

Cost effective Building Materials for Temporary Construction: A Study based on Sustainable Alternatives

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ABSTRACT - There is a growing need and market for temporary buildings for various purpose, including large construction projects. This gives an overview about the reusable light weight materials in temporary construction without creating the construction waste.

This paper aims to environmentally friendly temporary spatial structure without sacrificing the design aesthetic aspects, compatible criteria of recycle, reduce and reusing the material with low cost by achieving ancient construction techniques using : paper, haritaki seed, eggshell, fenugreek seeds and water proofing materials gives a sturdy binding material which can be handled facile. A flexible modular extension is possible. Assembling and disassembling the individual components can be done. This method gives an excellent renewable alternate way for temporary green buildings.

KEYWORDS : Sustainable, 3R management, low cost, ancient construction techniques, lightweight, strong, waste materials.

I. INTRODUCTION

Paper is a recently evolved construction material that consisting re-pulped fibre, it is an environment friendly material due to the vital recycling. As per the ancient construction ideas the recycled paper should be grinded and mixed with the paste of haritaki seed, eggshell, and fenugreek seeds. The mixture itself acts as water resisting material for the temporary structures. Newspaper is most commonly used because it produces consistent results.

When paper is mixed with the mixture, it creates a very good bond and the final product is light weight and strong.

It helps to contribute sound insulation properties and helps in crack control due to rich fibre content in the mixtures.

This combination of materials are inspired from binding materials used in Tanjore Brihadeeswarar temple.

ABOUT SHELL STRUCTURE:

A thin shell is defined as a shell with a thickness which is small compared to its other dimensions and in which deformations are not large compared to thickness. A primary difference between a shell structure and a plate structure is that, in the unstressed state, the shell structure has curvature as opposed to the plate structure which is flat. Membrane action in a shell is primarily caused by in-plane forces (plane stress), but there may be secondary forces resulting from flexural deformations. Where a flat plate acts similar to a beam with bending and shear stresses, shells are analogous to a cable which resists loads through tensile stresses. The ideal thin shell must be capable of developing both tension and compression.

APPLICATIONS OF SHELL STRUCTURE:

Thin-shell structures are also called plate and shell structures. They are lightweight constructions using shell element. These elements, typically curved, are assembled to make large structures.

- 1) Shell is a type of building enclosures.
- 2) Shell belongs to the family of arches. They can be defined as curved or angled structures capable of transmitting loads in more than two directions to support.
- 3) A shell with one curved surface is known as a vault.
- 4) A Shell with doubly curved surface is known as dome.

II. PROPERTIES OF MATERIALS

- 1) The materials get easily binded.
- 2) Density of the material increased with increase in the percentage of the paper, structure is extremely lightweight.
- 3) Shrinkage occurs but doesn't affect the structure. Binding materials get stronger daily.
- 4) It doesn't absorb water once dried.
- 5) Doesn't need any plastering finish in both exterior and interior.

III. APPLICATION

As a part of assignments, we are conceived and designed various shell structures using this mixture.



Fig. 1 Simple shell steel structure

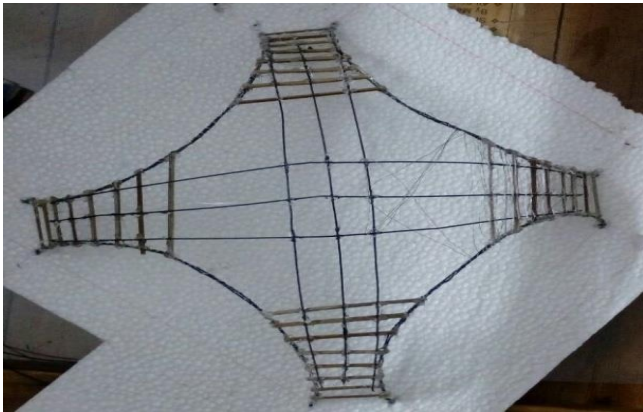


Fig. 2 while covering with mesh



Fig. 3 Mesh Finish



Fig 4 Applying the mixture above the mesh finish

We have designed a simple shell steel structure using thin steel rods, and covered the steel structure with mesh plates then we applied the mixture paste above the mesh, it took nearly 40 hrs to dry completely. The structure doesn't need any smooth finish.

It also can be used as facade material where the benefit of reduction of dead load can be attained. For interiors it provides aesthetics and pleasing appearance. It is an excellent replica for cement in curved temporary structure



Fig. 5 Final model without plastering

IV. ADVANTAGES AND DISADVANTAGES

This material is far lighter in weight and has remarkable sustainable qualities, unlike cement which is relatively heavy. It can be easily shaped and dried. The total cost and weight are reduced, resulting in an eco-friendly and light weight material. This material can create a viable option for low-cost temporary shelters and offices. Crisis of building material leads to high demand and need for recycling industrial waste or finding alternative sources. Wastepaper helps in low-cost, eco-friendly and sustainable design. As per India's context, only a fraction of paper is recycled annually. This means that the rest is still disposed off, mostly ending up in landfills for slow degradation and capacity consumption of dumpsites. It takes about 15 trees to make 1 ton of paper. As it is recycled material, there is a benefit in embodied energy due to reutilization.

- 1) Colour and texture can be added for better aesthetics and design versatility.
- 2) Addition of silicon, concrete sealer or epoxy compound can help in waterproofing of structure.
- 3) Admixtures can be added to improve setting and bonding properties.
- 4) It is resistant to water, fungi, pests to a larger extent.

V. CONCLUSION

This study was conducted with an aim to give a flexible material for temporary structure. This study recognized the mixture as a sustainable building material. It can be developed as a material which is suitable for temporary construction and can reduce carbon footprint. It is thus evident that it can be looked upon as a sustainable building material and has a promising future.

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