Manufacturing and Performance Testing of Paver Block Using Innovative Natural Composites

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ABSTRACT

In the research paper done experimental work of replacement the cement paver block to natural composite fiber paver block. The use of fibres reduces the cost of paver blocks as compared to traditional concrete paver blocks. In this research work, manufacturing the paver block with different types of natural fiber with different types of orientation. Then we have taken various test like Tensile, Compressive test using Universal testing machine. Water observation test done using water observation tester. Natural fibre composites have recently gotten a lot of interest in the marine industry because of their numerous appealing structural applications. Improved properties include high strength-to-weight ratio, good mechanical properties(tensile& compressive) and low cost over existing paver block. The bio composite is made utilising a manual lay-up approach using an unsaturated polyester matrix and fibres such as jute, sisal, coconut, areca, and banana.

Key words: Nature fiber, hand-lay method, UTM, Composite

1. INTRODUCTION:

The aim of this project is to replace cement with natural composite fiber. It is considered to be one of the Eco-friendly materials. By utilizing fibers, it will reduce the cost of paver block compared to that of Conventional concrete paver block. In this project we used different types of natural composite fibers. These paver block fibers are introduced to increase strength, durability, and reduction in cracks. It also increases the resistance to impact and improves the quality of construction. This paver block has good acoustic properties and acceptable mechanical properties. Compared to ordinary paver block versus fiber utilized paver block, proposed fiber block has higher compressive strength and flexural strength at

the season of substantial activity territory, additionally higher rate of surface resistance. This paver blocks were prepared by hand lay-up techniques and tested. The general natural fiber life cycle phases are extraction, processing, fabrication, disposal and recycle. By utilizing fiber in concrete paver block will enhances the nature of development. These natural composites are very much essential for its application as an engineering material.

2. MATERIALS AND METHODS

2.1. INNOVATION IN MATERIALS:

Synthesis of the newer innovative materials for Paver block. These Thermoset composite materials is rigid, durable and light weight. These innovative composite materials developed best suitable property.

2.2. MATERIAL SPECIFICATION:

The following materials are used in the experiment:

Epoxy Resin (LY-556): Epoxy is the thermoset plastic material. Epoxy resins, also known as polyoxides, are a class of reactive prepolymers and polymers which contain epoxide groups.

Hardener (HY-951): Hardener is a curing agent for epoxy or fiberglass. Its help to hardening the material.

2.2.1. NATURAL FIBER: There are many types of natural fiber. In the project we are use four type of natural fibers as shown figure 1. They are,

- Jute fiber
- Coconut fiber
- Banana fiber
- Bamboo fiber

Figure 1 Natural fiber

In the following natural fibers, we build a fiber mat or sheet. Now layer of the natural fiber mat in the paver block is 10 to 15mm thickness and then 35 to 60 ml of Epoxy Resin (ly-556) and Hardener (hy-951).

2.3.MANUFACTURING MATHODOLOGY

Extract the natural fiber and select the fiber which is taken to fill as reinforcements in the composite. We are using Hand Lay-Up method for manufacturing process. First, a gel is sprayed on the Mould surface to prevent the polymer from sticking to the surface. To get a superior surface finish on the product, thin plastic sheets are employed at the top and bottom of the Mould plate. Apply the epoxy resin and hardener to the suitable proportion and poured to the surface of the mat already placed in the Mould. Place the fiber to the suitable orientation and place it in the specific temperature. Mould is opened after curing at a certain temperature,

and the formed composite part is removed and further treated. After finishing the product, investigate with mechanical behaviors and analyses the result as shown in figure 2.

