



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 7, July 2023

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

ijirset@gmail.com

www.ijirset.com

Interlocking Concrete Paver Blocks Made With Recycled Coarse Aggregate and Marble Powder

Purnima K Biranagi^[1], Manu D M^[2], Akshatha V^[3], Dilip D G^[4], Lavanya N^[5], Likith Kumar M^[6]

^[1]Assistant Professor, Department of Civil Engineering, Dr. Ambedkar Institute of Technology, Bengaluru, India

^[2]U.G. Student, Department of Civil Engineering, Dr. Ambedkar Institute of Technology, Bengaluru, India

^[3]U.G. Student, Department of Civil Engineering, Dr. Ambedkar Institute of Technology, Bengaluru, India

^[4]U.G. Student, Department of Civil Engineering, Dr. Ambedkar Institute of Technology, Bengaluru, India

^[5]U.G. Student, Department of Civil Engineering, Dr. Ambedkar Institute of Technology, Bengaluru, India

^[6]U.G. Student, Department of Civil Engineering, Dr. Ambedkar Institute of Technology, Bengaluru, India

ABSTRACT: Interlocking concrete paver blocks (ICPB) are brick-like piece of concrete normally used as outdoors floors which may be used as an opportunity pavement to asphalt and urban pavements. ICPB is shaped from person concrete paver blocks (CPBs) that match subsequent to each other on a appropriate sub base leaving a selected joint area amongst them to be packed with jointing sand. For this purpose, diverse commercial wastes which include fly ash, Marble powder, recycled coarse aggregate have been decided on and their bodily and chemical residences have been studied. Construction waste which is generated in India is 150 million tons annually, in that India recycles only 1% of construction and demolition waste that is produced.

KEYWORDS: Asphalt, Fly ash, Pavements, Concrete, Interlocking.

I. INTRODUCTION

This part incorporates a concise prologue to the ongoing circumstance of the development of interlocking concrete paver blocks asphalt, the significance of concrete use, and the usage of modern results in concrete paver blocks in asphalts. It makes sense of the extent of study, goals, and association of work. Interlocking concrete pavers make any surface resistant to hazards like skidding and slipping, making the pavement surface cooler. Concrete paver blocks are readymade strong cement blocks which is available in different sizes and shapes. Construction demolition waste is generated from Construction, Renovation, Repair and demolition of Houses, Bridges, large building structures, roads and dams. In current days concrete paver block went in to a part of towns and metropolitan regions. It is to situate in private, business and modern regions like as shopping centers, stopping regions, pathways, transport stops and so forth

II. LITERATURE SURVEY

Several studies have been conducted to utilize Construction demolition waste. Rafeeullah [1] made a Replacement of cement with marble powder up to certain limit will reduce the CO_2 emissions, By this study the optimum percentage for replacing the cement is about 20%. Similarly Khandve .P .V [2] used the waste material which reduces the cost of manufacturing and solves the problems of disposal. From the overall study on which he made we came to know that the marble stone waste gives the satisfactory result for the compressive strength 47.45 MPA. B Kaviya [3] she concluded that the dust obtained from the stone crusher is fully replaced with fine aggregate. The test was conducted for compressive strength and it was observed that the replace of fly ash with 10%, 20% and 30% with cement. There was a decrease in compressive strength of paver block. Kushboo Tiwari [4] made a study on marble waste used in paver block. The grade, selected for casting the paver blocks is M40, the paver blocks manufactured by various percentages 0%, 10%, 20%, 30%, 40%, 50%, 60% of the coarse aggregate replaced by marble stone in the concrete

III. METHODOLOGY

Procurement Of Materials: It involves gathering the ingredients necessary to produce the particular type of concrete. The required number of materials is collected before going to casting or mixing of concrete. fly ash is procured from white field, Marble powder procured by marble and granite store in Nagarbhavi . It should be free from dust debris and other harmful things, especially cement should be free from lumps and it should be having new manufactured dates.

Characterisation Of Materials: The suitable tests are conducted for all the materials. For Marble powder fineness test, specific gravity test, sieve analysis and for cement specific gravity test, initial setting time test, normal consistency, fineness test, and for aggregates impact test, crushing strength test, specific gravity test, abrasion test, sieve analysis, Bulk density, water absorption test. These are all tests are conducted according to IS specifications. Based on the results of testing materials if it matches the IS values then it's suitable for work if it doesn't match with IS values of material that should be neglected and not used for the concrete.

