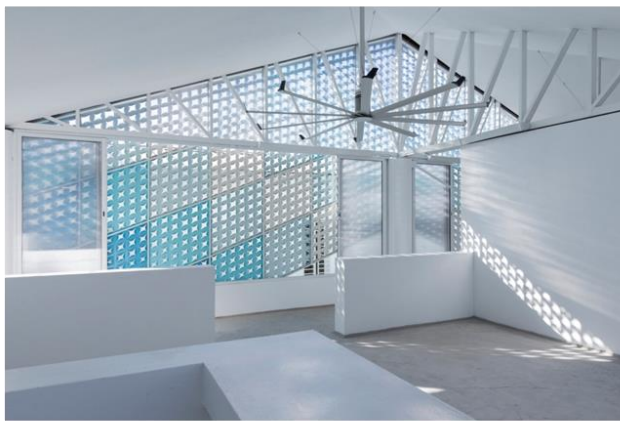


Figure 2.2.7: views

2.3 CD HOSPITAL (Communicable disease)

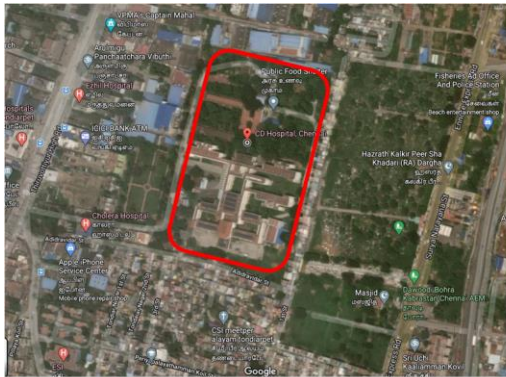
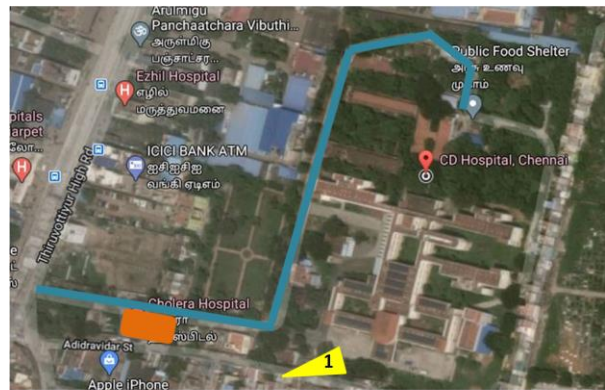


Figure 2.3.1: satellite image



Figure 2.3.3: surrounding vegetation



Cholera hospital access

Figure 2.3.2: access



Figure 2.3.4: front view admin block

2.3.1 PROJECT DATA

Location: Location: 187, Thiruvottiyur High Rd, Kasipuram, Tondiarpet, Chennai, Tamil Nadu 600081

Established: 1914

Site Area: 14 acres (1,01,317sq.m)

No of stories: g+2

Program: 360 beds, 9 wards , airborne diseases, waterborne diseases, vector borne disease

2.3.2 DESIGN

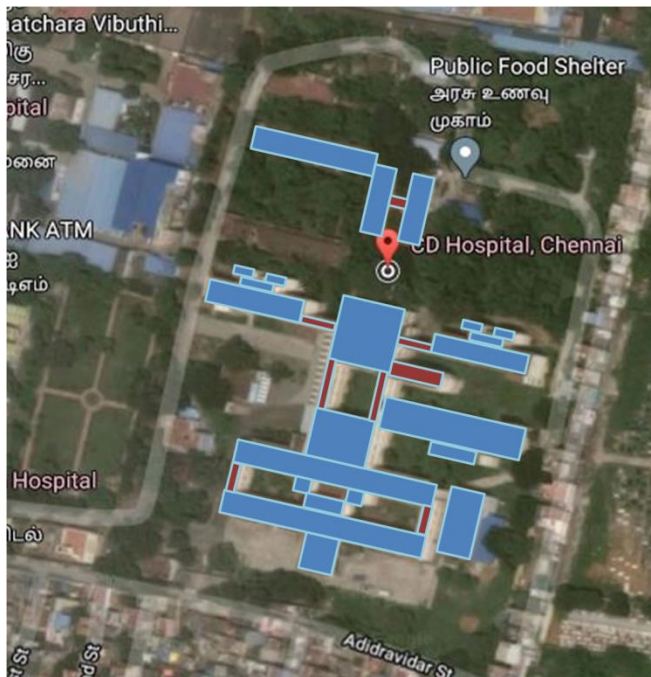


Figure 2.3.5: blocks



Admission block

Un planned vegetations near site. Which may act as breeding grounds for mosquitoes



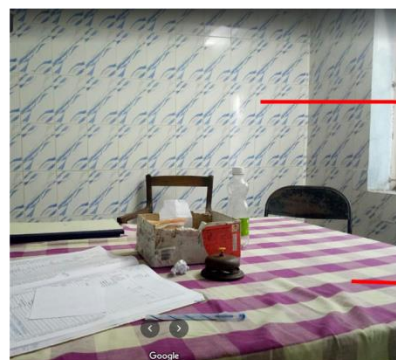
Figure 2.3.6: admin

- Admission block is placed on the front and all the other treatment spaces are connected through the corridors.
- The buildings are surrounded by herbal trees like neem which filters air.
- Each blocks are segregated with proper spacing and courtyards .
- Which allows more air flow and dilutes microbes exiting building by mixing with fresh air.
- Green cover around the site provides fresh air flow.
- Each blocks are segregated separately and connected through corridors.



Car parking adjacent to building

Figure 2.3.7: car parking



**Ceramic tile surface
Easy to clean**

Using a cotton table cloth which can be subjected to contagious diseases

Figure 2.3.8: interior

2.4 Butaro Hospital / MASS Design Group



Figure 2.4.1: car parking

2.4.1 PROJECT DATA

Location: Burera District, Northern Province, Rwanda

Year: 2011

Architects: MASS design group

Build up area: 6,000 sq. m.

Program: A 150-bed tertiary hospital with in- and outpatient services that employs natural cross-ventilation to mitigate airborne disease transmission.

