Prefab bamboo partition wall

N.Tondonsana Singh[1]

[1]School of design-II, Interior and Furniture Design, Lovely Professional University, Punjab

Abstract

In this modern materialistic world people are urged and eager to find out new innovative material which it could be more comfortable to the users. Bamboo prefab partition wall could be easy to install and easy to transport. We know the properties and benefits of bamboo. It would give good effect in indoor air quality of the building; the hole between the nodes of the bamboo takes an important role. For more stronger and loaded the weight, the bamboo can be arranged in vertical way. The four side of the wall is bounded by concrete according to the dimension of the surface area. From both side of the wall apply bamboo strip mesh and apply a composite of mud, cow dung, and dry straw in traditional way finish with natural plaster of Paris. This innovative method has certain benefits to the present generation where the materials are pure sustainable.

This study would enhance the use of sustainable material in present and future generation. We generally know about the benefits of sustainable materials in building construction. Among the sustainable materials, bamboo is one of the very popular materials in present day and also one of the oldest materials used by human. Bamboo is also one of the fastest growing woody plants. Bamboo prefab partition wall is a new innovative idea where it can be implemented in modern building.

Key words: bamboo, sustainable material, application in building, climatic condition.

1. Introduction

1.1 Statement

A prefab bamboo partition wall is an innovative idea which can be used by people for their own comfort and can be one of the future architectural materials. We have seen many prefabrication walls and partition, most of them are similar in function and even the materials are also common. Now architects and designers are looking for more sustainable materials like bamboo prefab wall. So my intention is to combine these elements into one unique and feasible design, acceptable to the user and the environment. “Life on sustainable world”.

1.2 Description

Assembling of building component which is manufacturing in factory or other site like wall, slab, beam, column etc. are called prefabrication. People are becoming lazy day by day as the technology are so far advanced and want to live in highest level of comfort. But there is also negative effect of technology; people have the experience about global warming effect too much hot in summer and too much cold in winter which leads to the increase of sea water level. Everything is done by our human beings only. So it’s time to think and do something for our future generation. Engineers inventing many new products and things which could help to reduce pollution to the atmosphere and also which could help people to live happily. Among them bamboo prefab partition wall could also be one. Bamboo prefab partition wall has some special features as comparing with others prefabrication walls. It has to be made from natural material or we can say sustainable like bamboo, cow dung, mud, and dry straw.

1.3 purpose of the study

These generation of people are well intellectual and search for easy and convenience way to live. But also at the best level we are trying to reduce environmental pollution and global warming which we are facing now. So people started implement sustainable materials in many ways and many fields. Architect and interior designer start using bamboo as a best sustainable material in building construction.

Bamboo is a type of grass which is tallest in world and Poaceae is the scientific name of the family. Bamboo has been used as a traditional building material since from long time in Asian countries like China, Thailand, India, Vietnam, and Laos, and also in Latin America, now in western countries also started making with bamboo. People now used to learn more about bamboo and start liking it, because it is renewable, sustainable material, light weight, durable, Eco-friendly, low cost, and long lasting. It is mainly found in tropical and sub-tropical region of the world. A bamboo can get mature in three to five years, and it also has harvesting time also, a bamboo contains glucose and there is time when the level of glucose is low. That is the right time for harvesting bamboo for the purpose of construction. Bamboo shoot is a new culm which is newly grown from the ground is eatable which is good for our health and also use as medicine.

2. Uses of bamboo:

Millions of years back people knew the uses of bamboo. But till 1920 there was no major research about bamboo. Now people start using bamboo in new technic in various ways like

- House
- Furniture
- Flooring
- Vehicle
- Electronic products
- Crafts
- Utensil

When people came to know that there are various native species of bamboo almost everywhere, it is now widely used in landscaping, but in two different styles running and clumping. While bamboo was so famous in the eastern countries for housing since many years back, now in western countries become popular. Many architects are using bamboo by seeing the properties of the bamboo and beauty and trying to enhance the bamboo in building material as it is become so famous. (Liwei)

2.1 Bamboos as a building material

Bamboo is widely used in building construction mostly used in housing of rural area, because it is easily available and renewable. A bamboo house can survive up to twenty-five years and maximum it can survive above hundred years. In north east India more than hundred years old bamboo house is there. Bamboo can tolerate high values of deformations in the elastic range that is possesses high elasticity. When bamboo house is properly constructed, they are ductile that is being able to sway and fort during an earthquake, without any damage to the bamboo poles. (Liwei).

Table 1: Comparative chart of Moso bamboo and Bambusa arundinacea……[7]

Moso bamboo 	**Bambusa arundinacea** 
It is a giant bamboo with respect to others	This species is also known as iron bamboo.

bamboo.	The size of the bamboo is medium.
It has a diameter of 3 to 7 inches and 80 feet tall.	It has 2.5 to 8 cm in diameter and 25 feet to 64 feet tall.
-120c to 220c is the ideal growing temperature.	-50c to 450c is the ideal growing temperature.
Need plenty of heat and water. Required well drained and red clay soils.	It can grow in semi dry and dry zone. Mainly grown in hills and plain area.
The internodes are shorter near the ground and gradually increase the length of the nodes towards top of the bamboo.	Nodes at the base are swollen, rooting and having branches. 8 to 30 cm at the base and 30 to 45 cm at above. It has thick wall.

