

Preventive conservation of vernacular architectural materials

Ashish Patil

¹School of Planning and Architecture Bhopal India

Email: ashish.patil@spabhopal.ac.in

Devarshi Chaurasia

Department of Architecture, School of Planning and Architecture, Bhopal- India

Apurv Shrivastava

Department of Architecture, School of Planning and Architecture, Bhopal- India

Sandeep Sankat

Department of Architecture, School of Planning and Architecture, Bhopal- India

Neelam Singh

Directorate of Economics and Statistics, Planning Department, Government of Uttar Pradesh

Email: neel06.singh@gmail.com

Abstract

The preservation of vernacular architectural materials through preventive conservation techniques is crucial to minimize deterioration and avoid major restoration interventions. In this case study, I examine the settlement of the Gond tribe in India. Basic factors that contribute to the deterioration of organic, inorganic, and composite materials by temperature, humidity, relative humidity, light, heat, water, dust and dirt accumulation, stains, vegetation, bird excreta, insects, fungus, climate, natural disasters, human negligence, human vandalism, and atmospheric pollution. The traditional methods for preventive conservation of vernacular architectural materials have largely disappeared due to a lack of documentation and the transformation of traditional knowledge, skills, and culture. Despite this, some people still use traditional methods to preserve local construction materials. These methods involve the use of herbals such as Azadirachta Indica (Neem leaves and bark), Ashwagandha leaves and bark, dried ginger, sandalwood, turmeric powder, garlic, tobacco leaves, lemongrass oil, citronella oil. These plants and their products have germicidal properties and insect repellency potential that have been recognized since ancient times. To increase the lifespan of local materials, it is important to address the scientific and preserve documents for further use in vernacular architectural materials.

Keywords: Conservation, Vernacular Architecture, Preventive Measures, Organic, Inorganic Materials, India

1. Introduction

Vernacular architecture is a unique style of architectural design that reflects the cultural and geographic context of the local community. It showcases the natural selection of sites and surroundings while emphasizing local construction methods with a focus on traditional and regional sustainability. This style is a symbol of cultural identity, manifested in both tangible and intangible forms of human existence. Local artisans use organic, inorganic, and composite materials that are sourced locally to construct Vernacular Architecture for the residents. It is a practice of traditional knowledge and culture that is still widely prevalent in rural areas across the world.

2. Aims

The aim of this paper is to apply the conventional technique of Preventive Conservation of Vernacular Architectural Materials. It explores the use of both organic and inorganic materials that have been employed since ancient times to preserve vernacular architectural building materials. Certain plants and their by-products have been recognized and utilized for their germicidal properties and insect-repellent potential. These plants are still being used in the form of Traditional Preventive Conservation Practices.

3. Objective

To preserve traditional knowledge for future generations, it's important to identify locally available materials for conservation and understand how to combine them with construction materials.

4. Materials used for construction

Indigenous materials are sourced from the local region and are often used in building construction. Such materials are climate-responsive and are tied to the culture and traditions of the area. Common materials used for vernacular architecture include Wood, Timber, Fibrous materials, Grass, Mud, Cow dung, Rammed Earth, Bamboo, Stone, Sand, Limestone, and Lime. These materials are classified into three categories, namely Organic, Inorganic, and Composite materials. Organic materials are derived from or produced by living organisms. They are complex molecules that contain carbon-hydrogen bonds, such as Wood, timber, grass, straw, bamboo, palm leaves, and dry leaves. In contrast, Inorganic materials are simple molecules that do not contain carbon-hydrogen bonds. They are derived from non-living components like Metals, Stone, and Mud.



Figure 1: Vernacular Architecture house built with organic, inorganic, and composite materials.

Source: Arush, Patangrah, a tribal village in Madhya Pradesh, India.

5. Deteriorating agents and issues

Vernacular architecture relies on a set of durable materials such as wood, timber, fibrous materials, mud, rammed earth, bamboo, stone, sand, and lime. However, these materials are not immune to physical, chemical, and biological deterioration, which can occur depending on the environment they are in. Some of the most common issues that affect vernacular architectural materials are cracking, fading, stains, shrinkage, brittleness, discoloration, fungi, bacteria, insects, termites, rodent attacks, fragility, acidity from atmospheric gases, breakage, weathering, human negligence, vandalism, dust, and faulty construction techniques. Additionally, mud walls can chip, lower walls can experience seepage due to capillary action.



