International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 04 | Apr 2019 www.irjet.net p-ISSN: 2395-0072

EXPERIMENTAL INVESTIGATION ON CONCRETE PAVER BLOCK BY ADDING SILICA FUME

M. Nishanth premhar[1], R. Jeyasundar[2], L. Muthukumar[3], A. Manoj kumar[4]

[1]Assistant professor, Department of Civil Engineering, Sethu Institute of Technology, Kariapatti, Virudhunagar, India.
[2,3,4]B.E., Student, Department of Civil Engineering, Sethu Institute of Technology, Kariapatti, Virudhunagar, India.

Abstract: *This study presents an experimental investigation on the effect of silica fume (SF) on various strength properties of replacement of cement. In the present investigation, recycled coarse aggregate was used as 10%, 20%, 30% and 40% replacement of cement in addition to silica fume partially replaces 10% of cement by weight. compressive strength is tested at the end of 7and 28 days whereas water absorption is done at the end of 28 days.*

Keywords: concrete paver block, silica fume, M40 grade.

1) INTRODUCTION

Concrete is the most common construction material prepared using cement, natural aggregates and water. With fast industrialization, infrastructure development and increase in the population leads to huge construction activities. Due to increase in the various construction activities the natural resources are fast depleting which in turn results in escalating the cost of construction matehe total cost of construction. Silica fume is added to Portland cement concrete to improve its properties, in particular its compressive strength, bond strength, and abrasion resistance.

1.1 General

Literature reviews are collected related to this project and studied thoroughly. The materials which are required are collected and the property ofa each one is determined in laboratory.

The concrete mix chosen was M40grade. Here, the silica fume is partially replaced in cement in thepercentageof10,20 ,30 and 40 .Harden tests are conducted at 7 and 28 days. The discussion is carried out based on the test result and concluded.

1.2 Present study Execution:

In this present study, various materials are used to prepare the concrete mix. Mix proportion of this Study is0.4:1:2.10:2.60.Three trial mixes with varying proportions of Silicafume (SF) had been used.

- Mix B1 = Cement + F.A+C.A
- Mix B2 = (Cement+10%SF) + F.A+C.A
- Mix B3 = (Cement+20%SF) + F.A+C.A
- Mix B4 = (Cement+30%SF) + F.A+C.A
- Mix B5= (Cement+40%SF)+F.A+C.A

2. CONSTITUENT MATERIALS

2.1 Fine aggregate:

Sand is a normally happening granular material made out of finely isolated rock and mineral particles. It is characterized by size, being better than rock and coarser than residue. Sand can likewise allude to a textural class of soil or soil sort; i.e. a dirt containing more than 85% sand-sized particles. Set up of sand we can likewise utilize base fiery remains which can be a substitution of sand up to a level of 20% substitution of sand gives a decent compressive quality.

2.2 Coarse aggregate:

Coarse aggregates are particles greater than 4.75mm, but generally range between 9.5mm to 37.5mm in diameter. They can either be from Primary, Secondary or Recycled sources. Primary, or 'virgin', aggregates are either Land- or Marine-

Won. Gravel is a coarse marine-won aggregate; land-won coarse aggregates include gravel and crushed rock. Gravels constitute the majority of coarse aggregate used in concrete with crushed stone making up most of the remainder. Additionally where the coarse total ought to adjust to IS-383-1970.

2.3water

Water plays a major role in mixing of concrete.. Water is an important ingredient of concrete as it chemically react with cement. The water Which is used to make concrete should be free from impur

ities and should have pH between 6 and 8. Portable clean drinking water available in the water supply system is used in this work. To get a good and proper workability of concrete, more water is used. For these reasons, the amount of water in concrete is important for constructabiliiy and service life. PH value of water should be more than 6.

2.4 Silica Fume: -

It may be added to improve the mechanical properties of scc. Silica fume is a mineral composed of ultra fine solid, amorphous glassy spheres of silicon di-oxide. Produced during the manufacture of silicon by the reduction of pure quartz in a electric furnace heated to high temperature. Silica fume is a by- product in the industrial manufacture of the ferrosilicon and silicon alloys. In this work, silica fume is crushed to powder and replaced forcement in 10%, 20%,30% and 40%

Figure-2.1: silica fume

3. EXPERIMENTALINVESTIGATIONS

3.1 Tests on Aggregates:

Crushed granite aggregates particles passing through 20mm and retained on 10mm I.S sieve was used as natural aggregates which met the grading requirements. The maximum size of coarse aggregate used here is 10mm.

