SELF SAFE MODULAR HOUSE

Homelessness and displacement

Loss of livelihood and income

Damage to houses, roads, bridges, and utilities
Loss of livelihoods (fishing, farming, small businesses)

Slows national development Repeated disaster cycles trap communities in poverty

Loss of crops, forests, and biodiversity

Loss of forest resources (timber, fuel,medicinal plants)
Damage to agriculture and fisheries

SELF SAFE MODULAR HOUSE

A self-safe modular house is a compact, disaster-resilient housing unit made from prefabricated modules that are easy to assemble, repair, and expand. It is designed to provide safe shelter during floods, cyclones, and earthquakes using local, sustainable materials. The house is affordable, adaptable, and suitable for vulnerable communities in disaster-prone areas.

Every year, with the merciless impact of climate change, countless natural disasters unfold across the world. In the face of this harsh reality, Bangladesh, situated so close to the Bay of Bengal, bears the brunt of these disasters in its coastal belt. I designed this special modular house with the poorest, most struggling people in mind—thinking of their pain, their loss, and their longing for safety. Each part of this house is built as a module, and each connection is also a module, allowing it to be moved effortlessly from one place to another. It is so easy to make, using local materials, at a low cost. This house is not just a shelter; it is a symbol of love for those who repeatedly lose their homes, a promise that, despite their hardships, they can rise again. This is a home that protects them from disaster, giving them a chance to stand tall once more, with a future they can finally believe in .

Concept - Metamorphosis

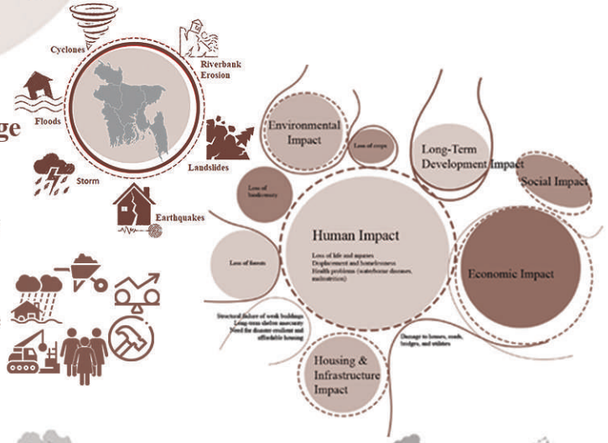
Metamorphosis = Modular House means:
Metamorphosis → gradual transformation, adaptation, change over time□Modular House → a house made of independent units

A metamorphic modular house is a house that changes and adapts over time according to:
climate conditions
family size disaster impact (cyclone, flood, erosion)
economic capacity

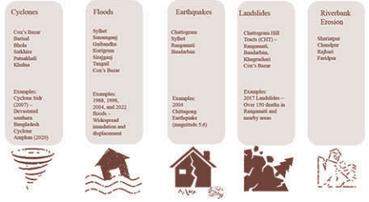
Module Challenge

Locally available material
Structural stability
Joint durability
Social acceptance
Disaster resistance
Dismantling

Bangladesh Natural Disaster



Area of Disaster



Flood Hazard Situation

Homelessness and displacement
Loss of livelihood and income
Damage to houses, roads, bridges, and utilities
Loss of livelihoods (fishing, farming, small businesses)
Water pollution and ecosystem damage
Slows national development
Repeated disaster cycles trap communities in poverty
Loss of crops, forests, and biodiversity
Loss of forest resources (timber, fuel, medicinal plants)
Damage to agriculture and fisheries

Flood Timeline

1954	1974	1987	1988	1998	2004
Affected Regions- Central and Eastern Bangladesh Impact-Severe – River Flood	Affected area – Nationwide Catastrophic – Led to famine	Affected Regions- Central and Northern regions Major – Urban and rural impact	Affected- Most of the country (Dhaka, Central zones) Catastrophic – 60% submerged	Affected area - Nationwide Worst in history – 68% flooded	Affected area -Dhaka, Central Bangladesh Severe – Urban flooding
July–August	July–September	August – September		July–September	July–August

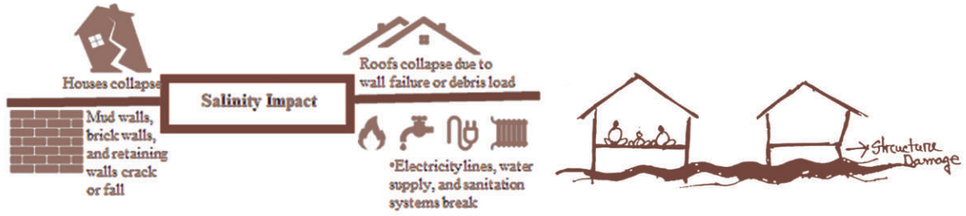
2010	2015	2017	2020	2022	2024
Affected Regions- Northern and central districts Impact- Widespread displacement and crop damage	Affected Regions- Low-lying areas across the country. Impact- Thousands affected; significant agricultural losses	Affected Regions-32 districts including northern regions Impact- Over 8 million people affected; extensive damage to homes and infrastructure	Affected Regions-33 districts nationwide Impact- More than 5 million people impacted; severe flooding in many areas	Affected Regions- Sylhet and Sunamganj Impact- Massive flooding, millions displaced; significant damage to homes and crops	Affected Regions- Sylhet, Sunamganj, Sherpur, and northern regions Impact- Destruction of approximateiy 1.1 million metric tons of rice, at least 75 deaths; significant agricultural losses
Heavy monsoon rains	Torrential rains	Prolonged monsoon rains	Continuous monsoon rainfall	Unprecedented rainfall	Heavy monsoon r water currents

Cyclone Timeline

1876	1965	1970	1985	1991	2007	2009
Name- Great Backerganj Cyclone Category- Category 1 Affected Regions- Barisal, Meghna Estuary	Name- Unnamed Cyclone Category- Category 3 Affected Regions- Barisal region , Coastal Bangladesh	Name- Bhola Cyclone Category- Category 4-5 Affected Regions- Bhola, Noakhali, Barisal	Name- Unnamed Cyclone Category- Category 1 Affected Regions - Khulna, Satkhira	Name-1991 Bangladesh Cyclone Category- Category 5 Affected Regions - Chittagong , Cox's Bazar	Name- Cyclone Sidr Category- Category 4 Affected Regions- Khulna, Bagerhat, Patuakhali	Name- Cyclone Aila Category- Category 1 - 2 Affected Regions- Satkhira, Khulna, Barisal
Oct 31	May 11 Dec 15	Nov 12	May 25	Apr 29	Nov 15	May 25

