

A Construction in Mud and Lime Mortar – An Ecological Sensitive Alternative for Post Modern Residential Dwelling in Goa

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Abstract—A residential built house form reflects the socio-cultural identity of the place which includes the traditions, life style, customs, values and the architecture with the building materials and construction practices adopted. The traditional residential environment had a use of locally available materials woven into its built form. In Goa the locally available laterite stone material was used combined with lime/mud mortar prepared out of sea shells obtained all along the coastal belt. So it was a combination of these natural resources i.e laterite as stone, lime mortar and lime concrete in the making of traditional Goan houses. On introduction of cement as an industrial alternative and the mass production approach towards residential construction the natural fabric of the built form got transformed into an artificially forced building technology and materials which had no connect with environment or sustainability. This attempt of an ecological sensitive alternative of a post Modern Residential house design aims to revive and tie-up the socio-cultural identity and also create a economically viable cost effective solution for the middle income group of people. This project is designed on the traditional courtyard ('Rajaangan') Houses of Goa by adopting traditional load bearing walls made from locally available laterite stone in lime+mud (Surkhi) mortar with combination of plastered and un-plastered walls adopting optimum use of local natural materials increasing the thermal efficiency of the house saving consumption of power. The roof top water harvesting systems incorporated took care of services especially during the monsoons cutting down the water bills. Introduction of kitchen garden system allowed natural living habits and took care of the daily cooking requirements of the household. Thus the amalgamation of traditional value system, built with traditional techniques and the combination of modern equipments suggest a bench mark as an attempt to revive socio-cultural identity of Goa.

1. INTRODUCTION

The traditional techniques in making the earlier indigenous Goan houses before the colonial period was in its built form which included the load bearing structures and building materials mainly that were locally available like laterite stone or the traditional rammed earth technique with the available mud resource along the hillside.



Figure 1: Traditional 'Tulsi court'- Bhave's house, Ponda-Goa.

The mortar used was either mud or lime or the combination of both. The process although was time consuming came about to be practiced naturally. The lime obtained from the coastal sea shells had to be dried and then burnt in order to get the fine powder form from which mortar could be prepared. The mortars were used extensively in masonry and plaster works.

The wall thicknesses of these houses would vary from 70 cms to 40 cms depending upon the scale of the construction thus increasing the thermal comfort of the built form and to complement this, the houses were designed with a central courtyard ('Rajaangan') which would facilitate the cross ventilation of the spaces around it forcing the warm air to move up and out from this courtyard.

The external stone walls used to be generally un-plastered supported by huge roof overhangs in order to protect the structure from rain water. The internal spaces were white washed with an inlay of graffiti work as part of decoration. The main binding material used was lime and this was allowed to slake for about 3 weeks before it was used to mix and prepare the required mortars.



Figure 2: Designed house (Girish's house), Curcholem, Goa

This house design for my client (Girish's house) at Pontemol, Curcholem, Goa is an attempt to explore all these traditional materials, techniques along with the courtyard design to revive the socio-cultural Goan identity and complement it as an ecological sensitive alternative in post modern residential spaces. Also explore it as an economically viable solution to the middle income group.

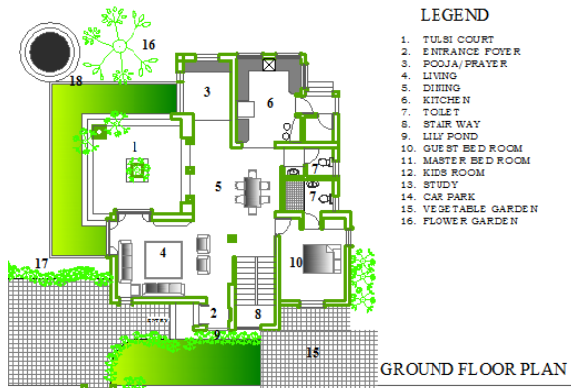


Figure 3: Ground Floor Plan of the designed house

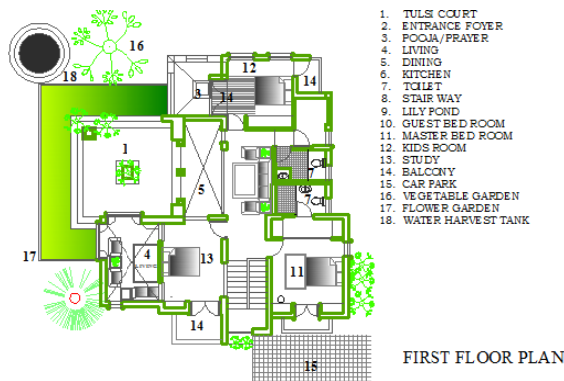


Figure 4: First Floor Plan of the designed house

2. THE SITE

Located in a village named Curcholem about 15kms from Goa's cultural capital, Ponda this house is designed in a plot area of 600m², wherein 400 m² of the plot was kept as a backyard, open for kitchen garden space ('Ghorbhat') which would accommodate all the fruit bearing trees and the plants required for everyday household needs of flowers and medicinal use.