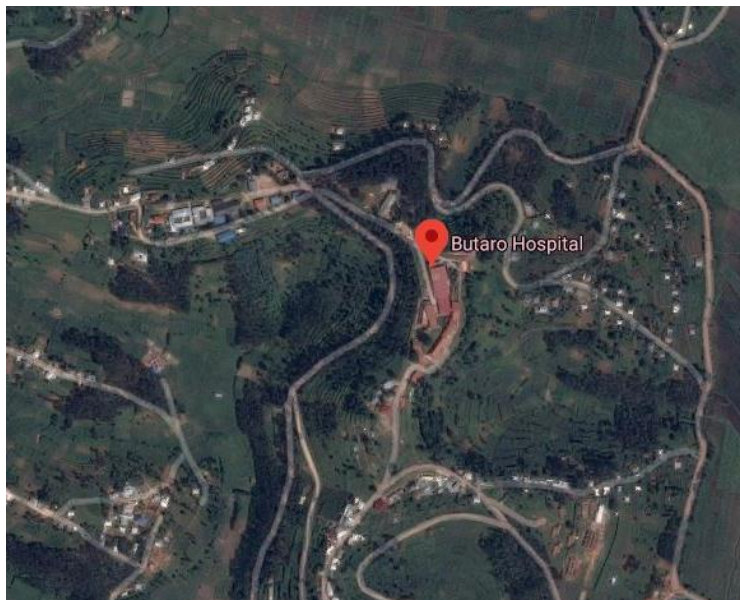


Figure 2.4.2: satellite image

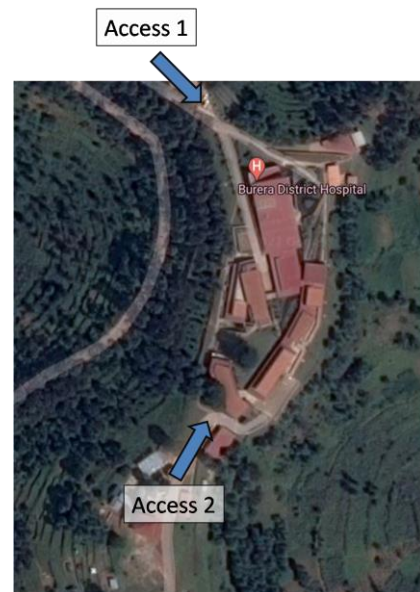


Figure 2.4.3: access



Figure 2.4.4: plans

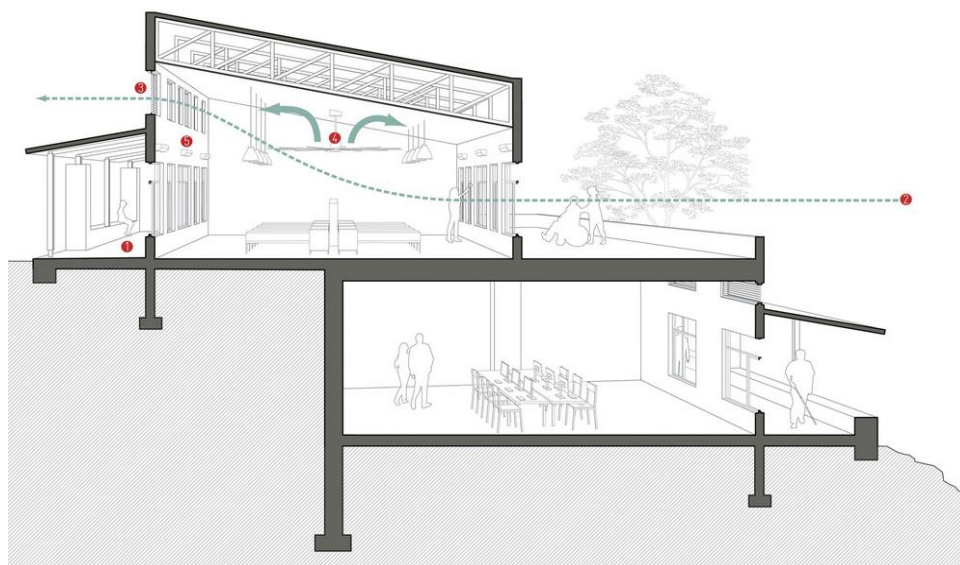


Figure 2.4.5: Section

2.4.2 ELEVATION

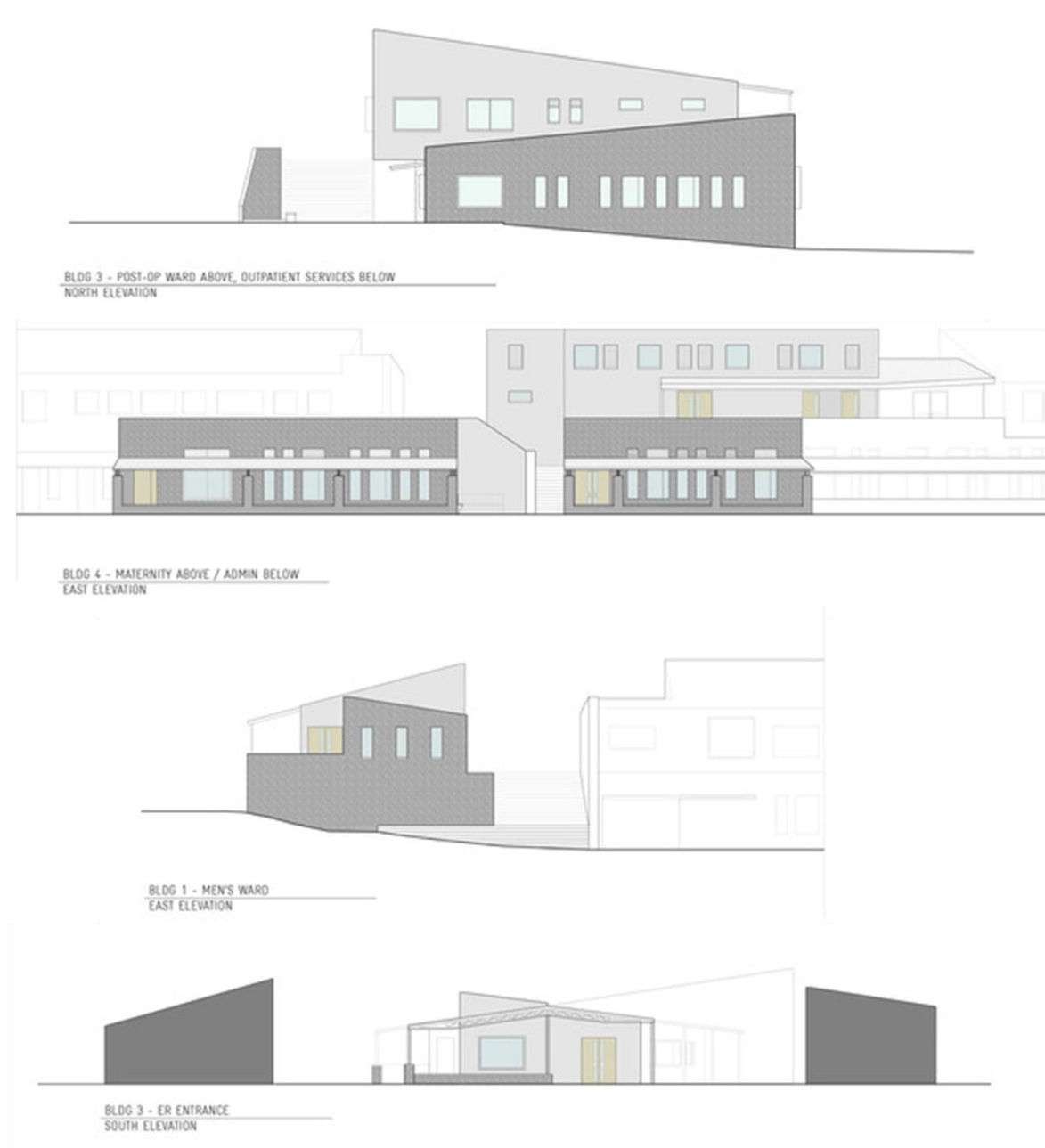


Figure 2.4.6: elevation

2.4.3 AESTHETICS



Figure 2.4.7: *views*

2.5 PAIMIO SANATORIUM



Figure 2.5.1: view of paimio sanatorium

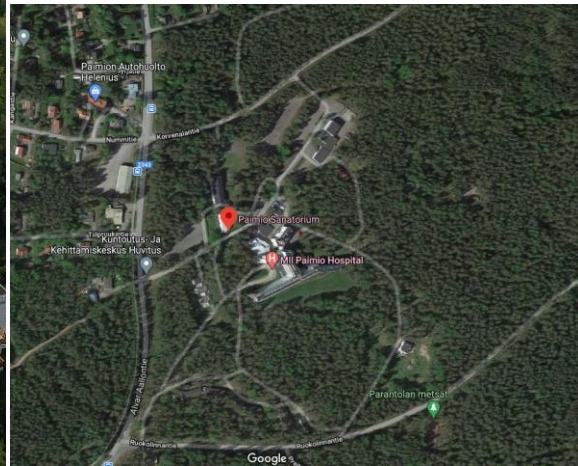


Figure 2.5.2: satellite image of paimio sanatorium

2.5.1 PROJECT DATA:

Location: Paimio, southwest Finland

Year built: 1930- 1933

Architects: Alvar Alto

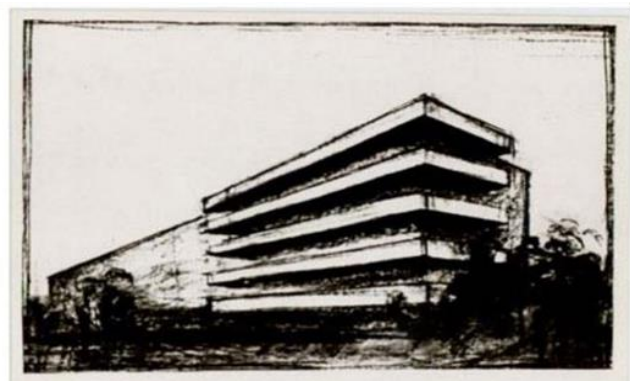
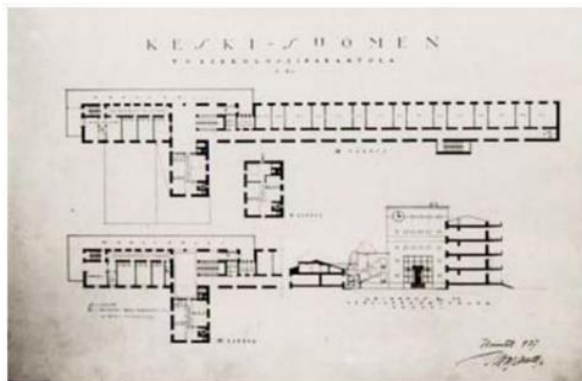


Figure 2.5.3: Alto's entry for kinkomaa tuberculosis sanatorium (1927)

Paimio Sanatorium is considered as the first example of modern architecture applied to healthcare.