3. Advantages of bamboo

Bamboo is one of the pioneer materials and there are many advantages of it. Bamboo is earthquake resistance material. It also one of the leading sustainable material and in this few years the product of bamboo is being promoted all over the world. It also

- Eco friendly
- High grow rate
- Easily available
- It's a renewable material
- Low cost
- Long lasting
- Highly productive. (distro home, 2013); (Liwei)

4. Properties of bamboo

1 Specific gravity (SG) is the ratio of the density of a substance to the density of a reference substance. Depending on the anatomical structure the SG of the bamboo also varies from bottom to top portion.

2 Bamboo contain very high moisture, 100% moisture contain in green bamboo and gradually reduce when it expose to sunlight by evaporation process.

3 The fiber contain is increase from bottom to top of the bamboo.

4 As the age of the bamboo varies the physical and mechanical properties of the bamboo.

5 The density of the bamboo is 16.02 kg/m3.

6 Shorter the internode of the bamboo the more is strength.

7 Thicker the wall of the bamboo the more is strength. (Li, 2004)

Table 2: General information of bamboo……..[3]

Species/year	Breath height		Total height (m)
	Wall thickness (mm)	Diameter (cm)	
Bamboo/one	8.15	7.81	13.15
Bamboo/three	7.87	8.12	12.58
Bamboo/five	7.94	8.46	13.65

Table 3: Average fiber length of bamboo in year wise……..[3]

Year	Layer	Fiber Length (mm)	Fiber number measured
one	Outer	2.16	484
	Middle	2.27	401
	inner	2.19	294
three	Outer	2.08	321
	Middle	2.32	301
	inner	2.26	229
five	Outer	2.03	456
	Middle	2.32	431
	inner	2.39	307

5. Bamboo harvesting

The best time for bamboo harvesting is at the age of three to five years and it should be harvested during dry season. At the age of three to five years the bamboo has less glucose level so it is good time for harvesting. It also will reduce attack from termites and beetle, since they are dull or less active during this season. So the best time for bamboo harvesting is autumn and winter.

For protecting the outer skin of the bamboo the branches should be removed carefully from the culms. It can be store in vertical or horizontal. It should be protected from direct sunlight, rain and soil moisture. The bamboo cane can be dried for 6-12 weeks. (Village Volunteers)

6. Bamboo Treatment

Treatment is very much required for those bamboos which should be used for constructing material. For protecting bamboo from insects like termites, beetles and fungus it is very much required for treatment. Without treatment the bamboo product can't be withstand for longer period. There are three types of method they are:

6.1. Immersion

Freshly cut bamboos are immersed in water for 4-12 weeks. During this period the nourishment for insects inside the bamboo is removed. Stream water is more suitable for this technique. This method can remove the glucose from the newly cute bamboo.

6.2 Impregnating coating

Coating with borax solution is a good technique. The borax salt solution being pressure-fed in the pole until it is seen at the outer end of the pole. This kind of treatment should be applied on the day of the harvesting of the bamboo.

6.3 Heating

In this method the bamboo cane should be heated for a short time at 150oC. And another method is the bamboo cane can be putted in a large container and boiled around 25 minutes. This method can protect the bamboo from termites attack. (Village Volunteers)

7. PATTRENS OF BAMBOO ON PREFAB WALL

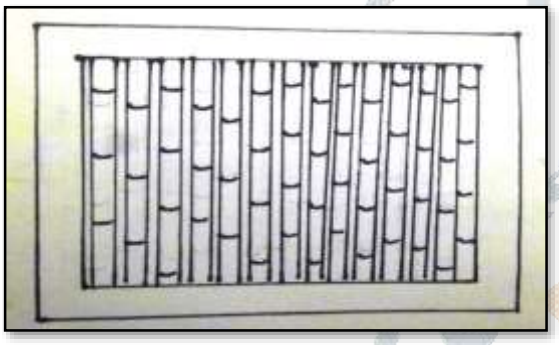


Fig. 1 vertical

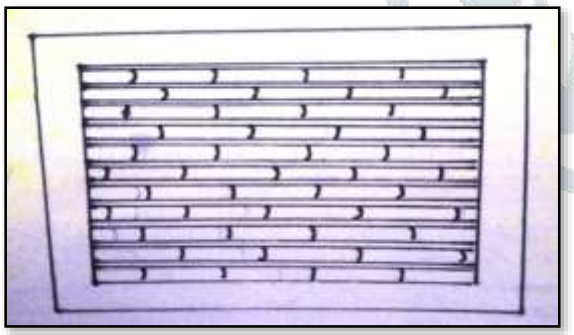
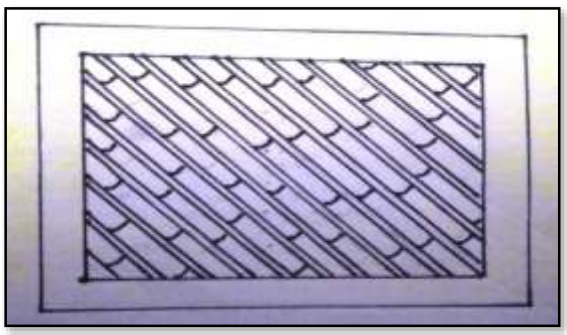


