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EXPERIMENTAL INVESTIGATION ON COST EFFECTIVE PAVER BLOCK

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ABSTRACT -
Interlocking concrete paver blocks (ICPB) are brick-like piece of concrete commonly used as exterior flooring which can be used as an alternative pavement to asphalt and concrete pavements. ICPB is formed from individual concrete paver blocks (CPBs) that fit next to one another on a suitable sub base leaving a specific joint space among them to be filled with jointing sand. The main aim of this study is to produce interlocking concrete paver blocks by using manufacturing sand without curing. The main reason for the use of the manufacturing Sand is to reduce the landfill problem and also to control the depletion of the natural resources. For this purpose manufacturing sand is selected and their physical and chemical properties were studied. Various mixes with different proportions of thesemanufacturing sands were casted and tested as per the standards given in the Indian standards for precast concrete blocks for paving (is.15658:2006). These test results are then compared with the results of the conventional paver blocks.

Key Words: manufacturing sand, paver blocks, naphthalene formaldehyde

I INTRODUCTION

1.1General

Many countries are witnessing a rapid growth in the construction industry which involves the use of natural resources for the development of the infrastructure. This growth is jeopardized by the lack of natural resources which are depleting worldwide, at the same time the generated wastes from the industry are increasing substantially. The sustainable development in construction involves the use of non-conventional and innovative materials, and recycling of waste materials in order to compensate the lack of natural.

1.2 Concrete paver block

Concrete block pavements (CBPs) are formed from individual solid blocks that fit closely next to one another to form a pavement surface. A typical CBP is placed on a thin bed of sand overlaying a sub base. CBP can be placed with a variety of shapes and patterns. There are joint spaces between blocks. These spaces are filled with sand having suitable grading. The blocks are restrained from two sides by edge restraints. CPBs are manufactured from semi-dry mixes. During manufacturing process vibration and pressure is applied to the mix. By this process dense and strong CPB can be achieved to form strong and durable paving surfaces. Moreover interlocking behavior of CBP gives the ability of spreading loads to larger areas.

1.3Benifits

If we use manufacturing sand and aggregate for manufacturing paver blocks, cost will be less. This is more suitable where the availability of natural sand is less.When we use chemical admixture in concrete mix to make the paver blocksothatwe can avoid curing.

1.3Scope and objectives

Many researchers had already found, manufacturing sand possible to use as a material in concrete. In this experimental study manufacturing sand is used in concrete paver block as replacement material of natural sand. For this study, M30 grade of concrete is used and the tests will be conducted for various additions of admixtures in concrete. The obtained results are compared with those concrete made with natural sand.

- The performance of paver depends on mechanical properties of concrete blocks and structural design of the pavement, for a serviceable paver, both factors has to be studied.
- To reduce the cost of the paver block, the maximum extent of the M Sand with using admixture will maintain in their standard strength.
- Strength will be occur without curing.
- Less water consumption.

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- I have learned that curing can be avoided by adding chemical admixtures.
- And also I have learned that the days taken for curing can be reduced by adding admixtures.

II EXPERIMENTAL INVESTIGATIONS

2.1. Materials

a). Cement and Chemical Admixtures

53Grade ordinary Portland cement conforming to IS 12269 was used and Chemical admixtures, namely, Naphthalene formaldehyde used in this experimental work.

b). Coarse Aggregates

Coarse aggregates complied with the requirements of IS 383 was used. As far as possible crushed/semi-crushed aggregates were used.

c). Fine Aggregates

River sand which is used as fine aggregates in conventional concrete was completely replaced by manufacturing sand. Manufactured Sand is produced by feeding stones of varying sizes into Vertical Shaft Impact (VSI) Crusher. The VSI crusher by means of its unique design and action produces well shaped fine aggregate particles.The process of attrition also enables the removal of surface roughness of the fine aggregate particles to agood extent.When the stones are processed through Vertical Shaft Impact (VSI) Crusher, not only fine aggregates, butthe coarse aggregates, another end product, also acquire improved particle shape and reduced surfaceroughness.VSI Crushers in quarry are sometimes used to convert entire coarse aggregates into fine aggregates.With an inherent process of screening, Manufactured Sand plants ensure better grading of fine aggregatesfor better particle size distribution.

2.2. Mix Design

In this study of development of paver blocks from manufacturing sand the mix design was determined to achieve target strength of M30.Fine aggregate i.e. River sand was replaced completely by manufacturing sand and coarse aggregates less than 12mm were used in mix.

2.3. Casting and Curing of Paver Blocks

With the finalized mix proportions of cubes the mix design for paver blocks using manufacturing sand (MS), cement (C), coarse aggregate (CA), and chemical admixtures were prepared, casted and checked for the result. The criteria assumed for these mixes are to attain the basic compressive strength 30 to 35 N/mm2. The prepared mix is discharged from the mixer and consumed in the next 30 minutes. Vibrating table is used for compacting the concrete mix in the moulds of desired sizes and shapes. After compacting the blocks are de-moulded and kept for 24 hours in a shelter away from direct sun and winds. The blocks thus hardened are cured with water to permit complete moisturisation for 14 to 21 days. Water in the curing tanks is changed every 3 to 4 days. After curing, the blocks are dried in natural atmosphere and sent for use. The concrete paving blocks gain good strength during the first 3 days of curing and maximum gains in strengths are secured in the first 10 to 15 days of curing.