Sanatorium is a Latin word used for healthcare centers for the treatment of tuberculosis, an infectious disease that had been a terrifying plague for centuries and took the lives of millions

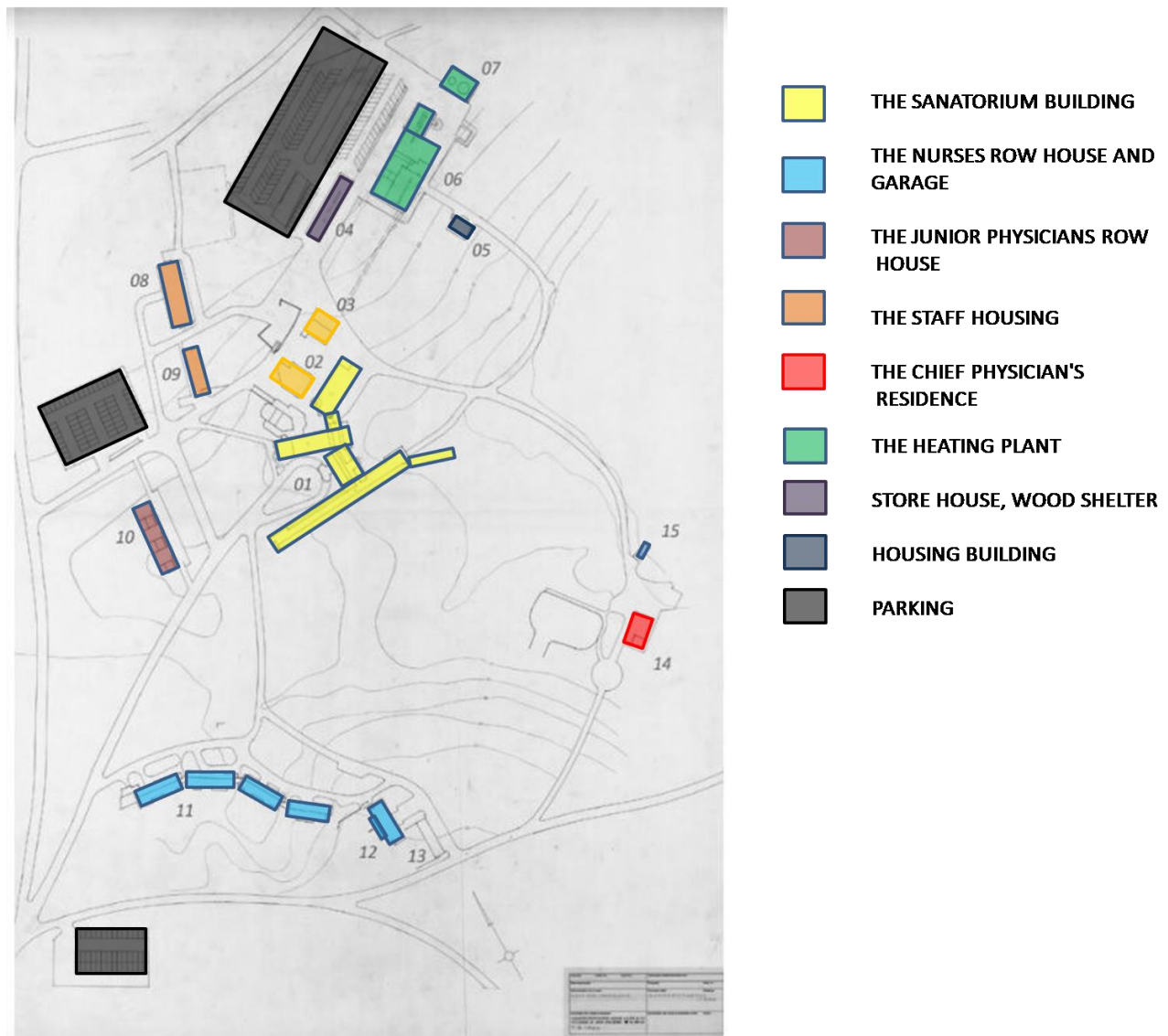


Figure 2.5.4: site plan of paimio sanatorium

- The buildings are properly spaced out the sanatorium building is placed on the center surrounded by other buildings which are properly connected.
- The healthcare workers accommodations are placed farther away from the sanatorium building.
- The site is surrounded by trees and there is proper air flow between and through the structure
- **The main building** of the former sanatorium consists of three wings, one facilitating the patients, another for various technical facilities, and the entrance/communal wing in between.
- All wings have a common basement level that contained a number of technical facilities.

