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Role of Pervious Concrete in Construction Industry

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ABSTRACT

Pervious concrete is a special high porosity concrete used for flatwork applications that allows water from precipitation and other source to pass through there by reducing the runoff from a site and recharging ground water levels. Pervious concrete is also called as no fines concrete in which fine aggregate is omitted. In this experimental study the compressive, tensile and flexural strength, of Pervious concrete are to be tested which is achieved by eliminating the fine aggregate content. Concrete manufacturing involve consumption of ingredients like cement, coarse aggregate, water, admixtures like fly ash, ground granulated blast furnace slag (GGBS) . Coarse aggregate of size 12mm is used. Using the above material lightweight aggregate concrete of M53 grade is being manufactured and tested for flexural behavior.

Keywords—Perviousconcrete,flyash,GGBS

I. INTRODUCTION

Pervious concrete is a composite material consisting of coarse aggregate, Portland cement and water. It is different from conventional concrete as the mixture contains no fines in it. The aggregate is usually of a single size and is bonded together by a cement paste. The result is a concrete with a high percentage of interconnected voids that allow the penetration of water through the material matrix. Normal concrete has a void ratio around 3- 5% and pervious concrete has higher void ratios from 18-40% depending on its application. Pervious concrete differs from normal concrete in several other ways. Pervious concrete has lower compressive strength, higher permeability and a lower density. Its compressive strength could be 65% lower than the normal concrete. Pervious concrete is increasingly being installed to improve storm water quality and reduce runoff produced by urban settings. During the last few years, pervious concrete has attracted more and more attention in concrete industry due to the increased awareness of environmental protection.

Many laboratory and field studies have been conducted to investigate into various aspects of pervious concrete. Many studies revealed that unlike conventional concrete, the performance of pervious concrete is highly dependent on both concrete materials and construction techniques. The focus of pervious concrete technology is the balance of permeability and mechanical properties as well as durability. If the mixture is too wet and easy to compact, the voids will be clogged and the permeability will be compromised. If the mixture is too dry and hard for compaction, the pervious concrete pavement will be weak and vulnerable to various types of distress.

II. SCOPE AND OBJECTIVE

In recent times many studies have been carried out on no fines concrete. The objective of the present study is to check the performance of no fines concrete on various percentage of flyash and ggbs . Concrete is the most important material for construction purposes and cement is the most expensive ingredient in it. The name of no fines concrete itself explains that the fine aggregate has been omitted in this kind of concrete. Due to the absence of fine aggregate in no fines concrete, there is a high percentage of void space which results in high permeability. The unit weight, drying shrinkage and hydrostatic pressure for no fines concrete is less compared to conventional concrete. Due to the less cement content in no fines concrete, the cost of the overall project reduces.

III.USES

[1]To construct walls and other structural members.[2] To construct in low-cost buildings.[3] parking lots ,sidewalks and secondary road ,sandwich panel, Drainage layers under reservoir and basement floors Paving and.[4] To reduce the runoff from a site, recharging ground water levels.

IV.ADAVNTAGES AND DISADVANTAGES

Low density, Low cost, Low thermal conductivity, relatively low drying shrinkage, No segregation, better insulating characteristics than conventional concrete because of the presence of large voids. Lack of construction experience, clogging, cold weather problems.