Fig. 2 horizontal



In prefab wall we can consider three types of bamboo patterns.

1. Vertical
2. Horizontal
3. Diagonal

Among these three the strongest patterns could be vertical as from the above studies. So I consider vertical patterns.

In horizontal patterns the load of the building or wall could give pressure horizontally on the bamboo. Though bamboo has high tensile strength but weaken on horizontal.

Diagonally the load of the building and wall could give pressure at the end point of the bamboo and it could not load the weight for longer time.

Fig. 3 diagonal

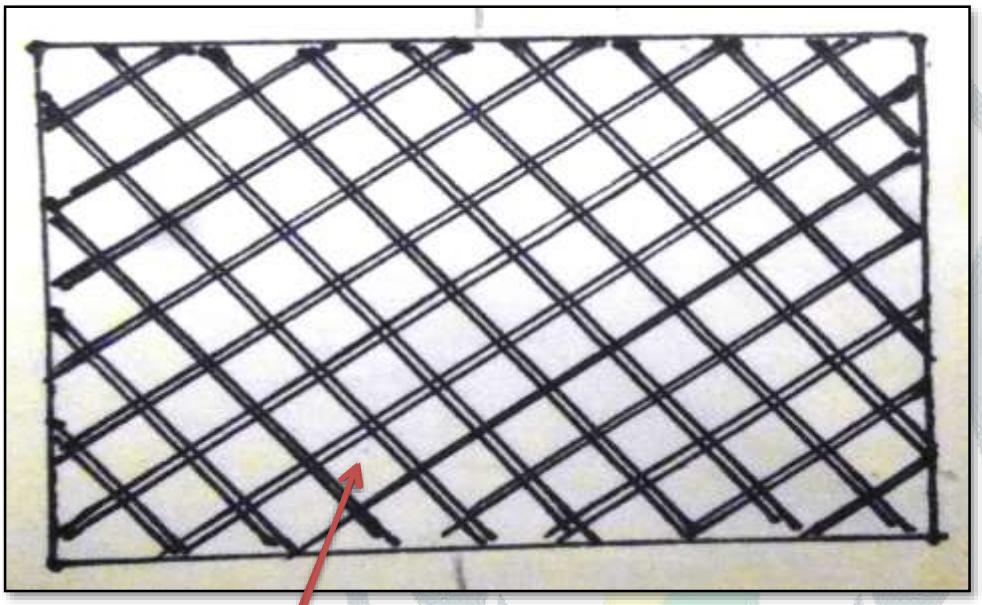


Fig.4 bamboo jali

