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EXPERIMENTAL STUDY ON STRENGTH IMPROVEMENT OF CONCRETE PAVER BLOCK USING GRANITE POWDER

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Abstract

TThis study is mainly focused on improving the strength of paver blocks using granite powder with concrete Paver blocks are commonly used as decorative method of creating a pavement .The main benefit is that the bricks can be separately lifted up and replaced. It does not require a lot of maintenance. Concrete is a combination of cement, aggregate and water. In this experiment Concrete Block Pavement (CBP) are formed from individual solid blocks that fit closely next to one another to form a pavement surface. CBP is placed with a variety of spaces and pattern. The block which is used in this project has a space of BI-ARC and having a dimension of 260 x 110 x 80 mm (or) 26 x 11 x 8 cm. In this study compressive strength test, Split tensile strength test are conducted in M40 grade concrete. Different portion of granite powder in the percentage of 10%, 20%, 50% were added to the concrete. In future, there is going to be a time when there will be scarcity for cement. So, we have used granite powder to reduce cement usage for producing paver block

Keywords: *CBP,Granite sludge powder,Strength property,Eco friendly*

1. Introduction

India is a developing country so, construction of roadways and buildings play important role. Nowadays paver blocks are used in outdoor purposes and also used in street roads and other construction places. Interlocking concrete block pavement (ICBP) technology has been introduced in India in construction, a decade ago, for specific requirement namely foot paths, parking areas etc. Concrete paver blocks were first introduced in Holland in the 50's as replacement of paver bricks which had become scares due to the post-war building construction boom. These blocks were rectangular in space and had more or less the same size as the bricks. During the past five decades, the block space has steadily evolved from non-interlocking to partially inter-locking to fully inter-locking to multiply inter-locking spaces. Consequently, the pavements in which non-interlocking box are used are designed as concrete block pavement (CBP) or non-interlocking (CBP), and those in which partially, fully or multiply inter locking blocks are used are designated as interlocking concrete block pavement (ICBP).

2. Literature review

Vishal Kumar et al (2016) has studied utilized the waste material in concrete paver blocks. They have been studied paper a study for producing paver blocks utilizing waste aggregate specially in the form of rounded bearing of size 6.35mm) is introduced. Waste rounded steel bearing are introduced in concrete of paver block in different rates. Compressive strength of paver block with different rates of waste aggregates and utilizing elastic cushions is examined. Test result demonstrate that including different rates of waste steel aggregates in paver blocks gives up to 50% more strength quality than customary paver blocks. They conclude that the compressive strength of cubes are increased with addition of waste marble powder up to 10% replace by weight of cement and further any addition of waste marble powder the compressive strength decrease and split tensile strength of cylinders are increased with addition of waste marble powder up to 10% replace by weight of cement and further any addition of waste marble powder the split tensile strength decreases.

Mithun and Chetan (2016) carried an experimental investigation on hypo sludge as a replacement for cement in terms of percentage and also replacement for fine aggregate in the casting of paver blocks for M30 grade, which suits for medium traffic as per IS standards. ICBP technology has been introduced in India in construction, a decade ago, for specific requirement namely footpaths, parking areas etc. But now being adopted extensively in different uses where the conventional construction of pavement using bituminous mix or cement concrete technology is not feasible or desirable.

Srishaila et al (2018) utilized the industrial waste such as pond ash, slag sand as a substitute of sand and studies were done to understand their effects on mechanical properties. This study also enumerate the amount of pond ash and slag sand as substitute of sand to be added to the concrete according to fresh and mechanical properties. The concrete workability was increased by increased in slag sand content and decrease in increase of pond ash content as substitute of sand. It was observed from the literature review incorporating pond ash or slag sand with optimum replacement for the natural sand enhances the mechanical properties, durability characteristics of the concrete. This study will introduce the lightweight paving blocks and more affordable because the waste materials such as tins, plastic and quarry dust are use in the development of the concrete paving blocks namely as Eco-Friendly Paving Block. Eco paving blocks will be compared to control paving blocks due to its durability and compressive strength. Based on the past research, tin and plastic are used as coarse aggregate while quarry dust will act as fine aggregate. The method and test for concrete work was conducted which is slump test, density test and compressive strength test. The result shows that Eco-Friendly Paving Block can be used at non-traffic area based on their compressive strength compared to control paving block with value of. The uses of this waste material also can reduce the environmental pollution

