VERNACULAR HABITATS: RETHINKING VERNACULAR TO COMBAT CLIMATE CHANGE
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(A Government of India Enterprise)

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Design ideas in this publication are compilation of award winning entries of HUDCO NASA Design Trophy competition 2022. The winners have been selected by a panel of jurors based on the information detailed in the presentation sheets and reports as provided by the participants. The publication has been compiled by NASA team.

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The Housing and Urban Development Corporation Ltd. (HUDCO) has since 1993 engaged in the conduct of design competitions for students of Architecture in collaboration with the National Association of the Students of Architecture (NASA), with the primary objective to sensitize and engage the students to contemporary challenges of sustainable development. Each year, the theme for the HUDCO NASA Design Trophy is chosen considering its relevance to the Indian context and aligning with the priorities of the Government of India programs in the urban development sector. In 2022, the theme chosen for the HUDCO NASA Design Trophy, providing the student community with a platform to showcase innovative and ingenious thinking to the complex challenges of rapid urbanization, was ‘Vernacular Habitats: Rethinking Vernacular to Combat Climate Change’.

Climate change impact is visible the world over in the form of changing weather patterns, rising sea levels, and extreme weather events which are disturbing the national economies and affecting lives. India too is witness to climate change issues like flash floods, droughts etc. and strongly believes that climate emergency requires to be addressed at all levels to save the lives and livelihoods of the inhabitants. Historically, India has not been a contributor to greenhouse gas emissions responsible for extreme climate changes, but, is committed to achieving Net Zero emissions by 2070, to avoid the catastrophic consequences of climate change, as also pledged at the UN Climate Change Conference COP 26 in Glasgow, United Kingdom.

To tackle the menace of climate change the Government of India under the leadership of Hon’ble PM Modi has walked the talk taking several initiatives placing climate change at the centre of its environmental policies which also get reflected in many of Gol launched programs such as National Clean Air Programme, Swachh Bharat Mission, National Mission on Sustainable Habitat, Ujjwala Yojana providing equitable energy access to the poor, PM KUSUM Scheme ensuring access to clean cooking fuel, promoting renewable energy with solar panels, standalone solar pumps & so on.

Talking of the built environment, buildings are the largest energy consumers and greenhouse gas emitters both in developed and developing countries. The construction industry generates an
estimated 39% of the world’s carbon emissions according to the World Green Building Council. With India making a ‘Net Zero’ commitment, there lies immense responsibility for the architecture industry to seek greener practices to reduce its carbon footprint.

Every region is known to have its unique identity with a climate base, responsive building design and knowledge in the form of vernacular architecture. As a concept, the term vernacular architecture is mainly known for its utilization of indigenous materials which are available in the nearby area, local labour and culture; and adheres to basic green architectural principles of energy-efficient materials and resources close to the site. By applying vernacular strategies to modern design, a structure can ideally achieve net zero energy use and be a wholly self-sufficient building. Accordingly, in the wake of the climate change crisis, recognizing well that vernacular architecture has a lot to say in respect of the use of materials in sustainable development and that green building is not limited to the products of modern society, HUDCO floated the theme “Vernacular Habitats: Rethinking Vernacular to Combat Climate Change” for the HUDCO-NASA Design Trophy 2022.

The theme received an enthusiastic response from the students of Architecture, and I would like to thank the participants of HUDCO NASA Design Trophy 2022 for engaging to seek innovative design interventions / innovative design solutions that address the sustenance of vernacular resources and settlements in the contemporary context. I am optimistic that these young students would become more sensitized professionals and would-be contributors to addressing urban housing issues on sustainable principles.

I congratulate the winners for all their endeavours and complement the efforts of the jury members, who painstakingly evaluated the entries and selected the winners. Last but not the least, I commend the HUDCO team’s efforts in the efficient conduct of the “HUDCO NASA Design Trophy-2022”, and for coming up with the compendium of the winning entries that are inclusive, flexible and adaptive, and shall ignite the imagination of others in the field. I am hopeful that this compilation will serve as enriching reference material for all involved in building sustainable design solutions for the underprivileged section of society.

M Nagaraj
Director (Corporate Planning)
HUDCO
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THEME: VERNACULAR HABITATS TO COMBAT CLIMATE CHANGE

CONTEXT

The world of architecture and design plays a massive role in determining the state of not only the natural environment but sustainable development as a whole. The buildings are one of the major contributors to Greenhouse gas emissions requiring concerted and coordinated efforts from all stakeholders to ensure the use of construction material that is environment-friendly and mitigates the effect of climate change. With India making a ‘Net Zero’ commitment, setting 2070 as its target year, there lies an opportunity for the architecture industry to seek greener practices to reduce its carbon footprint. As regards housing in India, to meet the housing deficit mainly concentrated in the economically weaker section of society, there have been advancements in terms of alternative design and building practices along with refreshed ways of thinking that are better at nurturing the natural environment. With the growing demand for shelter and related infrastructure for economically weaker sections (EWS) and lower-income groups (LIG), the Government of India (GOI) has been making resolute efforts to ensure ‘Affordable Housing for All’ through the ‘Pradhan Mantri Awas Yojna’ (PMAY). The GOI policy frameworks and the technological advancements in the construction industry consider/adopt green measures that are innovative, technologically advanced and have profound impacts in conserving the environment. Various EWS and LIG residential projects of the GOI have adopted such advancements, but despite several important steps towards a greener future, the approach adopted has been “selective”, as only the built housing through government agencies/developers suitably integrates the greener practices, new green technologies, advancements in building materials and techniques.

Challenges remain:
1) Around the adoption of these practices and advancements, by people and communities of the economically weaker sections of society, at remote scattered locations on account of either low awareness or/and constraints as regards availability and access to advanced tools and resources, maintenance and cost efficiency issues, and desired built quality.

2) Vernacular habitats, in the phase of the rapid globalization process, are seen to be changing with ever-changing practices and new cultures which may not cope with the ambient environment and reflect the uniqueness of each city/region and its people. An approach integrating successful vernacular approaches with modern design concepts (both material and techniques) is, therefore, required as part of renewed thinking to address the affordable housing issue while also combating Climate Change, thereby creating novel, sustainable, and resource-conscious solutions. The poorer segment of the society at the individual level is unable to afford these advancements to make the construction process greener. Designs based on sustainable principles using adaptive vernacular solutions promoting
local identities and cost-effective housing are needed to address/tackle both new and unsolved challenges in a way that generates mutual benefits and shared value for the poor people and nature combined, thus forming the basis of the theme for the HUDCO NASA Design Trophy 2022.

**DESIGN BRIEF**

In the wake of the climate change crisis, the Conference of Parties (COP) an apex decision-making body of the United Nations Framework Convention on Climate Change (UNFCCC), has recognized the need to strengthen knowledge, technologies, practices and efforts of local communities and indigenous peoples related to addressing and responding to climate change (https://unfccc.int/process-and-meetings/conferences/glasgow-climate-change-conference-october-november-2021/outcomes-of-the-glasgow-climate-change-conference). India, a diverse country both culturally and climatologically, has houses of indigenous people/local communities designed and constructed, influenced by a wide range of environmental, social, and economic issues at the local level. The approach required is to ensure a high degree of sustainability with no/meagre additional cost to the individuals in the lower-income segment, prioritize actions to make them compatible with available resources (local and/or new green materials) and capacity; recognize the important role of indigenous peoples and local communities, to address and respond to climate change.

Housing built using vernacular practices present a climate responsive approach to dwelling and are natural and resource-conscious solutions to a regional housing need. The relevance of vernacular architecture with the use of traditional and local construction methods and materials today, as also identified by the COP, becomes even more relevant for housing types having to deal with effective budget mechanisms, having limited resources and financial constraints. Under PMAY India has set a target of “Housing for All” by 2022. Through the Beneficiary-Led Construction (BLC) which is one of the verticals under Pradhan Mantri Awas Yojana-Urban (PMAY-U), the central government aims to address the housing shortage in urban areas of the country. The BLC focused projects, both for new constructions and enhancements, addressing the right to adequate housing for all urban poor, through self-help or otherwise, in the wake of inherent challenges, require structural changes/suitable response options to Climate Change. “One size” solutions will not fit all, and solutions will have to be found and implemented suited to taking into account the priorities of the locals, the requirements specific to the geoclimatic region, including enhancing the adaptive capacity of indigenous solutions and strengthening resilience. The design options, so generated by the Trophy participants, would serve as a repository of designs promoting local identities, cost-effective housing using adaptive vernacular solutions; which are simple, requiring indigenous skill sets, are easy to understand and can easily integrate with nature enabling optimum utility of space and flexibility.