Figure 2: Photograph depicts physical, chemical, and biological deterioration of vernacular architecture materials.

Source: Neelam Singh, Jageshwar village, Almora, India.



Figure 3: The image displays wall deterioration caused by water capillary action, dust and dirt accumulation, stains, vegetation, bird excreta, insects, fungus, mud wall cracking and chipping, human negligence and vandalism, as well as fading due to atmospheric gases and pollution.

Source: Arush, Patangrah, a tribal village located in Madhya Pradesh, India.

Analysis

The transfer of knowledge from one generation to another is crucial for preserving traditional practices and skills. Traditional knowledge is built up gradually over time, and it contains many layers. It's important for society to keep traditional knowledge intact by learning from the older generation's experiences and understanding of the material, including its nature, behaviors, and reactions with other materials. In daily life and settlement, younger generations learn informally from these experiences. If we neglect to pass down these skills and knowledge to the younger generation, we will not see innovation in natural materials building, and existing vernacular buildings will continue to deteriorate. Traditional building construction skills are related to various environmental factors such as temperature, humidity, light, heat, water, rain, dust and dirt accumulation, stains, vegetation, bird excreta, insects, fungus, climate, natural disasters, atmospheric pollution, negligence, vandalism, and human intervention.

Traditional building construction skill and Preventive Conservation of Vernacular Architecture materials helps to avoid poor workmanship lacuna in routine maintenance and strengthening and retrofitting of vernacular structures.



Figure 4: The image illustrates the passing down of knowledge and skill from one generation to another

Source: Udesb, Patangrah, a tribal village located in Madhya Pradesh, India.

6. Preventive conservation measures for mud and mud bricks in vernacular architecture.

As a conservator with 20 years of experience, I have observed that mud bricks are traditionally made using local soil, sand, and other raw materials mixed with water. To achieve good-quality mud bricks, I suggest adding certain materials as additives.

To achieve good tensile and bursting strength, we can mix cow dung with mud and add fibrous materials such as flax, hemp, and jute, which belong to the rope and grass group of plants. Additionally, we can use lignin-free materials such as esparto, rice, bamboo, sugarcane, and barley straw to increase hardness, strength, durability, and stability. *Azadirachta Indica*, also known as Neem leaves, and lemon grass can be added as insect repellents. Mixing lime and calcium hydroxide can improve binding, flexibility, and plasticity while also repelling insects and termites. Finally, combining mud with soil that contains iron oxide hematite magnetite limonite, latrine, etc. can make it more durable and insect and termite repellent.



Figure 5: As shown in the picture above, the process of preparing mud bricks is being demonstrated.

Source: Devanga, Patangrah, a tribal village located in Madhya Pradesh, India.

Wood and Timber Wood and timber have been traditionally used in Vernacular Architecture. To increase their life and protect them from insects and water damage, various traditional methods are used. These include

1. Applying a layer of oil, clarified butter (ghee), lemon grass oil, or citronella oil to create a protective layer that makes the wood waterproof and insect repellent.
2. Applying lime and calcium hydroxide to make the wood insect and termite-repellent.
3. Applying Indian red ochre and Vermilion red color, which is an inorganic compound extracted from the ore of hematite and Iron Oxide. These act as repellents due to the chemical constituent of mercuric Sulphide.
4. Burning cooking oil to form layers of smoke and soot, which makes the wood seasoned, waterproof, and flexible when placed on the kitchen roof.
5. Applying bee wax on doors and windows to protect from rainwater and humidity.
6. People tie red vermilion cloth strips on the roof of their houses for religious beliefs. However, the scientific reason behind this is that Vermilion red color is inorganic in nature, and its chemical constituent is Mercuric Sulphide, which acts as a repellent for insects, termites, and rodents.



