RESEARCH PAPER | Engineering | Volume : 5 | Issue : 12 | December 2015 | ISSN - 2249-555X

Review Paper on Sustainable Use of Debris in Paver Blocks

KEYWORDS: Concrete Waste, Crushing, Reusing, Interlocking Paver Blocks, Compression test, Water absorption.

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ABSTRACT *In India, total quantum of waste from construction industry is estimated to be between12 to 14 million tonnes per annum, out of which 7 to 8 million tonnes are concrete and brick waste. Construction, demolition, renovation generates large amount of concrete waste. This waste is either dumped or it is diverted towards landfill. This concrete waste can be qualitatively reused for manufacturing of various concrete blocks.*
In this report, we represent the concept of sustainable use of concrete waste in concrete which can be used in manufacturing of interlocking paver blocks. After crushing, this concrete waste can be used as a replacement of coarse and fine aggregates in two stages as complete and half replacement in paver blocks by considering IS specification.
In this project, by considering suitable materials, size, shape, mix design etc. and by accepting specific casting methodology and by performing various specific tests, we are going to cast interlocking paver blocks.

INTRODUCTION-

Recycled coarse aggregates are obtained by crushing of concrete waste from demolition of structural components in many structures such as old buildings, bridges, concrete pavements etc. Concrete paving block is versatile, aesthetically attractive, functional and cost effective and requires little or no maintenance if correctly manufactured and laid. Paver block is solid, unreinforced precast cement concrete paving units used in the surface course of pavements.[6] Interlocking concrete paving block technology has been introduced in India in construction, a decade ago, for specific requirement like footpaths, parking areas, gardens, etc.

We all know that the basic requirement of paver blocks is high compressive strength and low water absorption, so in order to achieve the same conventional results we are trying to replace the course aggregate and fine aggregate completely and partially (50%) in bottom layer because of environmental considerations and growing trend in reusing waste products.

Materials to be used in concrete paver block are cement, coarse and fine aggregate obtained from concrete waste, hardener and colour pigments. Cement of grade OPC 53 will be used as binding material.[9] Also basic test on cement will be performed. Coarse aggregates in bottom layer are replaced by crushed concrete waste in proper proportion. To increase compressive strength in paver block the effective use of angular shape aggregates are used for interlocking. Fine aggregate is also replaced by sieve analysis of crushed concrete waste which is passing from 4.75 mm and retain on 600 micron sieve. [8]Colour pigments are mainly used to impart the particular colour to the surface of paver blocks. This material does not contribute to strength of paver block, but is only useful to give good aesthetic appearance

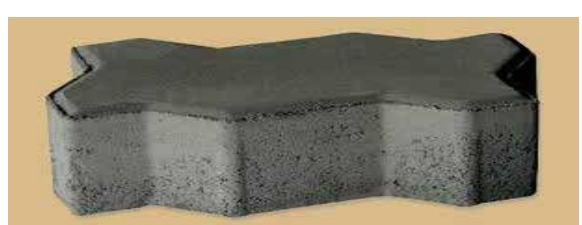

Photo: Selected Shape of Paver block.

LITERATURE REVIEW

Development of sustainable construction material using C & D waste.[1]

Eco bricks of size 230 mm x 90 mm x 90 mm are developed for six different compositions. Amongst the various trials carried out the brick with ratio of binder, fine aggregate and coarse aggregate as 1: 2.75: 2.25 exhibit compressive strength and water absorption within the limits of IS with minimum self-weight.

Volume : 5 | Issue : 12 | December 2015 | ISSN - 2249-555X

Development of low cost paver blocks by replacing PPC with used foundry sand.[6]

Foundry sand generated from metal casting industry is replaced in different percentages and test results after 7, 14 and 28 days are studied. Even after 50% replacement, water absorption is 2%, and compressive strength of 23.5 Mpa is obtained. By rate analysis of ingredients per kilo-gram gives cost effective paver blocks.

Manufacture of concrete paving blocks with fly ash and glass powder.[4]

Different mix proportions are prepared using cement replaced by equal quantity of fly ash and waste glass powder. Higher compressive and flexural strength was achieved when 20% cement was replaced by equal proportion of fly ash and glass powder. Tensile splitting strength and abrasion resistance seems to be satisfactory. Therese is saving in cost of cement and it also reduces burden of dumping fly ash and west glass on earth which is ecofriendly.