Manufacturing and has been used for the present investigation. The fine aggregate was sieved byusing4.75mmsieveto eliminate deleterious and oversized particles. The fine aggregate adapted here is coming under ZONE-II, which was determined by sieve analysis test. The specific gravity of fine aggregate is 2.10 which is found by using pycnometer apparatus. The properties of aggregates are listed below

Table – 3.1: Properties of aggregates

Properties	Fine Aggregates	Coarse Aggregates
Specific gravity	2.81	2.74

3.2 Tests on Cement:

The cement is tested as per IS:431 (part-4)-1988 and properties are listed below

Table-3.2: properties of cement

Properties	Value
Specific gravity	3.13

3.3 Design Mix:

As per Indian standard codes Mix design is to be prepared for M40 concrete grade to get a target mean strength of 26.6 N/mm^2. Mix proportion of this study is 1:2.10:2.60:0.4

4. TESTS ON PAVERBLOCK CONCRETE:

In order to determine the workability of Normal concrete and jute fibre concrete, Tests on Hardened concrete was carried out as per IS:1199-1959.

4.1 Materials Used:

- Cement - OPC53 grade
- Sand(F. A) -passing through 4.75mm
- Coarse Aggregate - 10mm
- Water-cement ratio - 0.4
- Mix proportions - 0.4:1:2.10:2.60
- Silica fume added - 10%,20%,30%,40%

4.2 Curing of specimens:

Resultant specimens are to be casted and curing process is to be done at the age of 7 days and 28 days.

4.3 Test of specimens:

The test on paver block concrete to be conducted and it described below.

4.3.1 Compression Test:

All the test specimens were tested in a compression test machine after the completion of curing days. Concrete paver block of the similar sizes 250mm x 125mm x 80mm were tested for determining the compressive strength.

Figure-4.1: Compression Strength Samples

4.3.2 Flexural Strength Test:

Paver block size of **250mmx125mmx80mm i**s tested for flexure. The flexural strength is found using the formula. The flexural strength is found using the formula.. The flexural strength of the specimen is expressed as fb which is calculated based on fb =PL/bd2

Figure-4.2: Flexural Strength Samples

4.3.3 Water absorption Test:

The test specimens were completely immersed in water for 24 hours. Then the specimen is taken out from the water and allowed them to drain for 1 minute. Then the specimens were wiped off and weighed immediately and weight of each specimen was noted. This can be represented as Ww. Then these specimens were dried in a ventilated oven at 107±70C for 24 hours. The dry weight of each specimen was recorded and cf it is represented by Wd.

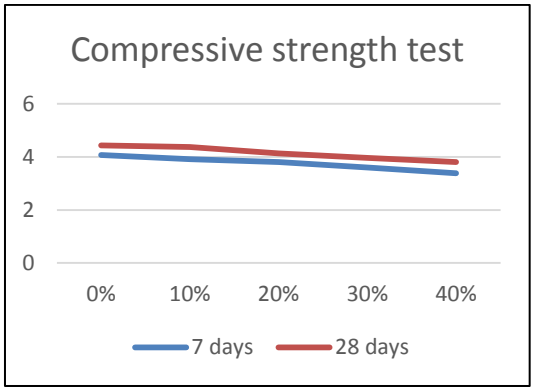
5.1. Compressive Strength:

Specimens are to be tested at the age of7 days, 28 days and their test results are to be tabulated in below table -1 respectively.

Graph-5.1: Compression Strength for 7 & 28 days.

Mix	% silica fume	Compressive strength for (N/mm^2)	
		7 days	28 days
B1	0%	32.7	40.9
B2	10 %	31.3	39.1
B3	20%	29.7	34.9
B4	30%	27.2	32.1
B5	40 %	23.4	29.6

Graph-5.1: Compression Strength for 7 & 28 days.



