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Experimental Investigation on Concrete by Partially Using Flyash and Laterite Aggregate

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ABSTRACT:
Concrete is one of the oldest manufactured construction material used in construction of various structures around the world. The increasing utilization of natural aggregate for concrete production has created negative impact towards environment. Thus, investigation on searching for alternative material which has potential to replace the use of coarse aggregate in concrete mix is very much in need. Laterite stone is the most abundant material in some of the hot and wet tropical areas. During last few decades several researches have been carried out on blending of the fly ash in Ordinary pozzolanic cement (OPC). Cement is a fine binding material which sets and strengthens when water is supplemented to it. It is largely used in construction with great advantages but cement with its wide range of properties has several disadvantages as well. Manufacturing of cement causes ill effect on environment at all stages of process. These include emissions of pollutants like dust, gas, noise and vibration. Manufacturing of cement causes emission of the most common greenhouse gas i.e. carbon dioxide, from 5% in cement structures to 8% in case of cement roads. Hence an attempt has been made in the present investigations to study the influence of fly ash and laterite aggregate in concrete at a dosage of 10%, 15% and 20% by volume of concrete with super plasticizer. Experimental investigation was done using M40 mix and tests were carried out as per recommended procedures by relevant codes. The study parameters of this investigation included compressive strength and Workability of concrete. The results indicated that the compressive strength has been increased and achieved good workability when compared to the conventional concrete.

***Keywords*: Laterite aggregate, Fly ash, Cement, Coarse aggregate, mix design, workability, Compressive strength, Super plasticizer**

1. INTRODUCTION

Concrete is one of the oldest manufactured construction materials used in constructing of various structures around the world and the most widely
Used in all types of civil engineering works, including infrastructure, low and high-rise buildings, local and domestic developments. The aggregate itself is categorized as fine and coarse aggregate. Aggregates for concrete may be obtained from natural sources or may be artificially produced. The increased demand for the usage of the huge quantity of concrete leads to increase in cost of binding material (cement) and depletion of natural sources of fine aggregate which in turn increase s cost of concrete. This project presents the results of concrete mix with partial replacement of fine aggregate by laterite soil and coarse aggregate by recycled aggregate in concrete. The replacement of normal aggregates with lateritic aggregate and recycled aggregate has influence on engineering properties of concrete. Concrete has progressively replaced most other competing construction materials due to its versatility and accessibility of availability. Architects and structural engineers prefer it since it is a long-lasting material that does not require any maintenance or protection. Concrete is currently the world's largest manufactured product in terms of volume.

2. MATERIAL USED

Cement: (IS 12269-1987)
Cement used here is 53 Grade Ordinary Portland cement. Selection of this cement depends on the strength and durability.

Fine aggregate: (IS 383-1970)
Fine aggregated used is obtained from a nearby river source. Sand is a vital role in self-compacting concrete.

Coarse aggregate: (IS 383-1970)
Coarse aggregate used is obtained from a local crushing unit having 10mm MSA,10mm and 12.5mm well graded aggregate according to IS:383 is taken.

Natural aggregates: laterite aggregates (20mm) and fly ash
Water:
Potable water is used for both mixing and curing work.

Super plasticizer: ECMC PLAST104SPL (liquid IS 9103-1999) to produce high strength, high grade concrete M30 & above by substantial reduction in water resulting in low permeability and high early strength. To produce high workability concrete requiring little or no vibration during placing.

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3. EXPERIMENTAL ANALYSIS:

3.1 preliminary tests results**:** preliminary tests on cement, fine aggregate and coarse aggregate were conducted in laboratory and results are obtained.

3.3 Test on Fresh Concrete:

SLUMP TEST:

To calculate the slump value, and to know more about the workability, and fresh concrete. The slump test is used vary often in concrete work. It is easily performed at a job site and is useful in detecting variations in mixes of given properties. The slump test cone is placed on a smooth, level surface with the smaller opening at the top. It is filled in three layers of equal volume, each of, which is compacted 25 times with a standard rod having a hemispherical tip. The rod is then struck off, and the cone is slowly lifted and set beside the unsupported concrete. The rod is laid across the cone and a measure of the distance from the bottom of the rod to the average top of the concrete is taken. A very stiff mix will have near zero slump. Lean mixes tend to be harsh and slumps can vary from true to shear in different sample of the same mixes. The same slump can be recorded for concrete of different workability, depending on the aggregate Used. The slump test is not a true determination of workability, but it is a useful for on-site checks of variations in material or mixing condition.