**AIM**

The competition is looking to showcase new vernacular designs that are mutable, inventive and capable of self-renewal. The aim is to generate innovative housing design solutions for varied geo-climatic zones that address the sustenance of vernacular resources and design practices for affordable settlements in the contemporary context. Advocate vernacular architecture based on the geographical location, climatological and resources in the proximity, conducive to local communities and create an identity to the habitat remaining rooted to the soil.
OBJECTIVE

Against the tide of a global trend in urbanization, the turnaround of a settlement towards traditional habitats is possible through a systematic intervention.
The objective, therefore, is to:

• Integrate vernacular approaches with modern design concepts to create novel, sustainable, and economic solutions.
• Arrive at proposals based on sustainable principles using adaptive vernacular solutions, beneficiary participation, using materials in the vicinity and indigenous techniques offering rational solutions to the climate and human needs.

DESIGN PARAMETERS

1. Identification of geo-climatic region, state and city
2. Identification of alternatives for house design based on climate, drought conditions and also seismic zones and establishing a decision matrix with parameters such as:
   a) Technical feasibility
   b) Financial feasibility
   c) Environmental feasibility
   d) Social acceptability
3. Design options (2 NOs) for a house of total carpet area of 30sqm (spread at single / two levels ie both single and double-storeyed construction as at times the available area of land with individuals of EWS may not permit the building of such minimum size of the house as per NBC at one level) suitable for the specific geo-climatic zone using and environmentally friendly, new green materials and technologies. The design should promote/provide an architectural, social and cost-effective solution to the shelter needs suitable for the geo-climatic zone.
4. Apply vernacular strategies to modern architectural design to adhere to basic green principles of energy efficiency and materials utilization such that the output includes natural ventilation, cooling and heating, daylight and shading devices, and functional facade, making it a useful reference for all stakeholders in the built environment.
5. Prioritise a zero-waste approach through:
   • Innovation, using local/new green materials and adaptive vernacular solutions
   • Use of low-carbon alternatives to minimize cost and environmental impacts.
   • Flexibility and modularity in design
   • Use of reused and reusable materials
   • Ecological practices built in to the design scheme, viz. Wastewater harvesting, Low cost/Green/Renewable energy option
NAVIKR
Reviving Roots; Revisiting Memories
Z212 IPS Academy School of Architecture, Indore

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INTRODUCTION

- Address the housing deficit in the country in a sustainable manner
- Reviving vernacular styles is essential to restore ecological balance of our habitats
- Alternative pathways to reduce building emissions need to be explored

BRIEF INTERPRETATION

Guiding Aims –
- India’s aim to achieve ‘Net Zero’ emissions by 2070
- PMAY’s target to resolve the housing deficit among the Economically Weak Sections of the society required design approach.
- Represents the virtues of a sustainable, vernacular design, other amenities offered by modern design.
- Prioritizing cost-effective solutions

OBJECTIVE

- Focus attention towards the development of traditional habitats
- Ensure beneficiary participation in the entire design process
- Make efficient use of local materials, skill and knowledge

WHOM

Rural/ Urban Poor – PMAY beneficiaries that fall under the categories of EWS and LIG

WHERE

Kath Kuni village, Uttarakhand, India
WHY KOTI BANAL?

Koti Banal emerged as the perfect site because it is supported by a strong presence of vernacular architecture. As the style is an integral part of the local culture, beneficiaries will be awarded with a sense of familiarity and comfort as it responds greatly to the region's climate.

- Fly in the Valleys
- Explore the local delicacies
- Fairs and festivals like Lavi fair trade etc.
- Architectural heritage

SWOT

- Inaccessibility
- Unexpected landslides and avalanches
- Cold temperature
- Lack of vegetation

- Increasing tourism
- Trade fairs
- Appointing Labour

- Habitat loss
- Human-Wildlife conflict
- Climate change

RURAL DWELLINGS

Existing dwellings are oriented for maximum solar heat gain, as is the approach for designing buildings in cold climates. Kath Kun homes have created their indigenous style of sun-space/solarium by using the balcony on the First Floor.

CONTOURS

Traditionally, vernacular buildings are designed along the contour to reduce site development work, i.e., cutting and filling of slopes.

VEGETATION

The site has a rocky terrain and poor vegetation, hence presents us with ample flexibility to think of innovative designs.

PATH WAYS

Connecting path ways create great accessibility to the users and lack of proper management of roads being a major problem in concerning with climatic factors.

SITE

Given that Koti Banal lies in a highly seismically vulnerable region, a massive solid platform at the base of our structure helps to keep the centre of gravity & centre of mass in close proximity and near the ground. Thus, this minimizes the overturning effect of our structures during seismic loads.
Jaunsar-Bawar Region a valley, spread over 1002 km² and 398 villages.

The river Yamuna at east and the river Tons in the west. Plan area extends not more than 1 or 2 acres. The entire region is composed of small fragmented lands, used for agricultural activities.

**MATERIALS**
Deodar wood is abundant.
One of the important aspects of architecture in the area is the wooden carvings and the slate laden gabled roofs.

Houses are usually built in stone and timber and roofed with slate tiles.

The traditional craft is weaving. Like painting, wood carving, jewellery making, candle making, decorative temples and of course performing arts like music and dance.

Most prominent craft is wood carving, + the fine-arts -including the Miniature Paintings and Aipan & Peeth. A lot of geometric patterns, ‘Gervi’ and rice paste.

Even though Amma has lived a life of scarcity, she recognizes how traditional homes provide inhabitants with a sufficient access to natural resources.

Typical house will have 2-3 floors. Upper levels = less stone and more wood. Structure is broader, which integrates a cantilevered balcony on all sides of the house. Open balconies allow dwellers to soak heat during the day. The lower floors are narrower, and without windows. The interiors are plastered with mud for insulation purposes, and cement or RCC is strictly avoided. The house only absorbs heat, and radiates it in the evening. The air gaps between stone and wood diffuse the seismic force and prevent any cracks.

LIFESTYLE AND DAILY WORKING HABITS:

- Agriculture and animal husbandry
- Milk, wool and meat are an integral part of the local economy.

Spending a hot summer day at the field, she always wished to have a go-to-space, something like a balcony, that would radiate gentle heat and intake a cool breeze, offering her a chance to spend some leisure time after a hard day at work.
ETERNITY

A representation of the region’s catastrophic earthquakes, this timeline showcases their devastating consequences, but the emotional destruction that happens beyond the lens is an inescapable burden natives are impelled to live with.

CONCEPT

Local culture empowers local talent as residents and neighbours build Kath Kuni homes themselves.

Our design concept encompasses a thoughtful blend of two vernacular architectural styles – Kath Kuni and Bhutanese Architecture.

Aiming to develop designs that are both Earthquake Resistant and Visually Appealing, a detailed analysis of the vernacular styles suggests that:

- Kath Kuni’s core building blocks help structures sustain seismic tremors
- Bhutanese Architecture’s vibrant decorative motifs reflect the common man’s daily life
- Both styles embody local and natural building materials hence are remarkably sustainable

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First Floor (Taenthok)

Living Room (Yuelkha)

Kitchen (Thabsang)

Bedroom

Front Elevation

Left Elevation

Right Elevation

Back Elevation

Section

Section AA'

Section BB'

Key Plan

Typical Lingo Payab

Typical Rabsel

Typical Jadhang Tazi

Eaves are ornamented with dangling fringes which sway with the slightest breeze
CONSTRUCTION TECHNIQUES

CONNECTION CORNERS
- Lap Joint
- Inner Blocking Pads: Straight
- Adding Wedge Shaped Blocking Pads
- Adding Diagonal Timber Boards

CONNECTION WALLS
- Tenon and Mortise Joint
- 6" Nails for Main Frame
- 1/10" Straps
- 1.5" Board
- Blocking Pad
- Connection of Timber Boards Inside and Outside to the Joint

INTERMEDIATE FLOOR
- Blocking Boards
- Connecting Upper Timberboards and Lower Wall Plate with Nails

FOUNDATION
- Plinth Formation
- Infill Consisting of Broken Clay Bricks and Flat Stones Packed with Wire Mesh and Mud Plaster
- Timber Framing and Infill in First Floor Walls
- Placement of Shed Roof Truss
- Final Dwelling

GOOD:
- 3/4 stone, 1/4 mud, stone flakes

RAIN BOARD
- Flat Roof

Citation | (Z212) IPS Academy's School of Architecture | 12 NASA
Wooden Shingles:
Wood shingles are thin, tapered pieces of wood primarily used to cover roofs and walls of buildings to protect them from the weather.

