

Experimental Study of Replacement of Ceramic Waste in Paver Blocks

VIVEKBALAN.V¹, SHANKAR.K², VIJAY.R³, SATHISH.R⁴, ARUN PRASATH.A⁵

^{1,2,3,4}Student, Department of Civil Engineering, K.Ramakrishnan College of Technology, Tamil Nadu, India

⁵Assistant Professor, Department of Civil Engineering, K.Ramakrishnan College of Technology, Tamil Nadu, India

Abstract - Usage of industrial waste in concrete will make the environment green and pollution free. In this the ceramic industries produce 30% product as wastages, and moreover the ceramic materials cannot be recycled. In this experiment we are attempt to find the suitability of ceramic wastes as a substitute for conventional crushed stone aggregate. Experiments were carried out to determine the compressive strength, Impact test and water absorption with ceramic waste coarse aggregate and to compare them with conventional concrete made with crushed stone aggregate. The properties of aggregate materials also taken and compared with each other. The test result indicates the workability of ceramic waste coarse aggregate is good enough to do this experiment. The replacement proportions varied from 15%, 25%, 35% and 100% by weight for conventional coarse aggregates. In addition to this we are added coconut fiber as a natural fiber admixture to this blocks to attain high strength. And we added silica fume to get higher strength. The final test results of compressive strength, impact strength and water absorption test were taken at 7, 14 and 28 days. The review indicates the use of waste ceramic coarse aggregate as a partial replacement of natural coarse aggregates in paver blocks. Therefore this provides better and efficient recycling and utilization of waste ceramic aggregate in our environment.

Key Words: Ceramic materials, Silica fume, Coconut fiber, etc.

1. INTRODUCTION

This project is about the use of ceramic waste in the form of chips mixed with concrete for making paver blocks.

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2. LITERATURE REVIEW

The following literature review are studied.

Someone use of ground husk in the paver blocks. In their study the fine aggregates were partially supplanted utilizing groundnut husk ash remains as a part of rate of 0, 10, 20, 30, 40, 50 and 60%. And density, compressive strength and water absorption was found out utilizing paver blocks. And it gives the result of density 13880-2200kg/m³.

Here they examined the impact on strength properties of the concrete in replacing some portion of concrete by quarry sludge got from nearby crusher unit. The research work is incorporated with the examination of strength properties of cement made with 2.5% to 20% substitution of cement by quarry dust under 75 micron particle size.

In this they are producing paver blocks using fly ash and glass powder. This project uses fly ash and finely powdered glass powder mixed with cement in various proportions in order to get high strength. Presently large amount of fly ash are released from the thermal power plants. And the glass materials are non-degradable so they are used in this project.

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1.2 DESIGN OF PAVER BLOCKS

All the design are described as per Indian standards.

Table -1: Thickness of paver blocks corresponding to traffic category and concrete grade

SI NO.	GRADE	COMPRESSIVE STRENGTH AT 28 DAYS	TRAFFIC CATEGORY	THICKNESS
		N/mm ²		mm
1	M-30	30	Non-traffic	50
2	M-35	35	Light-traffic	60
3	M-40	40	Medium-traffic	80
4	M-50	50	Heavy-traffic	100
5	M-55	55	Very high-traffic	120

In this project we are using high strength concrete blocks, so we decided to use high strength cement from a no.1 brand. We are designed to make paver blocks for Non-traffic category of M-30 grade. We tested the blocks after the 7, 14 and 28 days.

2.1. Materials used

Cement (grade 53), silica fume, ceramic coarse aggregate (chips), conventional gravel aggregate (chips), coconut fiber, hardener, water, m-sand.

2.1.1. Cement

1. The specific gravity of cement is about 3.19.
2. Consistency of cement is about 31.6%.
3. The initial setting time of cement is about 92 seconds
4. And the final setting time of the cement is about 223 seconds.
- 5.