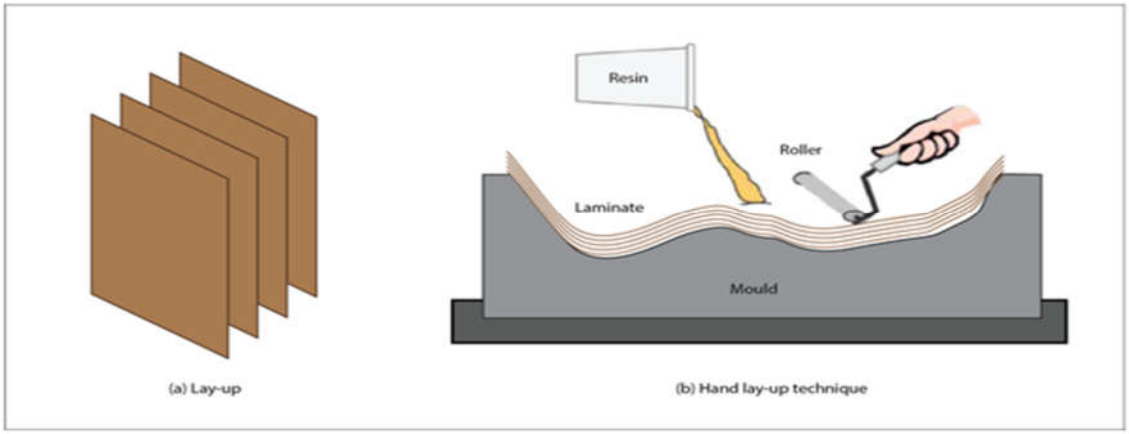


Figure 2. Hand lay up

Orientation Composition of Paver Block as shown in figure 3 & 4

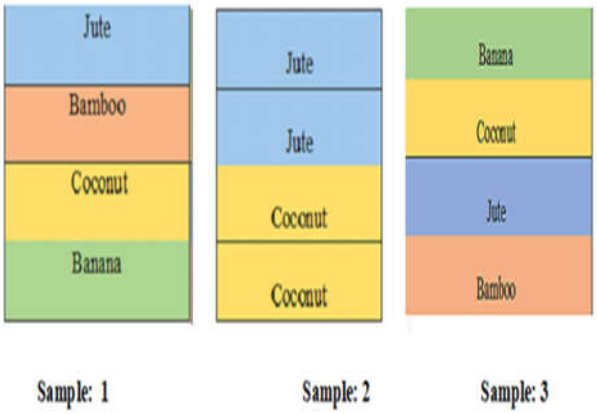


Figure 3: Natural Composite

Sample-1 : (Orientation of Jute, Bamboo, Coconut, Banana)

Orientation Method: Horizontal Method (Each Layer Has 15mm Thickness)

Sample -2 : (Orientation of Jute, Jute, Coconut, Coconut)

Orientation Method: Horizontal Method (Each Layer Has 15mm Thickness)

Sample – 3:(Orientation of Banana, Coconut, Jute, Bamboo)

Orientation Method: Vertical Method (Each Layer Has 15mm Thickness)

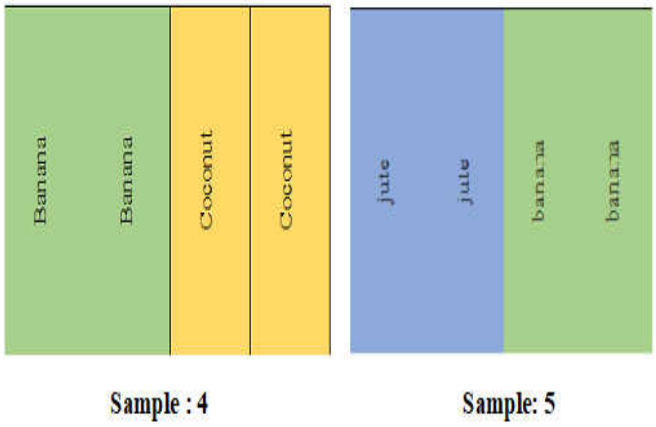


Figure 4 : Natural composite

Sample -4: (Orientation of Banana, Banana, Coconut, Coconut)

Orientation Method: Vertical Method (Each Layer Has 15mm Thickness)

Sample -5: (Orientation of Jute, Jute, Banana, Banana)

Orientation Method: Vertical Method (Each Layer Has 15mm Thickness)

Sample -6: standard concrete paver block shown in figure 5

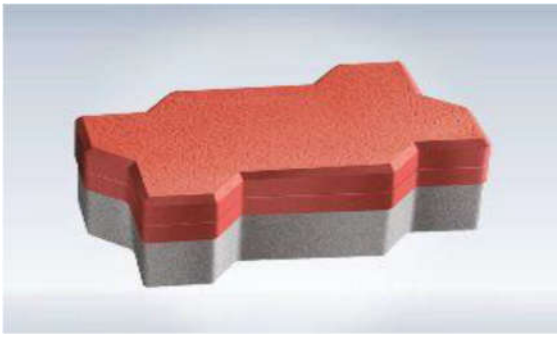


Figure 5: Concrete Paver Block

Mould of the Nature of composite as shown in figure 6.

Figure 6: Mould for Paver block &Natural composite Paver block

3. RESULTS AND DISCUSSIONS:

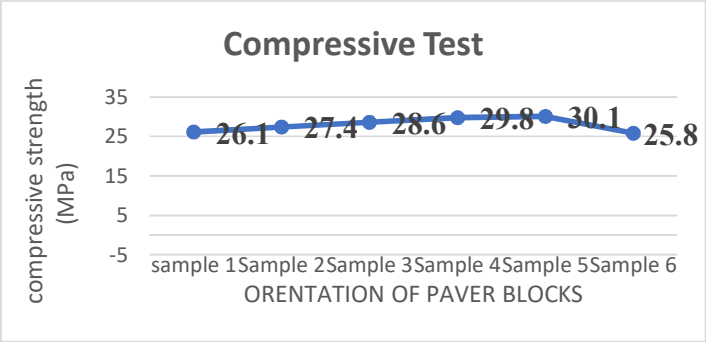
The composites are manufactured and tested by UTM (Universal Testing Machine). In flexural test, the horizontal combination of JJBB has 4.60 Mpa, which is higher than the value of standard paver block. In tensile strength the horizontal combination of JJBB has high Mpa of 3.85 Mpa, whereas the standard paver block has only 2.80 Mpa. By the comparison of compressive test of both existing concrete paver block and natural paver block. The existing paver block has less Mpa of 25.80 Mpa whereas the natural paver block in horizontal orientation of JJBB and JJCC has high Mpa of 30.15 Mpa.

