Compressive Strength of Paver Block by Adding Nylon Fiber

Rajendra Kumar Neekhra[1] Raja Rawat[2] Vishal Gupta[3]
[1]Resident Engineer [2,3]M.E Scholar
[1,2,3]Department of Civil Engineering
[1]MSV International [2]Samrat Ashok Technological Institute Vidisha (M.P) [3]RKDF, Bhopal (M.P)

Abstract— Nylon fiber is used to evaluate the compressive strength of paving blocks. Blocks are alternative material used in place of asphalt or concrete. Concrete paving blocks are widely used in variety of outdoor applications, street and construction places as well as in industrial applications. Various qualities like ease of removal and maintenance, low maintenance, ease of availability forced us to select concrete paving blocks over others. In this paper nylon fiber is as added to paver block concrete in different proportions to improve the compressive strength of paver block and it has been observed that the optimum dose of 0.3% of nylon fiber gives maximum strength of paver block.

Key words: Compressive strength, Material, Nylon Fiber, and Paver blocks

I. INTRODUCTION

Concrete block paving is versatile, aesthetically attractive, functional, and cost effective and requires little or no maintenance if correctly manufactured and laid. Interlocking concrete pavements or pavers are a special dry mix pre-cast piece of concrete commonly used in exterior landscaping pavement applications. Concrete block pavement (CBP) can be an alternative pavement to asphalt and concrete pavements. CBP is formed from individual concrete paving blocks that fit next to one another on a suitable sub base leaving a specific joint space among them to be filled with jointing sand. Cobblestones were the traditional method of stone paving, being uncut and often water-worn stones or large pebbles about 150mm in size. Later hand-cut stone blocks were introduced. Interlocking paving stones are installed over a compacted stone sub-base and a leveling bed of sand. Concrete paving stones can be used for walkways, pool decks and driveways and airport or loading docks. Some of the special tools needed for installing interlocking pavers are vibrating compaction machine or "Vibrant Plate". The former is used to compact the base material to 90% density minimum and also to set and interlock the pavers into the sand bed. The latter is used to cut the pieces to fit at corners and edges. The sand does not easily wash out with rain or garden hose water. Polymeric Sand or a sealant can be used to further lock or coagulate the sand. Standard thicknesses are 60mm (for light traffic) and 80mm (heavy traffic).

We all know for pavement of paver block required high compressive strength and to increase the compressive strength of paver blocks various efforts have been made. In this particular study M50 rectangular 800mm*500mm paver blocks have been cates of 100 mm thickness for heavy traffic and to increase its compressive strength Nylon fiber is added to concrete.

II. MATERIALS AND METHODOLOGY

There are different types of materials used in the construction of paving blocks.

A. Cement:

In the most general sense of the word, cement is a binder, a substance that sets and hardens independently, and can bind other materials together. For making paving blocks *Portland cement* is used. A mixture of sand, coarse aggregate, quarry dust is made along with the cement and water for construction of paving blocks. Ordinary Portland Cement of Grade 53 is used, which conforming IS 12269. 53 grade cement of ultra tech with a remarkably high CS3 (tricalcium providing long-lasting) durability of concrete structures. Produces highly durable and sound concrete due to really low percentage of alkalis chlorides, magnesium oxide. With specific gravity 3.15

B. Fine Aggregate:

Sand is used as fine aggregate in the preparation of concrete and cement mortar. The fine aggregate is consist of natural sand or, other inert materials with similar characteristics. Chunky particle shape and sleek textured aggregates are used in the construction of paver blocks. Natural river sand conforming to Zone II as per IS 383 (1987) is used. The fineness modulus of sand used is 2.70 with a specific gravity of 2.64.

C. Coarse Aggregate:

Coarse aggregate is consist of naturally occurring materials such as gravel, or resulting from the crushing of parent rock. Crushed rock coarse aggregate conforming to IS: 383 (1987) was used. Coarse aggregate of size 20 mm down having the specific gravity of 2.80 and fineness modulus of 7.31 was used

D. Nylon Fiber:

Nylon fiber is a generic designation for a family of synthetic polymers known generically as polyamides. Because of its high tenacity fibers, nylon fiber is used in construction. Nylon fiber is a thermoplastic polymer.