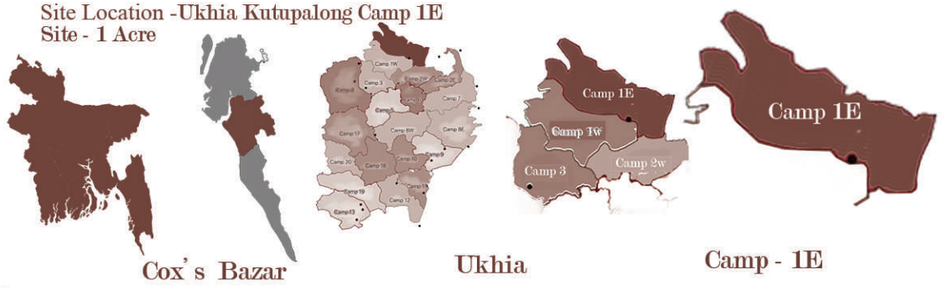
2013	2017	2019	2020	2021	2022	2023
Name- Mahasen Category- Category 1 Affected Regions- Chittagong, Bhola, Patuakhali	Name- Mora Category- Category 1 Affected Regions - Cox's Bazar, Chittagong	Name- Bulbul Category- Category 1 Affected Regions- Khulna, Barisal, Chittagong	Name- Amphan Category- Category 3 Affected Regions- Khulna, Rajshahi, Dhaka	Name- Yaas Category- Category 1 Affected Regions- Khulna, Rajshahi	Name- Sitrang Category- Tropical Storm Affected Regions - Chittagong, Barisal, Dhaka	Name-Hamoon , Mocha , Hamoon Category- Category 1 , 5 Tropical Storm Affected Regions - Chittagong , Cox's Bazar , Khulna, Barisal
May 16	May 30	Nov 9–10 May 3–4	May 20	May 26	Oct 24	Nov 17, Oct 25, May 14

