EVALUATING THE PERFORMANCE OF VERNACULAR STONE SALAI AND MODERN SALAI OF KURUMBA HAMLETS OF ATTAPPADI

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Abstract

Architecture serves as a tangible expression of a society's necessities, ambitions, and cultural identity, shaped by a complex interplay of socio-cultural, economic, belief, practice, environmental, and political influences. Vernacular architecture, which is harmonizes with local environments and climates, receives insufficient recognition in contemporary construction practices. This research seeks to comprehend the diverse architectural designs within settlement and assess the application of vernacular architecture in Kurumba settlements. The long-standing Salai (dwelling) of the Kurumba settlement that evolved from sustainable planning and construction techniques is evaluated. A comparative evaluation method is used for a vernacular Kurumba stone Salai and a Modern Salai, through factors of orientation, openings, building envelope, surface area to volume ratio, daylight factor, etc. The result of the whole study is recommendations that can sustain in a modern context through vernacular values and practices.

Key words

Salai or Aalai (Kurumba dwelling), Ooru (Hamlet), Kurumba, Kalam (place of social interaction), Thinna (space for seating in front of the dwelling)

Introduction

India comprises over 705 ethnic groups making up 8.6% of the country's total population. The scheduled tribes or Adivasis who reside in and near forested areas are officially recognized in India. The Adivasi communities are found throughout the state of Kerala in various locations, including Wayanad, Palakkad, Idukki, Malappuram, etc. The largest tribe is found in Attappady, a tribal taluk in Kerala's Palakkad district. The taluk's western regions are covered in 249 km² of protected reserve forest. The Irula, Muduga, and Kurumba Adivasi tribes are among the indigenous communities of Attappady. Their Hamlets are referred to as "Ooru," and the colony is divided based the different tribal communities.

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Figure 1 Location

Source: Author.

Figure 2: Location Map of Attappady

Source: Author.

Kurumba

The first Adivasi community to settle in this region was Kurumba. These are the Attappady's prehistoric tribes found in the deep forests of Palakkad's Attappady Valley. Kurumbabasha is the name of the aadivasibasha dialect of Kurumba, which is only spoken without a written script and is influenced by Malayalam and Tamil. They have remained mostly true to their ancient method of worship as animists and totems, albeit they are closely related to the Malleshwara temple (Nair N V, 2010).

The Kurumba of Attappady, make their living from agriculture, animal husbandry, and non-timber forest products. They are located in the Pudur panchayat of Attappady, a deep forest. Their sustainable lifestyle, diverse dietary habits, traditional farming methods, weaving skills, sustainable building methods, tattooing methods, Pachamarunnu (plant-based medicine practice), folk dance and song (kuthu), etc. are well-known (Nair N V, 2010). Comparing the community to other tribal communities in Kerala, however, it is among the most economically disadvantaged and vulnerable (ITDP Attappadi). The research makes an effort to through light on to the importance to preserve these vernacular architectural practices, which, if not preserved, future generations might find as historical trinkets, this research aims to comprehend, assess, and value them.

Methodology

The methodology uses both primary and secondary sources of data. The research involve the documentation of dwellings from Kurukkathikkallu and Mele Gottyttyarkandi two Kurumba settlements of Pudur Panchayat, Attappadi, at a planning and architectural level for a spatial, visual, and material understanding. The study also involves a comparative evaluation method where documentation, collection, and analysis of data related to sustainability, for a modern structure within the same location versus the Kurumba vernacular structure, is carried out. Further, based on sustainability parameters through the method of Systematic analysis results in a quantitative evaluation. The research involved structured and unstructured interviews with the residents of the settlements to understand their aspirations and needs further through analysis and evaluation formulating recommendation in the present day context with people's participation.

Literature review

Vernacular architecture is a response to the environment context, built by people for their purpose with locally available materials and techniques (Oliver, 1997). The primary elements of vernacular architecture that make it inclined towards sustainability, according to Sharma and Chandel, 2016 are the structure is based on the geography of the place, the factor of the orientation of all spaces(Interior and Exterior) concerning sun angle, locally available material with low embodied energy and the cost-efficient nature of construction. Vernacular materials like earth, bamboo, stone shows low ow embodied energy values along with low operational energy and transportation energy values as compared to modern construction materials (Shuklaetal, 2009). Earth wall have better thermal insulators as compared to brick or cement concrete block walls (Goodhewa and Griffiths, 2005). Stone as construction material in sub-tropical hill architecture acts as a thermal mass to the building envelope, which maintains a thermal comfortable atmosphere within the dwelling (Priya and Radhakrishnan, 2019). Wattle and daub construction is one of the most affordable construction with low life cycle cost, maintenance cost etc (Gautam, 2021).

