Traditional Methods to Maintain and Conserve Earthen Houses in Goa – India

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ABSTRACT

The Goan architectural landscape is dotted with earthen structures of small, medium, and big sizes. These range from animal sheds to Indo-Portuguese manorial houses (Goa is a past Portuguese colony in India). Some of them are centuries old and continue to be in use today. However, many structures and the practices associated with them are being replaced — at a fast pace — by swanky laterite-stone and/or cement structures. The latter, of course, are less/not sustainable. There exists substantial documentation of the larger old buildings such as churches, government offices, mansion houses, etc. However, the houses of laymen, which constitute the majority of Goa's architecture, are barely recorded or acknowledged in books and journals.

As part of my post-master's DSA-Earthen Architecture and Heritage dissertation, I studied 16 earthen houses in Goa and analyzed them to understand the traditional practices that contributed to the care, conservation, and longevity of these houses. The findings brought to light how local builders and inhabitants used functional designs, and local materials and techniques, to build as well maintain these houses. This paper intends to disseminate various indigenous architectural aspects, construction details, and conservation methods that were employed to maintain and prolong the life of Goa's vernacular earthen structures. The information is intended to be shared in the hope that it would, in current times, facilitate heritage professionals, custodians, and inhabitants, in Goa and other parts of the world, in the upkeep of their earthen buildings.

Keywords: Conservation, traditional practices, Goa, India

1.INTRODUCTION

Goa is India's smallest state and is situated on the country's south-west coast, along the Arabian Sea. Early Goans were hunter-gatherers.[1] Over the centuries, various empires ruled Goa, the last being the Portuguese who reigned from 1510 to 1961 (451 years). From then onwards, Goa became a part of the Union Territory of 'Goa, Daman and Diu' and on 30th May 1987, it was declared as an independent state of India.[2] Today, the state of Goa continues to exhibit a unique blend of Indian and Portuguese culture, more appropriately described as the 'Indo-Portuguese' culture. This blend of cultures clearly reflects on Goa's architecture.[3][4]

The earliest houses in Goa were caves.[5] As tribal communities evolved, they lived in settlements comprising clusters of houses nestled between trees and plants, which created a network of orderly and self-sufficient villages.[6][7] Houses were built using natural materials such as wood, leaves, grass, bamboo, and coconut and betel-nut palms. Later, they came to be built with mud walls, cow-dung, lime, wood and fired-clay roof-tiles.[8][9][10] Laterite-stones were gradually incorporated

in mud constructions. Currently, laterite-stone and cement are commonplace, and cements-block Goa's current architectural landscape comprises traditional settlements and indigenous houses (palm leaves, earth, stones, etc.), Indo-Portuguese style houses (earth, laterite-stones, etc.), bungalows and apartment buildings (laterite-blocks, cement, concrete-blocks, etc.) and modern eco-buildings (earth, stone, etc.).

This study focuses on the vernacular buildings that exist in Goa today. They belong to the 18th and 19th Century and are mainly built with earth or earth cum laterite-stones.[11][12] They were traditionally constructed by the owners themselves with the help of neighbours, masons, etc. Many of these buildings stand strong even today and continue to be in use. What has contributed to the strength and durability of these buildings? In order to find answers and define the scope of this study, 16 structures in Goa, mainly earthen, were studied and analysed. The aim was to unearth local building cultures that directly or indirectly contributed to the sustainability and longevity of these houses.

2. LOCAL BUILDING CULTURES OF GOA THAT CREATE SUSTAINABLE AND LONG-LASTING BUILDINGS

This study on the vernacular earth-buildings of Goa brought to light various construction details and architectural aspects that allow for sustainable and durable constructions in Goa's tropical climate. Some aspects of Goa's local building cultures are listed below.

2.1. **Thick, load-bearing external walls** assured the structural strength and stability of the houses.

Three main earth building techniques were recorded in Goa: cob, adobe-bricks and rammed-earth. Cob walls were found to be 42cm-70cm thick; a minimum thickness of 45cm was usually maintained to allow the builder to comfortably stand on the 'lift' while building the next one (a layer of earth in earthen constructions is referred to as a 'lift').[13] Adobe-brick walls were about 26cm thick and rammed-earth walls varied from 32cm-40cm.