Salinity Hazard Situation



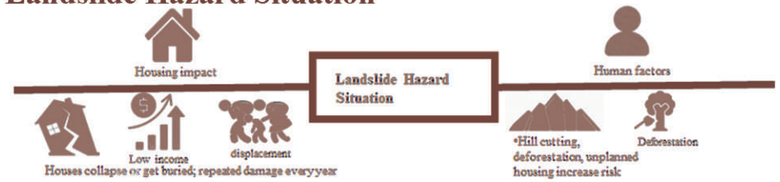
Site Location

Site Location -Ukhia Kutupalong Camp 1E
Site - 1 Acre

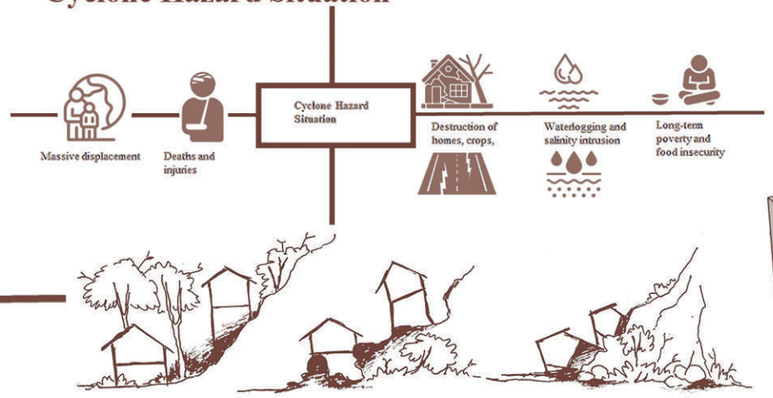


Earthquake Hazard Situation

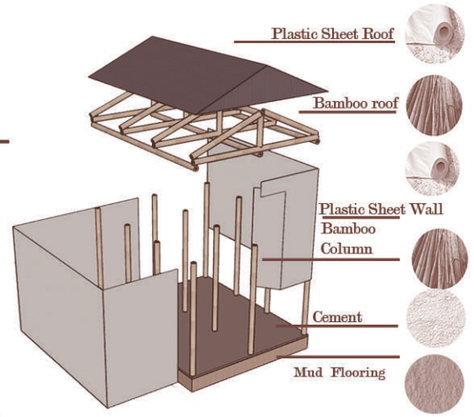
Landslide Hazard Situation



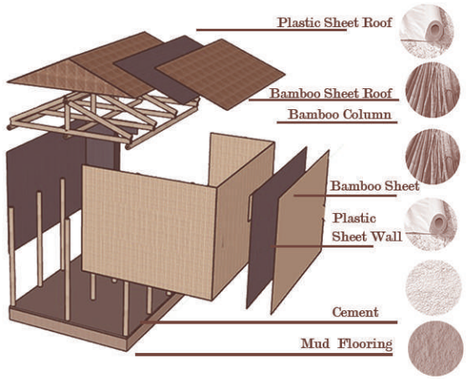
Cyclone Hazard Situation



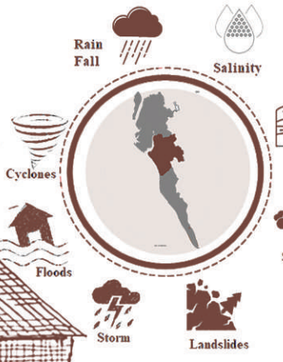
Before House Pattern



After House Pattern



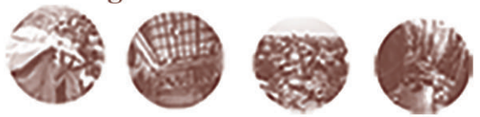
Cox's Bazar



Camp Main Challenges

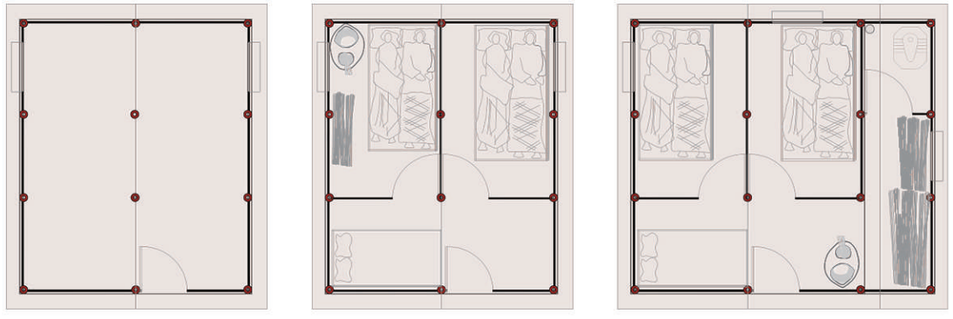
Their Need's

Existing Condition

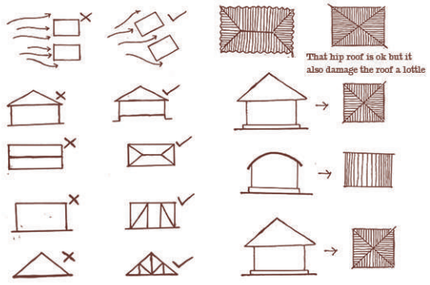


Existing House Material

Existing House Pattern



Design Idea

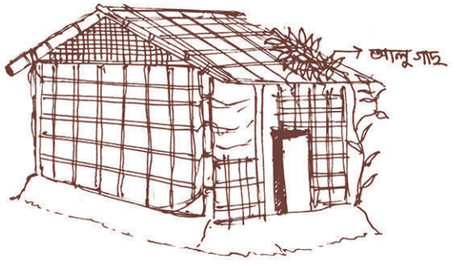


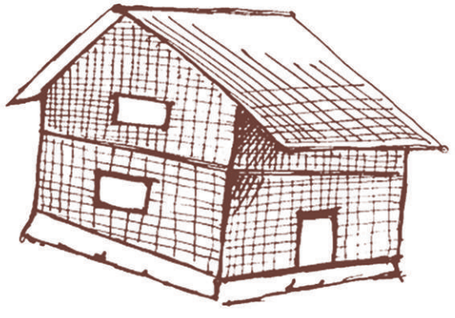
Local Trees -

Large Trees -

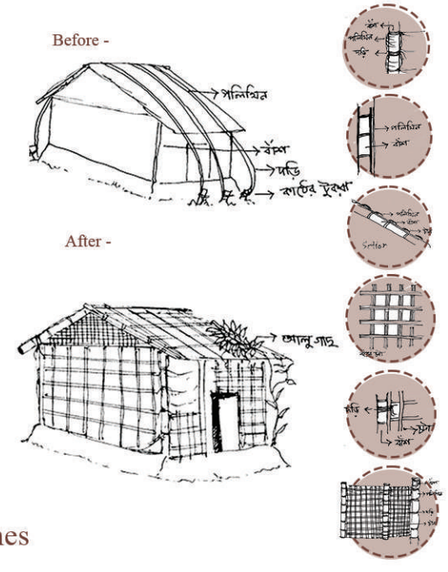
Medium Trees -

Small Trees -

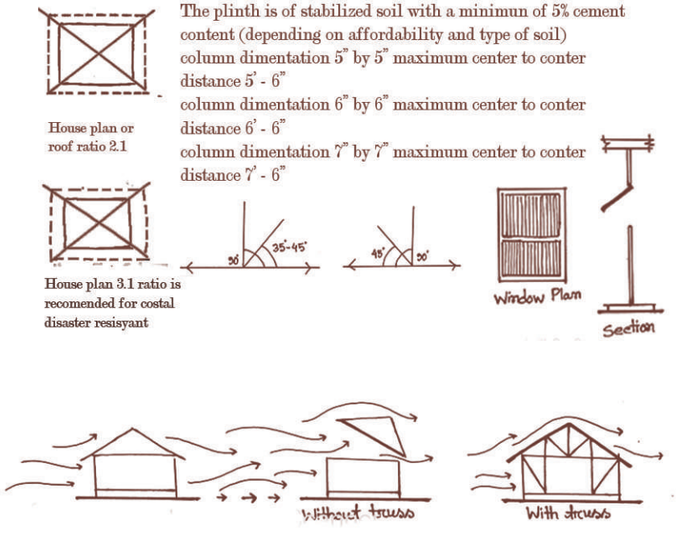




Material Joining



Design Idea



Project Framework

Police

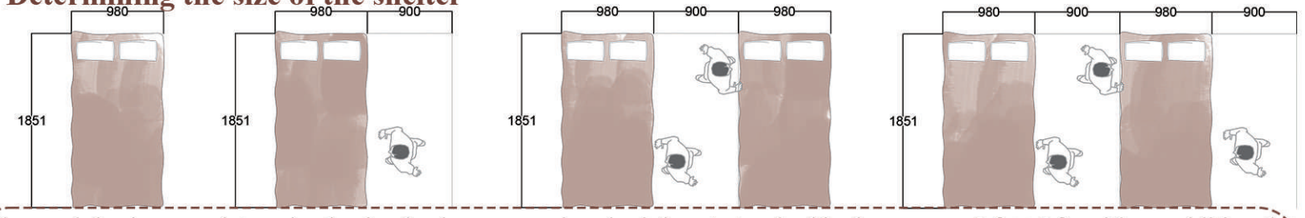

sustainability


solar panel


vegetation


rain water harvesting

Determining the size of the shelter



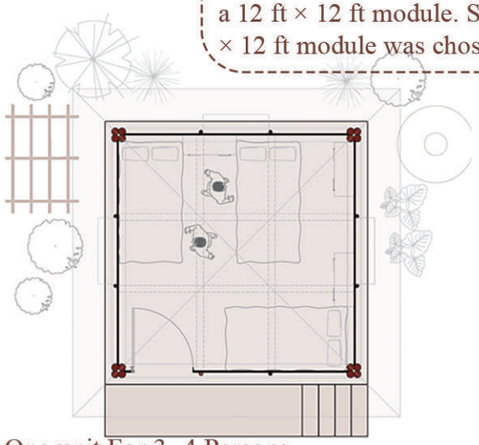
The module size was determined using basic ergonomic principles. A standard bed measures 3 ft × 6 ft, with an additional 3 ft circulation space required beside it. By arranging beds with adequate circulation, the layout naturally developed into a 12 ft × 12 ft module. Since the design is intended for rural families who typically live together in groups, a larger 12 ft × 12 ft module was chosen instead of a smaller 6 ft × 6 ft unit to provide comfortable shared living space.

