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A STUDY AND COMPARISION OF NORMAL COCRETE AND ADMIXTURE MIXED CONCRETE

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Abstract - The abstract describes the investigation of the behavior of glass fiber and fly ash in concrete. Concrete is a material that is weak in tension and prone to cracking and scaling. To enhance its performance, various additives, both chemical and mineral, have been used, including fly ash and glass fiber. Glass fiber, an inorganic fiber derived from molten glass, offers high tensile strength and fire resistance, which can reduce damage during fire accidents. Adding these fibers to concrete significantly improves its compressive strength, tensile strength, and split tensile strength. The study aims to test glass fiber concrete and assess the impact of fibers on concrete strength.Fly ash, a waste product from thermal power plants, presents environmental concerns. However, using fly ash in concrete offers environmental benefits, such as reducing cement requirements and saving raw materials like limestone. The investigation explores the utilization of fly ash in cement concrete as a partial replacement of cement and as an additive, providing an eco-friendly approach for its disposal and reuse.The abstract also mentions the effects of fibers in concrete, which include controlling cracking, reducing permeability, and minimizing water bleeding. Fly ash is described as a supplementary cementitious material used alongside Portland cement to enhance the properties of hardened concrete through hydraulic or pozzolanic activity.

Key Words: Admixture, concrete, fly ash, aggregate, specific gravity

1. INTRODUCTION

Concrete is a construction material made of a mixture of cement, sand, stone, and water that hardens to a stone like mass. A mass formed by the coalescence of separate particles. Concrete is a composite material composed of coarse aggregate bonded together with a fluid cement that hardens over time. Most concretes used are lime - based concretes such as Portland cement concrete or concretes made with other hydraulic cements, When aggregate is mixed together with dry Portland cement and water, the mixture forms a fluid slurry that is easily poured and molded into shape. The cement reacts chemically with the water and other ingredients to form a hard matrix that binds the materials together into a durable stone-like material that has many uses.Often, additives (such as pozzolans or superplasticizer) are included in the mixture to improve the physical properties of the wet mix or the finished material. Most concrete is poured with reinforcing materials (such as rebar) embedded to provide tensile strength,yielding reinforced concrete.

Advantages of concrete

The following advantages of concrete are -

- Concrete can be manufactured to desired strength with economy.
- The durability is very high.
- It can be cast to any desired shape.
- The deterioration of concrete is not app recyclable with age.

2. EXPERIMENTAL PROCEDURE

Sieve analysis of fine aggregate (sand) :-

Procedure:-

• The sample is brought to an air- dry condition before weighing and sieving either by drying at room temperature or by heating at a temperature of 100℃ C to 110℃ C.

• The dried sample is weighed.

• The weighed sample is placed on the sieve and sieved successively on the appropriate sieves starting with the largest.

• Each sieve is shaken separately over a clean tray until not more than a trace passes, but in any case for a period of not less than 2 minutes. The Shaking is done with a varied motion, backward and anti-clockwise. Lumps of fine materials if present may be broken by gentle pressure with fingers against the side of the sieve.

• At the end of sieving, 150 microns and 75 micron sieves are cleaned from the bottom by light brushing with fine hair brush.

• On completion of sieving, the material retained on each sieve together with any material cleaned from mesh, is weighed.

• This procedure is done for fine aggregates.

• A curve is drawn between percentage passing and the sieve size for fine aggregate.

Specific gravity of sand by pycnometer:-

Procedure:-

- Clean dry and weigh specific gravity bottle (pycnometer) (M_1).
- Take certain quantity of sand (about one third of the bottle) in the bottle and weigh (M_2).
- Pour water over the sand to fill the bottle and find the total weight (M_3).
- Clean the bottle thoroughly with water and fill the bottle with water and weigh (M_4).
- The Specific Gravity at room temperature is calculated from following equation, $\mathbf{G} = \frac{M_2 - M_1}{(M_2 - M_1) - (M_3 - M_4)}$
- Where,
- M_1-mass of pycnometer
- M_2-mass of pycnometer with dry material
- M_3-mass of pycnometer and material+ water/for cement M_3 =mass of pyconometer and material + kerosene
- M_4-mass of pycnometer filled with kerosene

Workability test of concrete:-

According to Indian Standard (IS: 1199-1959), workability of concrete is that properties of concrete which determine the amount of internal work necessary to produce full compaction. In its simplest form, the term “workability ” may be define as the ease with which concrete may be mixed handled, transported, placed in position and compacted. Test for measurement of workability of concrete are:

- Slump Test
- Compaction factor Test
- Vee-Bee Test
- Flow table Test

Slump cone test

Slump test is probably the simplest and commonly used test. It is used very often in concrete work. It is easily performed at a job site and is useful in detecting variations in mixes of given properties. In this test, concrete is compacted in a vessel of the shape of the frustum of a cone and open at both the ends. The frustum is made of thin steel sheet, with internal dimensions as: top diameter 100mm, the bottom

diameter 200mm and the height 300mm. It stands on a plane non-porous surface.