2.2. **Earth or laterite-stone base-courses and corners** were noted in the earth-buildings of Goa (Figs 1 and 2). Stones were preferred, but their procurement depended on availability and spending capacity of the owners. Stone base-courses lower the risk of water ingress in earthen walls, especially that Goa is a rain prone and humid region. Stones along corners helped avoid the degradation of walls, which tends to begin at corners.

The distribution of earth and laterite-stones could vary on the same building. For example, some walls have laterite masonry on lower walls and earth on higher walls, in other structures, laterite-stones are placed at intervals along corners (Fig. 1).

Figure 1 and Figure 2. Laterite-stone base-courses and corners

2.3. **A small, earthen gradient covers the foot of the external walls.** It acts as a barrier and keeps rainwater from seeping into the earthen wall. As spelt-out by one of the inhabitants, Romeo Braganza, "If rainwater accumulated around the house and rose by a few centimetres, the slope would prevent the water from entering the wall. However, if there is a flood, the slope would be of little help".

The gradient of one of the surveyed houses measured 45cm (height) x 60cm (width). In some cases, it takes the form of a step giving an impression that the house is on a height. Sometimes, laterite-stones fringe the gradient (Fig. 3).

Figure 3. A small, earthen gradient covered the foot of external walls
Figure 4. Sometimes, laterite-stones fringe the gradient. Lime made from sea-shells were used to plaster Goan houses

2.4. Almost all houses in Goa have **verandas**; some have 'sopos' too. 'Sopos' are in-built masonry seats in the veranda and are indigenous to Goan houses. The facades of rural Goan houses also had a lean-to thatch roof held by wooden posts. This space was called the 'padvi' or 'pakadi'. With the Portuguese influence, it took a fancier form with intricate colonnades and railings and evolved into the veranda (referred to as 'balkâmv' in Konkani, and 'balcão' in Portuguese).[14][15]

The 'padvi' was meant to protect the walls from rain water, and for residents to enjoy the breeze on sunny evenings, chat and gossip. Today, the veranda serves the same function of protecting wall facades and continue to be used for resting, socialising and occasionally, for performances such as the traditional Goan 'mando' music.

Figure 5. The Goan veranda or 'balkâmv' [Source: shorturl.at/tAORT (accessed October 2, 2020)]
Figure 6. 'Sopos' or masonry seats in verandas are indigenous to rural Goan houses [Source: shorturl.at/nsK58 (accessed October 2, 2020)]

2.5. Traditionally, **lime made by baking and crushing sea-shells** was used in constructions in Goa. Lime was usually used as plasters and renders. For mortars in laterite-masonry, it was sometimes mixed with earth or used for re-pointing.

Lime plasters and renders provided walls with extra protection from everyday wear and tear. As sea-shell lime is a breathable material, this protective layer allowed water that usually seeps into walls, especially during the monsoons, to evaporate. Lime plasters, thus, prevented humidity from degrading walls. Besides, when mixed with earth, lime served as a binding material and improved the strength of the building.

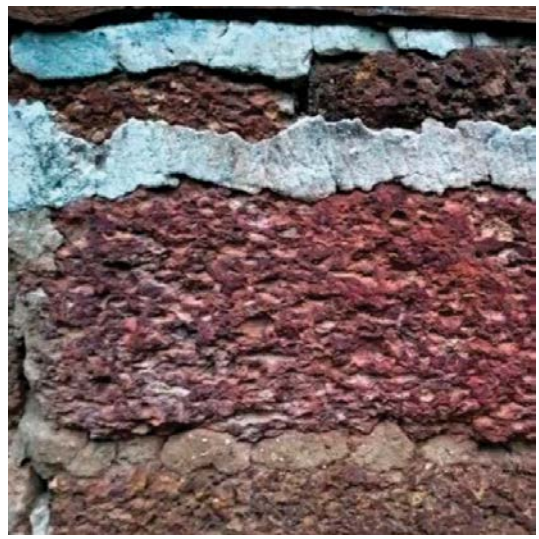

Figure 7. Earthen mortars with lime re-pointing

2.6. **Palm-leaf barriers poised parallel to earthen walls** ('dollios' in Goa's local language, Konkani) were usually constructed every year, before the rainy season, in order to prevent rainwater from damaging the walls.