Mix Proportioning: Concrete mix ratios are the proportions of concrete components such as cement, sand, aggregates, and water. These mix ratios are decided based on the type of construction, and mix designs. In this study, the control specimen was designed as per IS 10262-2009 to achieve an M40 grade of concrete with a water-cement ratio of 0.40. Concrete of mixing is a process of mixing the ingredient of concrete such as cement, sand, aggregate, water, and admixture together to make concrete of suitable grade. To make the different Grades of concrete, mixing of concrete materials should be done properly as per the mix design of concrete to achieve the design strength of concrete. Mixing of concrete is a very complex process.

Tests On Fresh Concrete: Concrete is referred to as fresh where the setting and hardening process has not yet started. Fresh concrete should be capable of spreading uniformly without inducing any segregation of the aggregates. A workable concrete should have a right balance between the plasticity and mobility for a particular job in a particular place, and to know the workability of fresh concrete some tests are commonly employed to measure workability. i.e., slump test, compaction factor test, flow table test, vee bee consistometer test. And slump is the most commonly used method for measuring consistency of concrete.

Casting And Curing : Clean the standard Paver block moulds and apply oil to all contract surfaces of mould and size of is normally from the mixing spot while concreting. Fill the fresh concrete after all the tests done on fresh concrete. Fill the concrete in a mould in 3 layers and each layer compact with 25 numbers of stroke can blow by tamping rod and finish the top surface by trowel after completion of the last layer. Cover the mould by damp hessian cloth immediately to prevent loss of water. After 24 hours remove the specimen out of the mould, while removing, take care to avoid breaking of edges. Put coding on cubes by paint or marker, coding should be a self-explanatory showing site name, number, and date of casting, and submerge the specimen in clean fresh water till the time of testing .

Tests on Hardened concrete :Test the specimens for 7 days and 28 days of curing period and take the average strength of cubes representing the strength of concrete of a particular portion of the structure. The various Test on hardened concrete is compressive strength test, Flexural strength test.

IV. EXPERIMENTAL RESULTS

Series 1

In this series the marble powder is added as a filler material to concrete. Partial replacement of cement by fly ash about 30%, fly ash kept constant throughout the series 1. And marble powder adding 10%, 20%,30%, 40%. The ratio of water to cementitious ratio of 0.45 is kept constant, Here M0 represents conventional paver block, prepared for the compare to other mix.



COMPRESSIVE STRENGTH

As discussed earlier in chapter 3.7.2.1 the compressive strength test carried out on paver blocks, results were discussed below. Tale 4.2 gives the compressive strength of series 1.

Mix designations	Compressive strength (MPa)	
	7 days	28 days
MO	29.78	41.04
M1	26.88	37.09
M2	29.26	40.26
M3	35.4	47.93
M4	31.9	42.5

Table – 1:- compressive strength of series 1

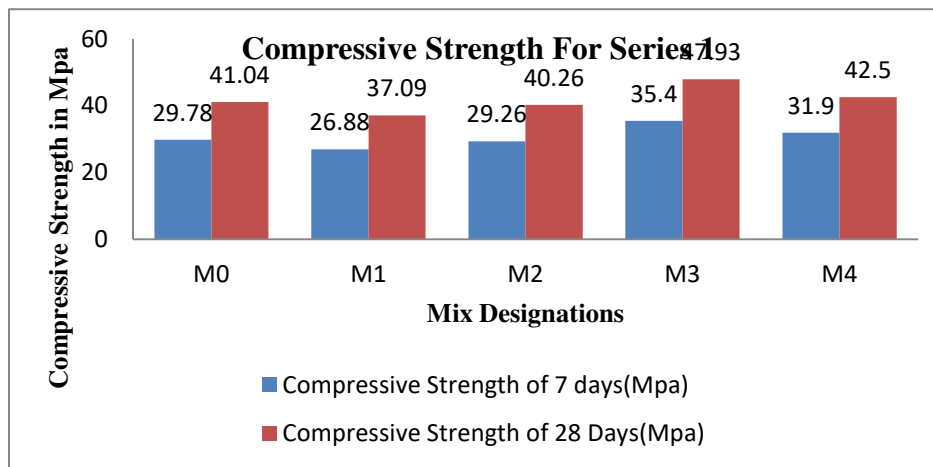


Fig 5 : Results of compressive strength test of series 1

Here, it can be seen series 1 compressive strength in fig 4.2. A0 mix shown 32.4 MPa compressive strength of 28 days. When 10% of marble powder added to concrete M1 mix shown decrease in compressive strength. It might be due to heat of hydration when the addition of cement more than its requirement it will cause increase in temperature during heat of hydration. Which leads to cause micro cracks leading to the increase in pores. Might be 10% of marble powder not filled all voids. A2 mix shown increase in compressive strength might be 20% of marble powder reduce voids in the concrete. Again, M3 mix shown increase in compressive strength it might be by again increase in marble powder and A3 shown optimum strength. again, increase in marble powder content in the concrete by 30% it might be reduced voids in concrete. the A4 mix shown decreasing in compressive strength the reason behind this might be excess amount of marble powder. A3 mix is the optimum. The series 2 based on A3 mix.



