ISSN:2348-2079

Volume-7 Issue-2

International Journal of Intellectual Advancements and Research in Engineering Computations

Experimental investigation on paver block with partial replacement of cement by fly ash with addition of glass fibre

M.Yeswanth[1], M.Tharani[2], T.Baskar[2], P.Manikandan[2], V.Karthikeyan[2]

[1]Assistant Professor, Department of Civil Engineering,

[2]UG Student, Department of Civil Engineering, Nandha Engineering College, Erode, Tamil Nadu.

ABSTRACT

In this experimental investigation compressive strength and water absorption of paver block were evaluated by replacing portion of cement with the Fly ash by addition of glass fibre. The glass fibre having higher tensile strength and it can be used for the modern building works. Strength of glass fibre can be arrest by the cracks in the paver blocks. The maximum strength of paver block gives by optimum value 15 % of fly ash. Then 5% to 25% by weight of cement was replaced with the fly ash and admixture 0.4% of glass fibre to be added. Totally 5 mixes were prepared by 0.4% of glass fibre. Replacing cement with the same amount of fly ash can reduce the heat of hydration of concrete. Cost analysis of paver block was done and was compared with conventional paver block.

Keywords: Fly ash, Glass fibres, OPC 53 grade cement, Compressive strength, Water absorption, Paver Block.

INTRODUCTION

Concrete is a mixture of cement, water, aggregates, fly ash and other admixtures like glass fibres. Concrete should be in various ratios and strong in compression. Consequently, pavements in which non-interlocking blocks are used are designed as concrete block pavement. Paver block is the most popular flexible pavement in now a days. Mainly blocks should be used for exterior pavement. It is the best material for the residential and commercial buildings. Cracks does not appeared when they are in closed pattern. The block should be durable and low maintenance. Load carrying capacity of block to be high so that it can be used for petrol bunks and other traffic areas. Blocks are skid and slip resistance. Many number of such applications for light, medium, heavy and very heavy traffic conditions are currently in practice around the world. The recommended thickness of paver block shall be 60mm and maximum 80mm. The main advantage to be mortar does not require for the fitting of paver blocks. It is the quick process for usage when compare to concrete. The damaged paver block to be easily removed with the help of diesel or petrol spillages. The main benefits of the paver blocks are versatility, environmentally sustainable, low maintenance, durability, visual appeal. Recently in concrete paver block fibres are introduced to increase strength and reduce the cracks. Instead of using fibre used in paver block to increases the properties of paver block. Fly ash is the non-combustible mineral of coal and coal is used in the power plants. Basically fly ash has two types as Class F and Class C. It is eco-friendly [1-5].

LITERATURE REVIEW

The effect of fly ash as partial replacement of cement on the various properties of paver blocks. Applications of fly ash, which is increasing

Author for correspondence:
Department of Civil Engineering, Nandha Engineering College, Erode, Tamil Nadu.

pollution level, weight, low cost material for sustainable development [6-11]. In this study, partially replacement of cement in paver block by used fly ash and added to glass fibre for determining the change in the compressive strength of paver blocks and cost of paver block. The compressive strength, flexural strength and water absorption test has been determined at the end of 7, 14 and 28 days. The paper also shows the cost comparison per block for the paver block mix proportion. KEYWORDS: Various Test, Ordinary Portland Cement (OPC) Used Fly ash, Glass fibre, Paver Block, Cost.

In this experimental work glass fibre was added to the concrete at 0.03% by concrete volume. Comparison study was carried out to show the effectiveness of with and without glass fibre. The increasing in compressive strength for all the grades of concrete mixes was varied from 20 to 25% when compared with 28 days. The flexural and split tensile strength for all the grades of concrete for all the grades of concrete mixes was varied from 15 to 20% when compared with 28 days strength.

The concrete consist of cement, sand, Aggregate and water. Fly ash has been used as a mineral admixture in cement and concrete. Glass fibres acted as good crack arrester. Fly ash as partial replacement of cement and glass fibres are used as additional reinforcement, which satisfies the various structural properties of concrete like compressive, flexural strength. There is no increased compressive strength at 7 days and spilt tensile strength in fly ash mixes.