E. Mix Design:

Mix Proportion: Mix design of the concrete is done strictly as per the stipulation of the IS 10262 : 2009. According to IS code specification mix of M30 grade is designed with 0.1, 0.2, 0.3, 0.4 and 0.5% of Nylon Fiber. Here 0.1, 0.2, 0.3, 0.4 and 0.5% of Nylon Fiber is added by cement.

F. Casting and Curing:

Wet mix fresh concrete is placed and compacted into moulds, stripping the moulds when adequate strength has been reached. However in a dry mix, a semi-dry cohesive concrete mix is placed in the mould, which is later, compacted and extruded (pushed out) from the mould, right after compaction. The units are then cured and stored. This later process is commonly used in the manufacture of concrete masonry and paving units as it is large volumes of bricks, blocks and pavers the most economical way of

producing, Aggregate, cement and other additives were added in the drum mixer first and were mixed thoroughly. Concrete mix were filled in the mould and put on the vibro forming machine, after that concrete mix in the mould dried, for compression test a set of three paver blocks is prepared. After one day, the blocks were removed from their moulds and placed at safe surface. The blocks were tested after an interval of 7, 14 and 28 days.

III. Experimental Program

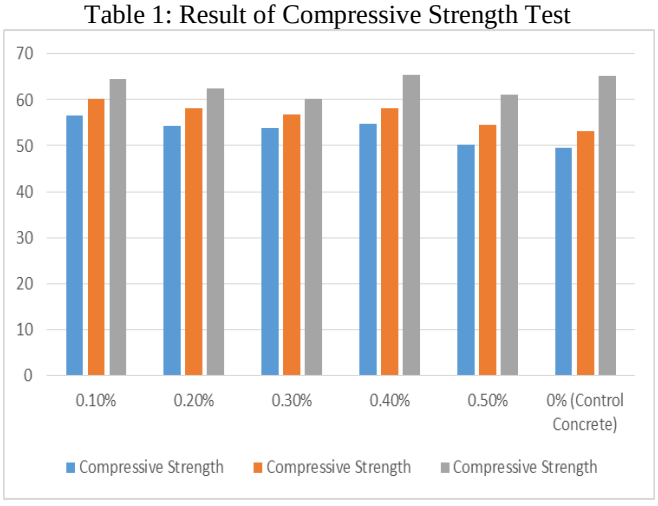
Compressive strength is an important parameter in evaluation of paving block quality. The compressive strength of the specimens was determined at 7, 14, 28 days of age. Three sample of paving block were tested using Standard compression testing machine, average strength value reported in this paper

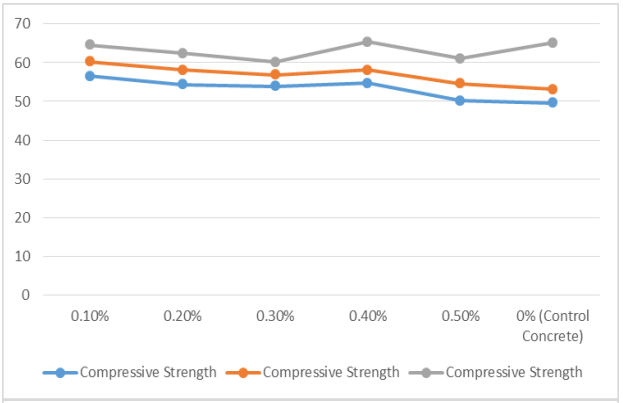
IV. Result and Discussion

After performing compressive strength test on the paver blocks. It is observed that by the addition of nylon fiber at 0.3% gives the maximum compressive strength at 7, 14 and 28 days. When optimum percentage of Nylon Fiber is added to concrete i.e. 0.3% of cement, it gives maximum compressive strength when it is compare to conventional concrete paver blocks and also other nylon fiber paver blocks (0.1%,0.2%,0.4%,0.5%).When we prepare mix of concrete with 0.3% Nylon Fiber by cement. Result of compressive strength test is given below in the table 1 and Graph 1, 2 and 3.