Stone Infill:
Dhajji Dewani is a timber frame with stone and earth infill, typically used in the mountain regions of South Asia.

Deodar wood:
Deodar is in great demand as building material because of its durability, rot-resistant character and fine, close grain, which is capable of taking a high polish.

Slate Stone:
Slate is a fine-grained, foliated, homogeneous metamorphic rock derived from an original shale-type sedimentary rock composed of clay or volcanic ash through low-grade regional metamorphism.

Timber-cedar:
Timber is often considered to be the most sustainable building material within the construction industry. With a low embodied carbon footprint,

Teak wood:
Teak’s high oil content, high tensile strength and tight grain make it particularly suitable where weather resistance is desired.

Cast Iron:
Cast iron is an incredibly sustainable material, mainly down to the fact that it can be recycled without losing its properties or any of its quality. It doesn’t rust in the normal way – it slowly oxidizes.
Upon its completion, Amma names her beloved home as 'नवीकृ' (naviṣkṛ), a word with Sanskrit roots, it means 'to revive'.

She attributes this choice to the thoughtful amalgamation of vernacular and modern design. Reflecting on her involvement in the design process, she says it helped her to realize the style’s true value.

When asked about how she likes her new home, she says that it has been very pleasant. She appreciates the planning of dedicated spaces, the optimum level of thermal comfort, and mentions that the structure’s sturdy feel has provided her with a renewed sense of security. Fond of painting herself, the vibrant Bhutanese aesthetic is her favourite feature. In a sprightly mood, she acclaims how the beauty of this house represents the fulfilment of her life’s purpose.
“My work is not about “form follows function”, but “form follows beauty” or, even better, “form follows feminine”.”

- Oscar Niemeyer
Z214 Faculty of Architecture, SCET, Surat

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Hetvi Pancholi
Maria Rangwala
Meet Panchal
Nimit Makwana
Priya Sapariya
Vishvam Patel
Nilesh Hadiyal
SYNTHESIS - Anchoring Traditions through Resilience Vision

The congregation of three important factors of **affordability**, **sustainability** and **liveability** that define the scenario of the housing sector envisages a development consisting of the amalgamation of **modern-day technology** with the vernacular traditions of the past. It proposes a **framework** connecting all the parameters in consideration to **lifestyle** of the various user groups.

Maslow's Hierarchy of Needs & Affordable Housing

Maslow's Pyramid provides the base for studying the various needs of users. The classification of parameters generates an insight upon understanding the relation between people and their housing environment through the fulfillment of both **tangible** as well as **intangible** needs.

Housing Crisis

The rising **population** in various urban contexts of the country highlight the major concerns developing in the **housing sector**. Migration of communities in search of work pose a challenge for the concerned authorities in providing adequate facilities to the targeted user group with the **shortage of housing** in the current scenario, people ought to be caught in the vicious cycle of **urbanization**.

Demographics

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**Growth of Urban Population**

**Source**: World Migration Report - UNHCR

**Distribution of Urban Housing Shortage**

**Source**: New Pittsburgh Courier

Sustainability

**Greener Practices**

**Renewable Strategy**

**Onsite Generation**

**Adapting Technical Advancements**

**Resilient Architecture**

**Protecting Environmental Condition**

**Energy Efficiency**

**Enhancing Lifestyle**

**Reusable and Recyclable Materials**

**Site Map**

**Stakeholder Mapping**

**Objectives**

**Community**

**Health**

**Essential**

**Financial**

**Development Sector**

**End Users**

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PMAY-U

Pradhan Mantri Awas Yojana-Urban (PMAY-U), is a flagship mission which addresses urban housing shortage among EWS, LIG and MIG category ensuring pucca house to eligible candidates. Several main stakeholders play an important role in implementation and success of PMAY-U. The scheme is hence further divided into four verticals.

Four Verticals of PMAY (U)

- **Beneficiary Led Construction:** BLC assists an individual eligible EWS family to construct their new house or to enhance existing house.
- **Affordable Housing Partnership (AHP):** AHP provides financial help to EWS house built in partnership with state/UT/cities including private sector and industries.
- **In Situ Slum Redevelopment:** ISSR provides Rs. 1 lakh per house to eligible slums for redevelopment projects with participation of private developers.
- **Credit Linked Subsidy Scheme (CLSS):** CLSS offers home loans at reduced EMIs with help of interest subsidy to EWS, LIG & MIG category.

Geo-Climatic Zones of India

The states of India are classified into different geo-climatic zones according to the variations in temperatures. The north-east region falls under the tropical monsoon climate, prone to floods.
Glance At Assam: Land of Blue Hills

Assam - ‘a peerless land’, is a gateway to the North East India. adorned with the vibrant landscape and hillocks, it bears a testimony of rich cultural heritage through its temples, monuments, and torrential Brahmaputra River.

Topography of Assam

The state has three major physical regions:

1. Brahmaputra River valley in the North.
2. Barak River Valley in the south.
3. The hilly region between Meghalaya and Nagaland in the South-central part.

Demographics

Why Assam?

Climate Change

The temperature varied from 1.7°C to 27.5°C between the years 1970 to 2030.
Rainfall variation: 940mm TO 1330mm

Disaster

Located in the eastern -most projection of the Indian Plate that makes the state prone to earthquakes. All the rivers in Assam are subjected to floods, because they receive bursts of heavy rainfall in a short amount of time.

Climatic Conditions

It is divided climatically on the basis of topography, seasonal precipitation and temperature changes.

Assam’s climate is classified as:
- Tropical monsoon rainforest
- High humidity
- Heavy rainfall
Aspects Addressing The Issues

**INTANGIBLE ASPECTS:**
- User comfort:
  - User oriented spaces
  - Privacy inclusive
  - Social acceptability
  - Storage spaces
- Easy adaptability:
  - Similarity in perception of current space
  - Understanding of house and surroundings
- Space efficiency:
  - Modularity in design fixtures
  - Fluidity between spaces
  - Pragmatic organisation
- Increase in social interaction:
  - Contextual integration
  - Forming liminal spaces
  - Integrating inside with outside

**VERNACULAR APPROACH:**
- Participatory design:
  - Traditional construction techniques
  - Reviving the lost indigenous identity
- Sustainable design:
  - Adopting ecological practices
  - Energy efficient practices
- Resource optimization:
  - Utilizing locally available materials
  - Optimizing operational and maintenance practices

**TANGIBLE ASPECTS:**
- Standardised level of living:
  - Ventilation & daylight
  - Security
  - Basic services
  - Solar geometry
- Resilient structure:
  - Maintaining integrity of the physical envelope
  - Resistance against various natural forces
- Financial feasibility:
  - Integrating government practices
  - Procuring materials from vicinity

**ANGIKAAR Campaign:**
Angikaar campaign was launched to mobilise communities for changed management through awareness as an approach towards conversation and sanitation.
- Waste management
- Water conservation
- Healthcare facilities & much more

**INDIAN HOUSING FEDERATION (IHF):**
Enables access to housing for low income communities by collaborating with various stakeholders along the entire housing value chain to bridge the gaps in the sector.

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Citation 2 | (Z214) Faculty of Architecture, SCET, Surat | 20
Conceptualization

The aim is to adopt a pragmatic approach that involves the local community and their traditional practices in designing a prototype to satisfy the standards of living. It paves the way for achieving user comfort by optimizing locally available materials and climate-responsive elements.

Why Beneficiary Led Construction (BLC)?

BLC referred as Beneficiary Led Construction caters flexible and affordable housing needs. Big idea behind the scheme is to rehabilitate the beneficiaries instead of relocating them. By providing basic municipal amenities, it improves their quality of life. It also maintains track of the construction progress, making it more favourable.

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DESIGN MODULE 1

A grounded structure comprising of all the basic amenities as stated in the norms of BLC houses. The proposed design fulfills all the basic standards of life of an urban poor by incorporating pragmatic organization of spaces.

Spacial Organization

Spatial arrangement follows a generic model of interconnections with the kitchen positioned in the centre and livable spaces arranged in and around it.

Hypothetical Site

The site selected has a plot size of 105.6 sqm, 45-50% of which occupies the ground coverage of the structure built. Being situated in the north-east of India, true north is considered accordingly.