Ghannam et al (2016) carried out an experiment to explore the possibility of using the granite powder and iron powder as a partial replacement of sand in concrete. The percentages of GP and IP added to replace sand were 5%, 10%, 15%, and 20% of the sand by weight. It was observed that substitution of 10% of sand by weight with granite powder in concrete was the most effective in increasing the compressive and flexural strength compared to other ratios. It was also observed that substitution of up to 20% of sand by weight with iron powder in concrete resulted in an increase in compressive and flexural strength of the concrete

3. Material Collection

3.1.Cement

Ordinary Portland cement(53 grade) cement conforming to IS 8112 was used. Various laboratory tests were conducted on cement and the properties such as standard consistency, initial and final setting time, were determined as per IS 4031 and IS 269-1967.The results conform to the IS recommendations.

3.2. Quarry Dust

Quarry dust is a byproduct of the crushing process which is a concentrated material to use as aggregates for concreting purpose, especially as fine aggregates. In quarrying activities, the rock has been crushed into various sizes; during the process the dust generated is called quarry dust and it is formed as waste.

3.3.Coarse aggregate

Making sure of the availability of crushed coarse aggregates of nominal size 10mm were used in this work. The coarse aggregate particles passing through 10mm and retained on 12.5 mm I.S Sieve used as the natural aggregate which met the grading requirement of IS 383-1970

3.4.Water

Ordinary potable water

3.5. Granite sludge powder

Granite sludge powder has been collected from the granite manufacturing unit Vadippati.

4. Methodology

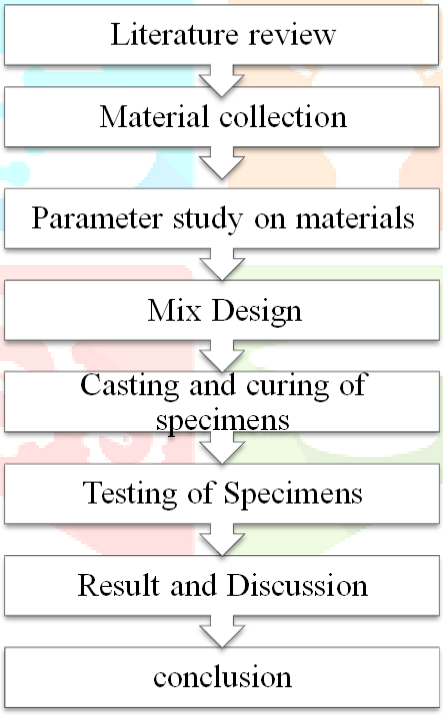

Figure 1. Methodology

4.1. Mix Design as per IS 10262 –2009

M40 grade concrete
Opc 53 grade cement
Specific gravity of cement =3.1
Specific gravity of Quarry dust =2.74
Specific gravity of coarse aggregate (10mm)=2.66
Specific gravity of Granite powder =2.58
Specific gravity of GGBS =2.75
Water cement ratio=0.4
Mix ratio=1:1.4:1.39

COMBINATION OF MIXING

The following combination quantity for $1m^3$ concrete.

MATERIALS:

Binding material - Granite sludge powder(by proportion)
Fine aggregate - Quarry dust
Aggregate - Coarse aggregate (10mm)

4.2. Combination of Materials

Table 1. Combination of Materials

Combination Mix	Binding materials		Quarry dust in %	Coarse aggregate in %
	Cement	Gsp in %		
CC	100	-	100	100
GC-C1	90	10	100	100
GC-C2	80	20	100	100
GC-C3	50	50	100	100

