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ijirset@gmail.com



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# Experimental Investigation on Paver Block with a Reinforcement Layer

Prathi Hegde<sup>1</sup>, Maithra D Naik<sup>2</sup>, Gopi V<sup>3</sup>, Shrinith S K<sup>4</sup>, Anusha Jain<sup>5</sup>

U.G. Student, Department of Civil Engineering, MITE, Moodbidri, Mangalore, India<sup>1,2,3,4</sup>

Assistant Professor, Department of Civil Engineering, MITE, Moodbidri, Mangalore, India<sup>5</sup>

**ABSTRACT:** The impacts of GGBS and geosynthetic reinforcement in interlocking concrete paver blocks are highlighted in this work, which is a recent achievement in the field of reinforced concrete pavement design. For a better look and finish, interlocking concrete paver blocks are suitable for laying on footpaths. As a civil engineer, it is our responsibility to provide the facility with the lowest possible cost and the highest possible output. These blocks also enhance the area's aesthetic appeal. Experimental investigations like split tensile strength, compressive strength test and flexural strength tests are carried out on interlocking concrete paver blocks made for M40 grade. In the Interlocking concrete paver blocks, GGBS is added in various percentages (0, 10 percent, 20 percent, and 30 percent). Split tensile, compressive strength, flexural strength tests all used to determine the strength of a material. Geosynthetic fibre's as reinforcement material acts environmental friendly. Also use of quarry dust as Fine aggregates also eases the difficulty of taking the sand from the rivers which also helps economically.

**KEYWORDS:** Geosynthetic, Reinforcement, mesh, paver blocks.

## I. INTRODUCTION

Interlocking concrete paver blocks have become a common sight in modern towns and cities. It will be located in residential, commercial, and industrial sectors such as malls, parking lots, sidewalks, and bus stops, among other things. Interlocking concrete pavement blocks were first used in building in India a decade ago to meet specific needs. The notion of block pavements can also be traced back to the Roman Empire. The blocks are precast cement concrete units that are solid and strengthened. They are utilized on the surface course. It is problem solving method to construct pavement in places where building methods are due to a variety of operational and environmental challenges. Interlocking Concrete Paving Blocks (ICPB) have been employed in underdeveloped countries like as India. India Interlocking concrete paving block technology was first introduced 10-15 years ago for specific applications such as footpaths, parking lots, gardens, and other places, now being used in different places where construction methods like bituminous mix are not efficient. Semi-dry mixes are used to make interlocking concrete pavement blocks. In the production process, vibration and pressure are imparted to the mix. Sturdy concrete paving blocks can be made with this method, resulting in strong and long-lasting paving surfaces. The capacity to spread loads over wider regions is provided by the interlocking nature of concrete paving blocks. In terms of structural design, aesthetics, construction, and maintenance, interlocking concrete paving blocks have significant benefits over asphalt and concrete pavements. They're found on sidewalks, in gardens, in yards, and in parking spaces. Interlocking concrete paver blocks can be laid out in a variety of forms and designs over a thin bed of sand atop a sub base. When compared to a solid plain surface, interlocking concrete paver blocks are more environmentally friendly. They are made comprised of various properties that allow them to join together flawlessly without the usage of mortar. Interlocking concrete blocks are currently being used as a pavement alternative to asphalt and concrete. These interlocking pavers are a cost-effective alternative for today's applications. Interlocking concrete paver blocks have more strength in precast concrete parts that comes on a variety of size, colour and shapes for matching, while also improving the aesthetic. Greater products are produced with better material and manufacturing process quality control. Paver blocks require little upkeep and are inexpensive. It can be utilised in high-traffic areas if its compressive strength is enhanced. The rectangular concrete paver blocks were approximately the same size as

the bricks. Segmental Pavers are another name for them. When concrete is not reinforced, it collapses suddenly under tension and cracks. Concrete is traditionally reinforced with steel rebar. However, it is prohibitively expensive. Natural fibres are abundant in tropical climates, and when used, they can reduce the cost of reinforced concrete while also improving its performance.