FIG 1. MIXING PROCESS

FIG 2. SPECIMENS

III RESULTS AND DISCUSSIONS

The following tests were conducted on designed paver blocks and their results are as follows

3.1.Tensile Splitting Strength Tensile splitting strength was conducted on the paver blocks. On comparing the result of 14th day and 28th day it was observed that there is an increase in average value from 3.22 N/mm2 to 3.42 N/mm2

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Table 1. Tensile Splitting Strength Results

Specimen	Split tensile strength (N/mm)	
14th day		**28th day**
1	3.90	3.56
2	3.09	3.63
3	3.38	2.43
4	2.35	2.82
5	3.75	4.02
6	2.9	4.10
AVERAGE	3.22	3.42

3.2. Flexural Strength Test

Three point loading test was conducted on the paver blocks. On comparing the 14th day result and 28th result of the flexural strength we observe that there is an increase in the average value from 6.75 to 7 N/mm2

Table 2. Flexural Strength test Results

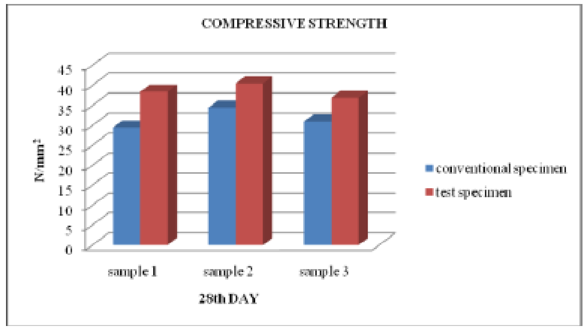
Specimen	Weight (kg)		Load test (kN)		Flexural (N/mm2)	
14th day	28th day	14th day	28th day	14th day	28th day	
1	3.020	2.975	6	6.56	6	6.90
2	3.041	3.084	8.88	6.72	8	6.24
3	3.08	2.993	8.80	6.72	8.35	7.07
4	3.02	3.036	6.32	7.28	6.25	7.34
5	2.99	3.082	6.92	6.24	7.05	6.29
6	3.20	3.064	5.36	8.48	4.9	8.21
AVERAGE	7.04		7	6.75	7	

3.3. Water Absorption Test On comparing the water absorption test result of 14th and 28th day it was observed that water absorption rate is less than 6% in both instance and the more promising thing is that the water absorption is comparatively reduced from 5.89 to 5.56.

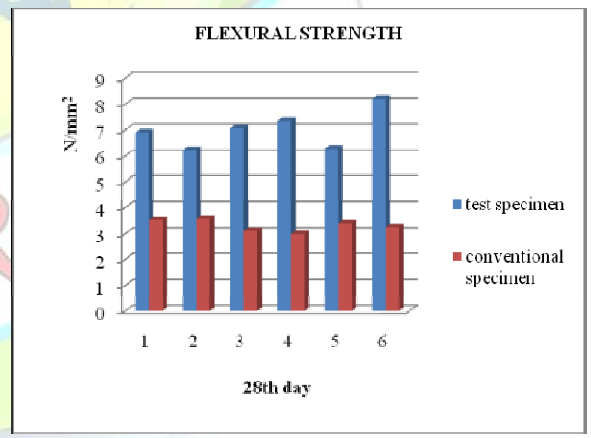
3.4. Compression Strength Test The compressive strength test was conducted on paver blocks and it's 28th test result was found to be 38.6KN which is equal to the desired concrete strength.

IV. COMPARISON BETWEEN CONVENTIONAL PAVER BLOCKS AND INDUSTRIALWASTE PAVER BLOCKS

a).COMPRESSIVE STRENGTH:



b).FLEXURAL STRENGTH:



4.3. SPLIT TENSILE STRENGTH:

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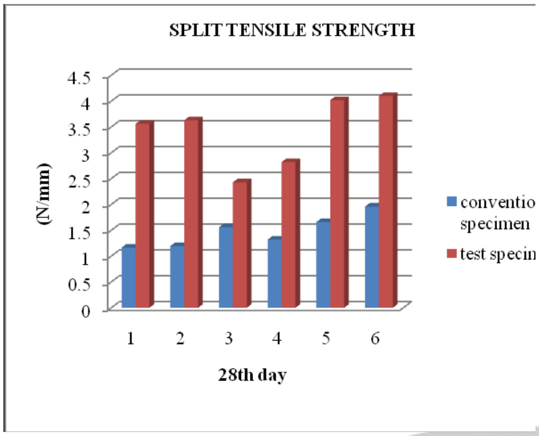

IV CONCLUSION

CONCLUSION

Our main aim of the experiment was to produce interlocking paver blocks from manufacturing sand thereby avoiding land filling and reduction in the use of naturally available resources. The casted specimen was then subjected to many tests such as compressive strength test, water absorption test, flexural strength test, tensile splitting strength test. The tests results were computed and the best among the trial mixes was selected. The computed results were then compared with the results of the conventional paver blocks which are available commercially in the market. On comparing it was found that the designed paver block was on par to the conventional paver blocks for all the tests specified in the Indian standards for precast concrete blocks for paving(IS15658:2006).

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