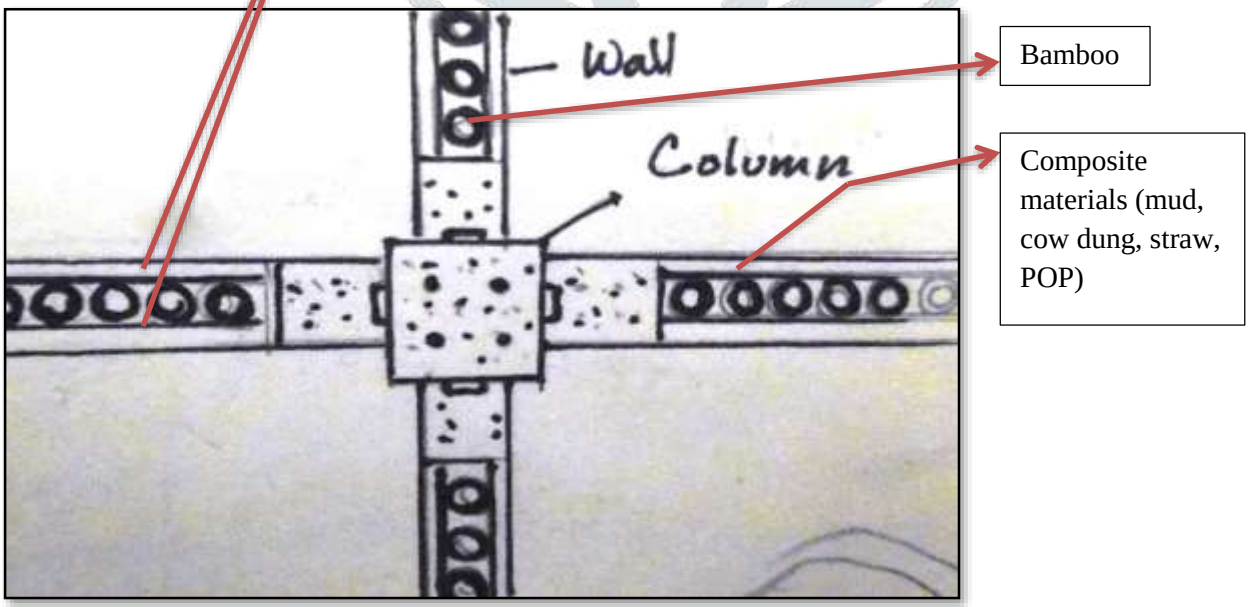


Fig. 5 sectional detailing

The bamboo jali is fixed on both the side of the structural bamboo with cane wire so that it could fix harder and sustainable. It would be easy to apply composite materials.

8. Different sizes of prefab bamboo partition wall

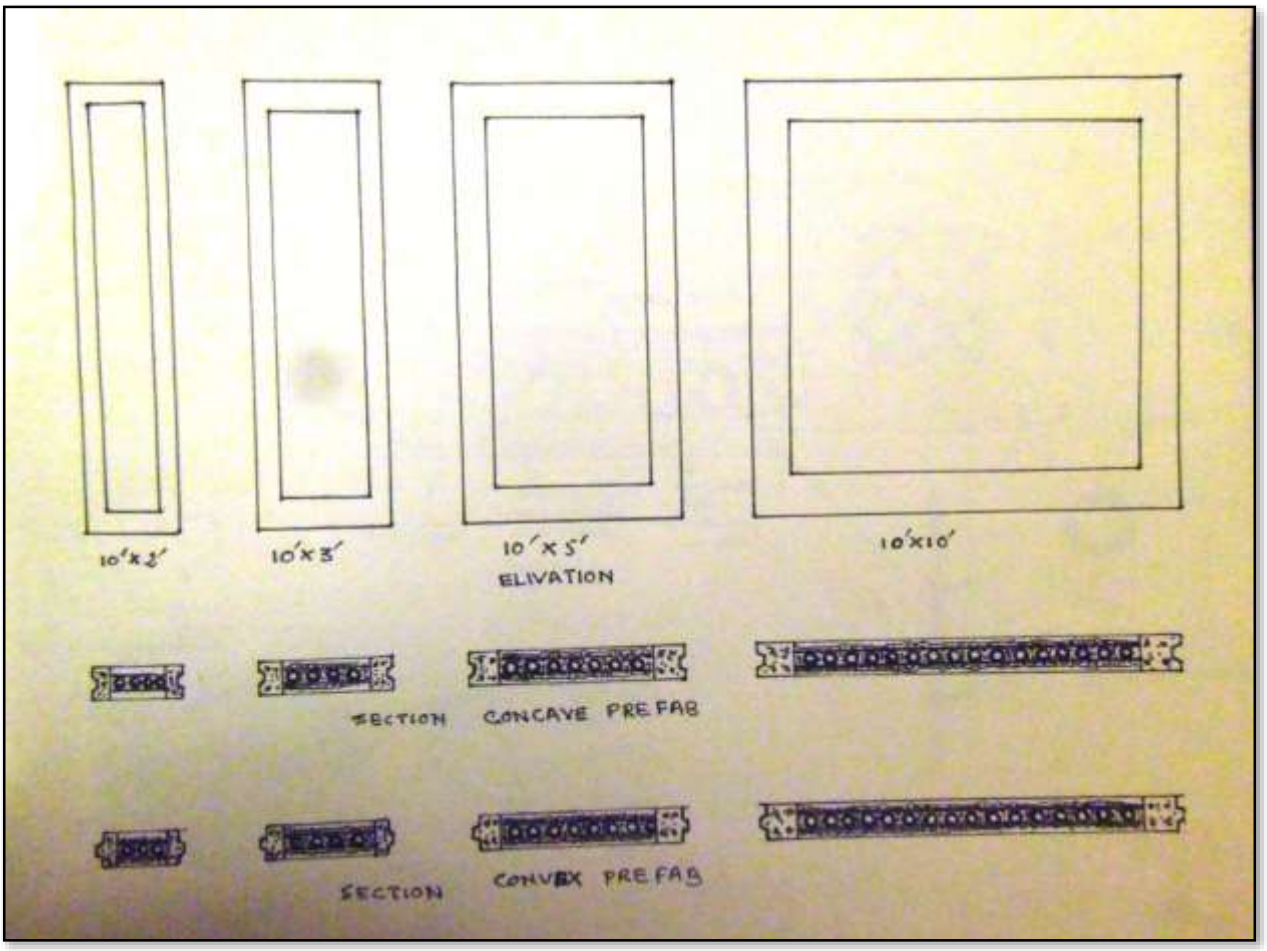


Fig. 6 dimensions of wall

There would be different sizes of prefabricated wall. Each size has specific function. The dimensions are 2'x10'; 3'x10'; 5'x10'; 10'x10'. These sizes of the wall could adjust the dimension by joining according to the dimensions of the room. And there are two types of joining they are:

1. Concave joining
2. Convex joining

9. DETAILING

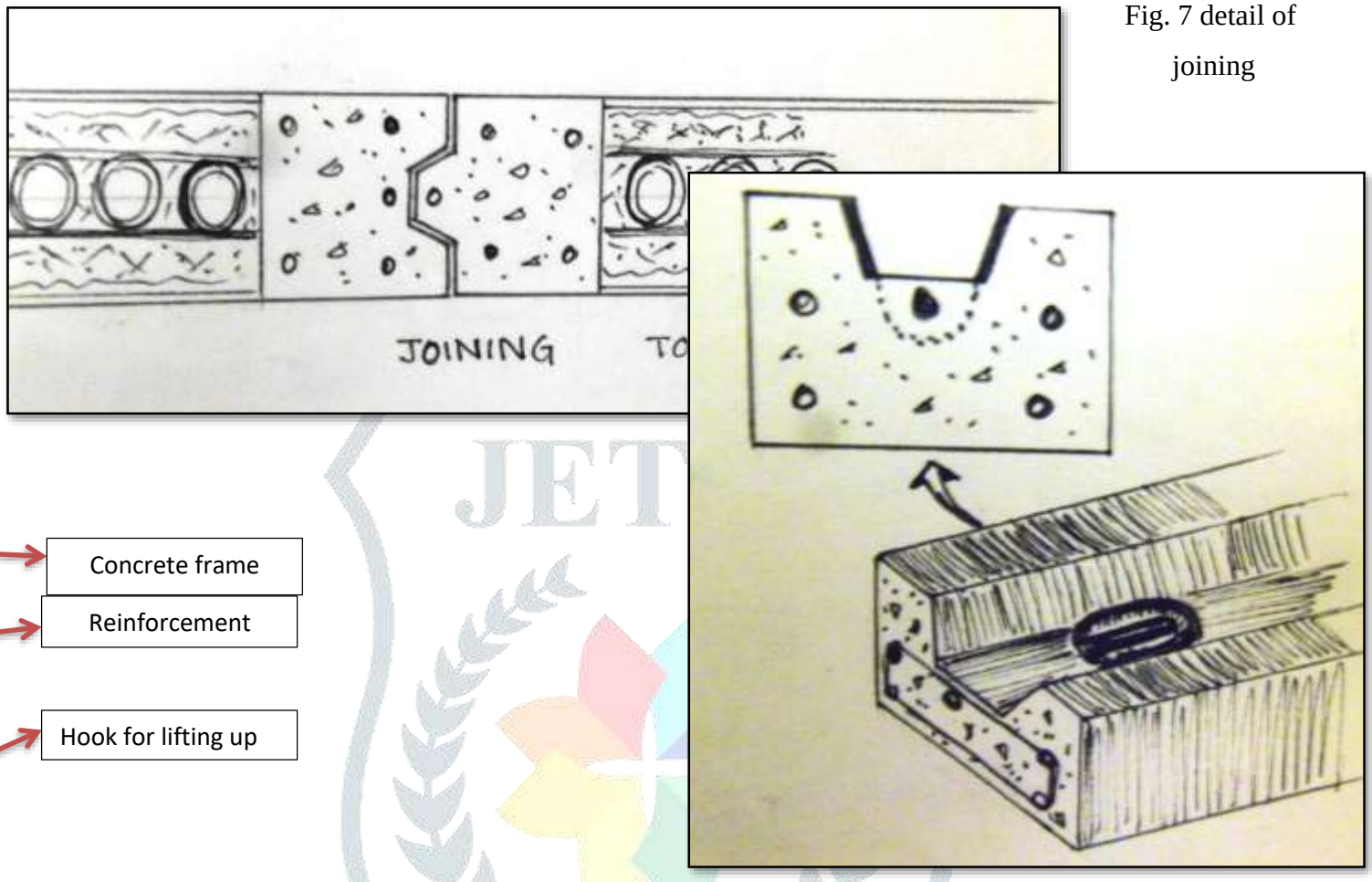


Fig. 7 detail of joining

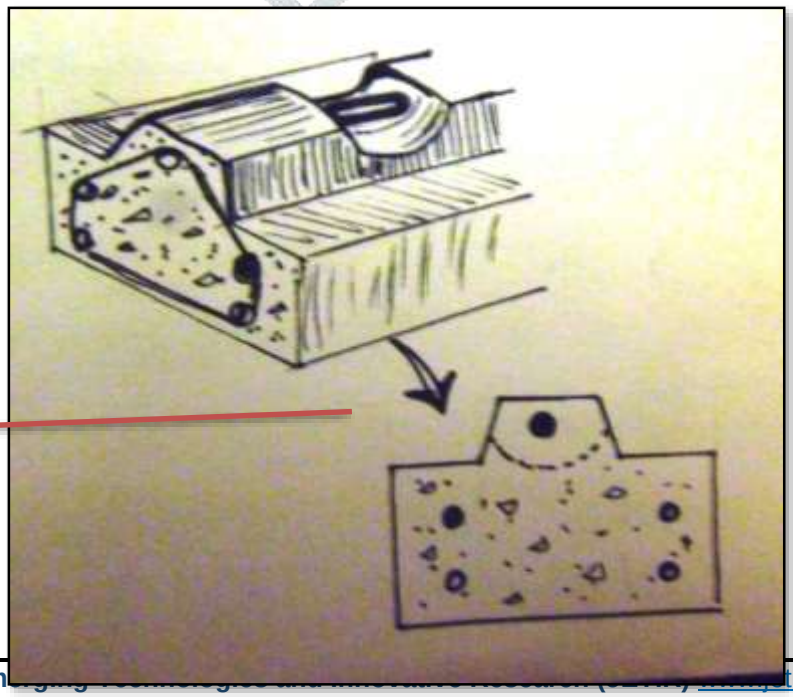