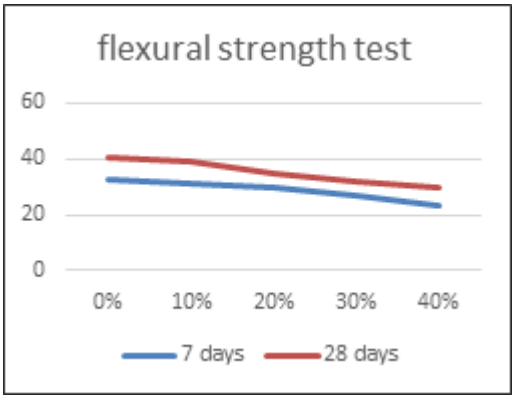
5.2. Flexural strength

The flexural strength of the specimen is expressed as fb which is calculated based fb =PL/bd2**.** Specimens are to be tested at the age of 7 days, 28 days and their test results are to be tabulated in below tabl-3 respectively.

Table-5.3:Flexural Strength for 7 and 28 days

Mix	%Silica fume	Flexural strength for (N/mm^2)	
		7 days	28 days
B1	0%	4.07	4.43
B2	10 %	3.91	4.37
B3	20%	3.81	4.13
B4	30%	3.6	3.98
B5	40 %	3.38	3.80

Grape-5.2: Flexural strength for 7 & 28 days



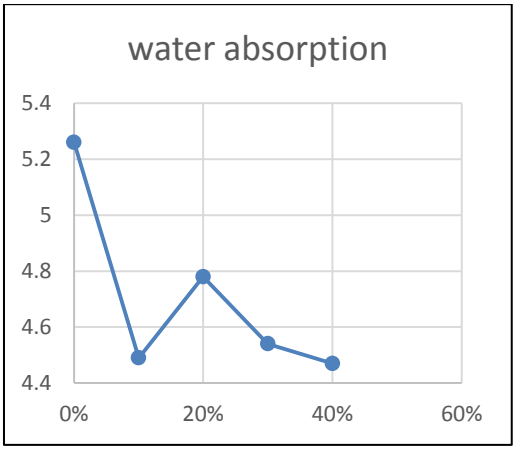
5.3: water absorption

The test specimens were completely immersed in water for 24 hours. Then the specimen is taken out from the water and allowed them to drain for 1 minute. Then the specimens were wiped off and weighed immediately and weight of each specimen wasnoted.

Table5.5: Water absorption Test

% of silica fume	Wet weight	Dry weight	Water absorption
0	4.00	3.80	5.26
10	3.95	3.78	4.49
20	3.94	3.76	4.78
30	3.91	3.74	4.54
40	3.88	3.69	4.47

Graph - 5.3: water absorption



6. CONCLUSION

From this study, the following conclusions can be drawn. The concrete consists of cement, fine aggregate ,coarse aggregate and water. The silica fume is replaced for in 0%,10%,20%,30% and 40%. Out of these, 20% of silica fume by weight of cement is the optimum content which does not affect the properties of concrete.From the above observation, it is possible to use the silica fume upto 20% by weight of fine aggregate.The silica fume in concrete reduces the unit weight of concrete. The maximum compressive strength occurred at the age of 28days. Are suitable .Silica fume for making paver block as the water absorption is lesser than 7%. As silica fume has the basic property of water resistance, the concrete mix require more quantity of water than calculated amount during mixing.They were determined at the end 7 days and 28 days. Test result indicate that addition of silica fume by 30% paver block attains maximum compressive strength .The paper also shows the cost comparison per each block.

7. REFERENCES

1) B. Shanmugavalli, K.Gowtham, and B.EswaraMoorthy, “Reuse of plastic waste in paver blocks”, International Journal of Engineering Research and Technology, Vol. 6, (2017).
2) G.Lavanya and P.Vasanthakumar, “Experimental study on paver blocks utilize in PET fibres”, International Journal of Advanced Engineering Research and Technology, Vol.4, (2016)
3) Ganesh Tap kire, Satish parihar, PramodPatil and Hemraj R Kumavat, “Recycled plastic used in concrete paver block”, International Journal of Research in Engineering and Technology(IJRET).
4) S.Vanitha, V.Natrajan and M.Praba, “Utilisation of waste plastics as a partial replacement of coarse aggregate in concrete blocks”, Indian Journal of Science and Technology, Vol.8 (12).