Vernacular dwelling should be evaluated in the light of thermal performance under parameters of surface area to volume ratios to understand the heat loss or gain, daylight analysis along with the above parameters to evaluate the sustainable practice, but under the frame of comparative evaluation method between a modern and vernacular structure (Priya and Radhakrishnan, 2019).

According to authors (Pandey and Vishwakarma, 2017), sustainable development should satisfy the conditions of holistic and harmonious development with nature. The development should provide a living and breathing consciousness that is an ecosystem

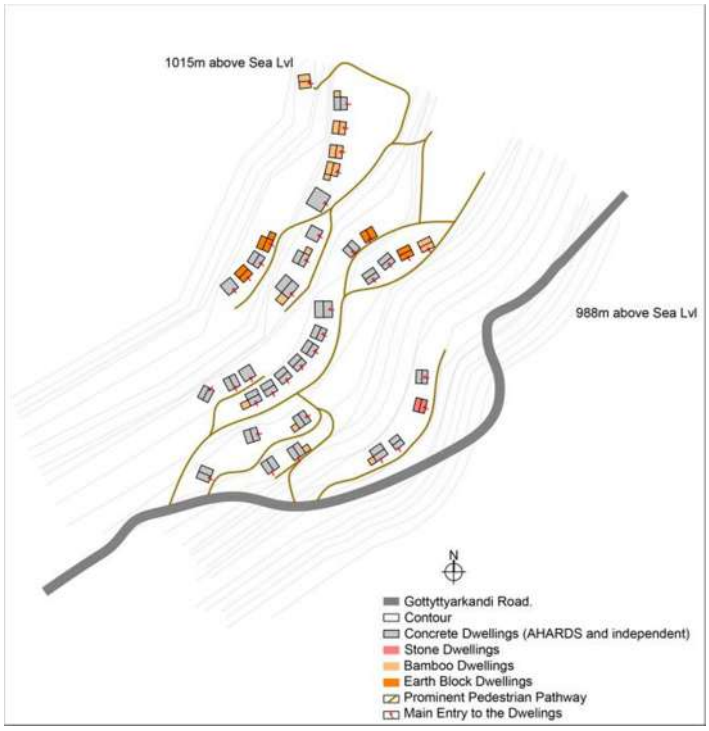
with coexistence. The transformation and collaborative nature of architecture and built environment (for the present day condition) which may help resolve this major issue. The purpose of sustainability not just to sustain today, but also sustain for the future. Hence development goals incorporate multiple ontologies and indigenous knowledge practices, suggested in the book 'The Anthropology of Sustainability' (Marc Brightman, 1976).

Introduction to different types of dwellings in the settlement

The dwelling clusters placed within the settlements are based on kinship and social hierarchy [Hiearchy - Moopan (head of the hamlet), Mannookkaran's (agricultural head), Kuruthala's (assistant of Moopan), Bhandari's (Treasure) then other inhabitants of the hamlet]. This reflection of the social hierarchy within the settlement is also seen in the architecture. The Salai in these settlements were primitively stone, bamboo, depending on the socio-economic condition. Today, because of various housing schemes (PMAY(R), AHARDS, Life mission), and urbanization, some of the old salai's and the newly constructed salai's have moved to hollow concrete block constructed.

