



Bamboo Architecture for ecological living

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ABSTRACT: *Nowadays Bamboo has been gaining attraction all over the world. Bamboo is cost effective, practical, aesthetically pleasing and environmental friendly building alternative. Bamboo is extremely Strong, versatile, and flexible and light weight material & considered to be as sustainable and renewable alternative to hardwoods because it regenerates at very fast rate. Bamboo is cost effective especially in areas where it is cultivated and is readily available. Bamboo is an ancient solution to new problem; it is an alternative solution as a building material being renewable resources absorbs greenhouse gases. Bamboo also has a long history of use in buildings, being common to the vernacular architecture of China, Considering the architectural design there are many ways to design using bamboo. This paper explores the possible use of bamboo as structural and sustainable material in construction industry & also explains how architects have used this material as a cost effective, structural and aesthetically appealing building material in various projects.*

Key words ---cost effective, green house, renewable, sustainable, vernacular architecture.

1, INTRODUCTION:

Why should we concern ourselves with building with Bamboo in this age when we have so many new modern materials like steel, glass, aluminum and so on? Because bamboo is versatile and highly renewable resource it is very good example of sustainability, with respect to both the plant itself and also its use as building material its impact on environment is nil. At every stage of growth bamboo could be used. Because it could grow everywhere there is no transportation cost. The yield per year is almost 25 times that of timber because it grows very fast. Bamboo is self generating raw material and it is used as shelter belt near river bank and agricultural field. Bamboo plant purify air.

1.1 Bamboo as Sustainable building material.

Architects and designers making use of Bamboo created very innovative buildings. Bamboo architecture may well seem to be some sort of exotic form of field, especially in the Western context. And it is a fact that detailed literature about bamboo in modern architecture is hard to come by. But to put things into perspective, the bamboo industry (including small goods, fabric, etc) is expected to be worth \$25 billion by the year 2014. Moreover the cultures of East Asia and the South Pacific have traditionally shown affinity for bamboo as a construction material. Now equating that with its being one of fastest growing plants in the world, and having high tensile



strength (actually more than many alloys of steel), certainly have a great future ahead with bamboo construction. Following are the sustainable examples organic bamboo architecture.



Figure 1: Bamboo symphony office building

Bamboo symphony (Fig.1) is an office building in Bangalore that promotes the use of more natural building material like bamboo. The curvilinear office building extensively made use of locally sourced, recycled and natural building material like Bamboo, fly ash, recycled wood, metal and stone. Bamboo symphony is basically open air structure is built out of mud blocks made on site with locally available material and concrete shell roof over a lattice grid of bamboo provides shade and thermal mass. This office building attempts to use bamboo in place of wood or steel and even reduces the weight of the concrete by adding bamboo fibers in to the concrete mix. For walls Bamboo Crete precast wall panels are used. The office floors are made from bamboo. Some ambitious students at the Indian Institute of Technology in Bombay, India have constructed this bamboo bus stop (Fig.2) for commuters. The structure is intended to demonstrate the structural efficiency of bamboo and raise awareness of it as a strong, versatile building material.



Figure 2: Bamboo bus stop

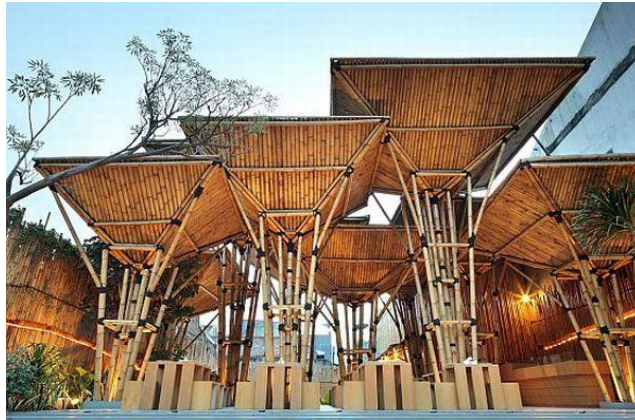


Figure 3: Noodle Restaurants in Bamboo structure

Minimalist in its form, organic in its bearing and utterly beautiful in its appeal, this is an outdoor Japanese Noodle restaurant (Fig.3) designed by DSA+s. The naturalistic and sustainable conception just provides the basic essence of shelter in form of shades from sun, wind and rain. The fabricated nature of the construction also allows it to be assembled and disassembled just as easily.



Figure 4: Vernacular bamboo housing project, Haiti

Simplicity infused with a traditionalistic virtue defines this interesting design concept of a housing project proposed for Port au Prince, Haiti (Fig.4). St Val Architect studio have supposedly been inspired by the prevalent traditional art of making cocoon-shaped baskets, composed from weaving natural plant fibers available from the local habitat. The buildings will maintain a vertical alignment so as not to increase the overall structural density of the area.



Figure 5: Multi storey building using Bamboo

According to structural engineering tests, bamboo has a higher tensile strength than many alloys of steel, and a higher compressive strength than many mixtures of concrete. It also has a higher strength to weight ratio than graphite. Taking advantage of such properties, Dutch architect Robert Verrijit along with Indian architect Shefali Balwani of Architecture Brio will design a 3 storied building (Fig.5) with bamboo as the most important supporting member.



Figure 6 : Bamboo Beach house, kerala

Located in the sands of paradisaical Varkala beach in Kerala, this sublime design in the form of a beach house (Fig. 6) studded in the gorgeous setting close to the sea, certainly manages to impart that all natural vibe. And ‘naturally’ some part of that essence has to do with its fully organic bamboo construction.



Figure 7: Tree house Restaurant

Looking like voluptuous petals of a grandiose lotus about to unfurl upon a tree, this stunning treehouse restaurant (Fig.7) was designed by Pacific Environments Architects Ltd. (PEL) in New Zealand. Though not strictly using bamboo, the conception does incorporate plantation poplar slats with redwood balustrading. Moreover it uses natural daylighting techniques to accentuate upon its naturalistic bearing.

This school project in the small village of Jar Maulwi, 35km northwest of Lahore, is an extension of the existing Tipu Sultan Merkez School, (Fig.8) which has provided education for underprivileged rural girls for more than ten years. The new two-story building will provide seven new classrooms. The building was under construction and is made from locally-sourced cob and bamboo. The structure is divided into two compact parts connected by a light gallery to mitigate earthquake risk.



Figure 8 : School Building, Lahore



Figure 9 : Roof construction



Using locally available material this school is constructed while the ceiling (Fig.9) is constructed out of Bamboo. Instead of using timber or steel beams the massive roof is fully constructed of locally grown bamboo. A damp proof course on top of the earth filling guarantees that no water comes in.



Figure 10. Bamboo low cost housing

A team of designers, architects to develop the first bamboo housing (Fig.10) prototype that can be extended out and up to accommodate a growing family. A low cost sustainable housing executed in rural villages of central India was costing 1.25 lakh. Providing a low cost alternative to the modern concrete home was the main objective. This project incorporated the properties of bamboos lightness and flexibility. Wall panels and roof trusses, and provision of future expansion if the family requires more space. Metal joints were used for the assembly of wall panels to the primary structure.

II CONCLUSION:

Because of the global demand for non-polluting, sustainable, and earthquake resistant building materials, the interest in bamboo construction among western innovative architects is now growing rapidly. Bamboo not only offers optimal solutions for communities with smaller resources, it is also a popular resource and study subject for professionals and institutions of a high economic level which translated itself in high scale residential houses, schools. it is always a challenge for architects and designers to use bamboo as construction material in the era of modern materials.

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