Fig-1: Line diagram of slump cone Fig-1: Line diagram of slump cone

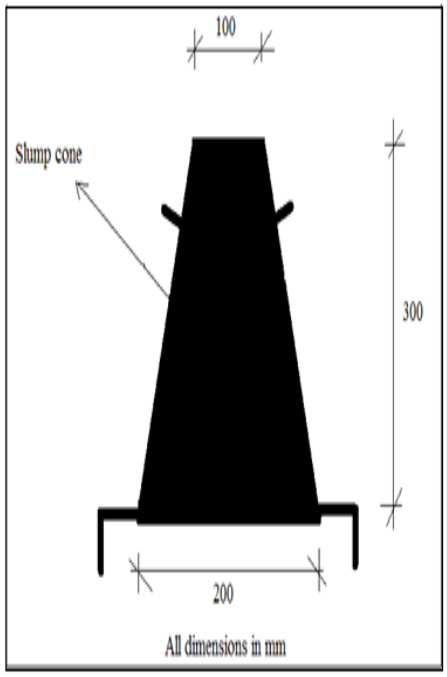


Fig-1: Line diagram of slump cone

Fig-2: apparatus with its measurements

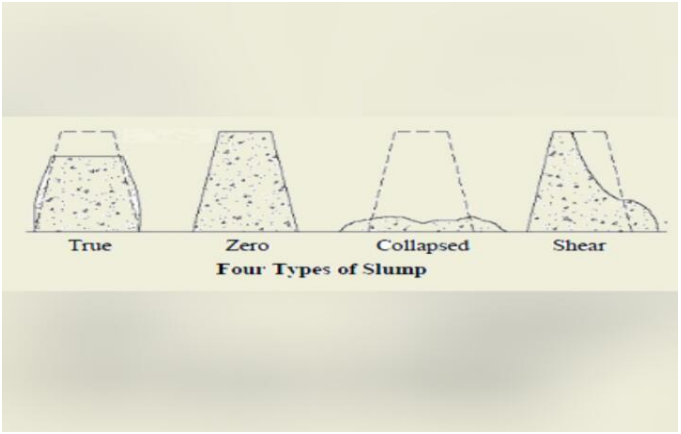


Fig-3: Types of Slump

Procedure:-

- Clean internal surface of the mould and apply oil.
- Place mould on a smooth horizontal non porous base plate.
- Fill the mould with the prepared concrete mix in 4 approximately equal layers.
- Tamp each layer with 25 strokes of the rounded end of the tamping rod in a uniform manner over the cross section of the mould for the subsequent layers; the tamping should penetrate into underlying layer.
- Remove the excess concrete and level the surface with a trowel.
- Clean away the mortar or water leaked out between the mould and the base plate.
- Raise the mould from the concrete immediately and slowly in-vertical direction.
- Measure the slump as the difference between the height of the mould and that of height point of the specimen being tested.

Compression Test:-

Compressive strength is the capacity of a material or structure to withstand axially directed pushing forces. It provides data (or a plot) of force vs.

deformation for the conditions of the test method. When the limit of compressive strength is reached, brittle materials are crushed. Concrete can be made to have high compressive strength, e.g. many concrete structures have compressive strengths in excess of 50 MPa. By definition, the compressive strength of a material is that value of uniaxial compressivestress reached when the material fails completely. The compressive strength is usually obtained experimentally by means of a compressive test.

Fig-4: Vibration Machine for vibrating concrete

Fig-5: Compression testing machine

Apparatus

Mould, Tamping rod, Vibrating machine, Compression testing machine,

Components

Loading Unit , the loading unit is of fully welded construction having a cross head, base and solid plates/Two pillars for four pillars nut or welded type having a cross head, base model.