Fig. 8 detail of concave joining and hook

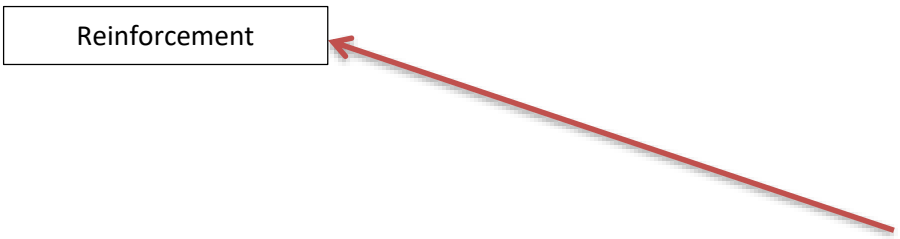
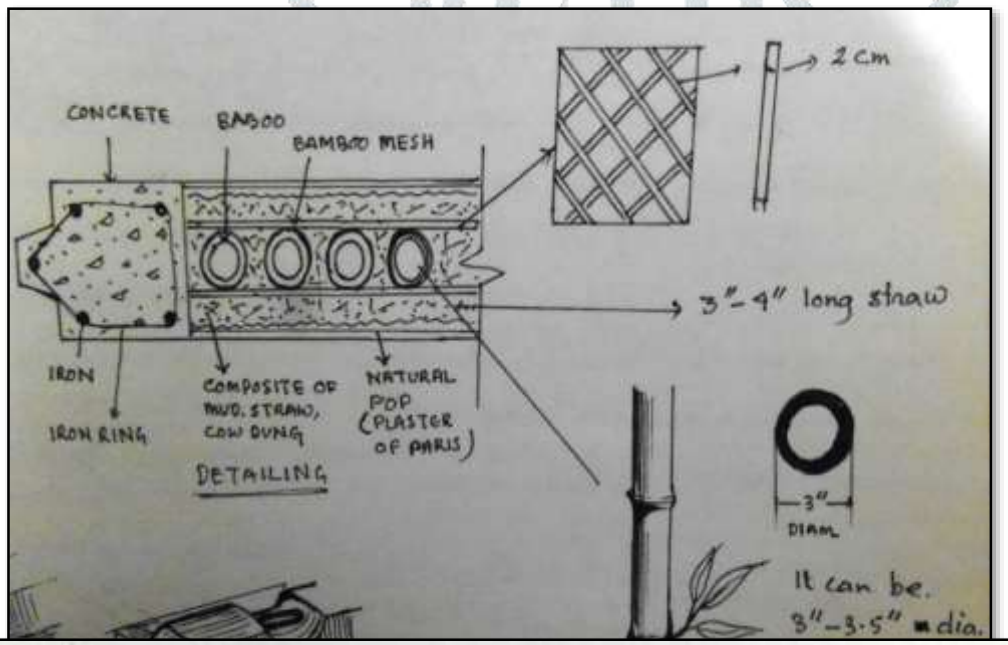