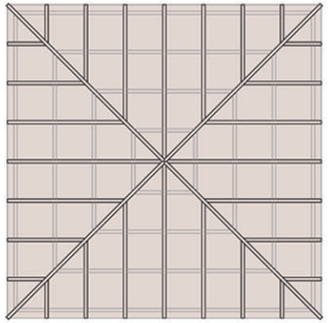
Emergency Shelter Timeline

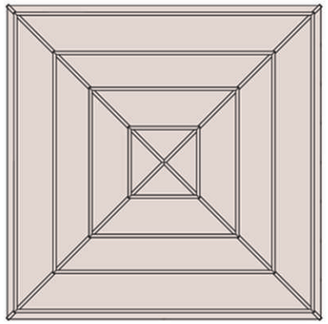

6 month Emergency Shelter

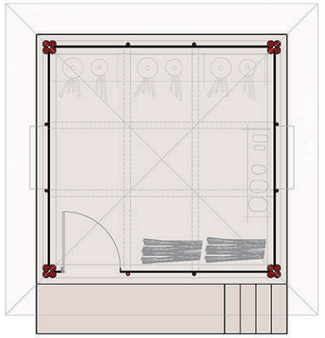

2-24 month Transitional Shelter


Long trem recovery permanent housing


One unit For 3 -4 Persons


Roof Plan




Kitchen

Design Consideration

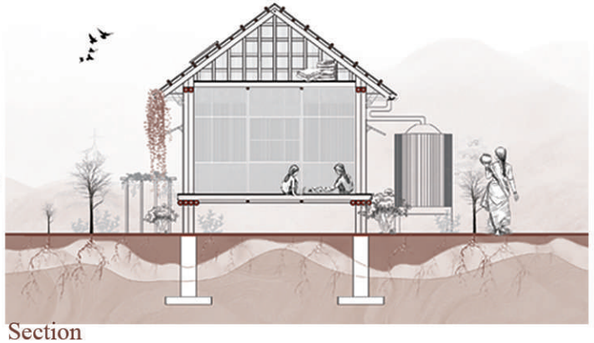

Shelter

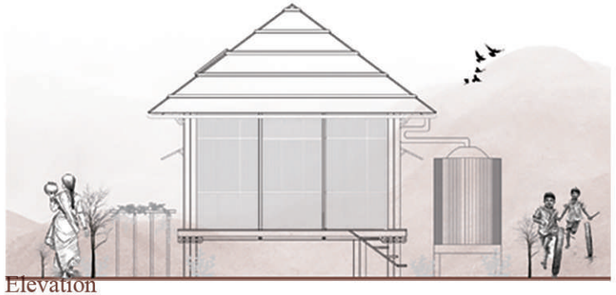

Food

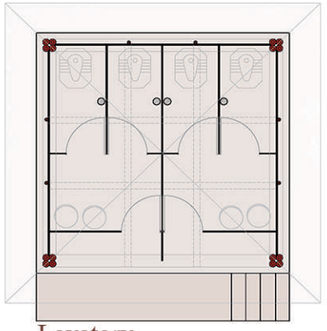

Human Basic needs

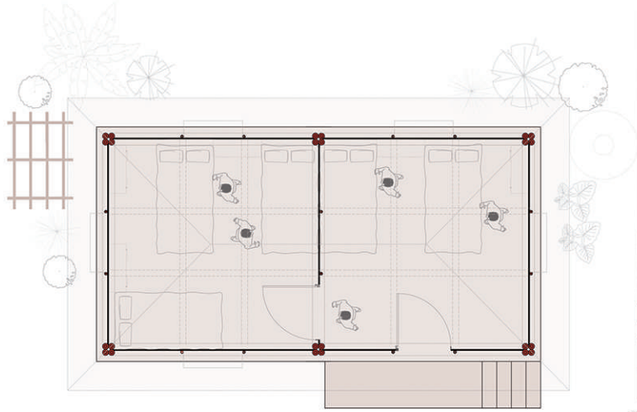

Water


Health

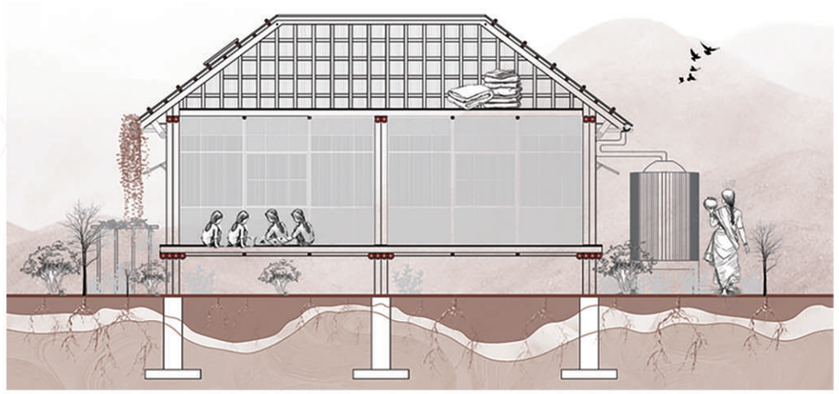

Section


Elevation

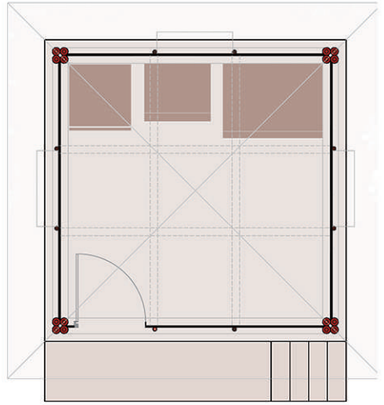

Lavatory



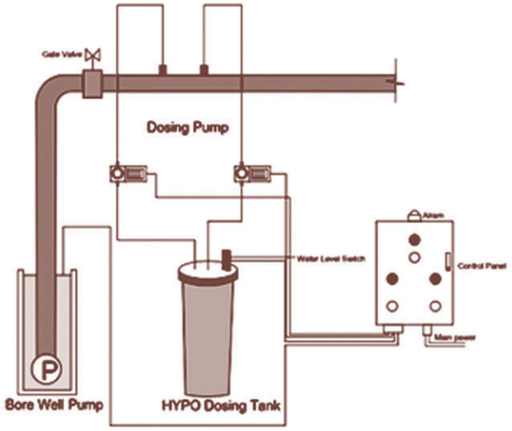
Merging 2 units to accommodate a large family of 5-6 persons