Materials

- Agrocrete
- Wooden
- Bamboo
- Lime Mortar
- Lime

Climatic Response

- High Plinth for protection during flood situations.
- Eaves providing shaded underneath space.
- Openings for cross-ventilation
- Opening via sloping roof exhales hot air from top

Generic Analysis

1271
635
430
10

SECTION AA'
DESIGN MODULE 2

The proposed ground + 1 structure fulfills all the basic needs required for a standardized living. With a fluid spatial arrangement the design offers varied experiences with the addition of a floor and the subsequent play of light through the sloping roofs.

Spacial Organization

Interaction between different spaces has been carried out in quite an organized manner with primary focus on the segregation between private and public spaces.

Hypothetical Site

The design is adaptable for any of the site conditions prevailing in the north-east region. The site selected has a plot size of 81.6 sqm, 45-50% of which occupies the ground coverage of the structure built.

Exploded View

Climatic Response

The openings between the slopes keep the internal spaces lit, and extend roof prevents rain from penetrating inside.

Bamboo keeps the heat and moisture out due to its tendency to resist energy transmission.

Multiple internal levels help phasal flooding of water.

Generic Analysis

Custom Solar (Whirl)
Provisions to tackle natural calamities

**STEP 1:** Being situated in a flood prone region the design provides provision for safety during floods. Built on a hollow plinth also reduces chances of structural failure.

**STEP 2:** When the flood level reaches a considerable height above plinth, the structure opens up and the occupants can climb a level up to mezzanine and ensure their safety.

Indigenous Skill Sets

Giving importance to indigenous skills and narrowing employment gaps in a way that respects and reflects indigenous people.

Conclusions

User oriented process allows the design to respond according to the requisites of occupant.

Spatial planning that allows for ideal interaction in between spaces.

A climatically adaptable design that stands firmly in any part of the north-east region.

A mutable design that alters its arrangement according to the function of the spaces.
### Ground Structure Costing

<table>
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<tr>
<th>Construction Phases</th>
<th>Level of Construction</th>
<th>Material Specification</th>
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### Annual Income Distribution of EWS

**Before**
- Non-Refundable Investment: 25%
- Refundable Investment: 15%
- Savings: 60%

**After**
- Non-Refundable Investment: 15%
- Refundable Investment: 5%
- Savings: 80%

**Net Non-Refundable Investment**
- Before: 15%
- After: 5%

**Overall Savings of the Proposed Design**
- Efficient than current scenario
- 33% of funds generated are spent on construction
- 20% of the funds utilized
- 100% savings
- **Total Savings**: $259,137.52

** HUDCO NASA DESIGN TROPHY | 2021-2022 | 25 **
Net Zero Energy: Building Back Greener

Net zero aims at achieving a balance between the greenhouse gases put into the atmosphere and those taken out. It requires operationalization in varied social, physical and economical spheres.

Impact Analysis

Urban poors categorised as the low income groups of a region possess a fair share in being the financial progressors of the country. The proposed design intervenes to revive the identity of the concerned user groups by enhancing their lifestyle. Implementing participatory approach and integrating housing sector with their customs and traditions.

Reanalyze

The first step towards net zero includes the detailed analysis of the prevailing conditions and arriving at basic conclusions.

Revise

Adaptability: the integration of modern technology in design provides an opportunity for the users to adaptively learn the process and implement it in future, whenever needed.

Redesign

Environmental aspect: a sustainable design that proposes a net zero commitment to overcome the challenge of environmental degradation.

Co-housing: an environment built in to create spaces that act as a mode for interaction among the residents establishing a sense of neighbourhood.

Financial aspect: A collaborative approach integrating the stakeholders with government schemes to maintain the overall economic growth of the housing sector.
“Architecture should speak of it’s time and place, but yearn for timelessness.”

- Frank Gehry
Z205 Maulana Azad National Institute of Technology, Bhopal

Team Members

Ronak Mittal
Yusuf Saifee
Shivam Poddar
Atul Tiwari
Bhavna Banjare
Divyansh Singh
Harsh Prajapat
Metta Lokesh
Muskan Mehra
Rajababu Dhakad
Pushpita Patel
Sneha Kaushal
Ashfaque Salahudeen
Aarsh Churhe

Aditya Sharma
Arjita Shrivastava
Gouri Rathore
Kankanala Dhatri
Diptangshu Mondal
Goutham Raju
Mansi Yadav
Meenu Chawda
Niyas Ch.
Poorva Lele
Ritika Biswas
Sachin Verma
Mohammed Shehzad
Y. Jhashwant Reddy
SITE LOCATION
Location - Kolkata, West Bengal, India

The Gangetic region of West Bengal is one of the fastest developing regions containing dense population with high counts of homelessness.

West Bengal lies in a hot and humid climatic region. West Bengal (88,752 km²) is the only Indian state that extends from the Himalaya to the Bay of Bengal. It can be divided into nine physiographic provinces.

WHY WEST BENGAL?
West Bengal has the least number of housing schemes aimed at the economically weaker sections of the society as compared to other states.

West Bengal has comparatively the most diverse range of vernacular architectural styles with a long legacy of cultural heritage.

West Bengal has had the maximum number of instances in the past, and is highly prone to future calamities.

The state of West Bengal has maximum urban housing shortage.

WHY KOLKATA?

DEVELOPING NOT DEVELOPED
Despite recent development Kolkata is yet to become a sustainable and inclusive city.

ECONOMIC DISPARITY
Extremely unequal and segregated distribution of opportunities.

OVERPOPULATED MEGACITY
Because of the huge influx of cross-border migration, the city has transformed into a premature metropolis.

URBAN MOBILITY / EXPLOITING FOR MOBILITY
Being a polycentric city, Kolkata has been struggling due to an escalating vehicular population.

SAFETY AND RESILIENCE
Kolkata has a dangerously congested residential layout and narrow roads.

UNPLANNED ORGANIC DEVELOPMENT
The city sprawled combustly in all directions, especially in the south and west, across and the Ganges.

EXTREME URBANIZATION
Land use and land cover are changing rapidly impacting the natural resources and surface

INFERENCES
West Bengal has the least number of housing schemes aimed at the economically weaker sections of the society as compared to other states.

West Bengal has comparatively the most diverse range of vernacular architectural styles with a long legacy of cultural heritage.

West Bengal has had the maximum number of instances in the past, and is highly prone to future calamities.

The state of West Bengal has maximum urban housing shortage.
LAND USE EVOLUTION

- The core of the city has experienced negative growth.
- Land use and land cover change analysis revealed that the built-up area has increased drastically over the study periods.
- The agricultural land and open land have transformed into built-up areas, indicating the sprawl growth within the Kolkata urban agglomeration.
- The overall result shows that urban expansion of Kolkata urban agglomeration is not compact in nature and it is an evidence of concentration of sprawl growth of the municipalities.

CLIMATE

Kolkata has a Tropical wet-and-dry climate. The annual mean temperature is 26.8 °C. Summers are hot and humid. Winter tends to last for only about two and a half months, with seasonal lows dipping to 9 °C – 11 °C between December and January.

SOIL TYPE

The soil of West Bengal is broadly divided into four types - Mountain soils, Alluvial soils, Red soils, and Saline soils.

DISASTERS

- Geologically Kolkata falls within Moderate Earthquake Damage Risk Zone (Zone-III) within very close vicinity of High Earthquake Damage Risk Zone (Zone-IV) of North and South 24 Parganas districts.
- Kolkata, the densely populated eastern metropolis of India, has been ranked seventh in a global assessment of natural disaster risk.
- With the Bay of Bengal a mere 180km away, Kolkata is vulnerable to widespread destruction from storms hitting the coast.
- The same area falls under Very High Wind and Cyclone Damage Risk Zone also.

STRENGTH

- Blend of architectural styles
- Fast developing city

WEAKNESS

- High homeless population
- High population to area ratio

OPPORTUNITIES

- Scope for further housing development
- Blend of vernacular and disaster responsive design possible

THREATS

- Reduction in green cover
- Disaster prone region
WHAT IS EWS?
Economically Weaker Section (EWS) in India is a subcategory of people belonging to the Economy Based Un-Reserved Category having an annual family income less than 8 lakh rupees and who do not belong to any category such as SC/ST/OBC across India.

PRESENT EWS STATISTICS

Metropolitans Developed villages Less developed villages Urban

DEMographics

HOUSING STATISTICS

CULTURE
West Bengal has a long tradition of popular literature, music and drama largely based on Bengali folklore and Hindu epics and puranas. Kolkata, the capital of West Bengal is also called the cultural capital of India as it was the birthplace of many Indian literary and artists who made Bengal the face of progress and culture in India.

FESTIVALS
Durga Puja is the biggest festival in Bengal and is the most vibrant festival throughout the state. Temporary pandals are raised everywhere to worship goddess Durga.