Figure 6: The picture depicts the use of treated wood in conjunction with religious beliefs.
Source: Kush Source: Patangrah, a tribal village located in Madhya Pradesh, India.
Stone

Stone is one of the most durable building materials that have been used for centuries to display man's artistic talents in the form of cultural property. However, its durability is not absolute as it can undergo different types of deterioration depending on the environment it is exposed to. Some common issues found on stone include cracks in the matrix, formation of surface crust, chipping and breakage of stone, corrosion of iron and rotting of wooden parts, fading, dissolution of surface details, powdering of surface, growth of biological agents such as plants, algae, moss, fungus, and lichen, dirt, calcareous deposition, deterioration by bird excreta, soluble salts, human vandalism, soot, and gum.

Preventive conservation measures for stone objects generally follow a sequence of steps. The first step is diagnosis, which involves a complete study of the object's history, causes, and mechanisms of decay. This step is important as it helps determine the nature of conservation treatment required. The second step is cleaning the surface of the stone object. Sometimes, the object may require the removal of weathering, crusts, dust, dirt, or other surface accretions. The cleaning can be carried out using dry brush, water-based, or mechanical methods depending on the technique used. The third step is surface protection. This involves applying a protective coating to the surface to protect it from rain, dust, dirt, and atmospheric pollutants. Lastly, periodic maintenance is necessary to check for any signs of decay and prevent deterioration. Regular checking of the vernacular architecture building for various signs of decay proves to be economical in the long run.



Figure 7: The picture shows various problems with the stone including cracking, fading, algae, moss, fungus, lichen, vegetation, dirt, biological deterioration, breakage, calcareous deposition, deterioration caused by bird excreta, human vandalism, soot, and soluble salts.

Source: Neelam Singh, Jageshwar village, Almora, India

7. Color used in art decoration can act as a repellent for insects and fungi.

The most remarkable aspect of Vernacular Architecture is its decoration, which involves decorative art forms created by households on the walls and floors of their houses. These art forms include Folk art, Tribal art, and geometric patterns, and are passed down from generation to generation with their respective techniques and materials. Each state in India has its unique way of making these art forms, which are known by different names. For instance, Rangolis in Maharashtra, Mandana in Rajasthan, Osa in Orissa, Chowk Pujan in Bihar, and Kolam Muddu in Andhra Pradesh and Tamil Nadu. The colors used in creating these decorative art forms are usually made from minerals. They possess certain properties that act as repellents for insects and fungi. The pigments used in these art forms have been found in cave paintings and are still used for decoration of Vernacular architecture. Red pigments were traditionally made from iron oxides such as hematite, while black pigments were made from charcoal and soot. Pyrolusite is the mineral form of manganese oxide that gives black color. Limonite, the mineral form of hydrated iron oxide hydroxide of varying composition gives a yellow color inorganic in nature with Zinc and Cadmium sulfate. Yellow ochre often forms limonite, and red ochre is made from hematite and limonite. White is often made from kaolin clay, burnt shell calcite, Limestone, calcite, or crushed shells, the mineral form of calcium, and carbonate. The mineral form of manganese oxide hydroxide gives brown color. All these dye paints are capable of preventing insects from entering the house.



Figure 8: The picture depicts inorganic minerals and ores used for ornamental purposes that also serve as a repellent.

Source: Ram, Patangrah, a tribal village, of Madhya Pradesh India

8. Documentation

It is important to document Vernacular Architecture through photographic and graphical means. This documentation helps in identifying the behavior of the building structure, the fragility of local vernacular construction materials, and the faulty execution of traditional building materials. It also helps in understanding the behavioral and weathering patterns of traditional vernacular materials, identifying the deterioration of materials, and recognizing weak materials.

9. Conclusion

Conservation, Preventive Measures, and Vernacular Architecture are important factors when it comes to preserving India's organic and inorganic materials.

Using herbal remedies, mineral ores, traditional knowledge systems, and natural products in preventive conservation is not a new concept. These practices have been passed down from generation to generation, and it is crucial to understand their effectiveness in preserving Vernacular Architecture materials. However, due to a lack of interest and changing social scenarios, the traditional preventive methods and indigenous knowledge systems have gradually been lost. Therefore, it is essential to document these practices not only for future research but also to save indigenous knowledge from completely disappearing. Traditional preventive conservation practices include the use of vernacular architecture and its materials. We need to systematically preserve them for future generations. The documentation of such practices is of great importance as it will not only help with future research but also ensure that indigenous knowledge is not lost completely.

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