3.4 Test on Harden Concrete:

Detailed descriptions about the materials used, specimens tested and testing methods are essentials for an experimental investigation. Hence, they are described in detail in the following sections.

4. COMPRESSION STRENGTH TEST:

In this study, there are two types of concrete that have been prepared. The first type of Concrete is the normal mix. The second type replacement concrete. In this chapter, compressive strength test conducted on the specimens will be looked into. The fresh concrete was tested for its workability while the tests for hardened concrete conducted were compressive strength. All samples were cured in water. A total of 18 cubes specimens with the size of 150 x150 x 150 mm were tested for compressive strength. The specimens were tested at the age of 7, 14 and 28 days after curing in water. Specimens were tested for compressive strength by applying increasing compressive load until failure. Thus, reading of the maximum load for failure can be obtained.

Results of 7 days compressive strength

Sl. no	% of Use Fly ash & Laterite Aggregate	Cube number	Compressive strength in N/mm^2	Average Compressive strength in N/mm^2
1	0 %	1	34.67	34.59
		2	35.11	
		3	34	
2	10 %	1	35.97	36.22
		2	36.89	
		3	35.82	
3	15%	1	37.98	38.27
		2	38.89	
		3	37.95	
4	20%	1	38.95	39.16
		2	40.52	
		3	38.01	

Results of 14 days compressive strength

Sl.no	% of Use Fly ash & laterite aggregate	Cube number	Compressive strength in N/mm^2	Avg strength in N/mm^2
1	0 %	1	47.11	44.52
		2	43.56	
		3	42.89	
2	10 %	1	44.98	46.16
		2	45.52	
		3	47.98	
3	15%	1	48.95	48.72
		2	46.26	
		3	50.96	
4	20%	1	49.52	49.31
		2	47.97	
		3	50.46	

Results of 28 days compressive strength

Sl. no	% of Use Fly ash & Laterite Aggregate	Cube number	Compressive strength in N/mm^2	Average strength in N/mm^2
1	0 %	1	45.11	46.24
		2	46.28	
		3	47.33	
2	10 %	1	49.96	50.25
		2	48.92	
		3	51.56	
3	15%	1	50.98	51.28
		2	52.92	
		3	49.95	
4	20%	1	49.92	52.41
		2	52.98	
		3	54.33	

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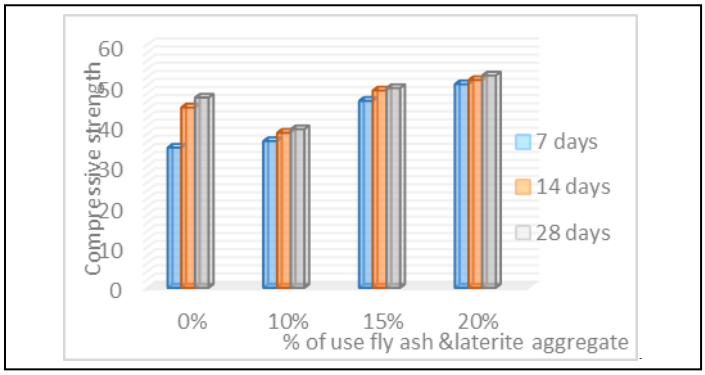

CONCLUSIONS:

From this study it can conclude that as the age increases the compressive strength of concrete increases.

In this study, there are two types of concrete that have been prepared. The first type of concrete is conventional concrete and the second type is replacement concrete.

In this work, fly ash and lateritic aggregate are employed to replace cement and aggregates in concrete on M40 grade concrete, then compressive strength is substituted.

Use of fly ash reduces the voids and cracks formation and corrosion. And increases the workability.

With increase in content of fly ash, air content increases whereas unit weight decreases.

From the results of this study, it is recommended that 20% of fly ash and 20% of laterite aggregate is adequate for partial replacement of cement and aggregates in concrete production.

Replacement of 20% of fly ash and 20% of lateritic aggregate was able to produce lateritic concrete exhibiting the targeted strength of 45.35 N/mm^2.

According to this experimental study, comparing both conventional concrete and replacement concrete are giving maximum strength.

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