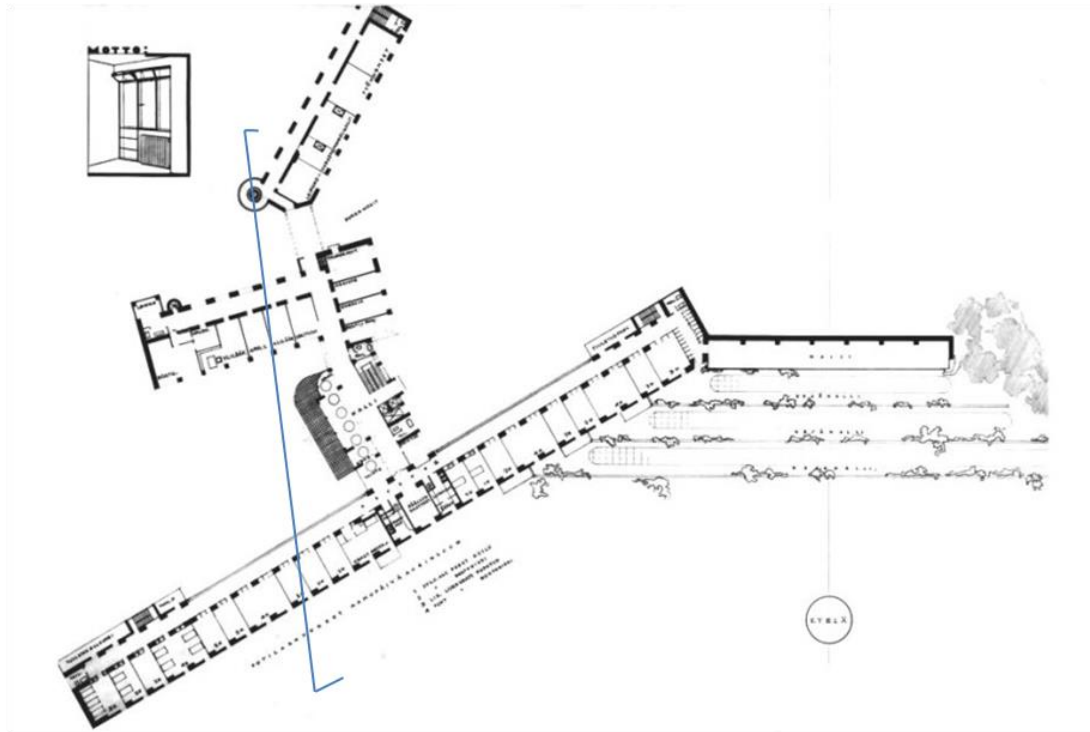


Figure 2.5.5: plan of paimio sanatorium

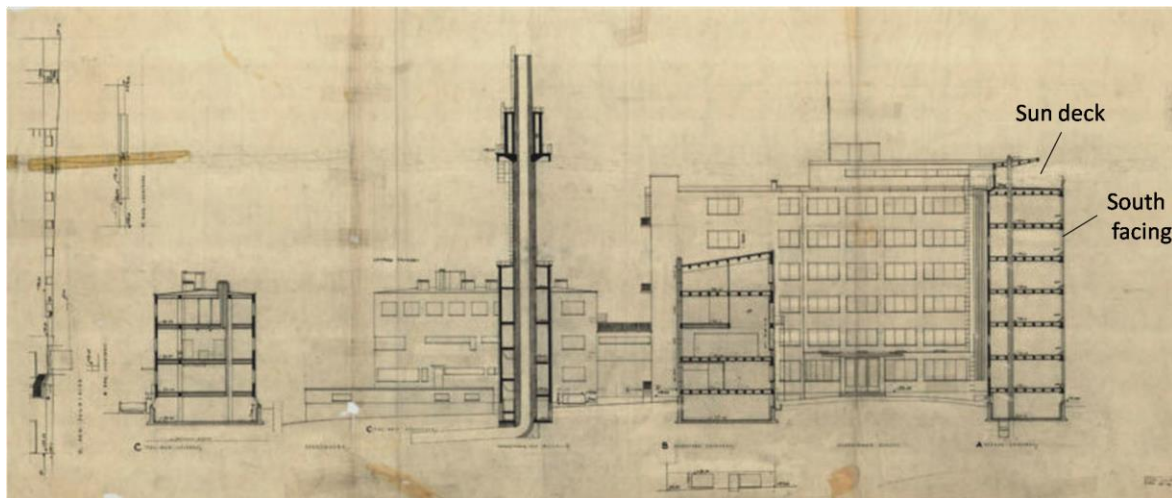


Figure 2.5.6: section of paimio sanatorium

- The patient wing is a seven-story reinforced-concrete construction topped by a **100-meter-long sun deck**.
- The wing contained 1,2, 3 and 4-bed rooms for a total of 296 beds.
- Each room has a **south-facing window** allowing **sunlight** into the interior space.
- Since fresh air was part of the patients' treatment, alto also designed an ingenious **natural ventilation** system that exploited the difference of pressure between the wing's lower and the upper floors, traditional opening windows and electrical exhaust vents.

2.5.2 AESTHETICS



Figure 2.5.7: views of paimio sanatorium

2.6 COMPARITIVE ANALYSIS

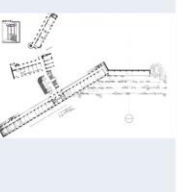
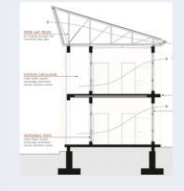
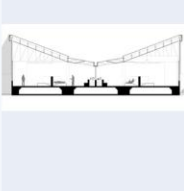
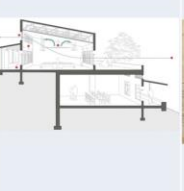
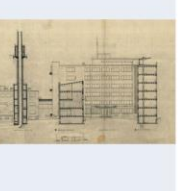
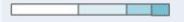
	GHEKIO Tuberculosis Hospital	GHEKIO Cholera Treatment Center	CD Hospital	Butaro Hospital	Paimio Sanatorium
VIEW					
PLANNING					
	courtyard was given to provide more natural ventilation	Planning is open with less walls	Buildings were spaced out allowing fresh air flow	Buildings are segregated and spaced out for mitigating infection.	Main Building is oriented in south west for receiving more sunlight.
SECTION					
	Passive design strategies have been implemented for enhanced natural ventilation	Roof structure is designed for collecting rain water	Corridors are connected throughout blocks connecting different spaces	Passive design strategies have been implemented for enhanced natural ventilation	Building is provided with a single corridor and covered on both sides with glasses for allowing more sunlight.
MATERIALS	reinforced concrete walls and a steel roof	compressed stabilized earth blocks and double skin facade	R.C.C structure	Brick and lava rock wall cladding	Reinforced concrete frame. External Walls faced with brick with insulation layer of cork.
YEAR	2015	2015	1914	2011	1933
COLOURS					

Table 2.6.1: comparative study

2.6.1 INFERENCE:

There are some patterns of design and elements that is observed in the case studies. Considering these elements and implementing in the design can be helpful in a successful infection control in the hospital.

3. SITE IDENTIFICATION:

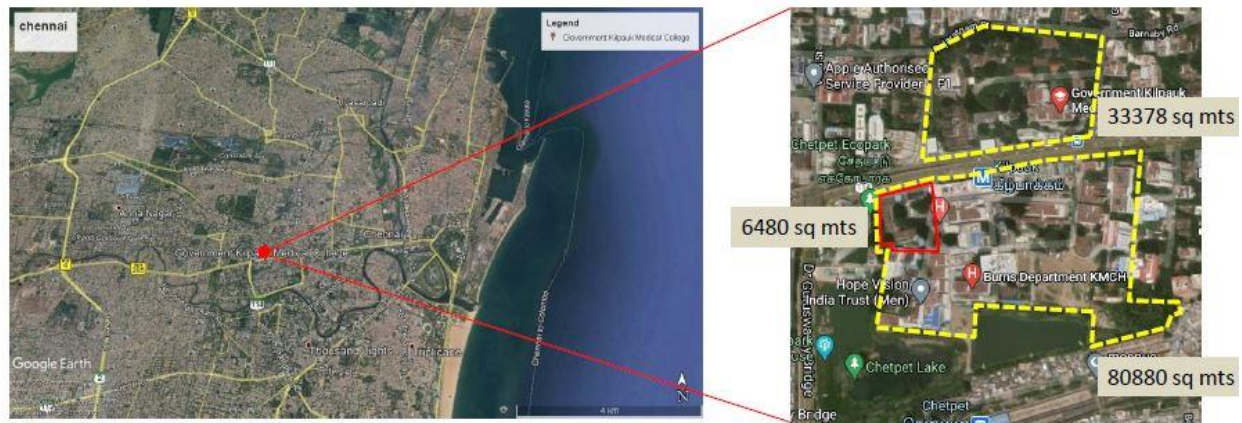


Figure 3.1: satellite image of site

Location:

Doctor Guruswamy Medicine Block, The kilpauk medical college hospital,
Poonamallee High Rd, New Bupathy Nagar, Kilpauk, Chennai, Tamil Nadu 600031

Latitude: 13°4'37.15"N

Longitude: 80° 14'30.43"E

Present land use: Institutional

Reason for site selection: The government kilpauk medical college hospital has a proposal for demolition of the Doctor Guruswamy Medicine Block and construction of new block for intensive care and emergency treatment.

Site extend: site extends are scaled up hypothetically. For a flexible design.

Climate: hot and humid climate

Predominant wind direction: south east to North West

3.1 HISTORY:

1925-In response to the feeling of Nationalism and keeping alive the ancient systems of indigenous medicine the school of Indian medicine was started.

1947 -the character of the institute was changed, upgraded and named as College of Indian Medicine. The College gave the degree as G.C.I.M.

1948- The College was again renamed as College of Indigenous Medicine

1953- The College was renamed as the College of Integrated Medicine.

1960- The Integrated Medicine Course

1965- The College was recognized as Women Medical College and named as Government Kilpauk Medical College, admitting only women candidates for MBBS degree.

1967- The women students agitated to have a co- educational institution.

1972-Development of the Medical College is set into pace with the Surgical Block coming into being. Later all the different super- specialties came into being between 1972 and 2001 and stands in its glory to-day.

1981- Intensive Care Unit was sanctioned with 10 beds and was commissioned,

1984- Department of Cardiology was sanctioned

1985- 50 bedded comprehensive Burn unit was sanctioned on the I floor of the out-Patient Block.

1987- Department of Nephrology was sanctioned and commissioned.

1988- Department of Surgical Gastroenterology was sanctioned

3.2 EXISTING DEPARTMENTS IN KHMC

THE PRE CLINICAL DEPARTMENTS IN THE COLLEGE SIDE

- Anatomy
- Forensic medicine
- Pathology
- Physiology
- Biochemistry
- Microbiology
- Pharmacology
- Community medicine

THE PRE CLINICAL DEPARTMENTS IN THE HOSPITAL SIDE

- Anesthetics
- Cardiology
- Dermatology & leprosy
- ENT
- Medicine
- Neurology
- Ophthalmology
- Plastic surgery
- Psychiatry
- Radiology
- Thoracic medicine
- Radio diagnosis
- Neurosurgery
- Physical medicine
- Blood bank
- Dental surgery
- Diabetology
- Medical gastroenterology
- Surgical gastroenterology
- Obstetrics & gynecology
- Neurology
- Orthopedics
- Medical oncology
- General surgery
- Urology
- Pediatrics with neonatology
- Vascular surgery
- Research
- Microsurgery

KMCH morgue: the KMCH can accommodate 48 bodies.