Fig. 9 detail of convex joining and hook



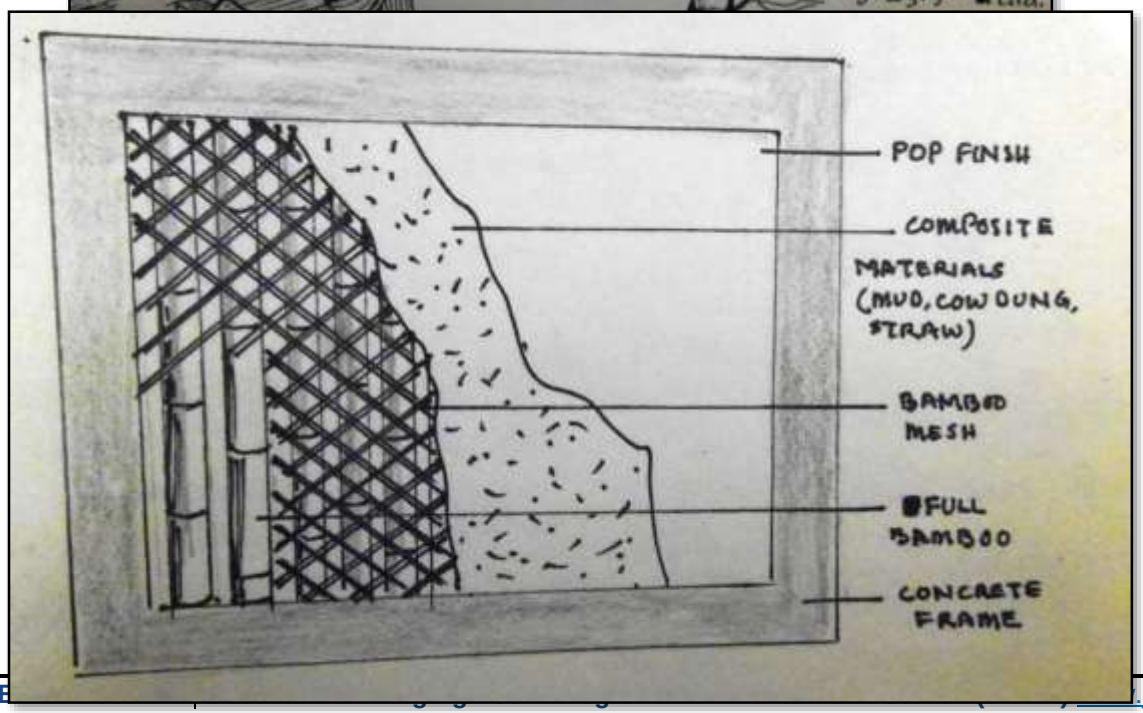


Fig. 10 sectional detailing of wall

Fig. 11 internal structure

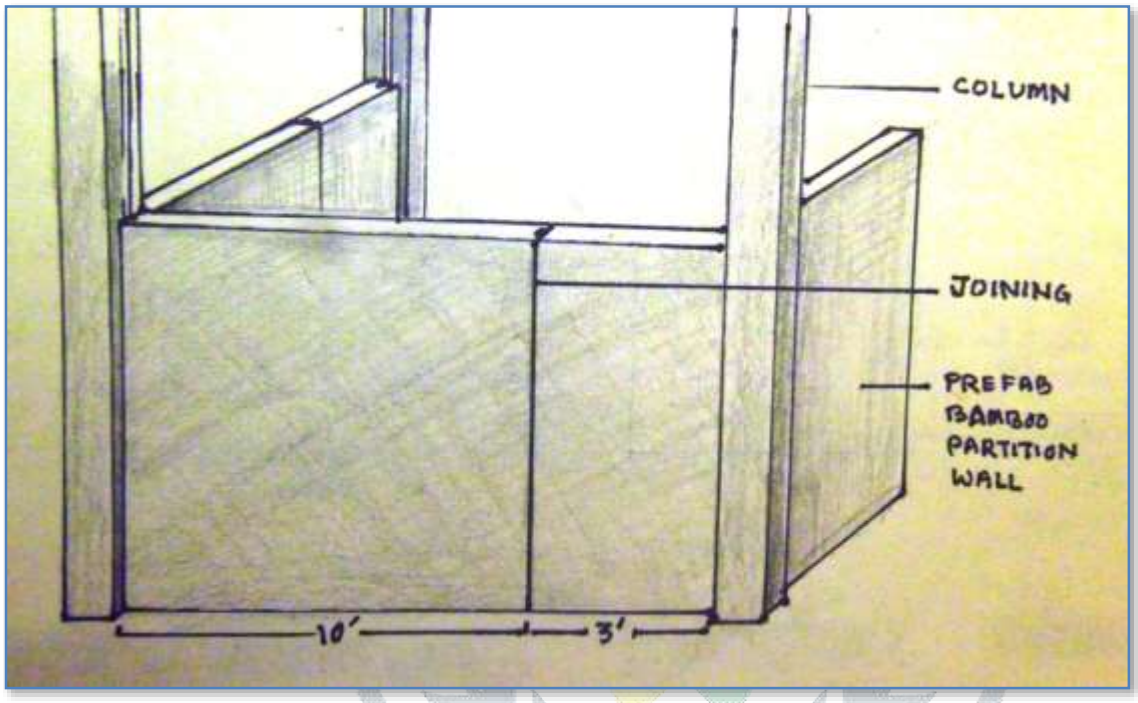
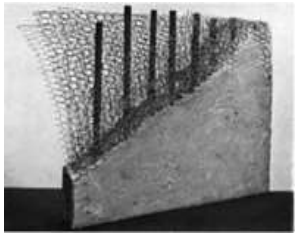