VERNACULARITY
The basic form of dwellings is in the form of a cluster around a central courtyard space. The permeable wall is emphasised by the verandahs, terrace and semi enclosures, creating an ambiguity from inside and outside.

• The most pervasive architectural presence in Bengal is the “pavilion” structure. Choushala, atchala, gacher ghor, basher ghor, tiner ghor, are various names categorised on the basis of material of house and form and planning of house.
MAJOR ISSUES OF EWS HOUSING

Accessibility Constraints
Lack of facilities for the people who are physically incapable of performing some functions.

Cultural Inadequacy
Current schemes fail to sanction funds for scope of development in light of expression of cultural identity and diversity.

Inadequate Financial Facilities
Lack of fiscal incentives to encourage the housing sector in general.

Scarcity of Developed Land
Land is available in suburbs, increasing the traveling cost to the city, thereby creating a new issue.

STRUCTURAL CONSTRAINTS

Accessible to only cheap & toxic materials
Plaster is peeling from the walls, railings are gone, brickwork is falling apart.

Ventilation
Lack of properly planned openings for adequate cross-ventilation results in proper air flow.

Thermal comfort
Lack of thermal planning like heat island effect results in rooms heating up unnaturally during summers.

PSYCHOLOGICAL MATRIX

Haven't heard of them
10%

What are your views on eco-friendly construction materials & techniques?
20%

Heard of them, but financial constraint
70%

Have you benefited from the affordable housing policies set up by the government?

9%
No

53%
Heard of it

38%
Yes

WHAT THEY NEED?

Incremental growth

Security and Surveillance

Affordability

Low Maintenance

Eco Friendly Materials

Special Mention  |  (Z205) MNIT, Bhopal  | 32
ALOK BAKSHI, 36: “We have been renting this apartment on Belgachia street for a couple of years now. During the rains, we experience long durations of power cuts and roof leaks. Even after many complaints, there has been no response from the owners and our condition has worsened.”

ANJANA BISWAS, 42: “The lockdown and cyclone had already made it difficult to arrange water cans from the market. We are ready to shell double the amount for water cans but nobody is willing to come to our apartment fearing the risk of virus spreading.”

CASE STUDY 1

LINUS KENDALL AND RUPSANATH’S HOUSE IN BARUIPUR VERNACULAR

A unique house with a blend of Vernacular & Modern Architecture despite being made from mud, bamboo & straw survived cyclone Amphan.

DISASTER RESPONSIVE FEATURES
- EARTHQUAKE PROOF - strong beams from locally procured materials that support the pillars; can withstand major tremors.
- THICK THATCHED ROOF - lasts 10 years

CASE STUDY 2

LOCATION: Jagacha, Howrah, West Bengal

BUILDING: bricks of clay, lime, Indian patent

MATERIALS: stone, wood, iron beams, brass

CONCLUSION
- It has a great blend of colonial vernacular architecture and modern architectural styles.
- Numerous climate responsive characteristics are used efficiently.
EARTHQUAKE NORMS

- Unsymmetrical geometry shows heavy damage as compared to the symmetric axis of geometry. Interlocking grooves, cross-faces, and "L" posts incorporate the unique geometry of the stones to improve the wall integrity.
- Wooden frame, adobe, rammed earth and masonry constructions are typically found in seismically active areas.

METHOD OF ANALYSIS

Concrete quality
The min grade for structural concrete is M-20 (20 N/mm²). For all buildings which are more than four storey in height in Zones IV and V, the 3min grade should be M-25.

FOUNDATION

Strip footing with RC band of 100 mm thick is to be provided.
Doors and windows jams vertical reinforcement corners are provided from ground beam.

WALLING

The exterior brick walls are provided with horizontal and vertical reinforcing bars. The height of the building is considered to be 3000 mm.

TECHNIQUES BANDS

Lintel bands are placed across the wall of the building.
RC Bands of steel with iron rods necessary for the adequate anchoring.

CONCEPT

Unsusceptible To Calamities:
The chosen region - Kolkata - is reputed for having endured disasters in several aspects in the past. Taking this into account, every part of the design from the form up to the materials-these homes could survive through any kind of disturbances - natural or manmade.

Epousing the Weak:
The design was made, keeping in mind the concern for their financial hardships and thus, the lack of functional and comfortable homes. This mainly includes the utility of low cost yet durable construction materials.

Green Collar Ideology:
Apart from providing homes for the needy, the structures’ impact in the long run should also be pondered over.
TYPOLGY I
PROPOSAL
The unit is designed keeping in mind the basic needs of a EWS housing unit with the essence of the vernacular architecture prevailing in the respective region. The living room acting as the base point connects all the major regions of the house. The kitchen, lobby, bedroom and the verandah open to the living room space.

UNIT PLAN
TYPE- 1

SECTION XX'

SECTION YY'

GROUND FLOOR

<table>
<thead>
<tr>
<th>Room</th>
<th>Area (SQ.M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living Hall</td>
<td>10</td>
</tr>
<tr>
<td>Bedroom</td>
<td>8.42</td>
</tr>
<tr>
<td>Bathroom</td>
<td>2.9</td>
</tr>
<tr>
<td>Kitchen</td>
<td>3.7</td>
</tr>
<tr>
<td>Circulation</td>
<td>4.5</td>
</tr>
<tr>
<td>Wash Basin</td>
<td>0.63</td>
</tr>
<tr>
<td>Verandah</td>
<td>4.95</td>
</tr>
<tr>
<td>Wind Tower</td>
<td>0.8</td>
</tr>
<tr>
<td>Wash Area</td>
<td>2.64</td>
</tr>
</tbody>
</table>

LIVING AREA 10 SQ.M
KITCHEN 3.7 SQ.M
BEDROOM 8.42 SQ.M
BATHROOM 2.9 SQ.M

HUDCO NASA DESIGN TROPHY | 2021-2022 | 35
TYPOLOGY 2
PROPOSAL
The unit is designed for plots where ground coverage of 30 sqm is not possible. The living room space acts as the base point connecting the kitchen, lobby, and verandah on the ground floor and the lobby does the same for first floor connecting bedroom and the terrace.

GROUND FLOOR
<table>
<thead>
<tr>
<th>Room</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living Hall</td>
<td>10 sqm</td>
</tr>
<tr>
<td>Bathroom</td>
<td>2.9 sqm</td>
</tr>
<tr>
<td>Kitchen</td>
<td>3.9 sqm</td>
</tr>
<tr>
<td>Verandah</td>
<td>3.93 sqm</td>
</tr>
<tr>
<td>Wind Tower</td>
<td>0.8 sqm</td>
</tr>
<tr>
<td>Wash Area</td>
<td>2 sqm</td>
</tr>
</tbody>
</table>

FIRST FLOOR
<table>
<thead>
<tr>
<th>Room</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bedroom</td>
<td>8.3 sqm</td>
</tr>
<tr>
<td>Balcony</td>
<td>2.78 sqm</td>
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<tr>
<td>Terrace</td>
<td>10.6 sqm</td>
</tr>
<tr>
<td>Circulation</td>
<td>4 sqm</td>
</tr>
</tbody>
</table>

KITCHEN 3.7 SQ.M  BEDROOM 8.3 SQ.M  BATHROOM 2.9 SQ.M  BALCONY 2.78 SQ.M
VERNACULAR ELEMENTS

WIND TOWER
To give a sense of courtyard skylight is provided in the limited area project also serving the purpose of wind tower.

DOORS
Wooden doors with tilted louvres running horizontally to provide reflected sunlight and air ventilation.

RAILING
Traditionally designed railings have been provided in the balcony and the terrace.

LOUVERS
Horizontal louvres at the top of the balcony act as shade and also gives direction to the wind thus catalyzing natural ventilation.

TECHNIQUES

HOME BIOGAS
It is a self assembled biogas system that turns kitchen waste and livestock manure into usable cooking gas and liquid fertilizer. The system produces clean cooking gas up to 3hrs/day.

EARTH AIR TUNNELS
Earth tunnels help with air ventilation in the form of air-to-subsoil heat exchange. In this, pipes are buried in the ground, which acquires the same temperature as the surrounding earth at its surface, so the air ventilated through the tunnel gets cooler in the summer and hotter in the winter.