V.LITERATURE REVIEW

Francesca Tittarelli [1] No-fines concretes with compressive strength in the range 7-30 MPa at 28 days of curing were optimized by changing the water-cement ratio from 0.41 to 0.34 and the aggregate-cement ratio from 8 to 4. Some mixtures were also repeated with the addition of a hydrophobic admixture and prepared by fully replacing the ordinary aggregate with recycled aggregate to evaluate durability effects. **Hussam. A, Rehman. A** [2] This work focus on studying the mechanical characteristics of polypropylene and carbon fiber reinforced no fine aggregate concrete, containing different percentages of fiber. This work was carried out using several tests. These tests were workability fresh and hardened density, compressive strength, splitting tensile strength and modulus of rupture. Tests were performed for specimens at ages of (7, 28) days. The test results indicated that the inclusion of fiber to the pervious concrete mixes did not affect the compressive strength significantly, while the splitting tensile strength and the modulus of rupture were improved significantly. **Amjad A. Bashir Alamet** [3] shows the investigation on the mechanical characteristics of no-fines bloated slate aggregate concrete (BSAC) through laboratory testing. The BSAC concrete employ locally available coarser aggregates formed of slate (clay rock), with no fine aggregates, where aggregate-to-aggregate bond is achieved through water-cement paste resulting in significantly lightweight concrete. Laboratory tests were conducted on cubes and cylinders to estimate the basic mechanical properties i.e. compressive strength, density, stress-strain behavior, Young modulus, etc., of BSAC concrete required in the design and analysis of concrete construction works using engineering tools. The effect of water-cement ratio and aggregate-cement ratio is also investigated for essential optimization

VI.MATERIALS USED

A. Fly ash-Class F fly ash is easily available at low cost. The specific gravity of Fly ash is found out by Pyconometer**.**

Table 1 Physical properties of Fly ash

S.No.	Property	Value
1	Specific gravity	2.35
2	Type	Class F

Table 2 Chemical properties of Fly ash

Component	Bituminous	Sub Bituminous	Lignite
SiO_2 (%)	20-60	40-60	15-45
Al_2O_3 (%)	5-35	20-30	20-25
Fe_2O_3 (%)	10-40	4-10	4-15
CaO (%)	1-12	5-30	15-40

B. GGBS-To increase the strength of concrete.

Table 3 Physical properties of GGBS

S.No.	Property	Value
1	Specific gravity	2.9
2	Color	Half white

Table 4 Chemical properties of GGBS

S.NO	Chemical Constituent	GGBS
1	Calcium oxide Cao	40%
2	Silicon dioxide sio2	35%
3	Aluminium oxide Al2O3	10%
4	Magnesium oxide Mgo	8%

C. Tests on coarse Aggregate

The coarse aggregate of 12mm size has been used and the properties are given in table 5 below

Table 5 Properties of Coarse aggregate

S.NO	Property	Value
1	Specific gravity	2.67
2	Impact value	2.7%
3	Crushing value	14.36%
4	Water absorption	0.5%

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D. Tests on OPC Cement

The test on OPC Cement 53 grade properties is shown in table 6 below

Table 6 Properties of OPC Cement 53grade

S.NO	Property	Value
1	Specific gravity	3.15
2	Standard Consistency	35%
3	Initial setting time	129min
4	Final setting time	320min

VII. EXPERIMENTAL PROCEDURE

A. Procedure

In this experimental study, the various mix ratios is designed by eliminating fine aggregate the ratio as 1:4,1:6,1:8,1:10(cement and coarse aggregate) with water absorption 0.45 is taken and tested and the optimum value is taken for that mineral admixtures like like fly ash, GGBS is to be added to the cement where fly ash is kept 10%,15%,20%,25% and GGBS is kept for 10%, 15%,20%,25% and the values are checked.

Fig. 1 pervious concrete

B. Mixing

Mixing shall be done in mechanical mixers only. If we choose drum mixer it is advisable to add some water into the drum before the dry material is added. After that the measured quantity of aggregates and cement shall be introduced in to the drum of mixer while it is revolving. The rest of the water shall be added slowly up to the necessary quantity and wet mixing of the batch shall be continued for minimum one minute till a uniform mix is obtained.

C. Compaction

Vibrators shall not be used for compaction of no-fines concrete. No-fines concrete is compacted by rod or gentle ramming. No water shall be added during ramming. Ramming should be done by one or more lines of men arranged across the width of the concrete with a lateral space of not more than 0’5meter. Square rammers shall be used for corners.