3.3 SITE SECTION:



Figure 3.3.1: Site elevation profile



Section x-x'

Figure 3.3.2:



Section y-y'

Figure 3.3.3:

3.4 CHRONOLOGY:

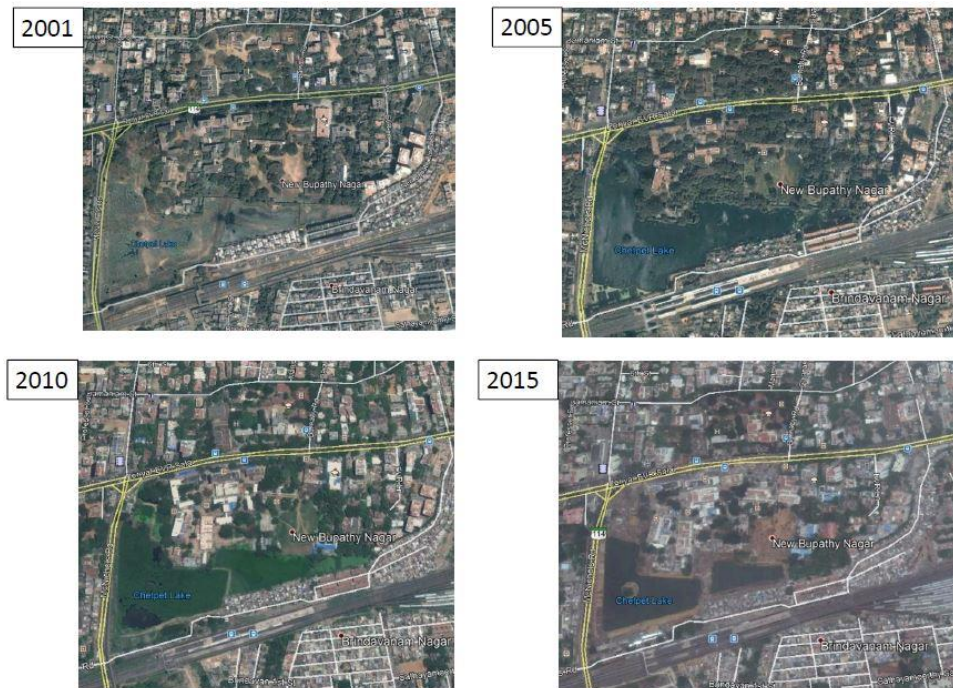


Figure 3.4.1: chronology

3.5 CLIMATE STUDY:



Figure 3.5.1: climate study

3.6 WIND STUDY:



- | | | | |
|-------------------------------|-------------------------------------|---|--|
| 1. emergency ward | 6. kmc ug mens's hostel |  more than 3 floors |  parking |
| 2. breast clinic | 7. directorate of medical education |  up to 3 floors |  vegetation |
| 3. kmc mosque | 8. kmc ground |  ground floor | |
| 4. kmc orthopedics department | 9. corporation mens shelter | | |
| 5. pandalai (nursing home) | 10. burns department kmc | | |

Figure 3.6.1: wind study

3.7 SITE ANALYSIS:

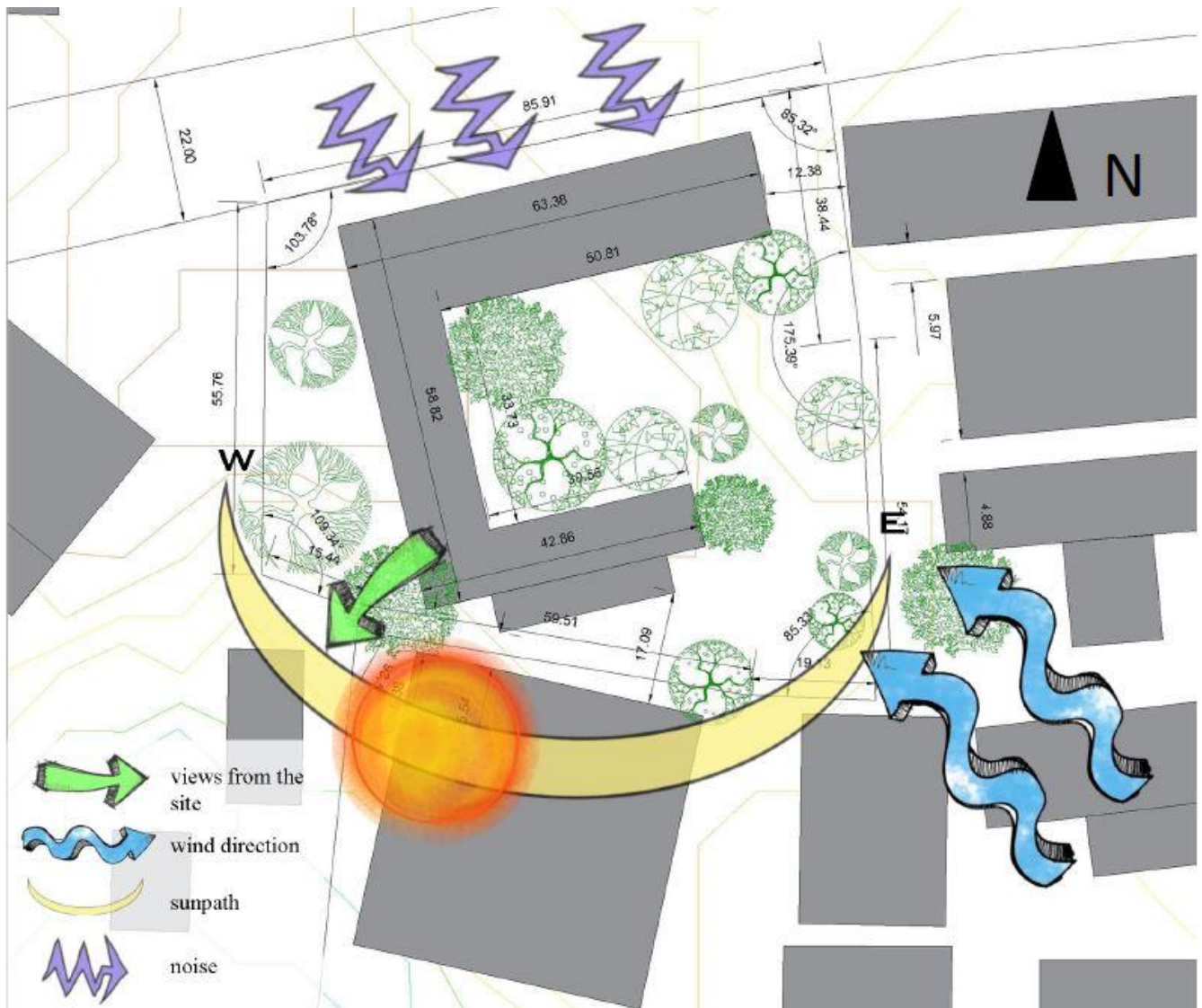


Figure 3.7.1: site analysis

3.8 GURUSWAMY BLOCK:



Figure 3.8.1: guruswamy block view from road

The Indian express 2016: “The officials intend to demolish very old buildings (75-80 years). The buildings were chosen after thorough study. ”



Figure 3.8.2: guruswamy block

UTILIZED FOR ISOLATION DURING COVID – 19:

the Guruswamy block was vacated to house the isolation facility the medical ward and gynecology ward in the building was shifted the hospital had 20 isolation beds (March 2020). it was expected to expand up to 100 beds in later week and the number of bed were increases in phases and it was expected to expand 250 -300 beds in later weeks the hospital aimed to expand up to a max of 400 beds during the crisis.

