Journal of Advances and Scholarly Researches in Allied Education
Vol. XV, Issue No. 2, (Special Issue) April-2018, ISSN 2230-7540

Effects of Use of Steel Fibres in Concrete Paving Blocks

Mr. S. R. Zagade[1], Ms. N. S. Dongre[2], Mr. P. H. Patil[3], Ms. J. S. Koli[4], Dr. A. S. Pote[5]*

[1,2,3,4] UG Student, JSPM's Imperial College of Engineering and Research, Wagholi, Pune

[5] Professor, JSPM's Imperial College of Engineering and Research, Wagholi, Pune

Abstract – Use of concrete paving blocks has increased in the areas where the normal flexible pavement does not last long. Application of concrete paving blocks is developing very fast for various reasons such as high resistance, to deformation, durability, easy and rapid quality construction, ability to carry traffic immediately after construction, compatibility with the environment and aesthetic features, etc. The structural behavior of CBP is similar to flexible pavement. However, the performance of CBP depends upon block shape, size, thickness, type of building and jointing stand, joint width. Block layout is also important, which affects the overall performance of CBP. The edge restraint is one of the features which are essential to stop mitigation of blocks outwards .The interlocking mechanism is one of the unique characteristic of the CBP. The performance of CBP largely depends on how well the interlock has achieved. The project deals with study of effects of steel fibres on concrete paving blocks. In many factories it is observed that there is no standard method used for manufacturing of paving block. In this project we use IS 15658:2006 code for design of concrete mix. In this project we investigate the effects of different test for compressive strength, flexural strength and tensile strength, behavior of mechanical and physical properties of FRC at various temperatures and investigation of reduction in cement content for different percentage addition of fibres in mix when permissible strength results are achieved.

Keywords- FRC, Steel Fibres, Paving Block, Comparison.

---------------------------------X---------------------------------

I. INTRODUCTION

1. What is paving block?

A self-blocking paving block is a piece of precast concrete commonly used in outdoor landscaping applications. Pavers were developed in Europe and introduced to the United States in the early 1970s. Interlocking paving stones are installed over a compacted stone sub-base and a leveling bed of sand. Concrete pavers can be used for driveways, patios, pool decks and driveways and loading docks or airport.

Instead of connecting the pavers by pouring grout between the joints as one would with tiles, sand particles are spread over the pavers and tamped down. Sand stabilizes interlocking pavers, but allows some flexibility. This type of pavers absorbs stress such as small earthquakes, freezes and thaws, and slight erosion of the soil by slightly moving each tile. As a result, they will not crack or wring like concrete, although bad weather can make potholes.

The special tools needed for the installation of interlocking pavers are the vibrating compacting machine or "Vibro-Plate" and Shear Cutter. The former is used to compact the base material to a minimum density of 90% and also to fix and lock the pavers in the sand bed.. The latter is used to cut the pieces to fit at corners and edges. The sand does not wash easily with rain or water from the garden hose and a sealant can be spilled to further block the sand. Standard thicknesses are 60mm (for light traffic) and 80mm (heavy traffic). 50mm too is common in some countries (used for footpaths etc). The benefits of paving on asphalt and poured concrete include high compressive strengths (7000 psi to BS and 8000 psi to ASTM codes), nice appearance, time saving, easy removal and relaying.

II. HISTORY:

Paving has been around for almost 5,000 years. The oldest paved road was discovered in the year 1994, in Giza, Egypt. This road is the oldest paved road on the planet built over 4,600 years to connect an old basalt quarry to Lake Moeris and carry large stones for the construction of Giza temples. This ancient road measures 7 ½ miles (12 km) in length and 6 ½ feet (2 m) in width. The road was paved with thousands of slabs of sandstone and limestone and a few logs of petrified wood. The still standing road was used to transport massive stones using sleds and proved to be reliable. In 500 BC, during the Roman Republic, Rome introduced segmental pavers into its road network.

In Rome, the roads were often muddy, created too much drag and created a lot of dust in heavily traveled areas. The problem was solved by creating roads with deep roadbeds of crushed stone and a top layer that included six sided capstones. The Roman roads provided the troops with much faster transport and proved to be reliable because they are still standing.

After World War II, most of Europe was in ruin and reconstruction began. The roads where rebuilt using paving stones as they have historically proved to be able to withstand certain demands that concrete and asphalt could not meet. German engineer developed a choice of shapes and introduced the use of colors in concrete pavers.

II. LITERATURE REVIEW:

[2.1] B. Krishna Rao (2010): Results indicate that pozzolonic reactions of high volume fly ash in the matrix composite were low in early ages, but by aging the specimens to more than 56 days considerable effect have been seen in strength. According to the study, the addition of a steel fiber reinforcement and a mineral admixture such as fly ash in the concrete can improve the mechanical properties of the samples. SFRSCC mixes show higher compressive, split tensile and flexural strength rather than normal compacting concrete. In this paper, we observed that, incorporation of HVFA reduced the water requirement of a SCC mixture. In other words, using high-volumes of a fly ash increased the workability characteristics of SCC.