S.No.	Material	Percentage Replacement	Compressive Strength		
			7 Days	14 Days	28 Days
1	Nylon Fiber	0.10%	56.55	60.22	64.57
2		0.20%	54.32	58.12	62.41
3		0.30%	53.89	56.85	60.2
4		0.40%	54.66	58.14	65.42
5		0.50%	50.12	54.58	61.03
6		0% (Control Concrete)	49.56	53.14	65.21

Table 1: Result of Compressive Strength Test





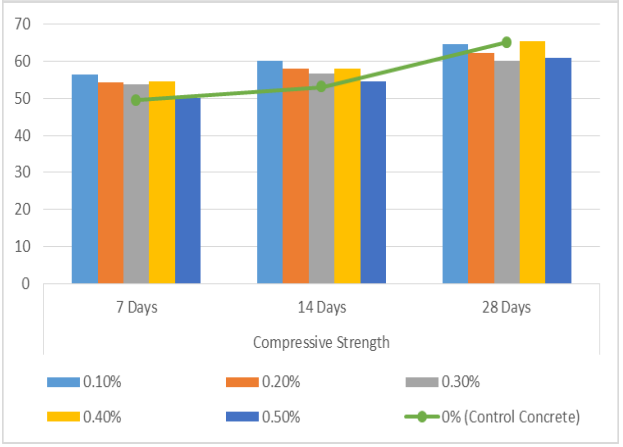


Fig. 1: Graph 1, 2 and 3: Result of Compressive Strength test

V. Conclusion

Following point are concluded from the current study:

1) Addition of nylon fiber in the construction of paver block increases its compressive strength up to 18.86% as compared to standard mix.
2) It is also realized that it also make blocks more opaque as compared to other paver blocks.

References

[1] ACI Committee 201, "Proposed Revision of: Guide to Durable Concrete (ACI201.2R)", ACI Material Journal, V.88, No.5, pp 554-551, Sept-Oct, 1991
[2] Bikasha C. P., and Ashok K.G., "Structural Behaviour of Concrete Block Paving 2: Concrete Blocks", Journal of Transportation Engineering, Vol 128, No.2, , pp. 130-135, 2002
[3] Dr. S.D. Sharma, "An Easy Approach For Road Construction-interlocking Concrete Paver
[4] Blocks", New Delhi, NBMCW, September 2009
[5] IS 456:2000 Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards. New Delhi.
[6] IS 15658: 2006, Precast concrete blocks for paving-Specification
[7] IS 7245 : 1974 Specification for concrete pavers
[8] IRC SP: 63-2004 Guidelines for Use of Interlocking Concrete Block Pavement
[9] IS 1893:2002 Code of Practice for Plain and Reinforced Concrete. Bureau of Indian Standards. New Delhi.

[10] Prof. Indrajit Patel, Dr. C. D. Modhera, "Experimental Investigation On Study Effect Of Polyester Fibre On Abrasion And Impact Resistance Of High Volume Fly Ash Concrete With Class-f Fly Ash", Gujarat, India, September 2012
[11] Ravikumar C.M. "Experimental Studies on Interlocking Iron-ore-Tailing Based Paving Tiles", M-Tech (I.S) Thesis, Mangalore University, May-June 2000.
[12] Sampathkumar N.N et al. "Utilization Waste Tailing in Roofing Tiles & Bricks", Workshop on Cost effective Building Technology, NITK, Surathkal, March 1988.
[13] Shackel.B, "The Design of Interlocking Concrete Block Pavements for Road Traffic" Proceedings of 1st International conference on Concrete Blocks Paving, London, pp. 23-32, 1980.
[14] Shackel.B. "Design & Construction of Interlocking Concrete Block Pavements", Elsevier Applied Science, London, pp 229-230, 1990.
[15] Sunil Kumar Jaladi, "Studies on Concrete Hollow Blocks with Iron ore Tailings as Fine Aggregate", M. Tech dissertation, Mangalore University, 2001