3.9 ARCHITECTURE:



Figure 3.9.1: surrounding building

4. COMMUNICABLE DISEASE IN TAMILNADU

COMMUNICABLE DISEASE CLASSIFICATION:

AIR BORNE

FOOD OR WATER BORNE DISEASE

DIRECT CONTACT

VECTOR BORNE DISEASES

AIR BORNE:

1. COVID 19
2. TUBERCULOSIS
3. PNEUMONIA
4. MEASLES
5. INFLUENZA (SWINE FLU)
6. DIPHTHERIA
7. CEREBRO SPINAL FEVER

FOOD OR WATER BORNE:

1. CHOLERA
2. TYPHOID FEVER

VECTOR BORNE:

1. DENGUE FEVER
2. MALARIA
3. PLAGUE
4. VIRAL ENCEPHALITIS

5. AREA STATEMENT:

SL.NO	SPACES	NO OF USER	NO OF BEDS	AREA IN SQ MTS
1	ADMIN	60	0	600
2	EMERGENCY UNIT	30	0	160
3	TREATMENT	80	20	900
4	STAFF	25	0	150
5	LAB	35	0	540
5	AIR BORNE DISEASE WARD	140 ,	80	4000
6	FOOD OR WATER BORNE DISEASE WARD	100	64	3000
7.	VECTOR BORNE DISEASE WARD	100	64	3000

SL.NO	SPACES	NO OF USER	NO OF BEDS	AREA
8.	STAFF ACCOMODATION	25	25	370
8	ENGINEERING AND MAINTAINANCE	30		160
9	BODY HOLDING AREA	60	0	600
10	HOUSE KEEPING	10		30
11	PHARMACY UNIT	60		100
12	DINING	70		184
	TOTAL			13800

Table 5.1: area statement

6. CONCEPT



Figure 6.1: existing building

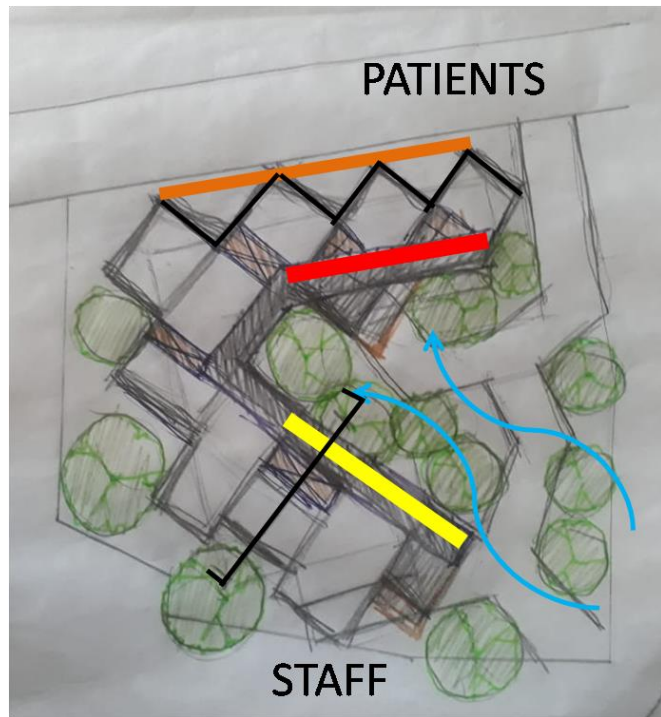


Figure 6.2: concept sketch

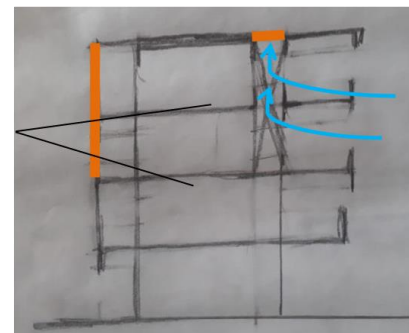
6.1 COPPER MATERIALS:

- The WHO acknowledges that the corona virus that causes COVID-19 only lives on copper for about four hours.
- Copper has the ability to kill viruses and bacteria by disrupting the protective layers of certain microorganisms and interfering
- With their vital processes.



Figure 6.1.2: concept sketch

treatment
of air borne
infection



— Copper

- Aligning building to
- Make use of natural ventilation.
- Copper facades acts as barrier from sun and noise From the road.
- Staggering blocks allows more natural ventilation and lighting.

6.2 SKETCHES:

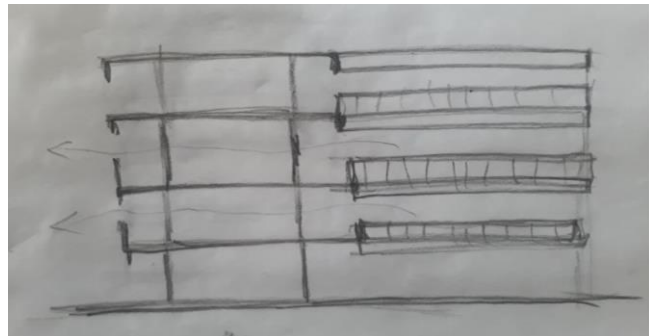
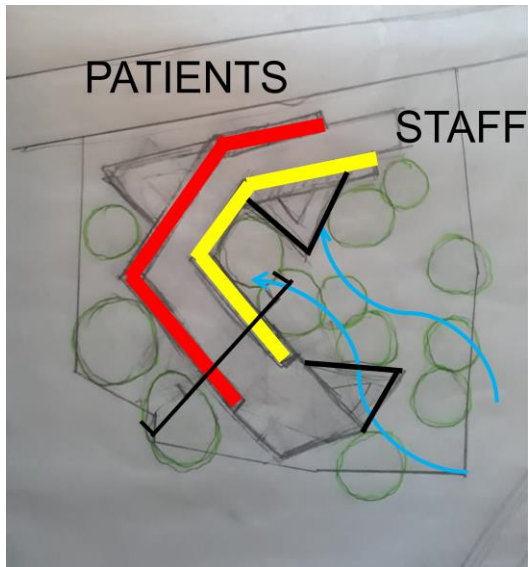


Figure 6.2.1: concept sketch

- Aligning building to Make use of natural ventilation.
- Two corridors acts as More secure means of movement within the building