Module Section

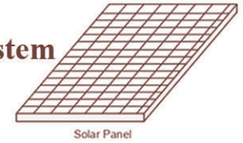


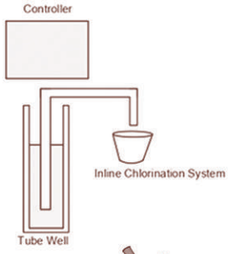
Water management

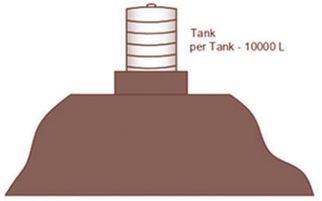


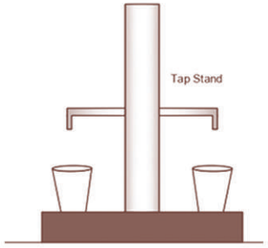
Day to Night Activity

Water management system

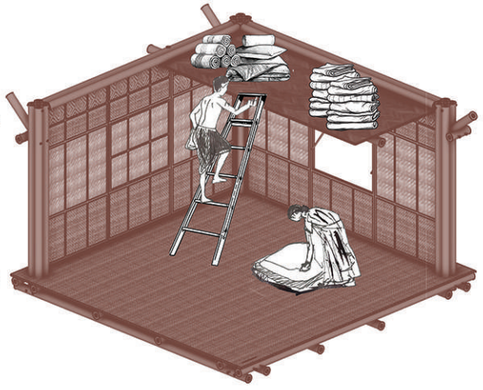








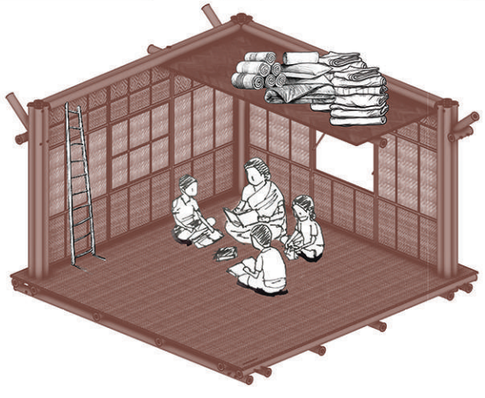
Night



Morning

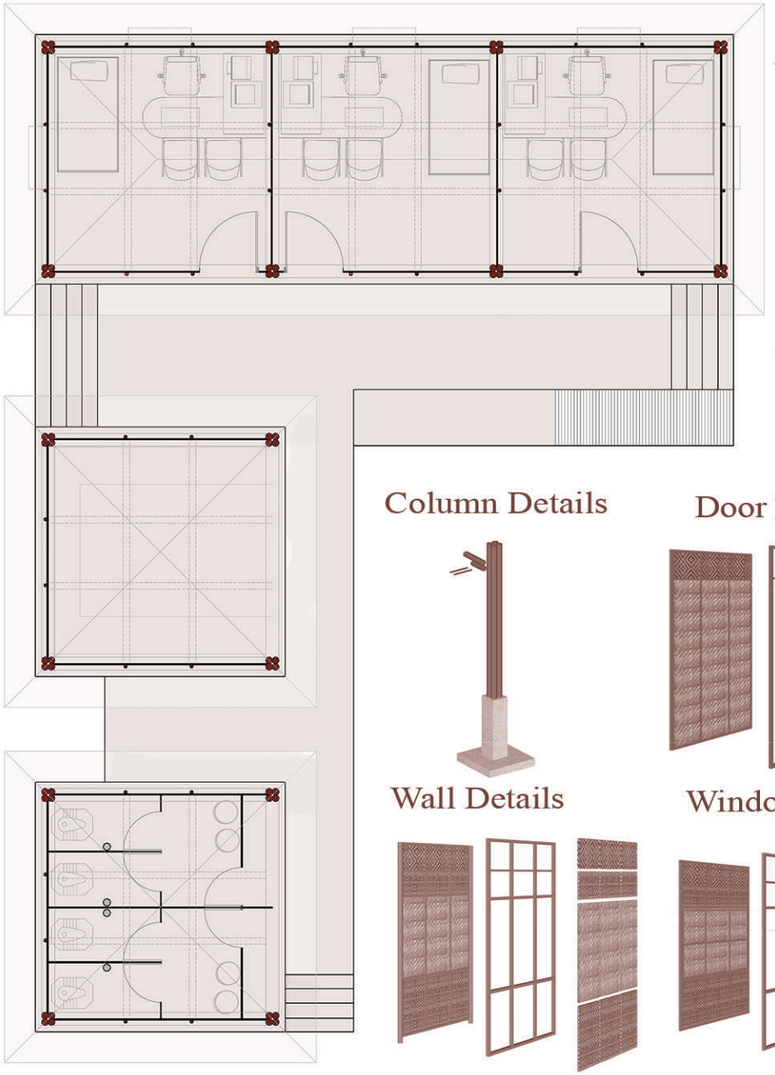
Day Time

Noon / Afternoon

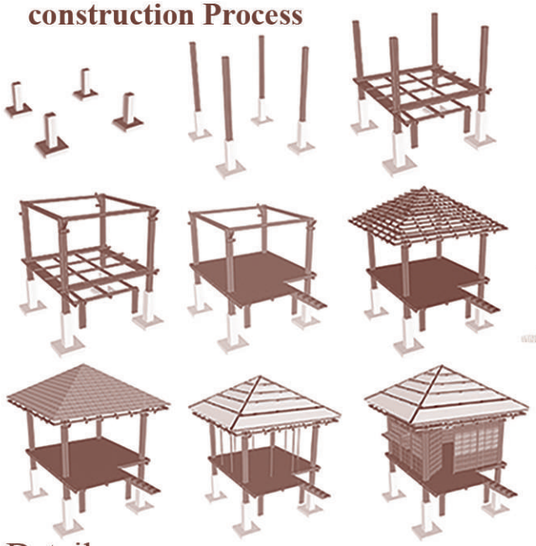


Evening

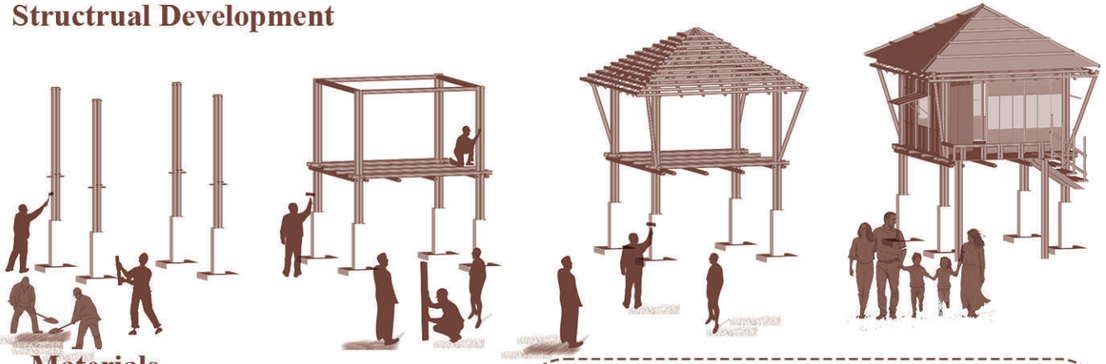
Healthcare Plan



construction Process



Structrual Development



Materials

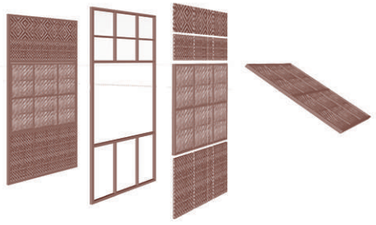
In this project Locally available materials are used: bamboo, bamboo sheets, terpal, and precast RCC footings. The RCC footings are precast, so they can be made in advance and used later; they are also reusable and can be relocated. I chose bamboo as the structural material because it is easily available in our country, grows rapidly, and has a low carbon footprint. It is also reusable. I used terpal because it can be reused and easily transported from one place to another.