D. Transporting

Concrete shall be transported from the batching plant to the site by various methods which will prevent separation or loss of any of the ingredients and maintain the necessary workability. It should not be allowed to set and then used with the adding water to give workability. During hot or cold weather conditions concrete should be transported in large containers.

E. Placing

The concrete should be poured in layers taking place continuously around the structure. Concrete cannot be allowed to pile up at a slope in the form work while until further deliveries, this practice results in a diagonal line of weakness. Care should be taken while laying the cement slurry doesn’t separate out and all the ballast is uniformly coated with a cement layer. After mixing the concrete should be placed as soon as possible.

F. Curing

If curing is inadequate, then no fines cement concrete will lose its water contents resulting in complete dehydration of cement which will cause collapse of concrete. Fresh concrete is highly sensitive to intense sunshine, wind and should be protected by damp sheet covers and by sprinkling with plenty water; sprinkling should not be started too early since it may dust off the cement from the surface. Sprinkling must be maintained for a minimum time of seven days.

VIII. TESTING OF SPECIMENS

The mechanical properties related tests were carried out on hardened concrete at the age of 14 days, and 28 days to ascertain the cube compressive strength, cylinder Split Tensile strength and prism Flexural strength.

A. Compressive Strength

For cubes, compressive strength test was conducted at the curing age of 7, 14 and 28 days as shown in figure 2.

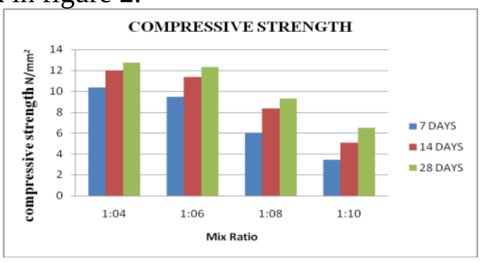

Fig. 2 Compressive strength of pervious concrete

B. Flexural Strength

For prism strength test was conducted at the curing age of 7, 14 and 28 days. The results are shown in Figure 3

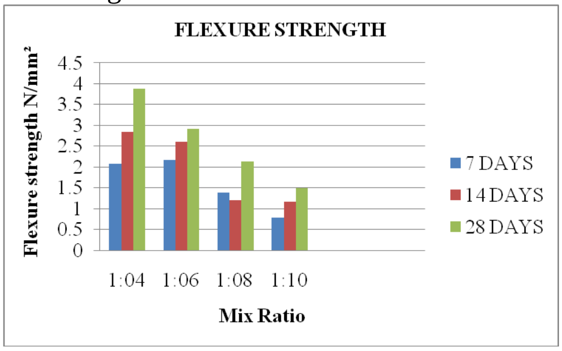

Fig. 3 Flexural strength of pervious concrete

C. Split Tensile Strength

For cylinder strength test was conducted at the curing age of 7, 14 and 28 days. The results are shown in figure4.

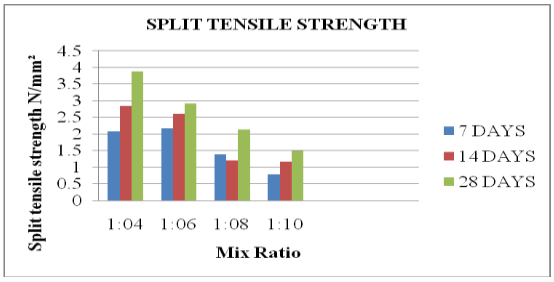

Fig. 4 Split tensile strength of pervious concrete

From the figure shows that 1:4 has the optimum value of compression split tensile and flexural strength. So the mineral admixtures fly ash GGBS is to be taken as the addition of cement and strength has been found out.

The fly ash is added to the cement as addition of 10%,15%,20%,25%. They are tested and values as shown in figure 5,6,7.

