DECODING THE POTENTIALS OF VERNACULAR TIMBER PRESERVATION TECHNOLOGY FOR STRUCTURAL APPLICATIONS

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Degree of Doctor of Philosophy in Civil Engineering

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ABSTRACT

Along with the celebrated history in the field of construction in the world, wood has been a building material for hundreds of years. The stability of timber structures is influenced by their reliance on external factors as it's a hygroscopic material. Where the moisture content has an impact on almost every structural parameter, including strength, stiffness, and dimensional stability. It is also extremely vulnerable to biological degradation caused by insects, fungi, and bacteria affecting the molecular structure.

These scarcities were undertaken in traditional wooden structures in a significant, yet sensitive manner in a tropical country like Sri Lanka. The durability of traditional wooden constructions exists under a highly appreciable status. In a tropical environment, the prolonged physical sustainability of wood is a challenging task. These show a greater degree of tolerance in the harsh tropical environment. Empirically expressive information sources were investigated, therefore structures for shelters were selected for further analysis.

In this case, *Tampita Vihara* (the shrines on pillars), *Devala* (shrines dedicated to deities), *Ambalam* (resting places for travelers), and *Mandapa* (the assembly spaces for administrative practices) of which physical remains are still available in a relatively preserved state of standing evidence were carefully chosen. Numerous literature findings are documented on their religious beliefs and the significance of their architecture. But the structural engineering aspects relevant to material perspectives have not been studied adequately.

A holistic investigation of timber in construction was carried out using knowledge from traditional vernacular buildings. Traditional vernacular[1] construction relied on a thorough awareness of the surrounding environment, as well as the characteristics of locally available materials and manual labor. Traditional people are essential stakeholders in forest management because they are often economically, socially, and culturally reliant on forests. This resulted in building artisans attaining a profound knowledge of the utilization and manipulation of materials.

This study examines the state of the structures, which entails a thorough understanding of past and present conditions. The goal of collecting extensive data from various typological structures is to establish a knowledge basis for the future. Field survey analysis around Sri Lanka was conducted to accumulate and consolidate the traditional vernacular timber processing and preservation technologies.

Results disclosed wood logs burying under paddy field mud as a well-established technique to treat wood. As well, three dominant plant species were identified as *Mikania micrantha, Titonia diversifolia, Gliricidia sepium* assorted with paddy field mud to enhance the properties before treatment. Further, the field survey results and the microscopic investigations proved *Mangifera indica* wood was used for roof elements utilized after the above treatment in traditional vernacular structures with in the use life range 40 to 50 years. This showed its potential to be used for structural applications after proper treatment.

Finally, an experimental trial was performed to evaluate the traditional vernacular technology with amendments, reinventing two types of wood preservatives based on the material matrix as plant extracts assorted with paddy field mud and only plant extracts obtained for water.

This combination of traditional vernacular and contemporary aspects could offer an interesting and profitable approach to the further development of the wood industry.

Keywords: Timber architectural typologies; timber preservation technology; *Mikania; Gliricidia sepium; Titonia diversifolia;* Plant extracts; wood preservatives.

[1] The term vernacular comes from linguistics, where it refers to language usage specific to a time, region, or group.

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When the broad mind has opened, I stare at the stars that shinning in the thoughtful skies and the glittering nature, as well as Earth's mysteries that I ever think of to feel by my thoughts that spread so deep on trying to work with things that sound 'creative'. Here I started my second journey, leaving 219 km away from home three years ago. This up-start was through Science, Engineering, and Design.

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