CONFINED MASONRY BUILDING CONSTRUCTION
Confined masonry construction is a better alternative to ‘Minimally reinforced masonry’ especially in earthquake prone areas.
## Materials

- Terrazzo in-situ flooring and tiles
- Fly ash bricks
- Broken China mosaic terracing
- Ferrocement
- Recycled plastic doors
- Rattan plant
- Low cost
- Recycle
- Sustainable
- Eco-friendly
- Cement made out of recycled plastic

### Costing for Typology: 01

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Rate/Unit</th>
<th>Quantity</th>
<th>Unit</th>
<th>Amount</th>
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</thead>
<tbody>
<tr>
<td>Structure</td>
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<td>10.80</td>
<td>Cu.m</td>
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<tr>
<td>Paint</td>
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<td>8.5</td>
<td>44.8</td>
<td>Sq.m</td>
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<td>44.8</td>
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<tr>
<td>Windows</td>
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<td>5100.00</td>
<td>6</td>
<td>Piece</td>
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<td>Stone Dust Slab</td>
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<td>Sq.m</td>
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<td>Windows</td>
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<td>6</td>
<td>Piece</td>
<td>30,600.00</td>
</tr>
<tr>
<td>Kitchen Slab</td>
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<td>Sq.m</td>
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<td></td>
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<td><strong>300,932.00</strong></td>
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### Future Scope

Our design dwells upon the holistic approach for the development of underprivileged sections of the city, and helps them heighten their independence in all aspects.

It also focuses on preserving nature and its resources for the future generation.
“Our tools cannot become our masters and should not rule our lives.”
- B. V. Doshi
SPECIAL MENTION

Z122 Amity School of Architecture and Planning, Noida

Team Members

Asvin Tandon
Shreya Jindal
Shreya Keshwani
Aakash Dhankhar
Anshika Rastogi
Anushka Khare
Akant Gupta
Harshita Choudhary
Aditya Balwant
Rishabh Jain

Aisha Tahir
Dev Nagarkoti
Sawan Negi
Aashni Choudhary
Lewanisa Pyrbot
Ujjwal Kapoor
Ishika Khurana
Dimple
Aarya Sharma
- India's urban housing issue/problem gets compound (acute) due to congestion; lack of tenure security, and inadequate basic services in existing informal housing. Alongside regional diversity, one single module cannot be designed to cater to the needs of all the people.

- Jorhat is a fast-growing city of Assam where a lot of rural people are migrating to the city for employment in industries. The population of the city is increasing at an alarming rate and affordable housing is a concern.

- The city prone to flood and earthquake demands disaster-resilient strategies which are currently lacking in the structures.

- The research shows that EWS housing is successful when it is designed according to the people involved and caters to their needs. The typical EWS layout does not take into account the basic needs of people living in Jorhat. The space division of EWS is not sufficient and doesn’t fit with their lifestyle.

- The vernacular of Assam state has been developed with respect to the climate and floods that it faces. The technique and local materials are being forgotten leading to damage to infrastructure and increasing costs.
CONCEPT

Analysing the geo-climatic region, it was found that some people prefer to stay on stilts while some on ground floor, lest the location demands the unit on stilts because of severe flood conditions.

Therefore, we proposed 2 options, one house completely on stilts while the other unit partially on ground and partially on stilts.

Stilt is provided so that the flow of water during flood is not obstructed. In the duplex unit, it is planned such that upper portion can be used and be independent during flood.

The Concept was to develop a Unit plan which functions independently and when brought together forms a cluster where all the units open to a central green space which encourages interaction and social gathering among people.

Developing on the vernacular to have a formal front of the house and a rear informal courtyard, the units have been planned such that they are independent yet in a cluster in which rear of unit opens to informal central courtyard.

Unit Zoning

Unit has been planned to segregate the public, semi-public and private zones.
For unit of this size, the idea was to provide clean functional spaces which are not hindered by door leaf, corridor etc.
WC is kept on rear veranda to separate it as desired by the local community.

Cross ventilation is provided in every space with windows and ventilators on opposite walls and varying heights.

Various planning decisions like considering the toilet and bathroom as separate units and placement of these units detached from the main house were outcomes of the vernacular residential spatial planning study.

---

Proximity Chart

FRONT VERANDHA
LIVING ROOM
BEDROOM
KITCHEN
WC
BATH
REAR VERANDHA

Cross Ventilation
INTRODUCTION

Vernacular architecture has been around for ages and is characterized by the use of local material, adaptability to context, and climate. In the current rapid developing world, their evolution has somewhat reached a standstill due to urbanization. Thus the brief indulges us to select a region, explore its vernacular architecture, adapt them with the help of modern technology to develop housing units for the economically weaker section.

The North-Eastern region of India, being prone to many types of natural calamities, uses building construction techniques that prove to be resilient to disasters. This type of construction uses lightweight materials such as bamboo, ikra (a locally available reed), wood, etc which prove to be extremely effective against earthquake events. Unfortunately, these houses are becoming extinct with the advancement in technology.

IKRA HOUSE

Houses are built with lightweight locally available materials like bamboo, wooden planks, thatch, etc. Proper system of bamboo/wooden beam-column that fulfill the earthquake safety requirements of rectangularity and simplicity.

Single-storey structures consisting of brick or stone masonry walls up to about 1 m above the plinth. This masonry supports the walls consisting of bamboo woven together with a wooden frame, and plastered with cement or mud plaster.

MUD HOUSE

Mud is a mixture of water and some combination of soil, silt and clay. The typical plan dimensions of these buildings are: lengths between 5 and 10 meters, and widths between 3 and 5 meters. The building has 1 to 2 storey(s). The typical span of the roofing/flooming system is 3-4 meters.

Roughly, the ratio of the length and width of the house can be expressed as 3:2 or 2:1

BAMBOO HOUSE

In the bamboo housing system, the main structural member bamboo is used. The brick wall is used for modelling. And it is rigidly connected with plinth as well as with bamboo. In this system, the wall is made of bamboo strips and it is plastered with mud. The houses are detailed out to combat the heavy monsoons. The roof of the house is built of local grass and can last up to 10 years before it is replaced again. The stilted part of the house is for protection against gentle floods. Bamboo houses are saving the lives of hundreds of people in inundated areas of Assam.

CHANG HOUSE

This house on raised stilts is an age old structure originating in the Himalayan ranges. In North Eastern India the tribes living on houses on stilts mainly live in hills amongst thick vegetation, forest and by the banks of rivers.

Traditionally people of the Mishing community of Assam live in houses on stilts; these houses with the flight of 5-7 stairs, have religious and social beliefs and practices attached to it. The house on stilts is a big hall with a central kitchen for a large joint family.
Jorhat Justification

Jorhat is situated on the banks of River Bhogdoi, a tributary of the Brahmaputra is the “Cultural Capital of Assam”. It is second largest city in Assam after Guwahati. Jorhat is considered as a major commercial and business hub of Assam with ever increasing numbers of malls, hotels and restaurants and educational institutes. Tea plantations are the main agricultural areas around the city. The world’s largest river Island, Majuli is located in Jorhat district. The city of Jorhat is 314 km from Guwahati by National Highway 37. Jorhat has grown into a thriving city with strong sense of character and identity.

Disaster Prone Area

Assam is a multi-hazard state prone to floods, earthquake, storms, and landslide besides man made disasters. Every year flooding and riverbank erosion cause devastating impacts. Riverbank erosion is a serious problem in Assam leading to the displacement of people due to the disappearance of villages year after year.

Apart from houses and livestock being washed away by floodwater, bridges, railway tracks, and roads are also damaged by the calamity, which causes communication breakdown in many places.

Continued deforestation and demand for more and more agricultural land has also led to the destabilization of hill slopes which during the monsoons come down as landslides.
SINGLE FLOOR UNIT

PLAN

Bedroom
4.05M x 2.9M
Area: 11.75 SQM
Bedroom is an important space, large enough to accommodate a double bed, wardrobe and small sitting.

Kitchen + Dining
2.85M x 3M
Area: 8.57 SQM
Kitchen is designed to accommodate sink, stove and fridge in triangular function. The dining table just opposite to kitchen can be folded upwards.

Living Room
2.85M x 3M
Area: 8.57 SQM
The living room is the largest space to facilitate gatherings. It accommodates sofa, center table and cabinets and seating couch.

WC
1.1M x 1.5M
Area: 1.65 SQM
WC is planned on verandah to keep it separate from the main living areas.

Bath
1.1M x 1.5M
Area: 1.65 SQM
Bathroom is planned close to WC and separate component so that both functions can be used separately.
DUPLEX UNIT

Living Room
3.1M x 2.0M
Area: 6.2 SQM
The living room is the largest space to facilitate gatherings. It accommodates sofa, center table and cabinets and seating couch.

PLAN
GROUND FLOOR PLAN

WC
1.1M x 1.5M
Area: 1.65 SQM
WC is planned on verandahs to keep it separate from the main living areas.