Figure 8. Palm-leaf barriers poised parallel to earthen walls protected walls from rainwater

2.7. **Rafters** were traditionally made from trunks of dead coconut trees. As explained by mason Bernardo Sequeira, "Dead coconut tree trunks were procured because they were dry of sap and contained less moisture, which kept termites away and allowed the roof's framework to last longer. Today, fruiting coconut trees are cut in order to make rafters, but they do not last long".

In order to prepare rafters, a single trunk is slit along its length; several rafters can be obtained from a single trunk. Nowadays, other wood is also used to make rafters.

2.8. Almost all the structures in Goa had **large overhangs** that extended from the roofs. In addition, temporary overhangs were mounted along wall facades (Fig. 9) or only above window-frames (Fig. 10). Overhangs protected the walls from rainwater. Those that covered windows prevented rainwater spatter from entering indoors.

Overhangs in Goan houses protrude outwards by several centimetres and may extend to a metre or more. Temporary overhangs were traditionally made using palm-leaves (Fig. 9) and were usually mounted every year before the monsoon season. Some owners have now chosen to replace traditional overhangs with metal-sheets (Fig. 10).

Figure 9. Coconut palm leaf overhangs
Figure 10. Metal-sheet overhangs

2.9. **Supports to hold temporary overhangs** were planned and fixed at the time of construction. These supports included wooden pegs, which are often visible along the lengths of some facade walls or above window openings. The pegs are usually aligned with one or two decoratively cut laterite-stones that jutted-out from the top edge of the wall. These stones were probably primarily meant to support the framework of the main roof but sometimes aided in holding the overhangs as well.

Figure 11. Wooden pegs along the lengths of some façade walls
Figure 12. Two decoratively cut laterite-stones that jut-out from the wall top were probably meant to support the roof framework, but sometimes aided in holding the overhangs as well

2.10. A special detail was observed in the **placement of batons in the roof's framework.** The approximate size of the batons is about 5cmx2.5cm each. Generally, the wider surface is placed on the rafters. However, the baton along the edge of the roof is placed with the smaller side resting on the rafters (Figs 13 and 14). This detail lifts the edge of the roof slightly and directs the downpour of rainwater further away from the wall.

In some cases, to obtain this effect, two instead of one baton are fixed along the ends of the roof's framework (Fig. 15). In some regions of Goa, where slits of the beetle-nut tree are used as batons, double slits are placed at the edge (Fig. 16).

Figure 13 and Figure 14. The baton along the edge of the roof is placed with the smaller side resting on the rafters

Figure 15. Two, instead of one baton was fixed along the ends of the roof's framework. Figure 16. Two splits of the beetle-nut tree were used as batons

2.11. Sometimes, one can spot small **wooden batons fixed on roof corners**. As elaborated by Architect Tallulah D'Silva (founder of 'Architecture t' – Goa), "The baton holds the edge tile up, or else the tile will dip lower than the overlapping tile". She added, "This detail is also noticed at the edge of the ridge of a mechanical-tile roof".

Figure 17 and Figure 18. Small, wooden batons were fixed on roof corners

2.12. **Eaves** are often seen in the bigger, mansion houses of Goa. They are usually made of wood. Their purpose is to keep rainwater spatter from entering the interior of the house; it also serves as an aesthetic element.

Figure 19. Eaves [Source: https://www.tanshikarspicefarm.com/# (accessed October 2, 2020)]

3. CONCLUSION

The traditional earth-buildings of Goa included architectural details made from other locally sourced materials such as stone, lime, palm-leaves to manifest. The assemble resulted in solid, durable and sustainable buildings that have stood the test of time. Many of them are centuries old and continue to serve the purpose of housing, storage, etc.

Inhabitants purposefully employed natural materials found in the surroundings of the construction site, and created thoughtful and functional designs, to manifest and maintain their houses. These houses were intelligently designed to shelter the owners from Goa's hot summers and harsh monsoons. As earthen walls possess thermal properties, they keep the house cool during summers and warm during winters. Laterite-stones, especially in base-courses and corners, and lime in mortars and renders, provided added strength to the buildings, thus allowing the building to last long. Elements such as verandas, gradients along the foot of walls, strong and detailed roofs, large overhangs, etc. enabled buildings to endure harsh climates and yet retain their structural strength and stability for decades. These well-thought details secured the inhabitants of Goa with reliable and beautiful houses that were comfortable to live in — irrespective of the weather conditions that prevailed outside the house.

4. ACKNOWLEDGMENTS

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