Figure 3: Dwelling typology in Mele Kurukkathikkallu

Source: Author

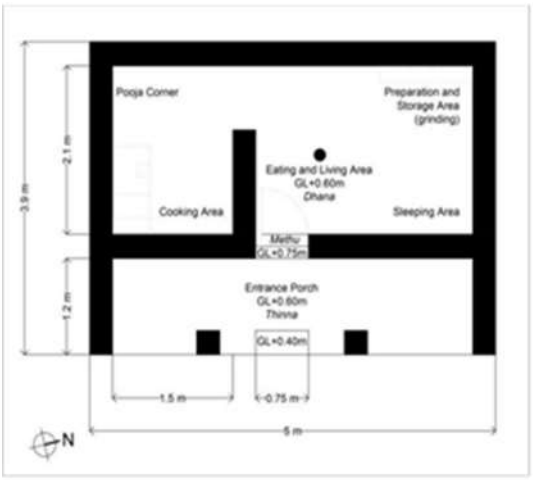


Dwelling typology

Stone Salai

The Salai's rectangular in shape, 5m long by 3.9m wide with an entrance pouch, and have a sloped roof (which was thatched in the past but now is tiled). The structure is elevated at a height of 0.6m and has a height of 1.9m above the elevated surfaces. The entrance pouch - thinna 1.2m is a deliberate design feature attached to the Moopan's Salai alone, this is to accommodate outside people. The raised platform entrance serves as a transition point between the outside of the Salai and its inside. This is the main source of social interactions that strengthen societal relationships. The interior of the Salai has a partition that divides the house from the kitchen and pooja area which are the most sacred space. There are only a few spaces and are flexible within the Salai.

Figure 4: Stone dwelling or Salai.



Stone Salai Plan.

Stone Salai Section

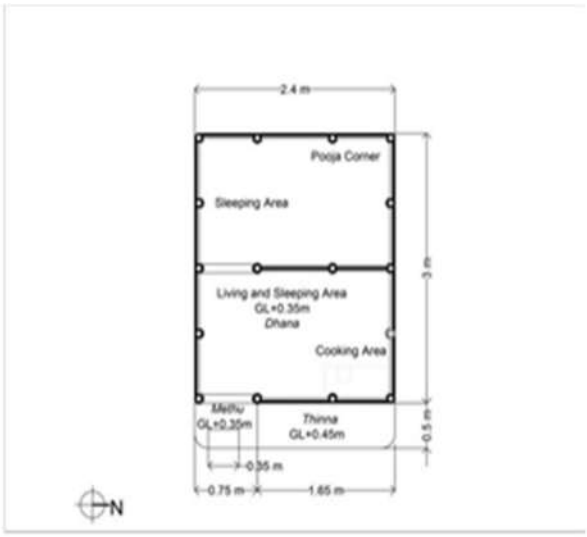
Photograph of Stone Salai

Source: Author

Bamboo Salai

A 40year old bamboo Salai of Mannookkaran's (agricultural head) is the only vernacular structure within the settlement. The Salai is rectangular in plan, 3m long by 2.4m feet wide and has a slopped roof (which was thatched in the past but now is tiled). The structure is elevated at a height of 0.35m and has a height of 1.8m above the elevated surfaces. The thinna 0.5m wide is used as outdoor seating space. The outsiders are allowed only till the thinna.

Figure 5: Bamboo salai or dwelling



Bamboo Salai Plan.