3. CONSTRUCTION

Structure- The house is a Ground+1storeyed, structurally designed as load bearing with locally available laterite stone and surkhi mortar (lime+mud) mixed with portions of sand and water. This mortar was prepared by the technique of continuous slaking of the lime on site.



Figure 5: Masonary with Laterite stone and Surkhi Mortar

Pointing- To optimize use of natural material resources external plastering was avoided where possible especially on the opposite side of rain direction and instead offset pointing techniques were used so that the lime mortar is safely away from direct exposure and contact with the rain water. This technique also enhances the architectural feature and cuts down the cost too.



Figure 6: Pointing in Masonary walls

Beams- To take up the load of upper walls and the roof, special RCC Pad beams were designed (20x45 cms) looping the entire perimeter at intermediate level. Cement was used in casting the RCC components of these Pad beams, upper floor and sloping roof.



Figure 7: Special RCC Pad Beams along the Masonary walls

Plaster- The internal plaster is in mud and lime mortar (Surkhi Mortar) which enhances the thermal efficiency indoors and has a direct reduction effect on power consumption on daily basis. The upper floors, toilet walls and duct areas were plastered using cement mortar due water proofing advantage. All the indoor spaces are also provided with natural sky lights which create a lot of lighted internal spaces and assist in less consumption of power.



Figure 8: Internal wall plastering with Surkhi Mortar

Mortar- The mortar used for internal plaster was a combination of lime, mud, sand, water along with the traditional binder liquid (Jaggery, Bel fruit, Neem leaves and few types of Dal boiled together). The contents are manually mixed together and kept for ripening for about 3 weeks. The whole process was undertaken on site itself as it is time consuming and involves skill patience and moisture control.



Figure 9: Boiling of the traditional binder to add in Surkhi Mortar



Figure 9: Mixing of Surkhi Mortar

Courtyard- The courtyard incorporated in the design creates the outdoor spaces within. It is lined with a raised platform to accommodate seating around for leisure and social occasions. Under this platform there is a water harvesting storage tank which functions to provide water to the service areas during the rains. Generally this water storage tank serves as an additional storage facility and also cools the temperatures around these spaces.



Figure 10: Water Harvesting Tank below the raised seating in courtyard



Figure 11: Courtyard space

For natural cooling additional smaller water bodies in the form of water lily ponds and fish ponds are introduced in the outdoor spaces in the windward direction of the site so that the cool air enters indoors. In order to accommodate the client's requirements for indoor colour scheme in few areas overcoats of wall putty and ecofriendly paints were used.

4. SENSITIVITY,

Apart from the design sensitivity it is also important to have an understanding of right usage of materials in the given context. The use of Courtyard space, incorporation of natural lighting, planning of structural components, preference of lime+mud over cement besides use of local techniques has

given shape to this post modern house which becomes a combination of both traditional sensitivity as well as modern time frame.



Figure 12: Planning sensitive spaces (Lime+Mud Plaster wall)

5. COST SAVING,

Although it is time consuming to replace the currently used cement mortar, the judicious use of lime has reduced the cost three times. The cost of a 50 kgs cement bag is an average Rs. 365/- and a lime bag cost Rs.40/- for 15 kgs even considering this form of use and all the other overheads the cost reduces by at least three times. This saving was then utilized in giving luxurious interior finishes to the spaces by using marble flooring and teak wood for the door and window shutters.



Figure 13: Interior spaces

6. CONCLUSION

This residential house designed for my client is a good example where both the time frames are balanced in terms of traditional design with value system put together with latest technology in automation, lighting, wall papers, murals etc. It is the need of the hour that we should try to revive this traditional wisdom in making the built form with not only the design sensitivity but also revive the traditional construction technologies used in earlier times. Thus a blend of resourceful use of materials and techniques with sensitive design and structural approach could very well bring about an

ecologically sensitive and cost effective alternative to a residential dwelling unit.



Figure 14: Façade look before painting

7. ACKNOWLEDGEMENTS

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