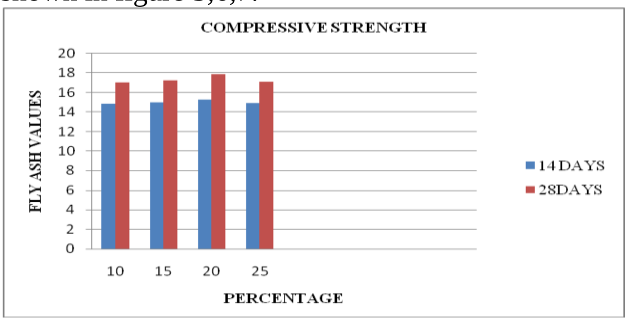

Fig. 5 Compression strength of pervious using fly ash

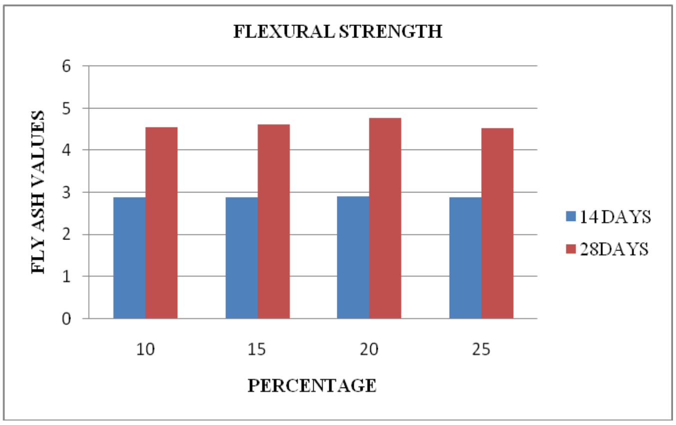

Fig. 6 Flexural strength of pervious using fly ash

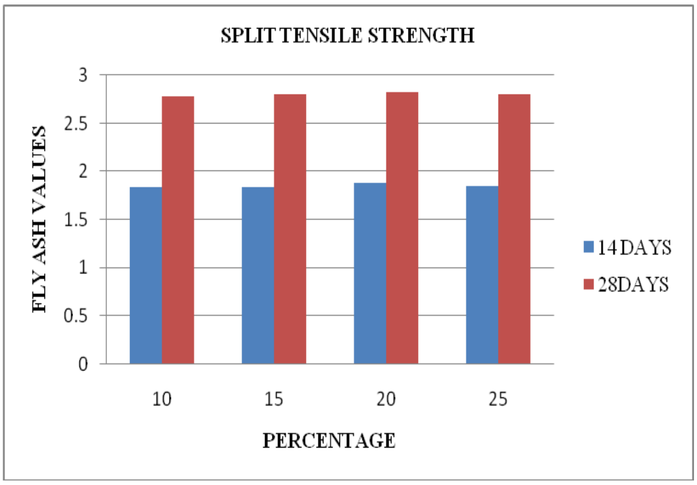

Fig. 7 Split tensile strength of pervious using fly ash

IX. CONCLUSION AND FUTURE WORK

- In this investigation concrete specimens were made and tested for 1:4 1:6, 1:8 and 1:10 mix ratios as per mix design M20, M15, M10.
- The mix proportions 1:4 gives more compressive strength than the other three mix proportions.
- It is clearly seen from the experimental result that No-Fines Concrete has very low Compressive Strength, Split Tensile Strength as well as Flexural Strength.
- So it cannot be used for "structural application" but it should be significantly used for so many other applications such as, sidewalks, parking lots, sports surfaces, swimming pool decks, driveways, etc.
- The mineral admixture has to be added to increase the strength of No-Fines Concrete in future work.

- In this study the fly ash values strength of 20% increases. For the future work the GGBS is added to the cement and the optimum is to be found.Then the optimum percentage of fly ash and GGBS are to put together the strength has to be found.
- The flexural behaviour have to be found for the strength of pervious concrete.The bond will be recuce in pervious concrete. The reinforcement is given with cement paste to increase the bond and also protect it from rusting for future work.

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