Bamboo Salai Section

Photograph of Bamboo salai or dwelling

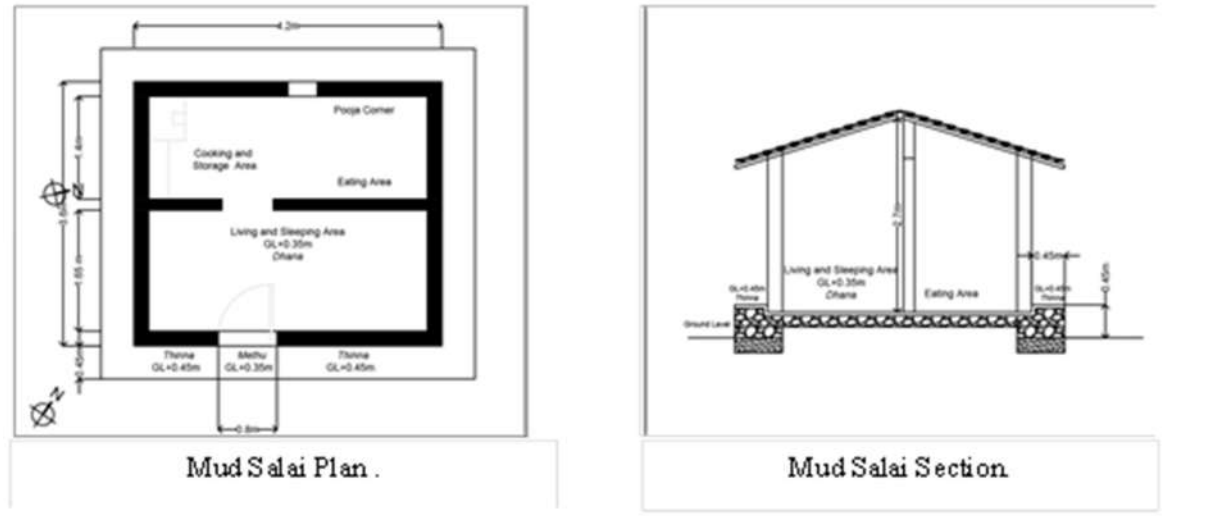
Source: Author

Mud Block Salai

A 20year old Mud block Salai which is built by government during late 90's, the construction was done using mud block which was made on site, followed a typical planning for all dwellings built in that period. The Salai is rectangular in plan, 4.2m long

by 3.6m feet wide and has a timber slopped roof structure with Mangalore tiles. The structure is elevated at a height of 0.45m and has a height of 2.7m. The thinna 0.45m wide is used as outdoor seating space this was a further addition by the inhabitants. The outsiders are allowed only till the thinna.

Figure 6: Mud Block salai or dwelling



Mud Salai Plan . Mud Salai Section

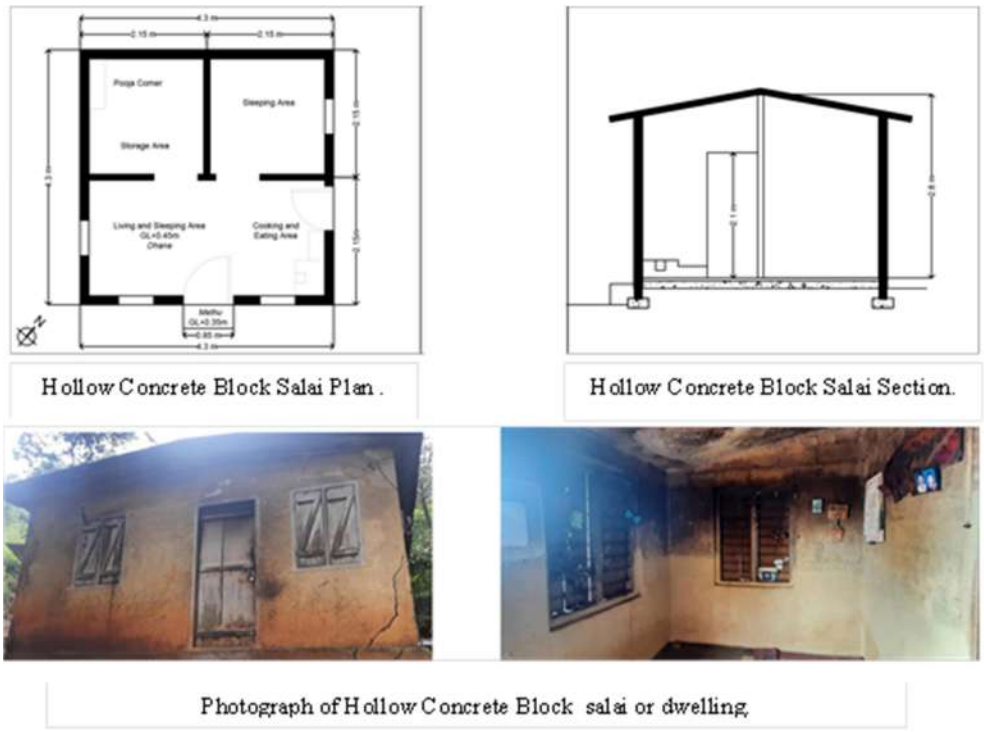
Photograph of Mud salai or dwelling.