2.1.2. M-sand

1. The specific gravity of m sand is about 2.6
2. The sieve size taken as per IS Code range from 150 microns - 4.75mm

2.1.3. Silica fume

1. The silica fume has the very good property to increase the strength.

2.1.4. Conventional coarse aggregate

1. The impact strength value of the conventional coarse aggregate is about 10.2%.
2. The water absorption value is about 1.5%
3. The specific gravity of coarse aggregate is about 2.36

2.1.5. Ceramic coarse aggregate

1. The impact strength value of ceramic waste chips is about 11.7%.
2. The water absorption value of ceramic chips is about 3%.

3. The specific gravity of ceramic waste coarse aggregate is 2.34

2.2. MIX PROPORTION

Table -2: Mix proportion

MIX PROPORTION	MIX 1	MIX 2	MIX 3	MIX 4
CERAMIC WASTE	15%	25%	35%	45%
SILICA FUME	10%	10%	10%	10%



Fig -1: Ceramic waste

3. PAVER BLOCKS

There are various types and shapes of mould used in the manufacturing or casting of paver blocks. In this case we are used zigzag mould and I shape mould.



Fig -1: Paver blocks

The area of the mould are find out and mix designs are done for M-30 grade of concrete.

3.1. Requirements of paver blocks

1. A good paver blocks should be free from air voids.
2. When there is minimum percentage of air voids the strength of blocks will be very high.

3. Their top surface should be shine and have required friction while walking on it.

4. The downside of the pavers should be having more friction.

5. A good paver blocks should not be get broken when it has been dropped from 1 meter distance and also free from chipping.

2. TEST SECTION

2.1. Compression test

The test were conducted on 7, 14 and 28 days.

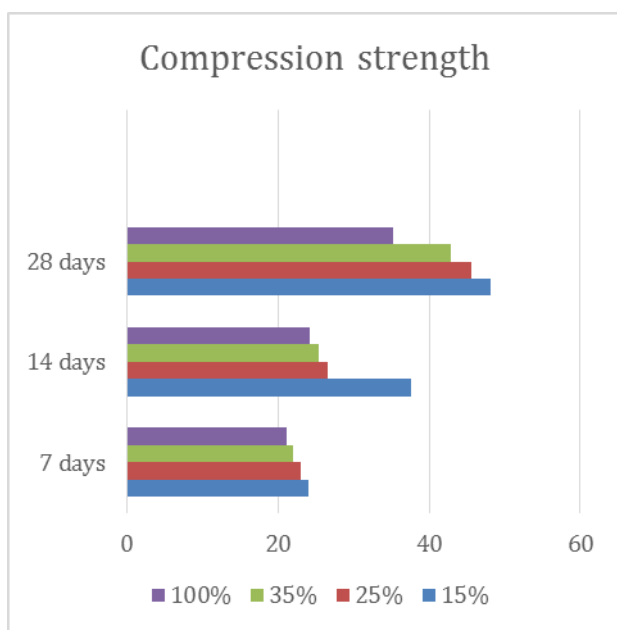


Chart -: Variation between Ceramic percentage and compression strength

2.1. Water absorption test

The water absorbing limit shall not be more than 6% of its total weight.

2.2. Visual observation

The paver blocks should be free from edge chipping. Any visual defects of paver blocks includes cracking, flacking shall not be recorded by observing the paved blocks from a distance of approximately 2m.

3. CONCLUSION

As per IS code the paver blocks has been designed and blocks were casted successfully. On observing from the strength, it is clear that the strength of our blocks are higher than the paver blocks available in market. On increasing the ceramic percentage the strength decreases gradually. To overcome this problem we are added silica fume with it, so the strength of the pavers are increased within the 14th days

of curing. Further curing for 28th day the strength goes to the maximum.

REFERENCES

- [1] IS 15658: 2006 – Precast Concrete Blocks for Paving-Specification.
- [2] IRC : 15-2011 – standard Specifications and Code of Practice of Concrete roads (Fourth Revision).
- [3] IRC:44-2008 – Guidelines for Cement Concrete Mix Design for Pavements.
- [4] IRC: SP: 24-1984 – Guidelines on the Choice and Planning of Appropriate Technology in Road Construction.
- [5] IS 2185-1(2005): Concrete Masonry Units, Part 1: Hollow Solid Concrete Blocks.