Column Details

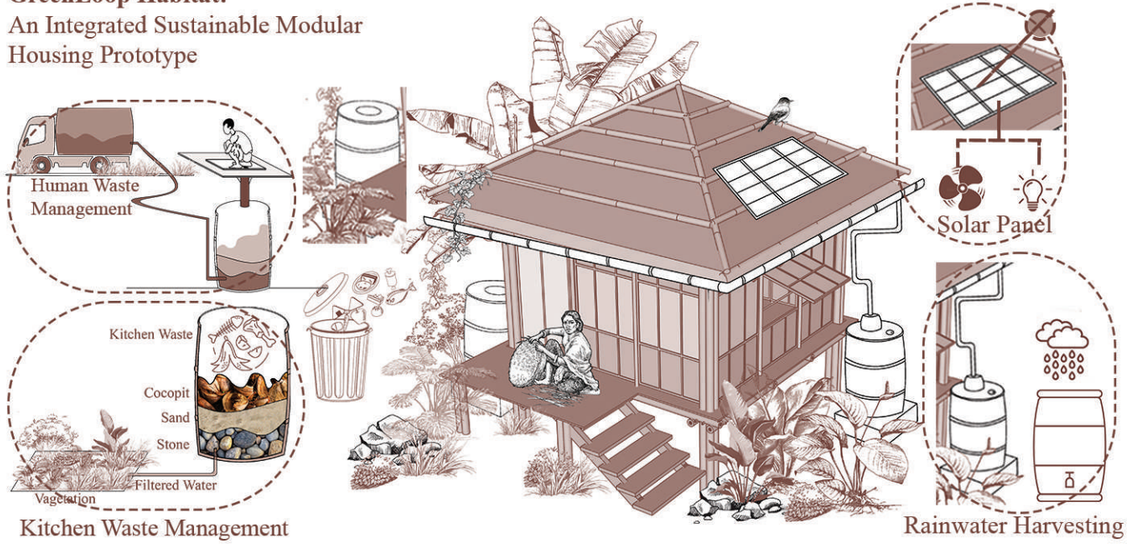
Door Details

Wall Details

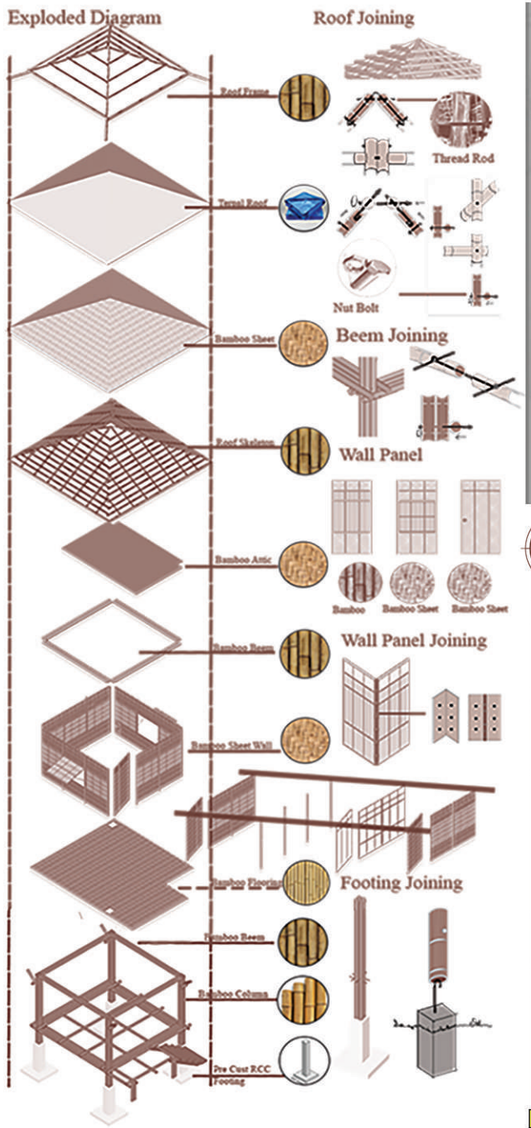
Window Details

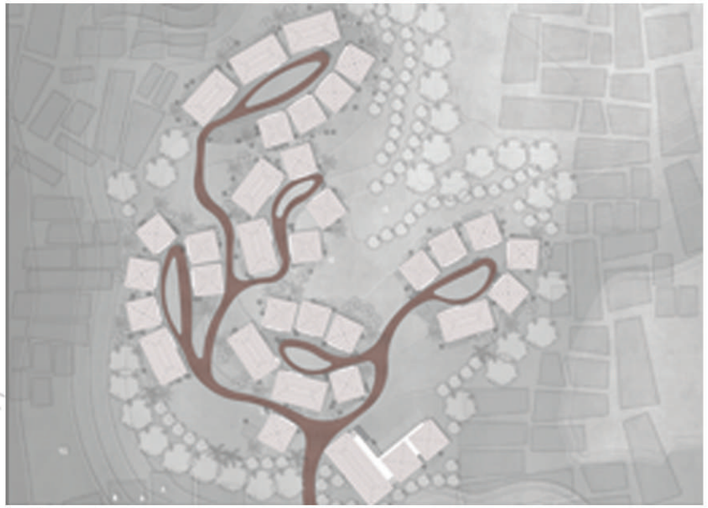


GreenLoop Habitat:
An Integrated Sustainable Modular Housing Prototype

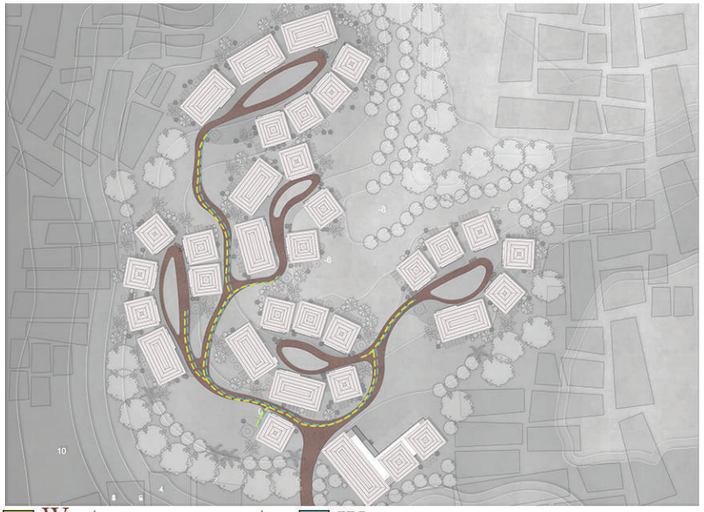


GI sheet are not use for the roof material instead of terpal, because once GI sheets are damaged, they have to be discarded. Terpal, on the other hand, can be reused for other purposes. Also, I did not use concrete or bricks as the structural material in place of bamboo, because concrete and bricks are very difficult to relocate and cannot be reused; they have to be broken down.