Source: Author

Hollow Concrete Block Salai

Modern Kurumba Salai is constructed by ITDP Attappadi in the year 2003. The Salai is square in plan, 4.3m long by 4.3m feet wide had a small raised platform at the entryway, living area, cooking and eating area and bedrooms, construction using hollow concrete blocks. The houses lacked elements of thinna, that established and indoor out door interaction space. The modern Salai are square in plan and has no resemblance to the traditional Kurumba structures, with inner walls dividing the rooms. At the entrance, there are windows and doors. These modern salai's are 2.8m - 3m in height, with ferro cement sloped roof.

Figure 7: Hollow Concrete Block Salai or dwelling



Source: Author

Figure 8: Various dwelling or Salai Typology

Source: Author

Comparative evaluation of stone and hollow concrete salai

Literature Review:

The Dwelling typology analysis would evaluation of sustainable practices based on the layout of the dwelling- Orientation, openings, the building envelope, Surface Area to Volume Ratio, Daylight factor, etc. The walls - thickness and material, radiation at day and night (Priya and Radhakrishnan, 2019) (Maria, 2008).

Figure 9: Stone Salai (dwelling)

Source: Author

Orientation

Longer walls face the East-West and shorter walls face North-South. The Salai is east-oriented due to factors of topography and culture, and the settlements associated with the sun. The entrance of the Salai should face the raising sun according to mythical beliefs. The east side has an entrance porch and the west side of the Salai is 3/4 buried inside protecting it from the harsh sun.

Walls and Roof

The walls were built using stone which is around 0.30m thick and the bamboo roof was made of bamboo frames and tiled. Stone walls that are thicker or have a high thermal mass retain heat during the day and emit it at night. In the past, the roofs were 0.45m thick and tightly built with bamboo, cane, and dried grass heaped above it as thatch to reduce the amount of infiltration the dried grass lowers heat gain and heat loss and was a right insulator for the Attappadi region (Fig 11) (Sub-tropical moist climatic zone with rain forest, during summers outdoor ambient temperatures range from 26 to 32 degrees Celsius, while wintertime readings range from 17 to 24 degrees Celsius).

Figure 40:Old Salai (dwelling)

Source: KILA archive 1980

Openings

The Salai's have no windows and have doors that are only 1m X 0.8m in size and around 13% of the entire floor space is covered by openings. To limit heat loss, there are hardly any openings.

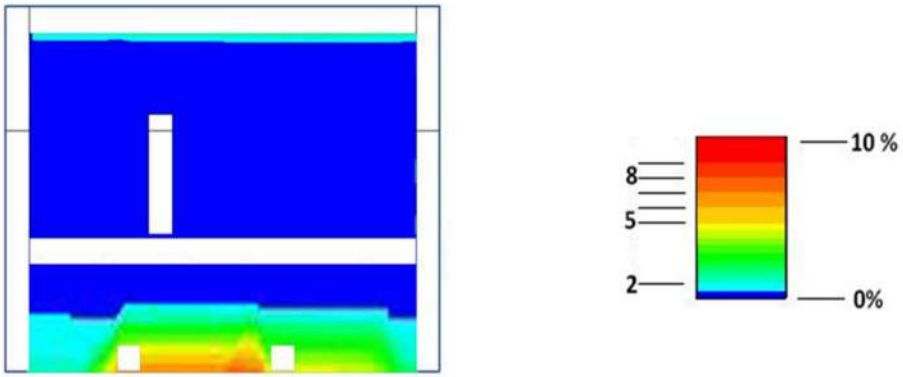
Surface Area to Volume Ratio.

Shape - Rectangle
Surface Area - 30-meter square
Volume - 19-meter cube
S/V ratio - 1:5
Heat gain and loss are significantly influenced by the surface area to volume (S/V) ratio. This primitive Salai has a low surface-to-volume ratio to reduce heat loss.

Daylight

The day light is poor in this structure due to minimum opening.