Pumping Unit , The two speed pump facilitates rapid approach of the platens for daylight closure and also provides comprehensive control over the application of load. A control valve provides fine control over the loading rate for accuracy of pacing. The digital read-out unit, incorporates a 4-digit display, calibrated in KN and features integral load pacing in kN/sec. Maximum load is held and retained for approx 15 min, unless cancelled, using the panel mounted reset switch. Pace rate set for running the test can be maintained manually with the help of a bar graph indicator. Logged data printing facility through a parallel port interface is provided in the machine. Readings of runs/tests can be stored in the memory. Hydraulic jack is fixed to the base. The platens of the machine are hardened, ground and polished. The upper platen is provided with self-aligning action. To facilitate testing of various size specimens, suitable size spacers are provided complete with ball seating arrangement.

Features

- Easy to control
- Cost-effective
- Durable
- Resistance to rust
- Safe
- Low maintenance

Procedure

- Tests should be done at recognized ages of the test specimens, usually being 3, 7 and 28 days. The ages should be calculated from the time of the addition of water to the drying of ingredients. At least three specimens, preferably from different batches, should be taken for testing at each selected age.
- The specimens prepared and stored in water, should be tested immediately on removal from the water and while still in wet condition.
- Specimens when received dry should be kept in water for 24hrs. before they are taken for testing. The dimensions of the specimens, to the nearest 0.2mm and their weight should be noted before testing.
- The bearing surfaces of the compression testing machine should be wiped clean and any loose sand or other material removed from the surfaces of the specimen, which would be in contact with the compression platens.
- In the case of cubical specimen, the specimen should be placed in the machine in such a manner that the load could be applied to the opposite sides of the cubes, not to the top and the bottom. The axis of the specimen should be carefully aligned with the centre of thrust of the spherically seated platen. No packing should be used between the faces of the test specimen and the steel platen of the testing machine. As the spherically seated block is brought to rest on the specimen, the movable portion should be rotated gently by hand so that uniform seating is obtained.
- The load should be applied without shock and increased continuously at a rate of approximately 140kg/sq.cm/minute until the resistance of the specimen to the increasing load breaks down and no greater load can be sustained. The maximum load applied to the specimen should then be recorded and the appearance of the concrete and any unusual features in the type of failure

S. No.	Particulates	Designation	1	2	3
1.	Mass of pycnometer	(M_1)	650 g	650 g	650 g
2.	Mass of Pycnometer + sand	(M_2)	1552 g	1286 g	1244 g
3.	Mass of Pycnometer + sand+ water	(M_3)	2242 g	2079 g	2052 g
4.	Mass of Pycnometer + water	(M_4)	1684 g	1684 g	1684 g
5.	Specific gravity		2.62	2.63	2.62
6.	Average specific gravity		2.623		

3. RESULTS AND OBSERVATION

Sieve analysis of sand

The following results were obtained -

Sl. No.	Fiber Added (%)	Slump Value (mm)
1	0.0	0
2	0.3	0
3	0.6	0
4	0.8	0

Table-1: Result of sieve analysis of sand

Sl. No.	IS Sieve	Particle Size D (mm)	Mass retained (g)	% retained	Cumulative % retained	% finer
1	4.75 mm	4.75 mm	15.0	1.5	1.5	98.5
2	2 mm	2 mm	84.0	8.4	9.9	90.1
3	1.18 mm	1.18 mm	282.0	28.2	36.6	63.4
4	600 micron	600 micron	610.0	61.0	92.2	7.8
5	425 micron	425 micron	176.0	17.6	78.6	21.4
6	300 micron	300 micron	794.0	79.4	97	3
7	75 micron	75 micron	29.0	2.9	82.3	17.7