In water absorption test, the existing paver block has high percentage of 42.25% and the natural paver block of horizontal orientation of JJCC has only 21.42%, which is less than the standard paver block. In these tests, the flexural test, compressive test and tensile test has the best result in natural paver block than the existing concrete paver block. In water absorption test, the standard paver block has high percentage, so it has the best results than the natural paver block.

Overall the comparison of both the standard paver block and natural paver block, the natural paver block has the best result than the existing concrete paver block.

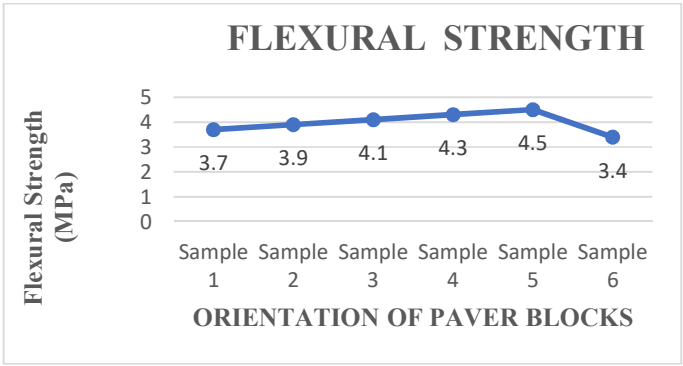
Table 1. Mechanical Properties of paver block

Material	Compressive Strength (MPa)	Flexural Strength (MPa)	Tensile Strength (MPa)	Water absorbed (kg)
Sample 1	26.10	3.70	2.50	1.60
Sample 2	27.40	3.90	3.10	1.75
Sample 3	28.60	4.10	3.20	1.80
Sample 4	29.80	4.30	3.40	1.32
Sample 5	30.10	4.50	3.60	1.62
Sample 6	25.80	3.40	2.80	2.55

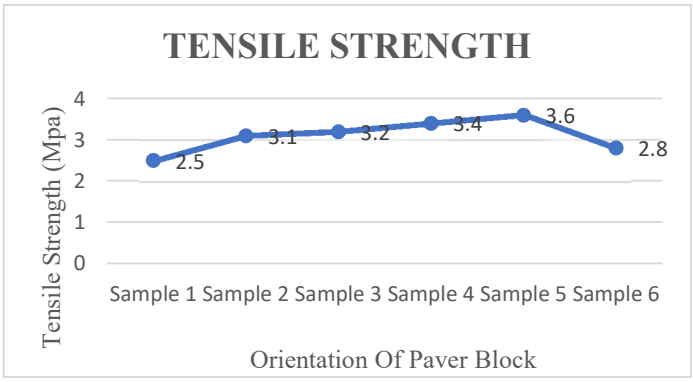


Compressive strength (MPa):

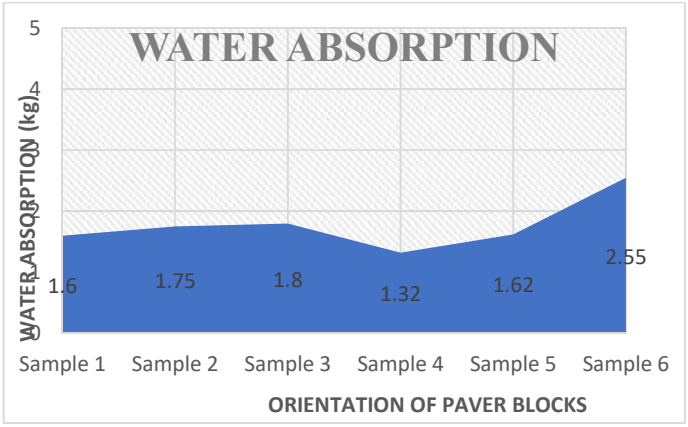
Flexural strength (MPa):



Tensile strength (MPa):



Water absorption teat:



4. CONCLUSION

This century has witnessed remarkable achievements in green technology in material science through the development of natural fiber reinforced composites. Developed of high-performance engineering products made from natural resources is increasing worldwide day by day. In the natural fiber composite material paver block tested compressive, flexural and water observation values grater the concrete paver block.

This is rapid attention in research and development in the natural fiber composite field due to its better formability, abundant, renewable, cost-effective and eco-friendly features.Thus, Natural fibers, characterized by sustainability, have gained a considerable attention in recent years, due to their advantages of environmental acceptability and commercial viability.

5. REFERANCES

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