## **II. RELATED WORK**

- Literature Study

Polypropylene fibre is used as a secondary reinforcement in the construction sector to stop cracks, boosts its toughness impact resistance, to improve construction standards. It improves the strength by up to 40% and minimises water absorption by adding polypropylene fibre [1]. The use of coconut fibres as a concrete reinforcement. If percentage of fibril increases from 0.1 percent to 0.3 percent, the toughness differs from 1.22 percent to 6.81 percent when compared to the concrete paver block after 28 days. When the fibre content is raised from 0.1 percent to 0.5 percent, the water absorption increases from 0.95 percent to 6.01 percent after 28 days compared to the concrete paver block [2]. After 7 days and 28 days results show by adding coconut fibre gradually enhances flexural strengths and water absorption. If percentage of fibril varies 0.1 percent to 0.3 percent, the compression strength varies from 1.22 percent to 6.81 percent, If compared to concrete paver blocks at 28 days. Comparing the block above the layer of 10mm to 40mm thick, the strength of compression improves steadily 3.94 percent to 12.11 percent after 28 days [3]. For quite some period, ICPB has employed different countries for supplying pavement in places where old varieties of pavement are not suitable.

## **III. METHODOLOGY**

From the results proportions for M40 grade is calculated. The proportions for 1m<sup>3</sup> is 1:1.79:2.96 (Cement: Fine Aggregates: Coarse Aggregates) with 0.40 w/c ratio was obtained. Cement 370 kg, Fine aggregates 663.86kg, coarse aggregates 1096.75kg and water 153.48kg. In the mix, the cement is replaced by 0,10,20,30 percent by GGBS and quarry dust is used as fine aggregate instead of river sand. The ingredients of the concrete are thoroughly mixed till uniform consistency is achieved. For set of blocks geosynthetic reinforcement is used. Paver blocks were casted in mould with area 25760mm<sup>2</sup>. Casting is done by giving vibration using vibrator. The specimen then removed from the mould after 24 hours, and then cured under water in the curing tank for a period of 28 days.

## **IV. EXPERIMENTAL RESULTS**

- Test of specimens

1. Compression strength Test
2. Split Tensile strength test
3. Flexural strength test

1. Results of Compression Strength Test

Compressive strength of paving blocks is calculated by dividing the maximum load (in N) by the area (in mm<sup>2</sup>).

Table1: Compression test results after 28 days

S.NO	SAMPLE	COMPRESSIVE STRENGTH TEST (N/mm <sup>2</sup> )
		28Days
1	0% of GGBS	32.99
2	10% of GGBS	27.17
3	20% of GGBS	29.11
4	30% of GGBS	36.87