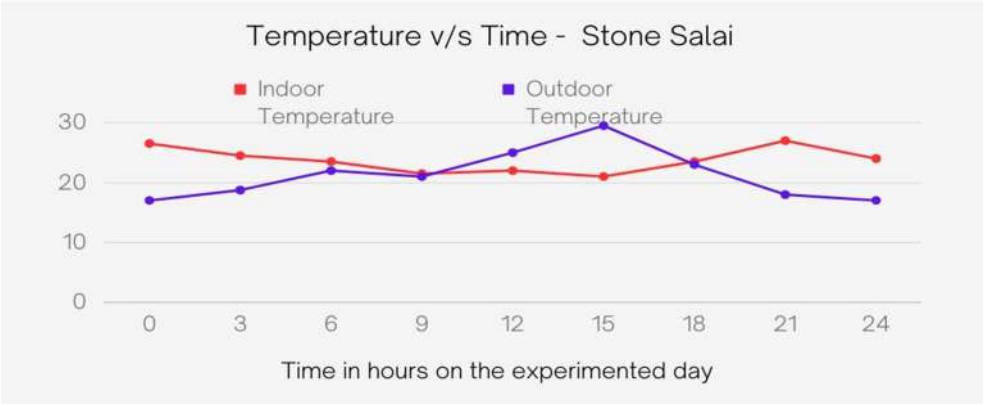
Figure 11:Day light analysis for Stone Salai



Source: Author (Revit 2023

Thermal Comfort

Figure 12: Air temperature v/s time on the experimented day - 19th June



Source: Author

It is demonstrated that the Stone Salai is thermally comfortable when the results are compared to the psychrometric chart and Olygay Bioclimatic chart it is found to fall within the comfort zone. Stone acts as a thermal mass and regulate the indoor temperature, making the interiors cool during summer and warm during winter.

Figure 13: Typology 1 -Hollow Concrete modern Salai structure

Source: Author

Orientation

The entry of the salai is to the South - East.

Walls and Roof

The walls were built using hollow concrete block which is around 0.15m thick exterior walls, inner wall of 0.1m and has a ferro cement slopped roof. In Modern Salai the rise in external temperature the building's envelope absorbing heat during the day, due to low time lag it releases the heat during the day itself. Due to maximum heat loss in buildings, from the building envelope and from the existence of openings, the Modern Salai is cool at night.

Openings

The Salai's has four windows and have two doors. The entry door is 0.85m x 2.1m in size, and the four windows are 0.75m x 1m, two on either side of the entry door, one in

the living and another to bed room. It is around 35% of the entire floor space is covered by openings. There is some heat loss due to opening sizes.

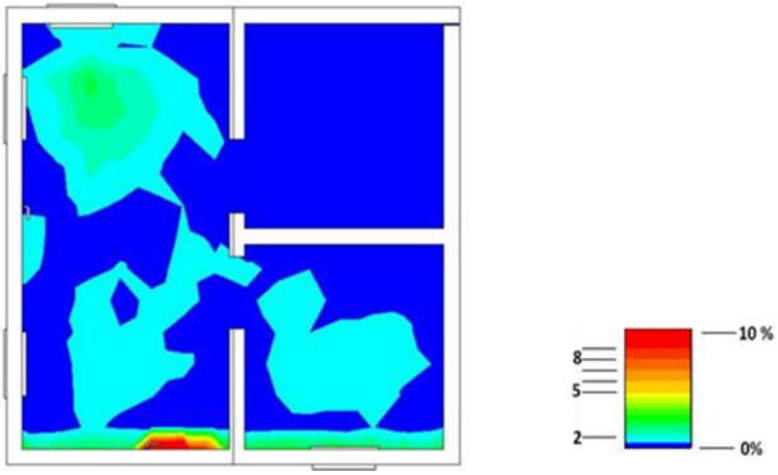
Surface Area to Volume Ratio.

Shape - Rectangle
Surface Area - 58.50 meter square
Volume - 46.25 meter cube
S/V ratio - 1:8
Heat gain and loss are significantly influenced by the surface area to volume (S/V) ratio. The Modern Salai's have a high surface-to-volume ratio the increases heat loss.

Daylight

Day light is better when compared to the primitive Kurumba structures.