5. Results and Discussion

5.1. Compressive strength test at 28th Days

Table 2. Compressive strength test at 7 and 28th Days Results

S.No	Combination	Strength at 7 days (N/mm²)	Strength at 28 days (N/mm²)
1	CC	24.67	**38.65**
2	GC-C1	26.78	41.05
3	GC-C2	23.44	40.17
4	GC-C3	22.17	39.65

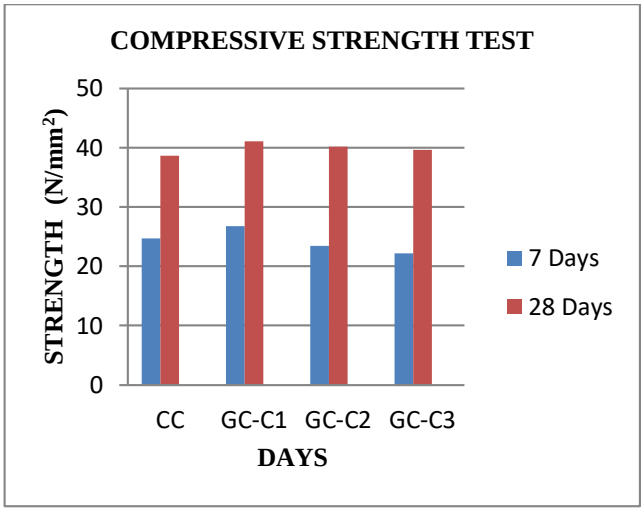

Figure 1. Compressive strength

5.3. Impact Resistance Test

Table 3. Impact Resistance Test

S.No	Combination	Number of blows required for the first visible crack	Number of blows at which the specimen fails	%increase in resistance from first to ultimate crack	Number of blows required for the first visible crack
1	CC	2	3	66.67%	2
2	GC-C1	3	4	75%	3
3	GC-C2	1	2	50	1
4	GC-C3	-	1	0	-

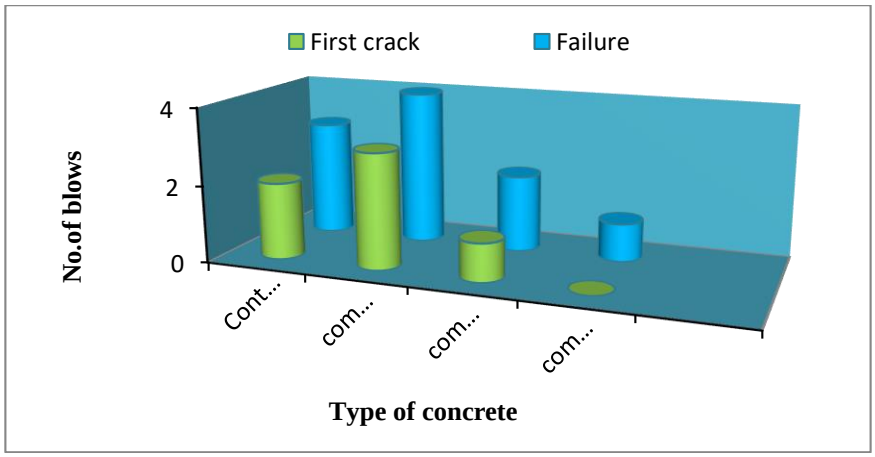

Figure 4. Impact Resistance Test

6. Conclusion

The following conclusions could be drawn from the present investigation.

- The Maximum values of compressive strength (26.78 N/mm^2 and 41.05N/mm^2) was obtained after 7 days and 28 days with addition of 10% Granite sludge powder and 90% cement into the mix as compare with normal M40 grade concrete without any additives.
- The residual compressive strength test result shows that there is a reduction in the compressive strength with concrete paver block having the combination of 50% Granite sludge powder and 50% cement
- Maximum impact resistance was observed in concrete paver block having 10% Granite sludge powder and 90% cement with initial crack at third blow and failure at fourth blow.
- Test results showed that these industrial wastes are capable of improving hardened concrete performance.
- . Due to addition of Granite powder there is considerable improvement in compressive strength of the concrete . With the replacement in concrete by Granite sludge powder and the concrete paver block prepared is environment friendly and cost effective.

7. References

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