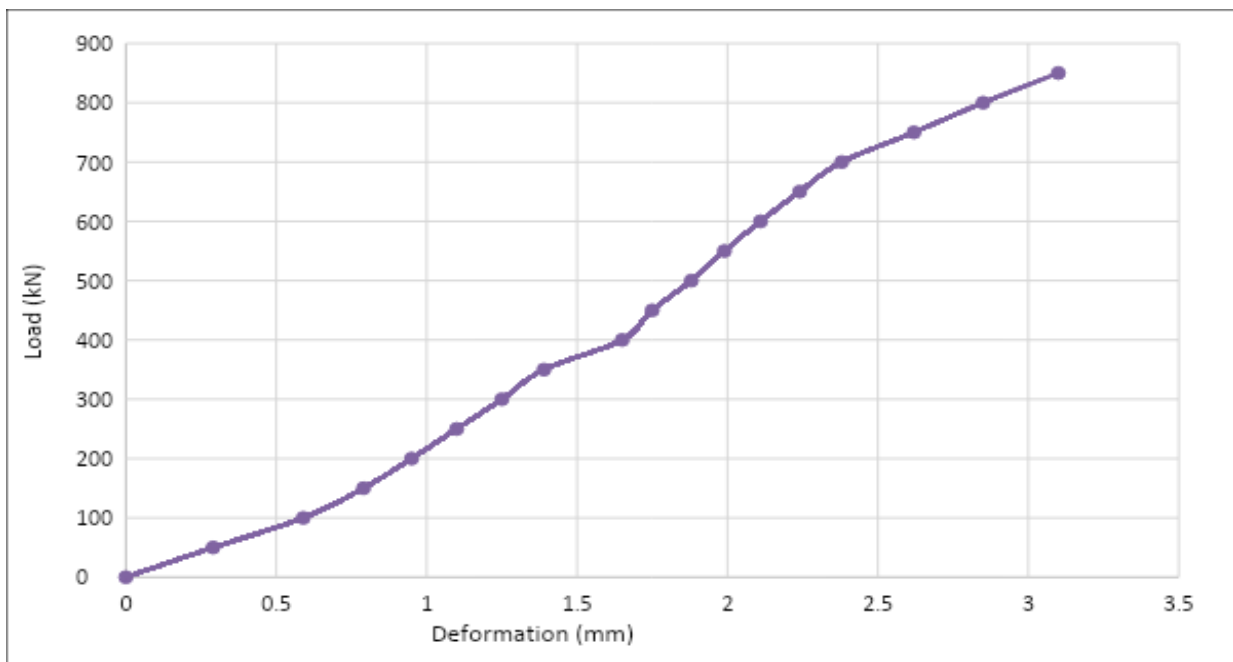


Figure 1: Load v/s Deformation curve for cement replaced by 0% GGBS

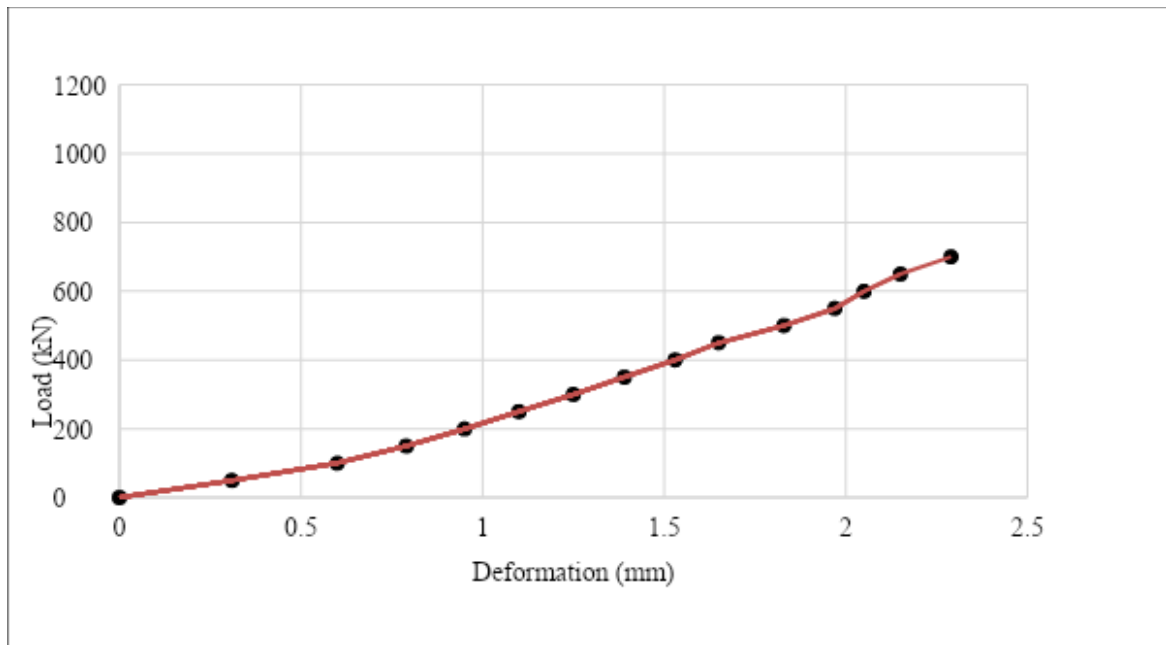


Figure 2: Load v/s deformation curve for cement replaced by 10% GGBS

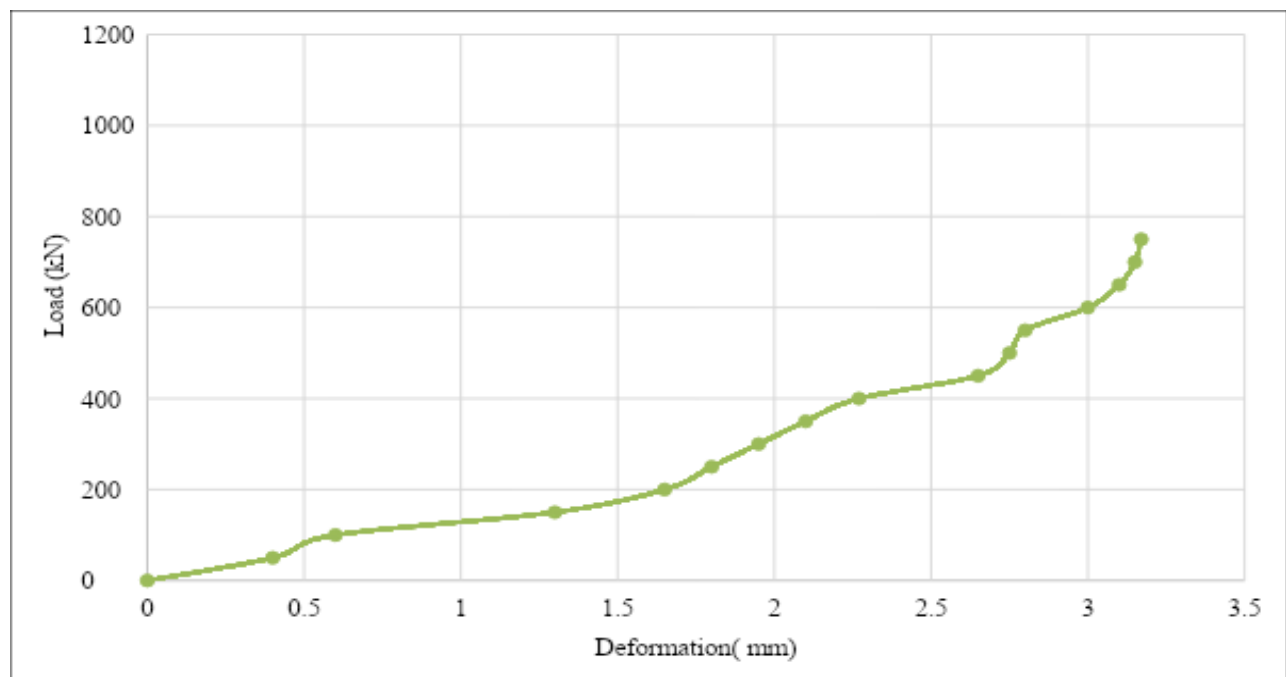


Figure 3: Load v/s deformation curve for cement replaced by 20% GGBS

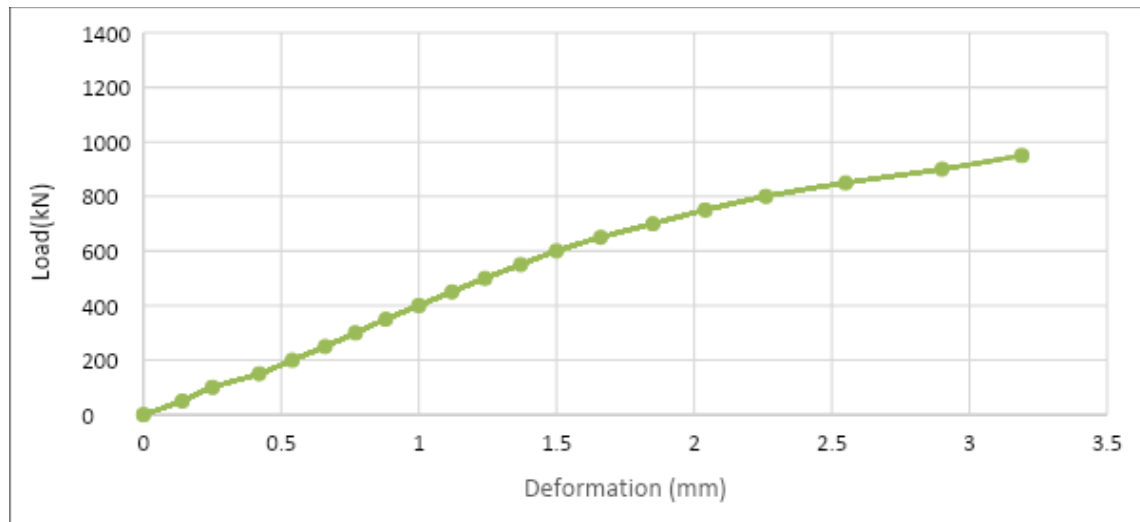


Figure 4: Load v/s deformation curve for cement replaced by 30% GGBS

Table 1 shows the results of compression strength obtained after 28 days. Fig 1,2,3,4 shows the graphical representation for different cases. Fig 1 Load v/s Deformation curve for cement replaced by 0% GGBS. Fig 2 Load v/s Deformation curve for cement replaced by 10% GGBS. Fig 3 Load v/s Deformation curve for cement replaced by 20% GGBS. Fig 4 Load v/s Deformation curve for cement replaced by 30% GGBS.