MATERIAL SPECIFICATION

Cement

Cement is a binding material and experimental study about OPC 53 grade cement. In OPC 53 grade all property can be tested by referring IS: 12269-2013 specification. casting of paver block to be IS:12269-1999 can be used.

Table 2.1 Properties of Cement

Fineness value	6
Consistency	38%
Initial setting time	31 min
Specific gravity	3.13

Fig, 2.1.Consistency Test

Water

The mixing and curing of concrete to be used by IS: 456-2000 and it should be free from impurities. The ordinary portable water to be used for the specimen.

Coarse Aggregate

The specific gravity of coarse aggregate is 2.7 and 10 mm aggregate used in the project. The aggregate were tested according to the code.

Table 2.2 Properties of Coarse Aggregate

Description of test	Test result obtained	Permissible limits as per IS:383-1970
Specific gravity	2.66	Minimum 2.5
Unitweight (kg/m^3)	1680	

Fine Aggregate

The fine aggregate of M-sand of size is less than 4.75 mm. The according to the code of IS:383-1970 and physical properties of fine aggregate can be determined.

Table 2.3 Properties of Fine Aggregate

Description of test	Test result obtained	Permissible limits as per IS 383:1970
Specific gravity	2.64	Minimum 2.5
Fineness modulus	3.34	
Unit weight of sand (kg/m^3)	1600	

Fly ash

Fly ash has two types Class F and Class C. We use Class F type in this project. It is pozzolanic in nature and contains less than 20% lime content in the fly ash.

Table 2.4 Properties of Fly ash

S.No	Description	Percentage of Content
1	CaO	6%
2	SiO_2	59%
3	AL_2O_3	21%
4	MgO	1%

Glass fibres

The Alkali resistant E glass fibre used in this project. This fibre is very good insulation to electricity and made from fine fibres of glass. This glass fibre should control the crack.

Table 2.5 Glass fibres

Specific gravity	2.6
Aspect ratio	7.05
Diameter	0.25mm
Density	2.55 g/cm^3
Colour	White
Length	5mm

Fig 2.2 Glass fibres

MIX PROPORTION

In this study, control mix cement was designed as per IS: 12269-2013 for OPC grade. Control mix M was designed as per IS 10262:2009 for M40 grade. Glass fibre was initially added 0.4% by weight of concrete. Fly ash was partially replaced for cement in percentages 5 to 25. The details of the mix proportions of blocks were given in following table 3.1. Each mix proportion for 11 blocks.

Table 3.1 Mix Proportion Details

Materials Mix	Cement (kg)	Fine Aggregate (kg)	Coarse Aggregate (kg)	Water (liters)	Fly ash(kg)	Glass fibres (g)
A0	3	6	16.8	2.22	0	0
A1	2.85	6	16.8	2.22	0.15	0.24
A2	2.70	6	16.8	2.22	0.30	0.24
A3	2.55	6	16.8	2.22	0.45	0.24
A4	2.40	6	16.8	2.22	0.60	0.24
A5	2.25	6	16.8	2.22	0.75	0.24

EXPERIMENTAL METHODOLOGY

Compressive strength test

After the curing of the specimen for 7, 14, 28, days compressive strength can be calculated using Hydraulic compressive testing machine.

Compressive strength can be calculated the load given to the specimen by area of the specimen. The code used for the compressive strength to IS 15658:2006. Now a result in glass fibres and Fly ash was determined.

Fig 4.1 Compressive strength test

Table 4.1 Compressive Strength Result

Compressive Strength Result		
Mix	**At 7 Days (N/mm²)**	**At 28 Days (N/mm²)**
0%	34.45	36.65
5%	35.26	37.67
10%	36.12	38.24
15%	34.69	35.26
20%	35.86	35.21
25%	33.57	34.67

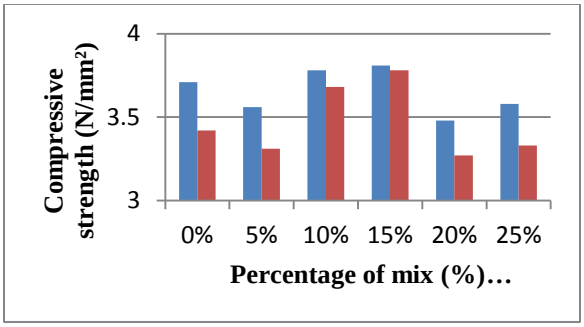

Fig 4.1 Compressive strength result

WATER ABSORPTION RESULT

The water absorption tests were conducted as per IS: 15658:2006. The water absorption values of the conventional concrete paver block & paver block with Fly ash and glass fibres was determined.