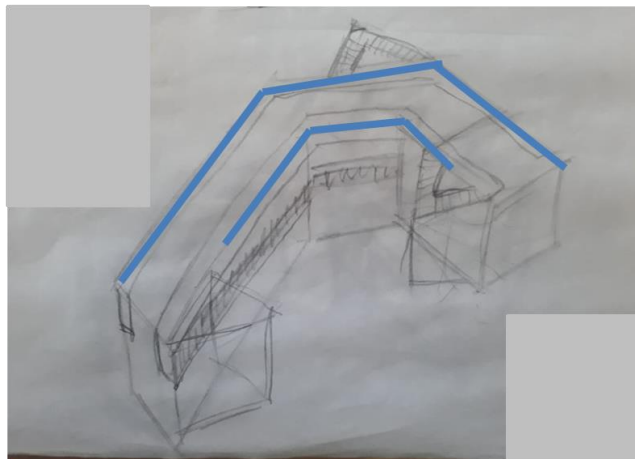


Figure 6.2.2: concept sketch

6.3 CONCEPTUAL ZONING:

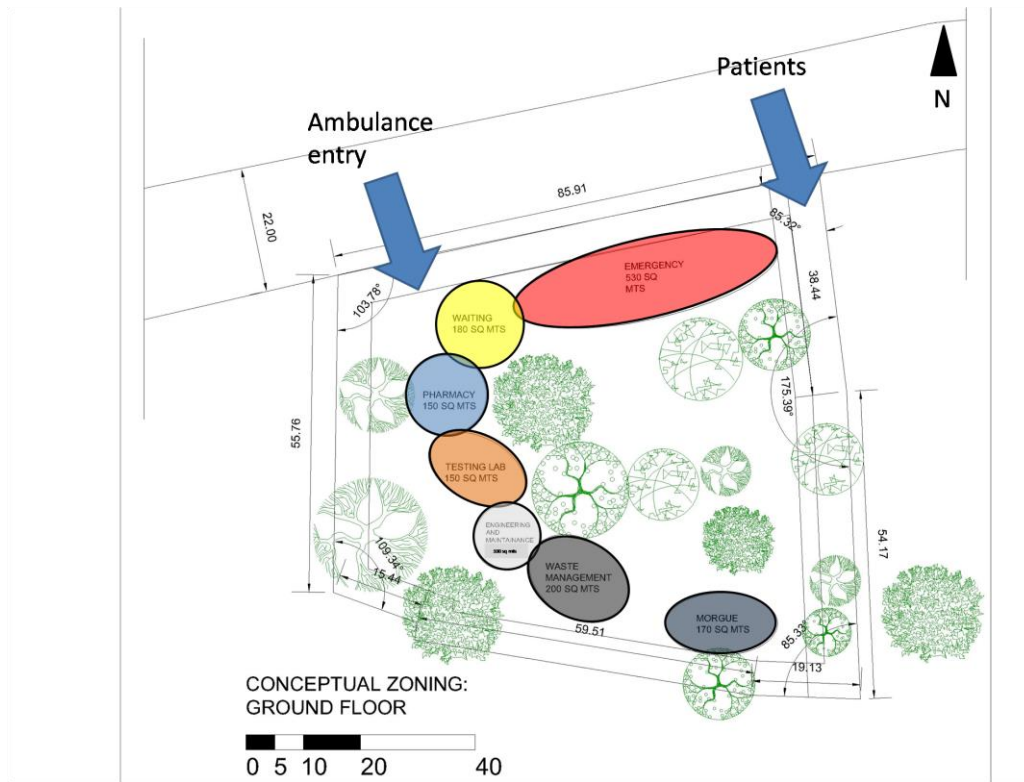


Figure 6.3.1: ground floor zoning



Figure 6.3.1: first floor zoning



Figure 6.3.1: second floor zoning

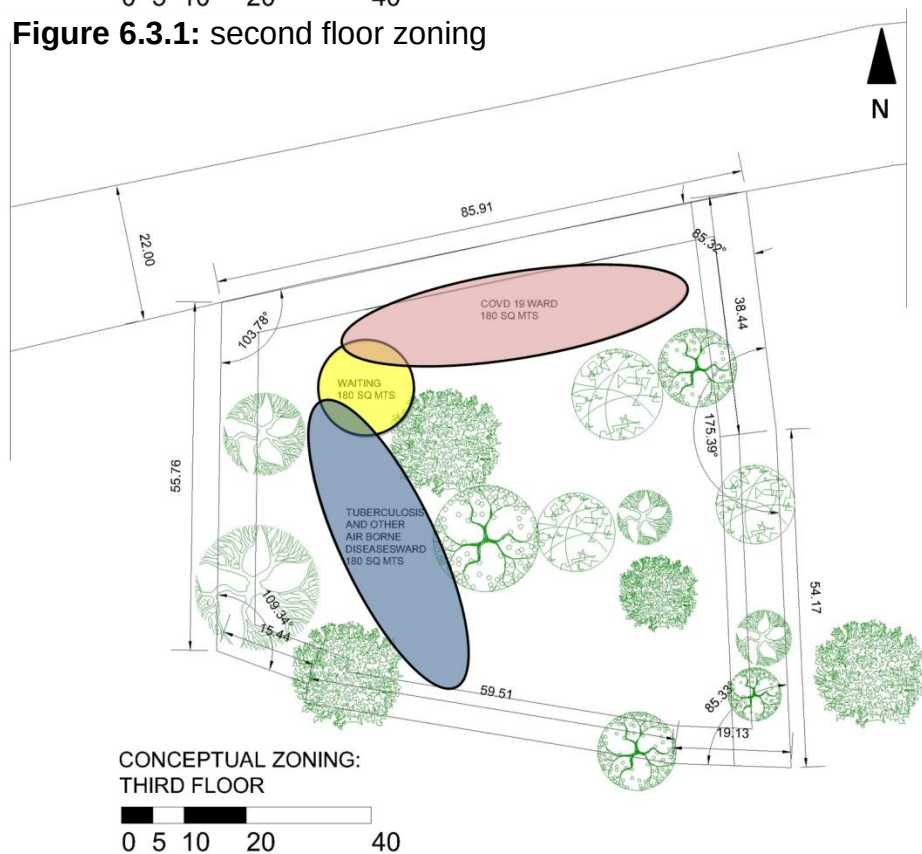


Figure 6.3.1: third floor zoning

6.4 STUDY MODEL

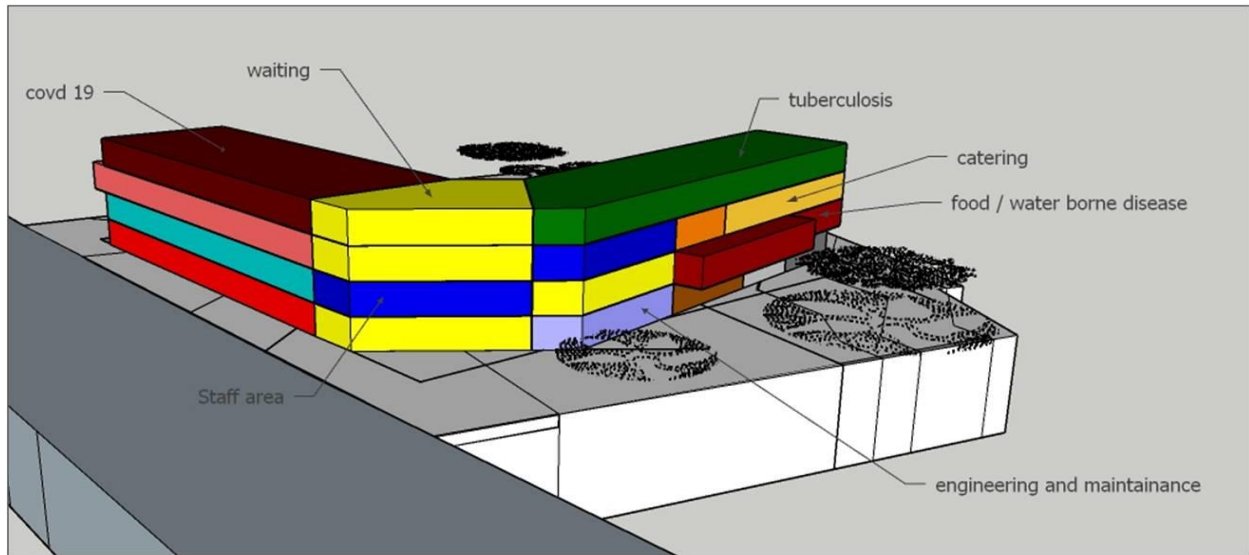


Figure 6.4.1: concept model 1

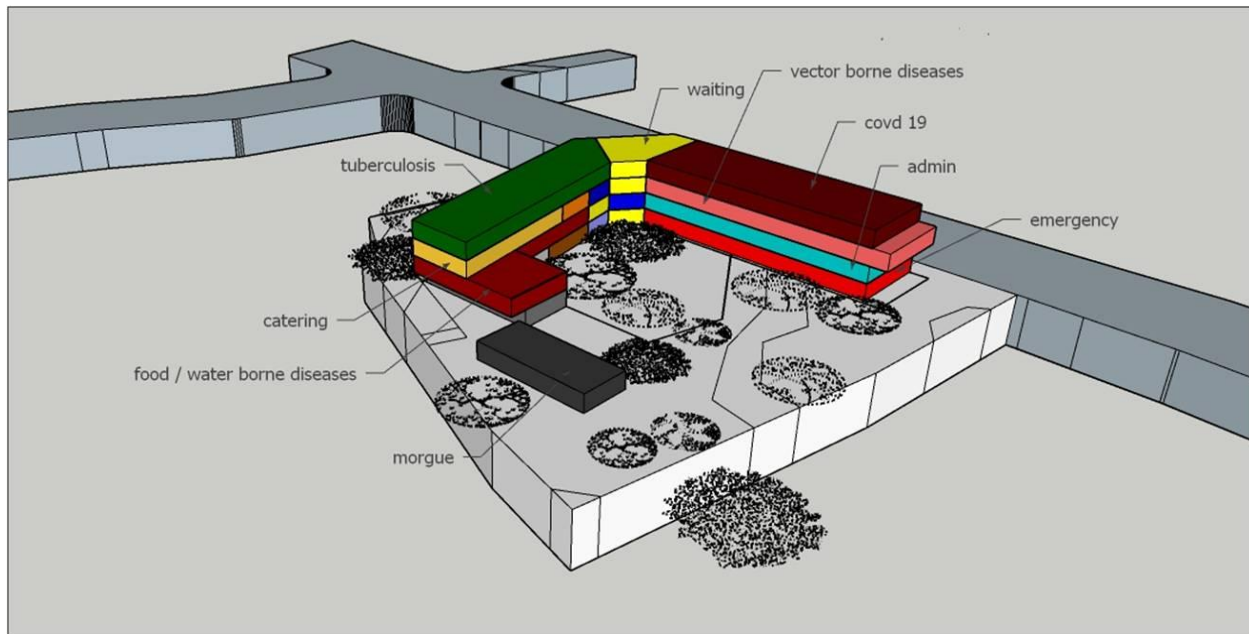


Figure 6.4.2: concept model 2

6.5 STAGE 2 MODELS