[2.2] Min-Yuan Cheng et al. (2010): Test results showed that FRC only in the connection region over two slab thicknesses from each column stub face was sufficient to increase punching shear resistance in the test specimens. A limit of (1/6) (MPa) (2 [psi]) for the average shear stress outside of the FRC region was found to be adequate for determining the extension of the FRC portion of the slab.

[2.3] J.R. Roesler (2010): Fiber-reinforced concrete (FRC) has been used in concrete pavement successfully but there have also been some premature failures. The specific FRC topics that will be addressed are potential applications of concrete pavement, fibrous concrete properties, design approaches, performance, and cost analysis for a typical airfield concrete runway. The advances in FRC materials, specifications, and design methods have significantly lowered the construction risk of FRC pavements. Finally, depending on the slab design criteria, the final cost could range between from a reduction of 6% to an increase of 11%, with the addition of structural fibers.

[2.4] Radhikesh P. Nanda et al. (2010): The test result shows that replacement of fine aggregate by crusher dust upto 50% by weight has negligible effect on the reduction of any physical and mechanical properties like compressive strength, flexular strength, split tensile strength etc. Result for compressive strength of blocks containing 0% dust and 25% dust is higher and equal. While the compressive strength of block containing 50%, 75% & 100% dust is found to be gradually decreased but the variation is very less. The flexural strength decreases as percentage of crusher dust increases. The split tensile strength for normal concrete was found to be higher. Variation of split tensile stress in concrete couting dust between 50% & 75% was found to be less. While that containing 100% dust shows much lower split tensile strength. The water absorption is well below the limit according to the Indian codes. Durability test shows no variation for different replacement of crusher dust. The percentage of saving was less but highly beneficial for mass production of paving blocks.

[2.5] Victor C. Li, et al. (2003): He investigated that the ultimate shear strength of longitudinally reinforced concrete beams and concrete beams without shear brackets is examined by testing the beams under the bending of the center point. All beams without fibres failed by the diagonal shear cracking. Increases in shear strength up to 183% were recorded due to random reinforcement with volume fractions of up to 2% short fibers. In some cases, shear failure was prevented and ultimate failure was in flexure, with yielding of the longitudinal tensile steel. It is shown that there is a correlation between shear strength and a parameter that involves flexural and fracture resistance, a / d ratios and reinforcement ratios, and beam depth. The relationship suggests simple means of predicting the shear strength of axially reinforced mortar and concrete beams containing fibers. The results are quite versatile for a range of fibre types. This work demonstrates that improvements in tensile strength across fiber reinforcements can result in improvements in shear capacity

III. METHODOLOGY

For comparative study of FRC paving block and ordinary paving block, the paving blocks is prepared using the same mix for ordinary as well as FRC paving block. Comparative study is then carried out by performing various tests on the blocks.

FRC is defined as a mortar or concrete, containing discontinuous discrete fibers, which are projected pneumatically at high speed onto a surface. Steel fibres are incorporated in the shotcrete to improve its crack resistance, ductility, energy absorption and impact resistance characteristics. Properly designed, FRC, can reduce or even eliminate the cracking, which is a common cause for concern in plain shotcrete.

Step 1:- Performing preliminary tests on the materials to be used for preparing the paving blocks.

Step 2:- Preparing the mix design of M40 grade of concrete and manufacturing the ordinary paving blocks and FRC paving blocks.

Step 3:- Finding the compressive, tensile and flexural strength.

IV. CONCLUSION:

From the above project data we concluded the following points:

- Steel fibres can improve the properties of concrete and can be used in the PCC to reduce or even eliminate the cracks.
- Optimum dose of steel fibres in the concrete can increase the strength of concrete
- FRC can be successfully used in the concrete paving block successfully.

V. ACKNOWLEDGEMENTS

We would like to thank Principal of our institution Dr. D. D. Shah, HOD Civil Department Dr. A. W. Dhawale, Dr. A. S. Pote and Prof. U. J. Phatak for guidance, all faculty members and all our dear friends for their support.

REFERENCES

B. Krishna Rao et al. (2010). International Journal of Engineering Science and Technology Vol. 2(9), pp. 4936-4943 Steel fiber reinforced self-compacting concrete incorporating class F fly ash

Gregor Fischer and Victor C. Li.: "Deformation Behavior of Fiber-Reinforced Polymer Reinforced Engineered Cementations Composite (ECC), Flexural Members under Reversed Cyclic Loading Conditions, Title no. 100-S4.

J. R. Roesler (2004). "Fiber Reinforced Concrete For Airfield Rigid Pavements", Tech note no.: 3, 25/10/04.

Min-Yuan Cheng and Gustavo J. Parra- Montesinos: "Increased Load Evaluation of Steel Fiber Reinforcement for Punching Shear Resistance in Slab-Column Connections"— Title no. 107-S11, Part I: Monotonically.

Radhikesh P. Nanda et al. (2010). International journal of Civil and Structural Engineering, "Stone crusher dust as a fine aggregate in concrete for paving blocks", Vol. 1, No. 3.

Corresponding Author

Dr. A. S. Pote*

Professor, JSPM's Imperial College of Engineering and Research, Wagholi, Pune

E-Mail – aspoteonline@gmail.com