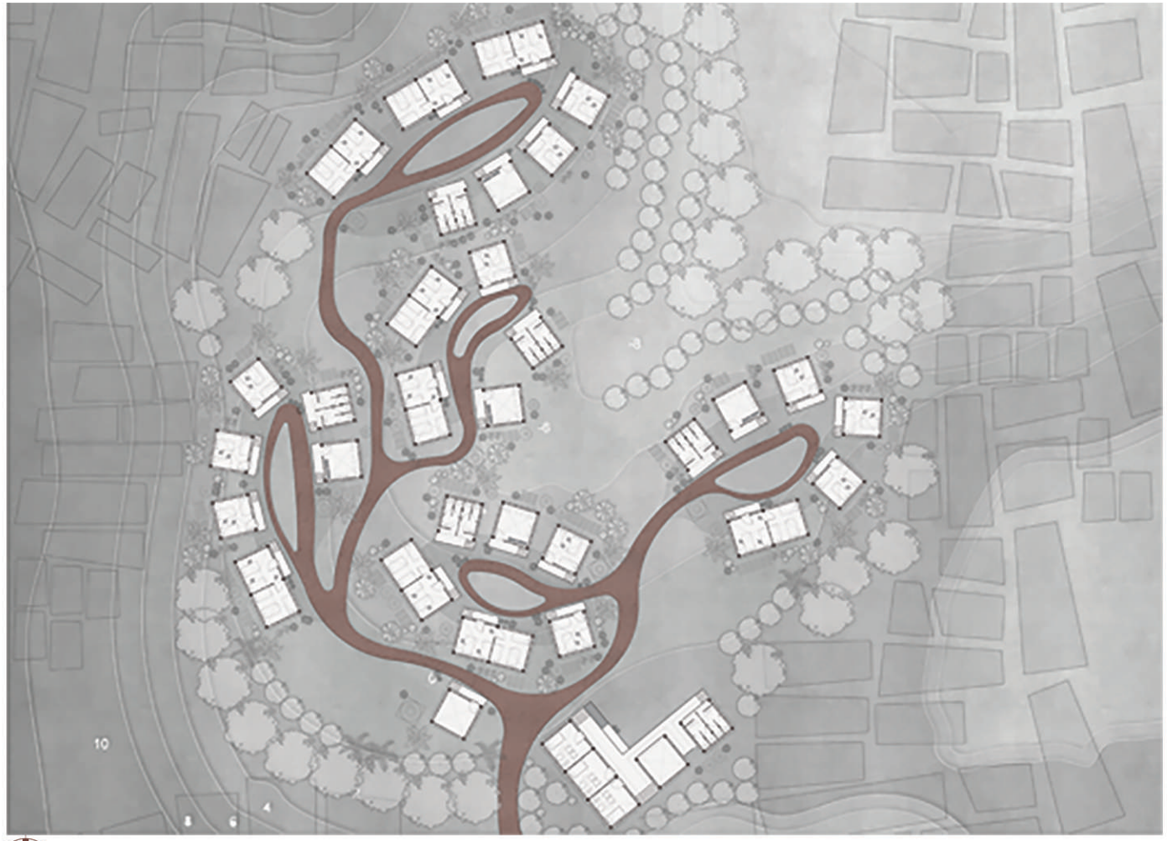




Ukhia Camp - e1Master plan

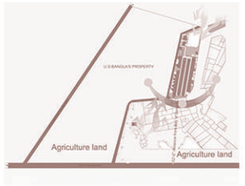


Waste management Water management



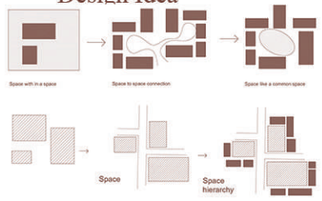
Ukhia Camp - e1Ground Floor plan

Site Analysis

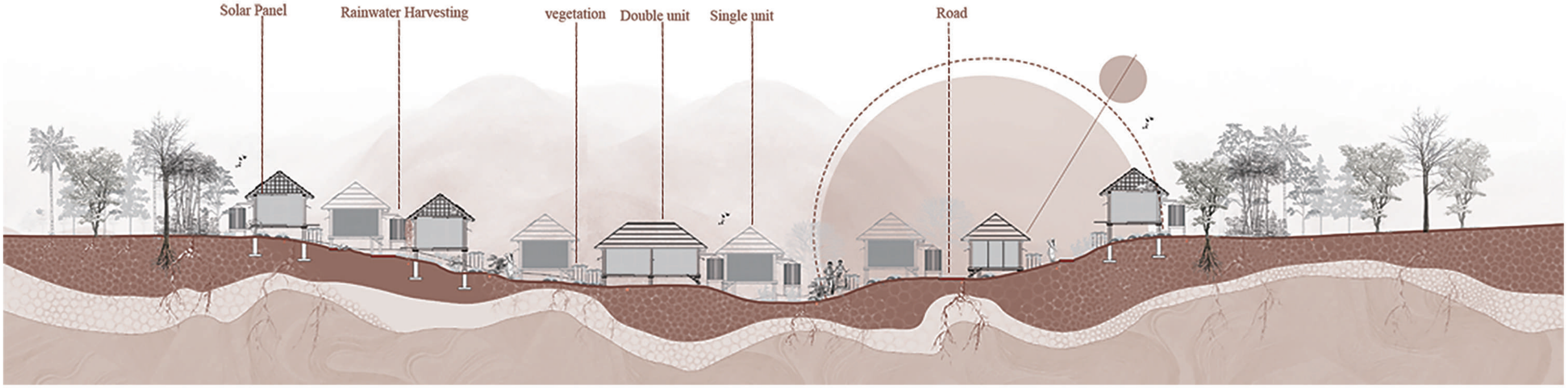


Location - Kuakata Orca Polli

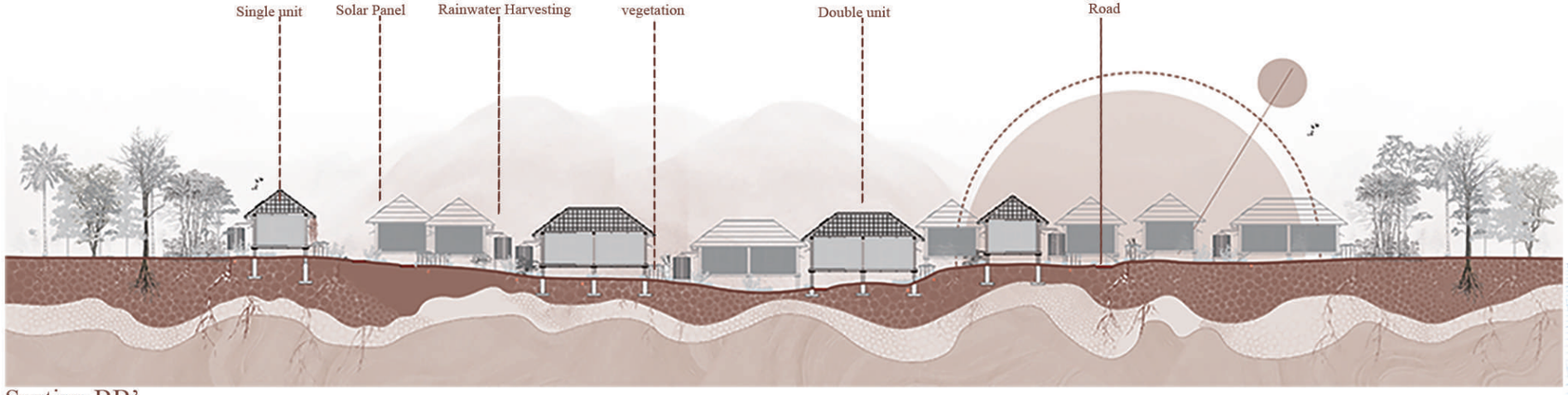
Design Idea



Cyclone Resistant

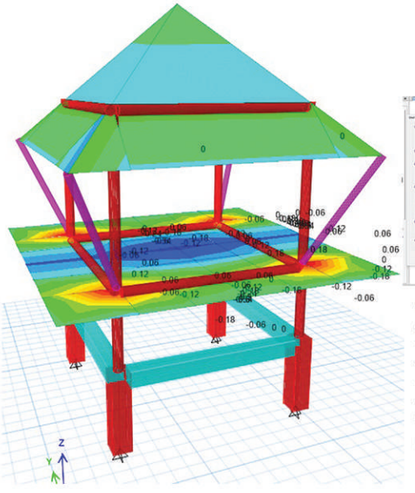


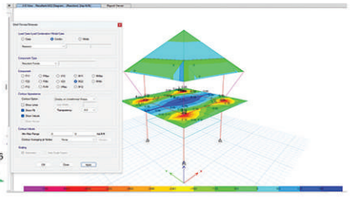
Section AA’



Section BB’

Simulation



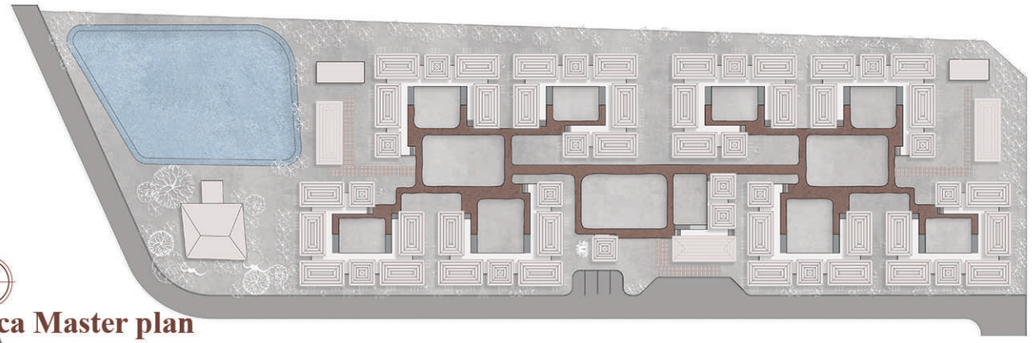


(Area-equivalent solid round sections)

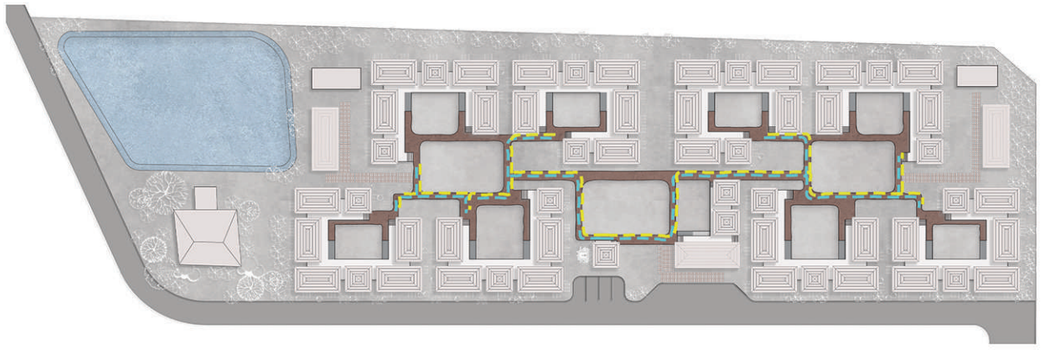
No. of Bamboo	Total Area $A = n A_1$ (mm²)	Equivalent Solid Diameter D_{eq} (mm)	Equivalent Inertia I (mm⁴)
1	6,050.71	87.75	2.90×10^6
2	12,101.42	124.04	18.39×10^6
3	18,152.13	151.95	32.90×10^6
4	24,202.83	175.55	46.62×10^6
5	30,253.54	196.15	73.04×10^6