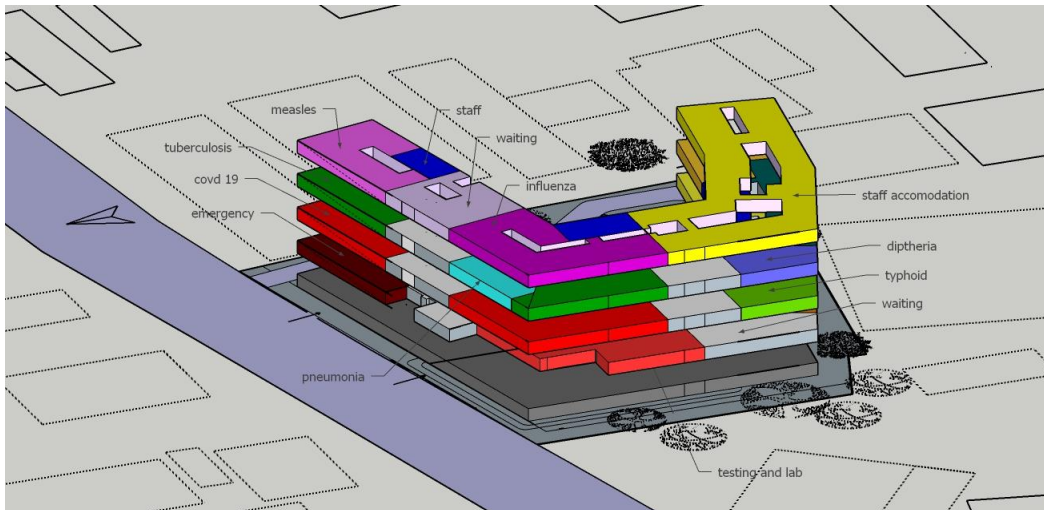


Figure 6.5.1: concept model stage 2

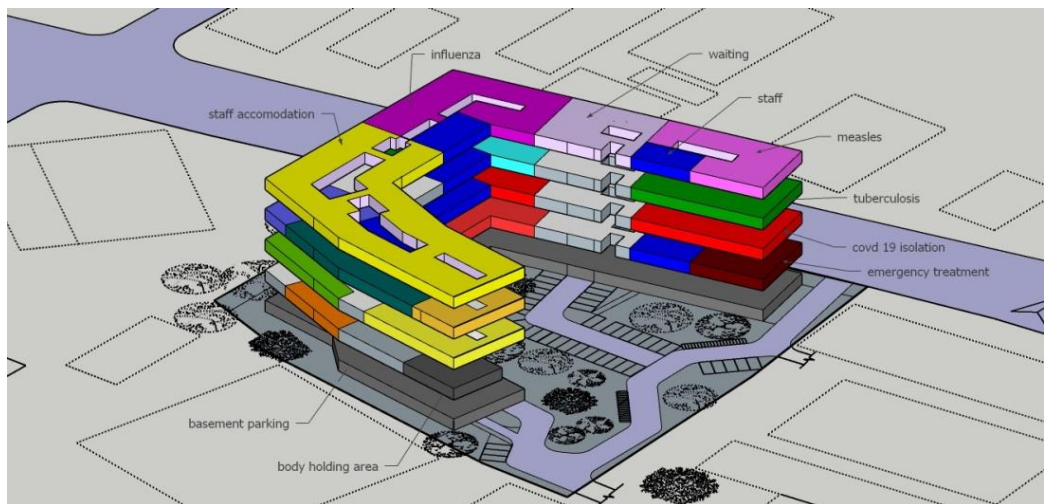


Figure 6.5.2: concept model stage 2

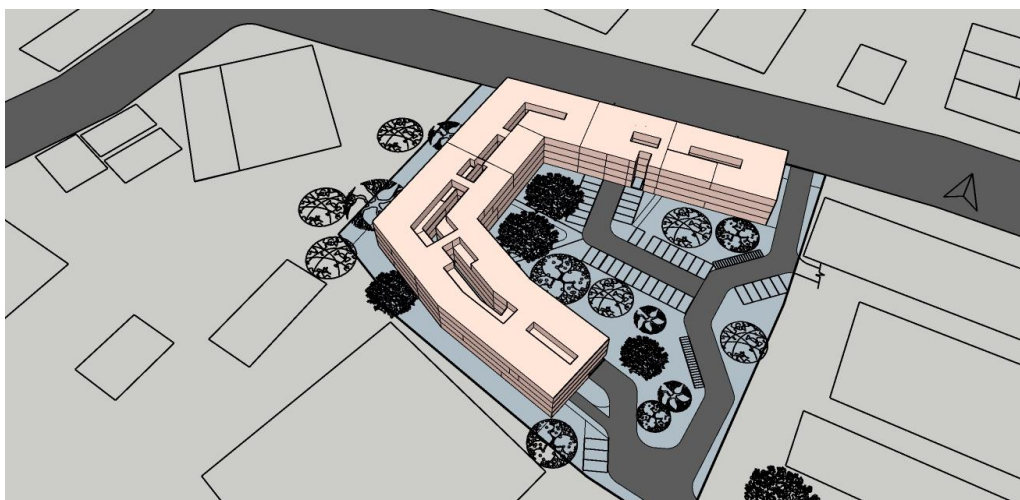


Figure 6.5.3: concept model stage 2

6.6 STAGE 3 DESIGN



Figure 6.6.1: concept model stage 3

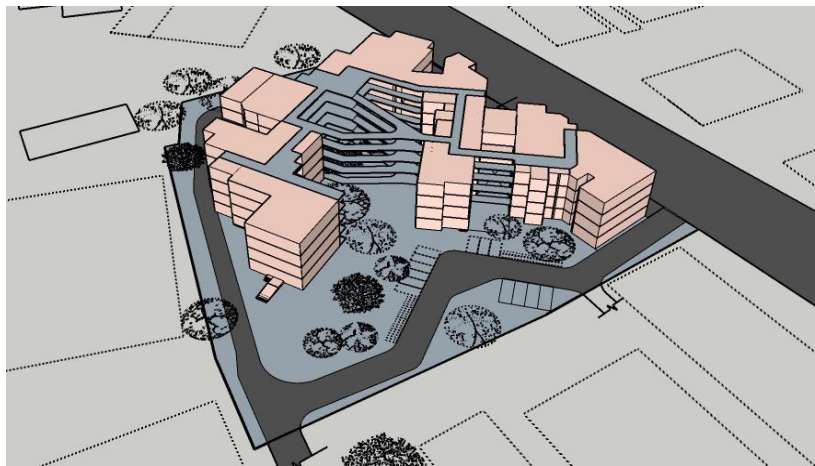


Figure 6.6.2: concept model stage 3

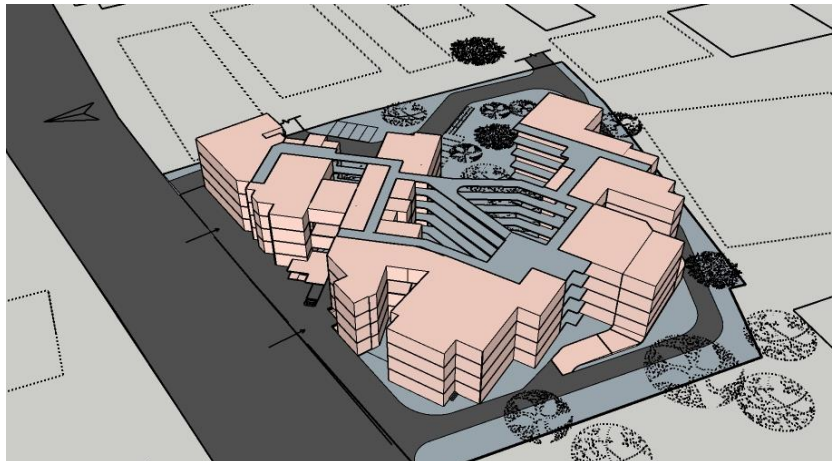


Figure 6.6.3: concept model stage 3

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