Figure 14: Day light analysis for Modern Salai

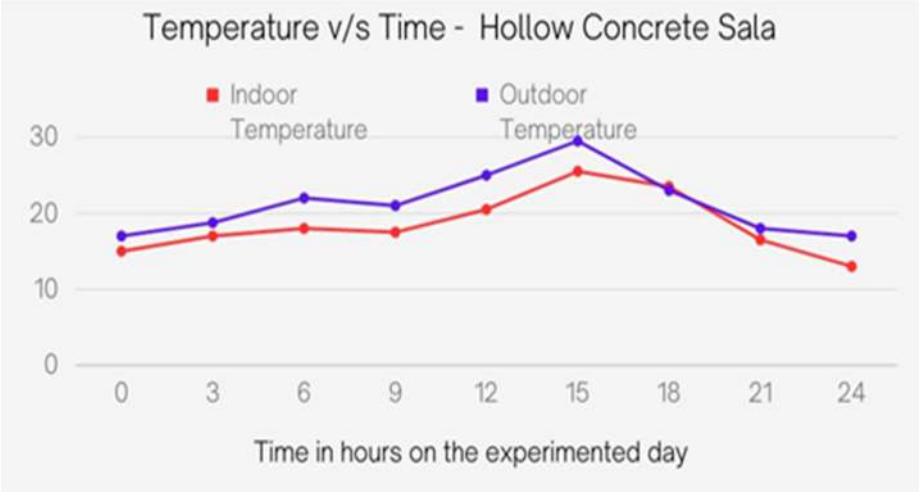


Source: Author (Revit 2023

Thermal Comfort

It is demonstrated that the Modern Salai do not lie under the thermally comfortable condition when the results are compared to the psychrometric chart and Olygay Bioclimatic chart. These is no thermal regulation within the structure.

Figure 15: Air temperature v/s time on the experimented day - 19th June



Source: Author

Conclusion

Vernacular structures in hilly areas serve as excellent labs for architects and examples for lessons in sustainable design because they frequently employ basic planning strategies, basic shapes, and resourceful material and technological utilization. Further evaluating the vernacular Kurumba stone Salai and a Modern Salai, vernacular Salai were significantly affected by the local climate, and they were built to maximize solar heat gain and reduce heat loss. These Salai's were created using locally available resources. In the future, a sustainable habitat can be designed using the design inspiration from these typologies, in the Attappadi region.

Recommendation

Making separate guidelines or policies and revision of the existing housing schemes for these vernacular settlements that could accommodate the cultural needs of the people and moving towards sensitive and sustainable design approaches. Example - Usage of locally available material with materiel truthfulness which is recyclable and has a low impact on the environment at the same time viable for this climatic zone, like stone, mud, bamboo construct. Establishing a PPP model for any construction by government in the settlements, further training them through workshops in the hamlet that would revitalize the construction practices and sustainable principle.

References

Shanthi Priyaand S. Radhakrishnan(2019), Evaluating the Thermal Performance of Traditional and Modern Toda huts in Nilgiris Hills. International Journal of Innovative Technology and Exploring Engineering, 8(9), 2752-2756

Thirumaran, K., & Reshmi, R. (2017). Analyzing Green Building Technologies in Indian Vernacular Architecture: A Case Study of Kerala. International Journal of Innovative Research in Science, Engineering and Technology, 6(5).

Singh, M. K., Mahapatra, S., & Atreya, S. K. (2010). Thermal performance study and evaluation of comfort temperatures in vernacular buildings of North-East India. Building and environment, 45(2), 320-329.

Zhai, Z. & Previtali, J. M. (2010). Ancient vernacular architecture: characteristics categorization and energy performance evaluation. Energy and Buildings, March, 42(3), 357-365.

Kashani, M. A. H. (2013). Sustainability indicators of Iranian vernacular architecture: The case of Yazd (Doctoral dissertation, Eastern Mediterranean University (EMU)-Doğu Akdeniz Üniversitesi (DAÜ)).

Jagatramka, R., Kumar, A., & Pipralia, S. (2020). Sustainability Indicators for Vernacular Architecture in India. ISVS e-journal, 7(4), 53-63.

Indraganti, M. (2010). Understanding the climate sensitive architecture of Marikal, a village in Telangana region in Andhra Pradesh, India. Building and Environment, 45(12), 2709-2722.

Thurston, E. (1909). Castes and tribes of southern India (Vol. 3). Government Press.

Nair, N. V. (2010). Tribal Health and Medicine in Kerala. DC Books.

Dhote, K. K., PREETI, O., & Santanu, D. (2012, March). Identifying the sustainable practices from the vernacular architecture of tribes of central India. In Proceeding of 2nd International conference–Workshop on Sustainable Architecture & Urban design organized by School of Housing, Building & Planning, University Sains, Penang, Malaysia.