Study on strength properties of paver blocks made from unconventional material.[3]

In this investigation, various properties such as compressive split tensile, bending strength and water absorption of paver blocks consisting of crushed granite, unconventional materials such as kadapa and broken paver for various percentage replacement of coarse aggregate are studied as per IS 15658: 2006. Broken paver aggregate is not suitable in making paver blocks as water absorption is more than 7 %. However, 50% replacement of paver aggregate with natural aggregate may be use.

Properties of concrete paving blocks made with waste marble.[5]

Marble industry produces large amounts of waste marble. In paving blocks they have partly replaced aggregate with waste marble. Although compressive strength decreases with increasing marble content in concrete, 28 days strength obtained was satisfactory. Addition of marble aggregates increases wear resistance of paving blocks. Water to cement ratio increases along with increasing concentration of waste marble aggregates.

Issue on construction waste: The need for sustainable waste management.[2]

Construction wastes are a prominent issue in many developing countries and haveadverse effects on environment, economy and social aspects. Studies show that material waste has significant impact to cost of project as well as on environment. The paper also has highlighted cause factors which can be mitigated for managing construction waste. Various steps of sustainable waste management like prevention, minimization, reuse, recovery, disposal, etc are studied.

Material and Methodology
Materials Used: –
1. Cement.
2. Crushed Sand.
3. Aggregates obtained from concrete waste.
4. Water.
5. Coloured Pigment.

Study on other additive materials is going on out of which suitable and effective material would be selected which will give better results.

Experimental Methodology: –
1 Test on materials-
Cement: Tests performed on Cement.

Sr.No.	Test performed	Results
1.	Fineness of cement.	2.86 %
2.	Standard consistency of cement.	26 %
3.	Initial setting time.	32 minutes.
4.	Final setting time.	600 minutes.

b) Aggregate: Tests performed on Aggregates.

Sr. No.	Test performed	Results
1.	Specific gravity of coarse aggregate.	2.13
2.	Water absorption test.	5.21 %
3.	Impact value test.	14.6 %
4.	Aggregate crushing test.	13.25 %
5.	Specific gravity of Fine aggregate.	2.63

2 Test on Paver Block [7]
1. Water absorption test. (If hardener not used)
2. Compressive strength test.
3. Flexural strength test.
4. Abrasion resistance test.
5. Split tensile strength test.

4. Methodology:
Paver blocks of suitable dimensions, thickness, and shape and mix design using rubber moulds will be casted. For proper mixing and compacting table vibrator will be used. Concrete paver block contains cement, coarse and fine aggregate in bottom layer and in the top layer a mixture of cement, crush sand and coloured pigment. In first stage, partial (50%) replacement of coarse and fine aggregates by aggregates obtained from crushed concrete waste and in second stage, complete replacement of aggregates by crushed concrete waste in the bottom layer will be made. For compression test blocks will be casted and test will be conducted after 14 days and 28 days on the set of four blocks as per IS(15658:2006). Similarly for water absorption, 3 blocks will be casted and test will be conducted.[7] Similarly for tensile splitting, flexural strength and abrasion resistance each of 4 blocks will be casted and test will be conducted.

5.0 OBJECTIVES:-
- To study the strength properties of concrete waste.
- To study the effect on compressive, water absorption and flexural strength, abrasion resistance and tensile splitting test on paver blocks with replacement of aggregates by concrete waste.
- To develop low cost interlocking paver blocks.
- To minimize the burden of construction and demolished waste on environment and dumping issue.
- Sustainable approach towards production of greener concrete.

ADVANTAGES:-
Sustainable use of construction concrete waste.

Avoiding dumping problems of concrete waste.

Results obtained are comparatively similar to standard blocks as studied in various research papers.

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Use of paver blocks gives good aesthetic view.

Economy can be achieved for large scale use.

DISADVANTAGES:-
Transportation cost of concrete waste will be more if site is at far distance.

Heavy machinery is required for proper crushing of concrete waste.

There is no standard mix design, hence require proper proportion of ingredients.

5.3 Expected conclusion:-

- From compression test, even after replacing aggregates completely, compressive strength is expected as selected grade of mix design.
- Water absorption should be below 7% as per IS recommendations. [7]
- For abrasion resistance test, flexural strength test, tensile splitting test, replacement of coarse and fine aggregates should give results as per the IS specifications.
- Cost optimization may be achieved.

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