Series 2

The M3 concrete mix taken for series 2, M3 gives the optimum strength compare to other concrete mix. In this series partially fine aggregate replaced by copper slag. 0% to 30% of copper slag have been added to the concrete. Marble powder and fly ash kept constant throughout the series 2. copper slag added 10% incremental in M3 concrete mix.

After the results and discussion of series 1, in the optimum mix M3 the fine aggregate replaced by copper slag partially, the blocks designated as M3C1, M3C2, M3C3,M3C4. Series 2 test results are discussed below.

Compressive strength:

Mix designations	Compressive strength (MPa)	
	7 days	28 days
M3C1	29.8	40.6
M3C2	35.6	49.8
M3C3	31.5	43.2
M4C4	28.7	37.8

Table – 4.2:- compressive strength of series 2

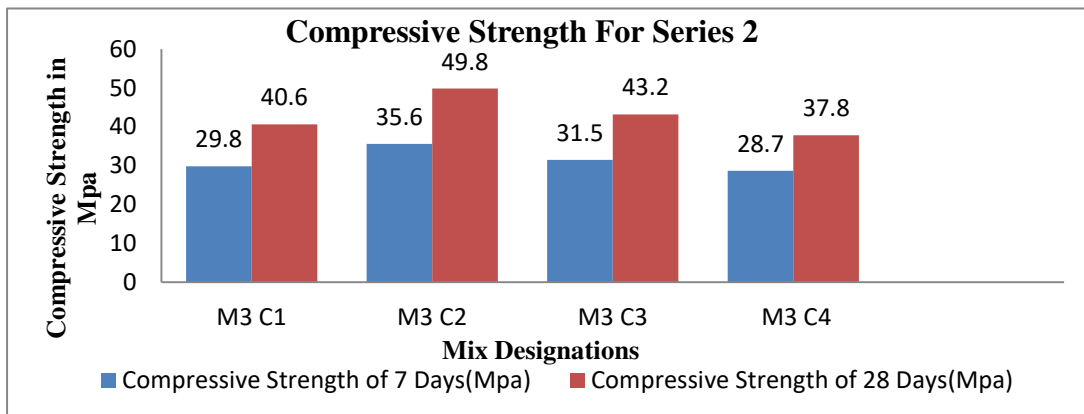


Fig-4.2: Result of compressive strength test of series 2

Here, it can be seen series 2 compressive strength in fig 4.5, A3 mix shown optimum strength in the series 1. A3 mix is taken for series 2. A3C2 shown increase in compressive strength for 40% recycle coarse aggregate. The chart shown decrease in compressive strength. The strength 46.87 Mpa with 40% replacement. A3C2 shows optimum mix. A3C2 (30% OF Marble powder, 40% of recycled coarse aggregate) concrete can be preferred for optimum strength respected to utilisation of alternative materials.

Summary

Here, tests have been done on hardened concrete; compressive strength test conducted on hardened concrete. A3



mix is showed optimum compressive strength with the utilization of fly ash and marble powder. The marble powder content more than 30% it will cause decrease in compressive strength. Coarse aggregate is replaced partially by recycled coarse aggregate and all remaining materials are constant.

Cost Analysis

Table – 5.1- prices of materials

Materials	Price of materials as per market value with units (Rs)	Price of materials/kg
Cement	450/ bag	9/kg
fly ash	500/tonne	0.5/kg
fine aggregate	800/tonne	0.8/kg
coarse aggregate	650/tonne	0.65/kg
marble powder	1000/tonne	1/kg
super plasticizer	300/litre	0.3/ml

Series 1

In series 1, cost analysis done for every mix. Cost analysis of every mix are discussed below chapters. The cost of series 1 given in table 5.2

Table:- 5.2:- Total cost of 1m³ of concrete for series 1

Mix designations	Total cost of 1m ³ of concrete (Rs)	Cost/ 1 paver block
M0	4947	11.62~12
M1	5041	11.8~12
M2	5134	12.06~12
M3	5212	12.24~12.5
M4	5290	12.43~12.5

Here, fig 5.1 shown Total cost of 1m³ of concrete for series 1, the chart shown increase in amount with respect to design mix. It might be due to addition of marble powder. Here no material replacing with marble powder. Another reason for increase in cost is rate of marble powder is high, if marble powder available for free definitely cost will reduced.