Fig. 12 external structure

10. SUSTAINABLE COMPOSITE MATERIALS

Table 7: comparative chart of different prefabrication wall

Precast material	merit	demerit	Raw materials

Ferro cement 	Low weight, maintenance costs and long lifetime in comparison with purely steel constructions.	Labor-intensive nature of it, air voids can turn to pools of water as the cured material absorbs moisture. If the voids occur where there is untreated steel, the steel will rust and deteriorated, causing the system to fail.	system of reinforced mortar or plaster (lime or cement, sand and water) applied over layers of metal such as chicken wire or woven or expanded metal (iron) mesh or fibers
Fly ash 	High fire insulation, low water penetration, no need to soaking in water, high strength.	Mechanical strength is low, limitation of size, larger the size has more breakages.	Cement, oil well cement, fly ash, sand, lime sludge, gypsum
Concrete 	Saving in time, mass production is easy, independence on climatic condition, high quality, easily available.	Heavy weight, Cranes are required to lift panels, Joints between panels are often expensive and complicated. Very heavy members.	A mixture of powdered Portland cement, water, sand, and gravel.
Bamboo 	Low cost, earthquake resistance, light weight, easy to install, longer life, more sustainable, natural material.	Need proper treatment, can't extend longer on fire, termite can attack, low water resistance.	Cement, concrete, sand, bamboo, mud, cow dung, dry straw.

11. ADVANTAGES AND DISADVANTAGES OF PREFAB BAMBOO PARTITION WALL

Advantages	Disadvantages

1. Bamboo prefab partition wall is more sustainable than others prefabricated building materials. 2. It would be low cost. 3. Bamboo has the quality of earthquake resistance. 4. The materials used in making this prefab wall are light weight. So the product would be light in weight. 5. It would be easy to install. 6. It required less force of work while installing. 7. It required less energy in transportation. 8. It needed less variation in technique of construction in spite of different climatic regions. 9. It would improve indoor air quality of the building. 10. The materials used in prefab wall are totally green materials. 11. All the materials are found locally and easily available. 12. Easy to reappearing 13. Materials are recyclable.	1. Need proper care because it could be damaged while transport. 2. Bamboo prefab partition wall needed proper treatment. 3. As comparing with other concrete prefabricated wall, it would be more soft can be cracked. 4. Should not use immature bamboo so that termite can attack. 5. Bamboo cannot extend longer on fire. 6. It needed frequent reappearing of exterior part. 7. Bamboo is sustainable and can grow fast as compare with trees but cutting bamboo is also give negative impact to the environment.

12. ANALYSIS OF THE STUDY

From the above review and studies we can understand that the purpose of the studies of this project is to maintain the environment and reduce the carbon emission by using sustainable materials. We can consider some points regarding with this projects

1. Contemporary products by using locally available materials would help economically.
2. 95% of prefab bamboo partition wall is made from sustainable materials.
3. Total internal structure of the prefab wall would be made from bamboo.
4. Materials like mud, cow dung, straw are totally sustainable, low cost, and easily available. And these materials don't emit any kind of harmful gases to the environment.
5. The bamboo itself is functioned as the load bearer of the structure.
6. The materials used in making prefab bamboo partition wall could control the temperature of the interior atmosphere.

7. Global warming is the main reason for this studies and how people could resolve it? That is the solution of this project.
8. Emission of CO2 an others greenhouse gases are done by people and we have to think how to control it. Unsustainable materials helps in global warming and my project would be contributed at least some points to control it.
9. We consider bricks, fly ash block are sustainable materials but the process of making is not sustainable, but the process of making prefab bamboo partition wall is totally different.

13. LIMITATIONS OF THE STUDY

1. Bamboos which are used in making prefab wall need proper treatment.
2. Should not use immature bamboo otherwise it could be damaged within few years.
3. If prefab bamboo partition wall is supposed to be made in factories, lots of bamboo is required.
4. As comparing with other concrete prefabricated wall, it would be more soft can be cracked.
5. Should not use immature bamboo so that it could protect from termite attack.
6. Should not use any kind of chemicals except wall paint.
7. The core part of the wall must be full bamboo.
8. The mud of the composite materials would not be sandy one so that it would be broken easily.
9. Straw must be dry one and it can't be more than 4 inches long.
10. This prefabricated cannot be used as floor, column, or slab.

14. Conclusion

World is in danger now, we all are plunged into the pool of death by knowingly. But we must understand one thing we were grown up within the nature and only nature could solve the problem. Bamboo is a sustainable material and renewable, so it can play a very important role in present day and for future too. It also take an important role in global warming, bamboo is not like tree, when we cut a bamboo it can grow again in short duration. Since from the time immemorial people use bamboo as a material for making home and tools and many other items even it could help for future technology, it has the potential for making airplane where bamboo car are already introduce. It also has been used as food and medicine too, so there is great potential where people can do many things with bamboo. Now we human are facing drastic change in climatic condition due to deforestation. So the only way to control the climatic condition is to use bamboo product.

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