Formulas used

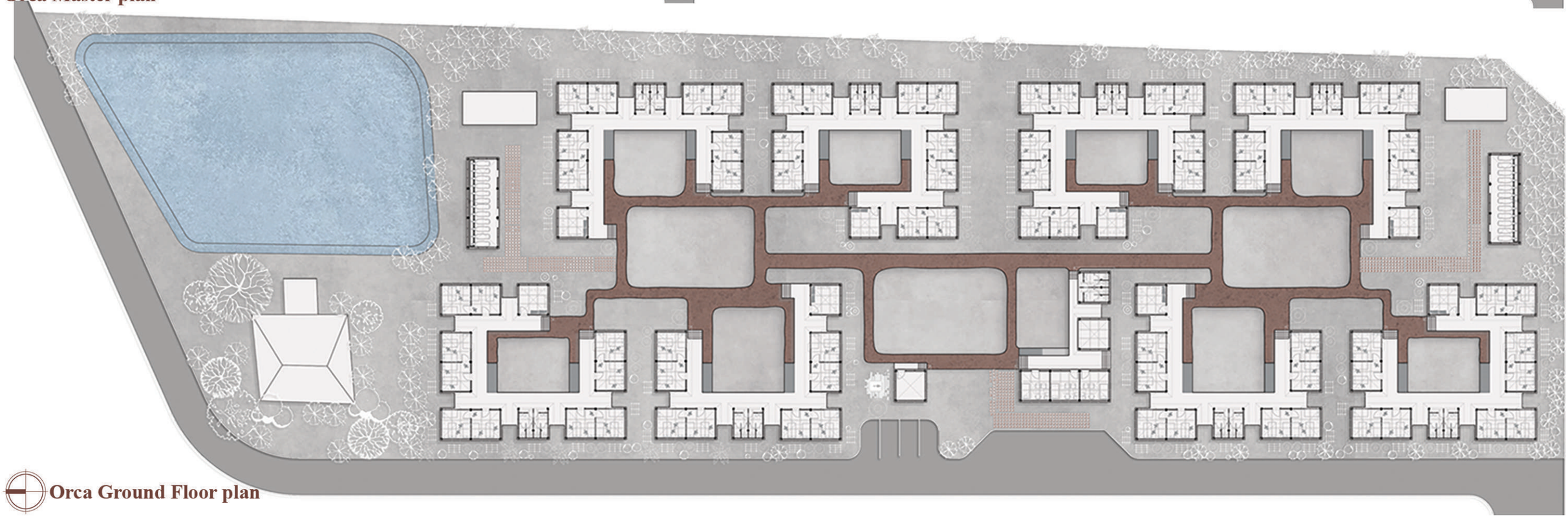
$$D_{eq} = \sqrt{\frac{4A}{\pi}}, \quad I = \frac{\pi}{64} D_{eq}^4$$



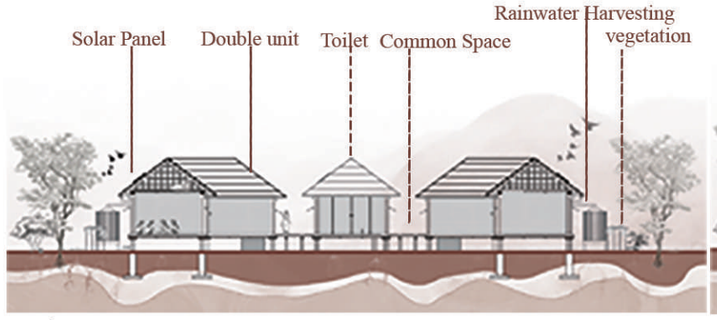
Waste management
Water management



Orca Master plan



Orca Ground Floor plan



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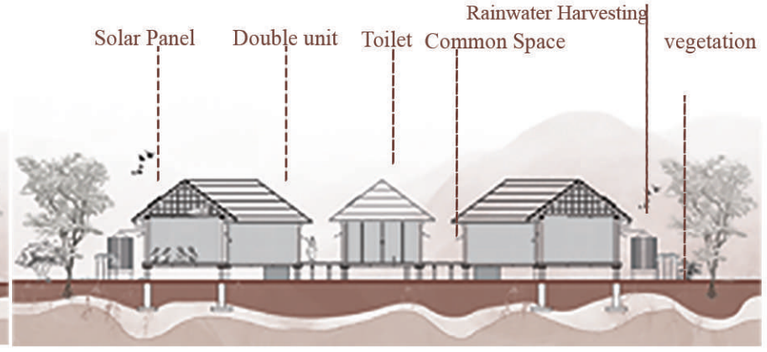

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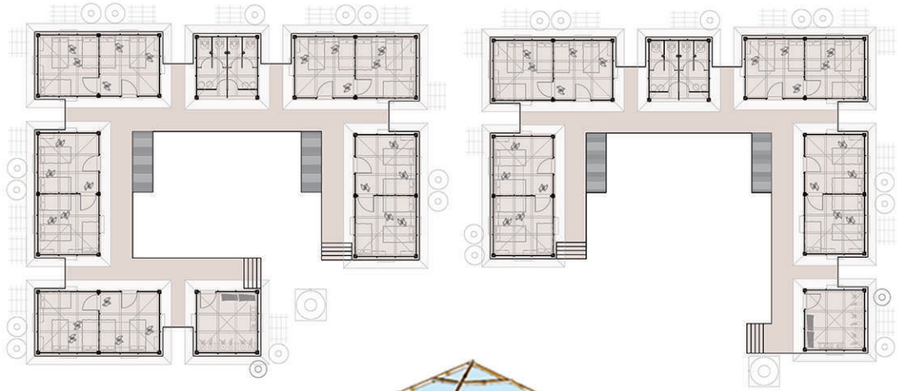

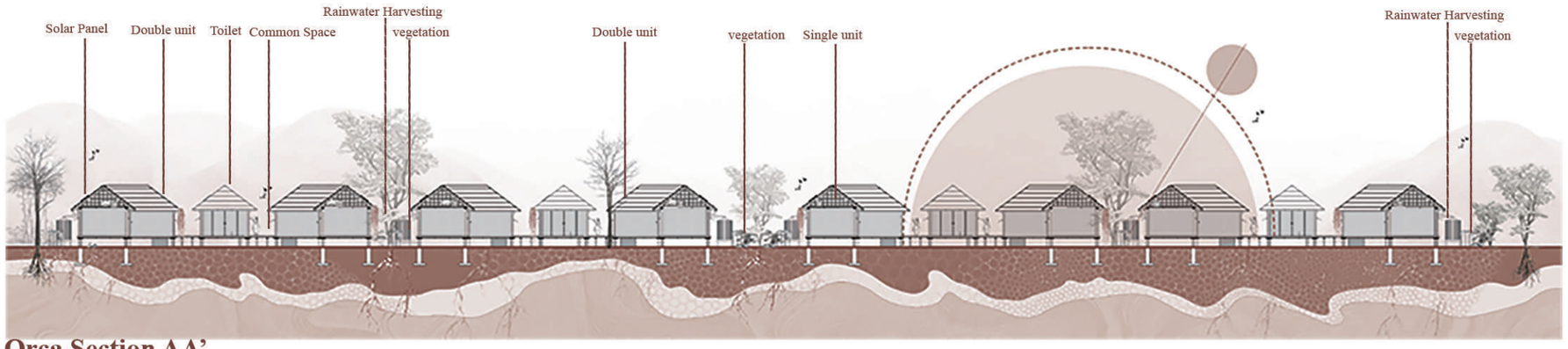

Orca Section AA'

Plan of a Cluster

Design Goals