Table 4.2 Water absorption result

Water Absorption Result		
Mix	**At 7 Days**	**At 28 Days**
0%	3.71	3.42
10%	3.56	3.21
15%	3.78	3.68
20%	3.81	3.78
25%	3.48	3.27
30%	3.58	3.33

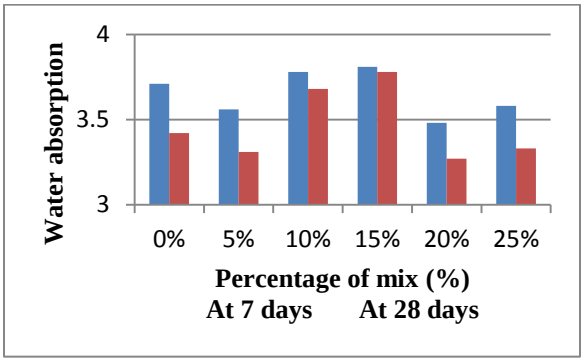

Fig 4.2 Water absorption result

RESULTS & DISCUSSION

By comparing with the conventional paver block 10% replacement of cement by fly ash gives more strength.

We have to observed that from water absorption result the value of the optimum percent will be 20%.

The usage of glass fibre can control the cracks and also have the usage of blocks for long time.

Then the heat of hydration can be reduced by using of fly ash in the specimen.

- Compressive strength of paver block increases by Fly ash, addition of glass fibres and optimum content of fly ash and glass fibres inclusion was 10%, 15% & 20%.
- The blocks should permit the rain water in to the ground then the ground water table level can be easily increased.
- When compare to conventional paver block the using of glass fibre increases the compressive strength by 95%.
- Fly ash can be reused then the disposal of waste can be reduced.

CONCLUSION

- Paver block control more wear and tear of the vehicle users and fly ash reduces voids and corrosion.

REFERENCE

[1]. Vishal panchal, LakshayaGupta, Chetan Deshmukh "Comparative study of Interlock Paver Block"IJSART, ISSN:2395-1052, 1(6), 2015.
[2]. IS 15658, Precast Concrete Blocks for Paving — Specification, 2016.
[3]. V. M. Soundhararajan and A.Sivakumar "Reinforcing efficiency of glass fibres in low volume class fly ash concrete" JCECT, 4(6), 2013, 184-191.
[4]. B.A.V. Ram Kumar, Prof. J. Venkateswara Rao "Effect of inclusion of Glass Fibres and GGBS in concrete paver blocks" IOSR-JMCE ISSN:2278-1684, 12(5), 2015.
[5]. Ritesh Mall ShardaShrama and R. D. Patel "studies of the properties of paver block using Fly ash" International Journal for Scientific Research & Development, 2(10), 2014.
[6]. SomNathSachdeva, VanitaAggarwal, S. M. Gupta "High volume fly ash concrete for paver blocks" International Journal of Civil, Architectural, Structural and Constrution Engineering, 8(3), 2014.
[7]. K. Vamshi Krishna and J. Venkadeswara Rao "Effect of Glass fibres in rigid pavement" International Journal of Scientific Research and Education, 2(9), 2014, 1797-1804.
[8]. IS 10262 Concrete Mix Proportioning-Guidelines, 2009.
[9]. IS 383: "Specification for coarse and fine aggregates from natural source for concrete", 1970.
[10]. IS 456 "Specification for Plain and Reinforced Concrete". Code of concrete (CED 2: Cement and Concrete), 2000.
[11]. Shetty M. S. "Concrete Technology" S. Chand & Co.Ltd, 1997.