## 2. Results of Split Tensile Strength Test

Table 2: Split Tensile Test Results after 28 days

SL.NO	SAMPLE	Split tensile strength in(N/mm <sup>2</sup> )
		28Days
1	0% of GGBS	1.26
2	10% of GGBS	1.17
3	20% of GGBS	1.21
4	30% of GGBS	1.62



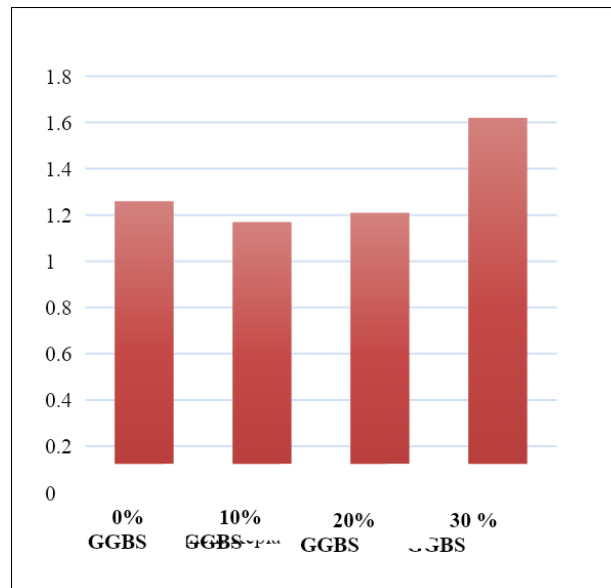


Figure 5: Variation of Split Tensile Strength of blocks for cement replaced by GGBS.

Table 2 shows the results of Split Tensile Test obtained after 28 days. Fig 5 shows the Variation of Split Tensile Strength of blocks for cement replaced by GGBS.

### 3. Results of Flexural strength test

Table 3: Results of flexural strength Test after 28 days

SL.NO	SAMPLE	FLEXURAL STRENGTH (N/mm <sup>2</sup> )
		28Days
1	0% of GGBS	3.33
2	10% of GGBS	2.73
3	20% of GGBS	2.88
4	30% of GGBS	3.80

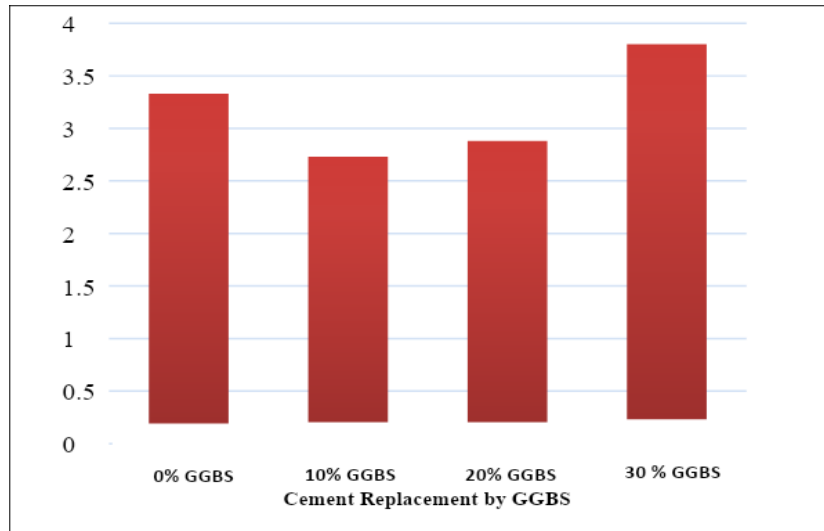


Figure 6: Variation of flexural strength of blocks for cement replaced by GGBS

Table 3 gives the results of Flexural strength obtained after 28 days. Figure 6 shows the Variation of Flexural Strength of blocks for cement replaced by GGBS.

## V. CONCLUSION

When cement is partially replaced by GGBS the cost of unit paver block reduces. When 30% of cement is replaced with GGBS increases the strength of the blocks. Geosynthetic material used for reinforcement acts as environmental friendly. Basic tests on cement, aggregates limits as per codal provision.

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