"EXPERIMENTAL STUDY OF REPLACEMENT OF STEEL REINFORCEMENT WITH BAMBOO"

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ABSTRACT- *This paper is study of comparison of cost and flexural strength of bamboo reinforcement with steel reinforcement. The regularly used steel reinforcement technique has many disadvantages like carbon emission, increasing cost, susceptibility of corrosion, weight, environmental impact etc. To overcome these problems we have decided to conduct an experiment by replacing steel with bamboo.*

Bamboo is effective material for construction due to its low cost, light weight. So by using bamboo we can achieve our main objective that cost effective construction. Bamboo construction is eco-friendly, does not have any bad effects on environment. Bamboo is known for its flexibility which is required in structural element like beam, column, and slab.

Keywords: - Cost effective, light weight, environment friendly, flexural strength.

1. INTRODUCTION

Bamboo is one of the strongest and fastest growing plants, reaching heights of over 100 feet. Bamboo is versatile construction material that is strong yet lightweight. Bamboo construction involves the use of bamboo as building material for scaffolding, bridges, houses and buildings. In recent years, the construction industry has increasingly turned its attention toward sustainable and eco-friendly building materials. Among the various alternatives being explored, bamboo has emerged as a promising substitute for conventional materials such as steel, particularly in developing regions and environmentally sensitive projects. Known for its rapid growth rate, renewability, and impressive mechanical properties, bamboo offers a viable solution to many of the environmental and economic challenges associated with steel use in construction.

This project aims to explore the feasibility of replacing steel with bamboo in various structural applications. Steel, while strong and widely used, has several drawbacks including high energy consumption during production, significant carbon emissions, and cost- related challenges. In contrast, bamboo is lightweight, flexible, renewable, and has a low environmental footprint, making it an attractive alternative for sustainable development.

The study investigates the mechanical properties, availability, treatment methods, construction techniques, and limitations of bamboo, comparing them directly with those of steel. It also assesses real-world examples and experimental data to understand how bamboo can be integrated into modern construction practices without compromising safety and performance .Ultimately, this project contributes to the growing body of research supporting the use of natural materials in green construction and seeks to demonstrate that bamboo, when properly treated and engineered, can effectively replace steel in many structural applications—paving the way for a more sustainable future in building design.

2. MATERIALS AND METHODS

Materials were collected from local shops for both Steel Reinforced and Bamboo Reinforced concrete. Materials needed for Reinforcement cement concrete are fine aggregate, coarse aggregate, cement, sand, steel rod, bamboo and water.

1) Fine aggregate/sand

It is also called as sand or crushed stone naturally available of small size of 4.75mm. It is used to fill the voids between coarse aggregate and improve workability.

2) Coarse aggregate

Typically gravel or crushed stone having size larger than 4.75mm. It is used to provide strength to the concrete. Makes up largest volume in the concrete mix.

3) Cement

It is the binding material that holds other components together. It hydrates and hardens when mixed with water. The cement used in the experimental work is ULTRATECH CEMENT.

4) Steel

Steel is used in combination with concrete, for what is known as reinforced concrete. Steel is provided to resist tensile stress-free 500 steel is used conforming to IS456 - 2000.

5) Bamboo

Bamboo is eco-friendly material having good tensile properties. It is largely available in India. It can be used after seasoning as a replacement to steel reinforcement. Bamboo used in this project is BAMBUSA VULGARIS.

6) Water

It is very important ingredient responsible for chemical reaction. It helps to form the strength giving cement gel, water used must be clean and potable.

3. SPECIMEN PREPARATION

The beams were designed having dimensions 700mm in length, 150mm in width, 150mm in depth and cover of 25mm.Bars of 12mm,10mm and stirrups of 8mm at a spacing of 100mm were used in each 3 beams. The larger diameter 12mm bars are placed in the bottom row to resist deflection effects.

Fig.1 Beam specimen used for casting (steel and bamboo)

Fig.2 Beam specimen after casting

4. TESTING OF SPECIMEN

After the casting, the specimen was tested for flexural strength. We have to compare both steel and bamboo reinforcement with the help of flexural strength.

FLEXURAL STRENGTH TEST:

All the beams are tested into flexural strength by the Universal testing machine. The beams were simply supported over a span of 600mm the load were applied 1/3rd of its span. The load was applied continuously until the first crack point and ultimate load reading were noted; the beam was deflected after applying load.

Fig.3 Beam specimen before applying load.

Fig.4 Beam specimen after applying load.

5. RESULT AND ANALYSIS

SPECIMEN TYPE	SPECIMEN NO.	BREAKING LOAD IN KN	AVERAGE BREAKING LOAD IN KN	FLEXURAL STRENGTH IN MPA	AVERAGE FLEXURAL STRENGTH IN MPA
STEEL REINFORCEMENT	S1 S2 S3	24.21 22.9 25	24.03	4.3 4.07 4.44	4.27
BAMBOO REINFORECMENT	B1 B2 B3	17.31 12.16 16.69	15.38	3.67 2.16 2.96	2.93

6. CONCLUSION

The seminar report shows that bamboo can substitute steel satisfactorily but not completely. The structural parts developed and studied could also be utilized in many building constructions. Bamboo reinforcement technique is used for every main and distribution reinforcement as a result of it was almost same earlier in deep hassle steel reinforcement. It's three times cheaper than steel reinforcement technique. While bamboo can be used in specific low-load, temporary, or eco-conscious applications, steel remains the preferred choice for long-lasting, high-performance structural reinforcement.

7. REFERENCES

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