Bath
1.1M x 1.5M
Area: 1.65 SQM
Bathroom is planned close to WC and separate component so that both functions can be used separately.

Lounge + Dining
3.2M x 2.0M
Area: 6.4 SQM
Lounge area is in front of kitchen, which can also be used as dining space.

FIRST FLOOR PLAN

Kitchen
1.6M x 1.7M
Area: 2.72 SQM
Kitchen is designed to accommodate sink, stove on L counter.

Bedroom
3.1M x 3.26M
Area: 10.10 SQM
Bedroom is an important space, large enough to accommodate a double bed, wardrobe and small sitting.

FRONT ELEVATION

REAR ELEVATION

SECTION AA'

SECTION BB'

Special Mention 2 | (Z122) Amity School of Architecture & Planning, Noida | 46
Cluster Planning

Cluster planning ensures the actual sense of Assamese settlement pattern, self-sufficiency in the community even during natural calamities.

Both the shared and private open spaces in the design would initiate and increase social interaction between communities, maintaining the essence of small indigenous settlements.

Mirror placement of units in the design ensures the true indigenous rural community character and settlement pattern and cost efficiency by shared walls.

Narrow street-like openings between the units in the cluster would create a venturi effect, improving the unit’s individual and cluster’s overall ventilation.

Shared open space provides an adaptable recreational area acting as a habitat for livestock, community-based activities etc.

Despite being in a cluster every unit has two entries, where one ensures the user’s privacy and independent functionality and the second ensures community social interactions.

Different orientation of every external wall opening in units ensures both external and internal views of the area.
Material used in the project:

**BAMBOO**
- Bamboo has been used as columns and beams.
- Waterproofing of stilts has been done by a coat of rubber oil.

**BAMBOO RAFTER**
- Roof rafters and purlins are made of bamboo supporting the covering above.

**BAMBOO WALL**
- Bamboo along with nylori sheet (waterproof) is used for wall.

**BAMBOO MESH**
- Fine bamboo strips forming a mesh is used to make flooring.

**CGI SHEET**
- GI Sheets used for roofing over bamboo rafters.
Cluster Planning

TRADITIONAL METHOD + MODERN TECHNIQUE → OUTCOME

- Raw Bamboo material
- Typical Shift (Chang House)
- Raw Bamboo material
- Typical Vernacular Gable Roof

- PVC Sheet
- Cross Bracing
- CGI Sheet
- Stack Effect Technique

- Waterproof Bamboo wall (Bamboo treated with Borc acid)
- Bamboo Reinforced Concrete with Cross Bracing (earthquake resistant foundation)
- Durable Roofing with Bamboo rafters and CGI roof covering (with 3 bolts)
- Vernacular House with formal front space and rear courtyard planning

- Tradition of placing toilet completely outside the house
- Modern planning of placing toilet inside the house
- Placing toilet on verandha for convenience and respecting the tradition
- Butterfly roof with cross ventilation by varying sill heights of opposite wall windows
- Efficient Planning of Units
- All units placed in cluster with formal front of the house and centralized informal courtyard for all units collectively.

Solid Waste Management

Dry Waste Composter-Vermicomposting
The compost holds dry leaves and wet waste from the site and converts waste into manure in period of 3-4 weeks. It improves soil structure, aeration, internal drainage and water holding ability.

Effective waste segregation
Firstly segregated, wet waste can be used to make manure, which can be sold.

Decision Matrix

<table>
<thead>
<tr>
<th>TECHNICAL FEASIBILITY</th>
<th>ENVIRONMENTAL FEASIBILITY</th>
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<tbody>
<tr>
<td>Use of local construction material and techniques.</td>
<td>Wide usage of bamboo, easily grown natural element.</td>
</tr>
<tr>
<td>Simple geometric floor plans, easing the assembly by users themselves.</td>
<td>Significant reduction of carbon footprints during and after construction.</td>
</tr>
<tr>
<td>Familiarity of materials used in unit by users, ensuring better maintenance.</td>
<td>No pollution due to construction process.</td>
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</table>

<table>
<thead>
<tr>
<th>FINANCIAL FEASIBILITY</th>
<th>SOCIAL ACCEPTABILITY</th>
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<tr>
<td>No major transportation cost.</td>
<td>Cluster planning/overall housing design inspired from small self sufficient assamese settlements.</td>
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<tr>
<td>No major labour cost.</td>
<td>Familiar material palette in the units.</td>
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<tr>
<td>No major maintenance cost.</td>
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<tr>
<td>No major construction cost post and pre natural calamity.</td>
<td>Spatial planning according to the user's workstation.</td>
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### Abstract for Estimate

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<th>RATE</th>
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### Unit Costing

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<td>2.5% WORK CHARGE ESTABLISHMENT</td>
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<td>DUPLEX UNIT</td>
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<td>3% CONTENGENCY</td>
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### Traditional Courtyards

In the traditional households of Assam, the courtyard in house brought life to the homes, as Courtyard Architecture is very much part of the Assam Houses. Being the focal point of the house, it brought in light and ventilation inside and created a truss between the indoors and the outdoors. They were primarily the focal points of the house.

Most of the rooms of the house pointed towards the courtyards in house, which usually became the heart of place by being a place where everyone gathered; a living area of sorts.
“I prefer drawing to talking. Drawing is faster and leaves less room for lies.”

- Le Corbusier
Z324 Institute of Design Education and Architectural Studies, Nagpur

Team Members

Adarsh Meshram
Aim
To identify and explore vernacular design of homes that espouse comfort to dwellers while including the social, economic, environmental aspects of living.

Objectives
To identify themes of sustainability and form, culture and the amalgamation of all these with the vernacular. Based on this analytical framework a set of principles are identified.

1) It should be built using locally sourced material.
2) It should amalgamate with nature harmoniously in coexistence that transmutes meaning.
3) It must strike balance between the use of technology and efficacy.
4) It must foster cultural elements that augment dwellers’ emotions.
5) It should aspire to acquire design from crafts whilst supporting local beneficiary participation.

Pradhan Mantri Awas Yojana (PMAY)
A flagship Mission of Government of India being implemented by Ministry of Housing and Urban Affairs (MoHUA).

AIM- The Mission aims towards urban housing shortage among the EWS/LIG and MIG categories including the slum dwellers by ensuring a pucca house to all eligible urban households. The Mission promotes women empowerment by providing the ownership of houses in name of female member or in joint name. All houses under PMAY(U) have basic amenities like toilet, water supply, electricity and kitchen.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>TYPOLOGY</th>
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<th>NO. OF UNITS</th>
<th>AREA PER UNIT (SQ. MT.)</th>
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<td>BEDROOM</td>
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<td>TOILET</td>
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<td>BEDROOM</td>
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</table>

Case Studies
Rachna Kshirsagar, 42
Beauty Parlour
“Expectations were not higher as compared to the amount we had to pay. But at least we are happy to have our own home rather than paying on rent.”

Saba Yusuf 33,
House Wife
“My family is happy shifting here, there are various kind of around we get to know also we could now own our shop in this premises.

Anant Mahajan 63,
retired government official
“We were provided our possessions on the basis of lucky draw setup, so my wife and I have to settle with the given flat on fifth floor. It gets difficult for us to move up and down for petty things.”
TARA HOUSING (New Delhi)

To identify and explore vernacular design of homes that espouse comfort to dwellers while including the social, economic, environmental aspects of living.

Location - New Delhi, India
Construction: 1975-1978
Site: 1.48 hectares
Program: Social housing with 160 units of two- and three-bedrooms
Client: Tara house society
Structure: Reinforced Concrete
Wall: Brick

The Concept- The Tara housing group project is a creative vernacular typology in terms of arranging and piling singular flat into united blocks, with interior garden, maintaining a private life. From lightning and ventilation all resources are equaled shared.

Spatial Organisation- During winters, the N-S orientation of the narrow built-up provides optimal sun exposure on the S-E side of the building for the top and bottom terraces as well as the central spine of the building.
Wind funnels are created by the large double height multifunctional hall on the east side and the small N-W openings. Staggered longitudinal decks provide mutual shading and good thermal comfort.

Orientation and Microclimate-
During winters, the N-S orientation of the narrow built-up provides optimal sun exposure on the S-E side of the building for the top and bottom terraces as well as the central spine of the building.
Wind funnels are created by the large double height multifunctional hall on the east side and the small N-W openings. Staggered longitudinal decks provide mutual shading and good thermal comfort.