Series 2

In series 2, cost analysis done for every mix. Cost analysis of every mix are discussed below chapters. The cost of series 2 given in table 5.3



Table :- 5.3:- Total cost of 1m³ of concrete for series 2

Mix designations	Total cost of 1m ³ of concrete(Rs)	Cost/ 1 paver block
M3C0	5350	12.5
M3C1	5278	12.3~12.5
M3C2	5205	12.2~12.5
M3C3	5130	12

Here, fig 5.2 shown Total cost of 1m³ of concrete for series 2, the chart shown decrease in amount with respect to design mix, it might be due to replace the coarse aggregate by recycled coarse aggregate. And another reason for decrease in amount the rate of Recycled coarse aggregate is lesser than coarse aggregate. If coarse aggregate fully replaced by recycled coarse aggregate definitely cost is very much reduced.

Summary

Market value is Rs. 17/ block in Bangalore. Here cost is Rs. 12/ block so can easily save Rs. 5 rupees / block. Cost analysis is done for all mixes, M3C2 mix is optimum with respect to cost among the all mixes which cost is Rs. 12.5/block

V. CONCLUSION

A suitable paver block can be produced by adding 30% of marble powder was found to be optimum for concrete paver blocks considering compressive strength. Mix M3C2 is found to be optimum mix and it can yield a compressive strength of 48 MPa. On comparing with the cost of the paver block available in the market about 30% of the cost can be saved with the optimum mix. When the addition of both marble powder and Recycled coarse aggregate in concrete, there are reduction in compressive strength, it might be due to effect of both marble powder and recycled coarse aggregate or recycled coarse aggregate alone. As a sustainable approach in construction, alternative materials of low energy can be successfully utilized in the manufacture of ICPB.

REFERENCES

1. K. TIWARI, "AN EXPERIMENTAL STUDY ON MARBLE WASTE USED IN PAVER BLOCKS,"
2. INTERNATIONAL JOURNAL OF SCIENCE AND REASEARCH, VOL. 8, NO. 7, JULY 2019.
3. RAFEEULLAH, "EXPERIMENTAL STUDY ON PROPERTIES OF CONCRETE PAVERS BY PARTIALLY
4. REPLACING OPC WITH MARBLE POWDER," IJAERD, VOL. 07, NO. 01, 2020.
5. B. S. J-JEGAN, "REPLACEMENT OF CEMENT BY GRANITE POWDER IN PAVER BLOCKS," IRJET,
6. VOL. 05, NO. 06, 2018.
7. K. KALINGARANI K, "DEVELOPMENT PAVER BLOCKS FROM INDUSTRIAL WASTES," IOSR JMCE,
8. W. B. OSMAN GENZEL, "PROPERTIES OF CONCRETE PAVING BLOCKS MADE WITH WASTE MARBLE," ELSEVIER, 2011.
9. H. PRIYANKA MARKETTA, " CONSTRUCTION OF CONCRETE PAVING BLOCKS USING INDUSTRIAL
10. WASTES," JOURNAL OF ENVIRONMENT NANO TECHNOLOGY, VOL. 7(4), 2018.
11. KAIYA, "A STUDY ON COMPRESSIVE STRENGTH OF PAVING BLOCKS PREPARED WITH STONE
12. CRUSHER DUST AND FLY ASH," JCPS, VOL. 9, NO. 2, 2016.
13. C MANIVEL, "EXPERIMENTAL INVESTIGATION ON PARTIALLY REPLACEMENT OF COPPER SLAG



|| Volume 12, Issue 7, July 2023 ||

| DOI:10.15680/IJIRSET.2023.12070046 |

14. POWDER WITH FINE AGGREGATE AND MUSSEL SHELL POWDER WITH CEMENT ON PAVEMENT BLOCKS," IJSER, VOL. 11, NO. 3, 2020.
15. KALAISELVI, "AN EXPERIMENTAL INVESTIGATION ON PARTIAL REPLACEMENT OF COPPER SLAG AS
16. FINE AGGREGATE IN PAVER BLOCKS," IJCR, VOL. 10, NO. 9, 2017.
17. NOR BAIZURA HAMID, "DEVELOPMENT OF PAVING BLOCKS USING WASTE MATERIALS," IJITEE,
18. VOL. 8, NO. 9S3, 2019.
19. AYANA J, "COMPARITIVE STUDY ON PAVER INTERLOCKS FROM DEMOLISHED CONCRETE WASTE AND COPPER WIRE," IJIRAE, VOL. 05, NO. 6, 2019.



INNO SPACE
SJIF Scientific Journal Impact Factor
Impact Factor: 8.423



ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

9940 572 462 **6381 907 438** **ijirset@gmail.com**



www.ijirset.com

Scan to save the contact details