Table-2: Result of specific gravity of sand

S. No.	Fibre Added(%)	Slump Value (mm)
1	0.0	0
2	0.3	0
3	0.6	0
4	0.8	0

Specific gravity of sand

The following results were obtained

Slump Cone Test for w/c =0.45

Slump Value For Fiber concrete

Table-3: Result of slump Value

Slump Cone Test for w/c=0.50

Slump Value for Fibre Concrete

Table-4: Result of Slump

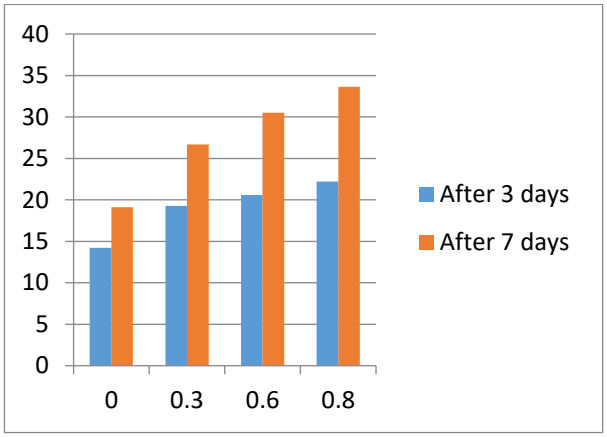
Compressive Strength Test

Compressive Strength value for Fiber Concrete with w/c=0.45

Table-5: Result of compressive strength Test

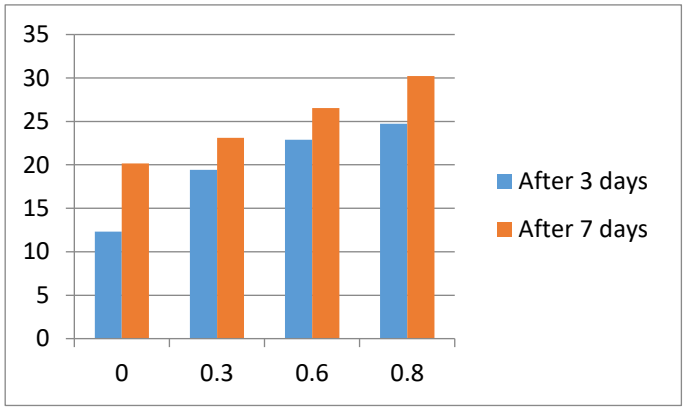
S. No.	Fiber Added (%)	Compressive Strength after 3 days in N/mm^2	Average Compressive Strength in N/mm^2	Compressive Strength after 7 days in N/mm^2	Average Compressive Strength in N/mm^2
1.	0.0	13.33	14.22	18.22	19.11
		14.22		19.11	
		15.11		20.00	
2.	0.3	18.22	19.26	26.22	26.67
		20.00		28.89	
		19.56		24.89	
3.	0.6	20.00	20.59	30.22	30.52
		21.33		29.78	
		20.44		31.56	
4.	0.8	21.33	22.22	33.33	33.63
		22.22		32.00	
		23.11		35.56	

Graph-1: Variations in compressive strength with fibre added for w/c=0.45



Compressive Strength value for Fibre concrete with w/c=0.50

Graph-2: Variations in compressive strength with fibre added for w/c=0.50



S. No.	Fiber Added (%)	Compressive Strength after 3 days in N/mm^2	Average Compressive Strength in N/mm^2	Compressive Strength after 7 days in N/mm^2	Average Compressive Strength in N/mm^2
1.	Nil	12.44	12.3	21.78	20.15
		11.11		19.11	
		13.33		19.56	
2.	0.3	19.56	19.41	24.44	23.11
		18.67		21.33	
		20.00		23.56	
3.	0.6	22.22	22.89	28.00	26.52
		21.78		24.89	
		22.67		26.67	
4.	0.8	24.44	24.74	31.11	30.22
		24.89		28.00	
		24.89		31.56	

Table-6: Result of compressive strength Test

4. CONCLUSIONS

Based on the experimental study on concrete mixes, the following conclusions could be made:

a) A reduction in bleeding is observed by addition of glass fibres in the glass fibre concrete mixes.

b) A reduction in bleeding improves the surface integrity of concrete, and reduces the probability of cracks.

c) The use of glass fibres significantly improves the compressive strength irrespective of affecting the workability of concrete mixes.

d) Maximum compressive strength is attaining in 1.0% addition of glass fibre. So adding glass fibre upto 1.0% only not exceeds the limit.

e) Ultimate compressive strength of concrete goes on decreasing with increase in w/c ratio of concrete.

f) The disadvantage of glass fibre is the spinning action which takes more time to prepare the concrete. It also does not mix homogeneously in concrete.

g) As fly ash replacement with cement can be replace up to 20% above this limits the strength will be decreased.

h) The strength of cube of controlled concrete specimen will be different from the standard strength of cylinder. Normally strength of cylinder is taken as 0.8 times the strength of cube, but experiments results in the study have shown that there is no unique relationship between the strength of cube and strength of cylinder.

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