Overall Master Planning-
The site includes five major sites, as well as peripheral parking along the north-west and north boundary walls, community spaces enclosed, and a children's play area.
By hiding services, water tanks, and powerhouses within 3m of site contours, the site appears visually interesting and requires less monitoring.

Conclusion- • The development is a schematic traditional urban form. This part-derivative specifically from the climatically rational of the narrow over hangs streets.
• An introvert street configuration is created. This was derived: ostensibly to shelter a humid green zone within the development. It is terraced to fit the topographic profile.
• The position and character of various spaces make them multi-functional and the position of these open spaces gives users the flexibility of using the spaces as a whole.
Geo Climate in INDIA

Indian climates vary enormously, from tropical to alpine in the Himalayan north, where elevated regions receive sustained winter snowfall. The nation’s climate is shaped by the Himalayas and the Thar Desert.

COLD AND SUNNY
Winter day: Average 2°C, winter night 0-3°C. Winters are dry, with snow at altitudes above 1000m. Rains occur occasionally, intense by otherwise cloudy skies. Cloud cover is below 50%. Solar radiation exerts a major impact on the land. Most of the houses are roofed with tiles, and the ground roof is low in height, being used for livestock storage, and for collecting rainwater.

COLD AND CLOUDY
In cold areas, there are high altitudes which have temperature ranging from 20°C in the summer and 2°C in winter. The winter months for the cold climate is strongly influenced by the monsoon and the desert.

COMBINED CLIMATE
The composite zone covers the central part of India. Composite climates depict the characteristics of both hot and dry, and warm and humid. They experience dry and humid conditions.

HOT AND DRY
Deserts and semi-deserts are characterized by hot, dry, and arid conditions. The temperature here is hot throughout the day, and temperature drops drastically at night. Rainfall is low and erratic.

HOT AND HUMID
Tropical: The climate is hot, with high temperatures and increased humidity. The climate is humid, with high temperatures and humidity throughout the day. Humidity is high in the evening.

Why Nagpur?

Nagpur, city, being city of Maharashtra lies in the central region of India. It is situated along the Nag River and is almost at the geographical centre of the country. The landscape in and around Nagpur consists of low flat-topped hills, flat tablelands and deep, black, fertile soils in the valleys of streams and rivers. The region has abundant life resources: Farming is main occupation due to availability of water and fertile soil. Vegetation is seasonal. Due to its location and topography the region experiences three prominent seasons, summer, winter and monsoon. The region displays architectural character which demonstrates the influence of context in terms of its resources.

Vernacular Architecture Of Nagpur

Foundation- The trench of about 1.2m is dug which is filled up with stone and mud as a binder.

Roofing – Timber truss, country tiles or Mangalore tiles are generally used as roofing material.

Door- Lintel ,door and window were made out of timber, were of small size and embedded in mud.

Plastering- Plastering is done in two layers; first one with a mixture of cow dung and mud, and second layer is of plain cow dung for finishing.

Mud Flooring- The area to be floored is first filled with rubble and mud mixture. Then the floor is pressed and finished with final layer of cow dung and mud slurry.
Site - PARDI, Nagpur

Pardi is a Locality in Nagpur City in Maharashtra State, India. Belonging to Vidarbh region, Nagpur district. Categorising pardi as pen urban because of its close proximity to the mother city. Nagpur, it showcases unique vernacular characteristics and diversity of users.

Settlement Pattern in Pardi

Pardi village is located on eastern part of Nagpur and consist of 30-35 houses featuring vernacular architecture of this region. This village comes in central part of India. A variable landscape and seasonal vegetation characterize this region. The intensity of solar radiation is very high in summer with diffuse radiation amounting to a small fraction of the total. This region receives strong winds during monsoons from south-west and dry cold winds from north-west. In summer, the winds are hot and dusty. The sky is overcast and dull in the monsoon, clear in winter and frequently hazy in summer. Generally, this region experiences higher humidity levels during monsoons than hot and dry zones. Thus, it comes under composite climate zone. The buildings in this region reflect more emphasis on avoiding heat gain since maximum period throughout year experience hot sun.

Detailed Study Of Pardi

Pardi has variable landscape and seasonal vegetation characterize this region. The intensity of solar radiation is very high in Summer with diffuse radiation amounting to a small fraction of the total. This region receives strong winds during monsoon from south-west and dry cold winds from north-west. In summer the winds are hot and dusty. The sky is overcast and dull in monsoon, clear in winter and frequently hazy in summer. Generally, the region experience higher humidity levels, during monsoon than hot and dry zones. Thus, the architecture of this region strongly respond to climate with compact planning, courtyards, use of locally available material and use of crop residue for composition of material displays.

Peri Urban

As those areas which are in some form of transition from strictly rural to urban. These areas form the immediate urban rural interface and may even fully evolve into being fully urban. Peri urban are places where people are key components. The majority are on the fringe of establishment urban areas but they may also be clusters of residential development within rural landscape. As an area around an urban settlement which is distinctive in character having diverse and mixed land uses and residents. These are the areas generally located outside the municipal limits.
Activity Mapping

1. After waking up they bring water from the well for washing clothes.

2. They wake up at 6 AM. The housewife starts their daily chores like cleaning the house and making the food. After their dinner is ready, they all get together and watch television and then go to sleep at 9 PM.

3. While the children play in the aangan, the other rest inside.

4. At dusk the whole family gathers and breaks their dinner.

5. The men leave the house for work and their children leave for schools, whereas the women continue with the rest of the daily chores.

6. Multipurpose use of common spaces

7. Use of front courtyard (Aangan)

8. Festivals

9. Problems faced by people from EWS sector

10. CLUSTER PLANNING AT PARDET

11. Occupation

12. Occupation

- Farming
- Vendors
- Industrial Workers
- Employees
- Labours
- Students
- Drivers
- Rickshaw Pullers
- Barbers
- Tailors

Problems Faced by People from EWS Sector

- Forceful Eviction
- Overcrowded
- Poverty
- Politics
- Social conflicts
- Lack of Education
- Informal economy

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AAWAAS Concept

The fundamental concept of the design lies in incorporating innovative housing design ideas ensemble with vernacular design techniques & climate approaches that are versatile, self-renewable in accordance with nature & the environment and the predominance and importance of these elements in human beings.

Vastu purusha mandala (building - energy - environment) represents the dictums that define this relationship on the built environment and therefore we subsumed this expression in our planning.

ZONING

FORM DEVELOPMENT

1. Embarking from a rectangular block module to engage maximum floor area.

2. To fabricate a welcoming notion, an entrance is paved, securing a parking space.

3. Elevating portions of ground plane develops linearity to cater easy form based movement.

4. Escalating a block to serve as the living room space

5. Within the form a block is demarcated as kitchen space.

6. The volume is defined in terms of vastu shastra.

7. Extending the toilet spaces are the passages leading to bedroom block.

8. Connection between the segregated spaces is achieved by passage alongside the toilet block.

9. The volume is defined in terms of vastu shastra.

AREA PROGRAM

LIVING ROOM - Area: 5.94 Sq.m
Living rooms are the largest social gathering spaces with unwinding spaces in the unit with sofas, dining tables, and wheelchair access.

BEDROOM - Area: 8.64 Sq.m
Bedrooms are important spaces as they can accommodate a double bed, a wardrobe and wheelchair space.

KITCHEN - Area: 6.39 Sq.m
Kitchen features an L-shaped counter with max utility & optimum functions.

TOILET - Area: 3.45 Sq.m
The bathroom has been ergonomically designed to make wheelchair movement easy.
Internal Attributes

Spiritual space - A sacred place; to perform daily rituals and spiritual proceedings.

Box Window – Creating a cozy sitting space, the window allows a scenic view along with more natural light.

Overhead storage tanks for kitchen utility and bathroom purpose.

Privacy

Ventilation

Circulation

Configuration: to integrate the functional relations of the users to the built environment, places are planned according to the vastu. Positioning of central space, peripheral zones, with respect to sunlight wind flow and relative functions of spaces bring notions of alacrity. North south orientation of the plan, north east placement of living room, south east location of kitchen and south west positioning of bedroom justifies it.
Internal Attributions

Inclined Wall - The southern wall inclined 105 degrees, so that direct sunlight cannot enter the facades and prolonging with ancillary spaces, which converge affordable, self-sustaining, cost effective housing.

Spiritual space - A sacred place; to perform daily rituals and spiritual proceedings.

Privacy

Ventilation and light - The incorporation of properly planned placement of openings granted good amount of light and ventilation.

Circulation

Special mention 3 | (Z324)Institute of Design Education & Architectural Studies, Nagpur | GO

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