Self Curing And Moist Curing on Bagasse Ash Replacement In Concrete

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Abstract- *Today, the growing demand for and scarcity of construction materials like concrete drives researchers all over the world to focus on developing strategies for exploiting industrial or agricultural waste as a source of waste materials and eco-friendly substitutes or alternatives. Because cement manufacture generates waste, the chemical reaction in cement causes a rise in CO2. If any additional pollutants are present, this output can be minimized. As an alternative to cement, a material with pozzolanic characteristics that does not contain CaCO3 is employed. at the same time Over time, ancient structures were demolished and new ones were built; also, aggregate scarcity is a major issue. forthcoming issue Because of the rapid rise of industrialization, aggregate demand is rapidly expanding. rates are high This challenge also necessitates the discovery of the coarse aggregate's next level alternative. Recycled Aggregates can function as conventional aggregates. This waste product must be used in construction. industry in order to rescue the environment The current research focuses on how bagasse ash and debris can be used in concrete. in order to employ farming as well as modern garbage that pollutes the environment.*

Keywords- Bagasse ash,High strength concrete; farming waste; modern waste, Ash

I. INTRODUCTION

Because the sugar industry is one of the most important industries in the world today, its residue causes pollution. Although it is a biodegradable waste, the quantity produced causes disposal issues. Bagasse is the remaining sugarcane after extraction, which accounts for around 40-45 percent of the sugarcane. Because of the inconvenience caused by direct disposal, it is disposed in the form of ash, which accounts for around 8-10% of the sugarcane in India. This 8 percent is around 10 million tonnes per year in which is the second-largest producer of sugarcane. According to recent research due to its frequent use, this ash contains silica and other metal oxides that are commonly found in cement pozzolanic efficiency SCBA is commonly recommended as a partial replacement for cement. Bagasse ash has pozzolanic action qualities when mixed with cement in concrete because of this chemical feature. Rapid industrialization necessitates the usage of cement, making it critical to employ alternative cements whenever possible. The basic qualities of sugarcane bagasse ash mixed with cement are beneficial. Researchers are working to develop new technologies based on sugarcane bagasse ash. A brand-new hydrated product Because of the interaction of silica, CSH is generated when any pozzolanic material, such as bagasse ash, is combined with cement. of pozzolanic material and lime in cement, which can boost the strength of the concrete mix However, the formation of bonds The use of cement in conjunction with other components in concrete produces ozone-depleting chemicals, with CO2 being mostly responsible. for approximately 5% of global anthropogenic CO2 emissions.

Bagasse ash

Definition: Bagasse ash is the waste from the combustion process and is mostly disposed of as landfill. Only a small quantity of bagasse ash is utilized as pozzolan in concrete, and a considerable quantity is left unused due to its high carbon and crystallite content.

II. LITERATURE SURVEY

Rahul Mohan, et.al (2021) Conducted study on, "Systematic Pretreatment Process and Optimization of Sugarcane Bagasse Ash Dosage for Use in Cement-Based Products"Studies on the characterization and performance of residual sugarcane bagasse ash (SCBA) obtained from high-temperature cogeneration boilers in concrete are highly limited. This study investigated the pretreatment process and optimization of SCBA collected from high-temperature boilers by various physicochemical methods. The effect of recalculation and grinding on the physical and mineralogical properties of SCBA were also examined. The percentage replacement of cement with SCBA was optimized using packing density and flow. The performance of optimized binder with combinations of cement and SCBA was validated through compressive strength of mortar specimens. From the results, it was observed that SCBA from high-temperature boilers can be used as a supplementary cementitious material with minimal processing efforts, and a 15% level of replacement is suggested as the optimum level for SCBA-blended cement. Based on the investigation, a framework with a step-by-step procedure including pretreatment and optimization methods is suggested for the use of SCBA.

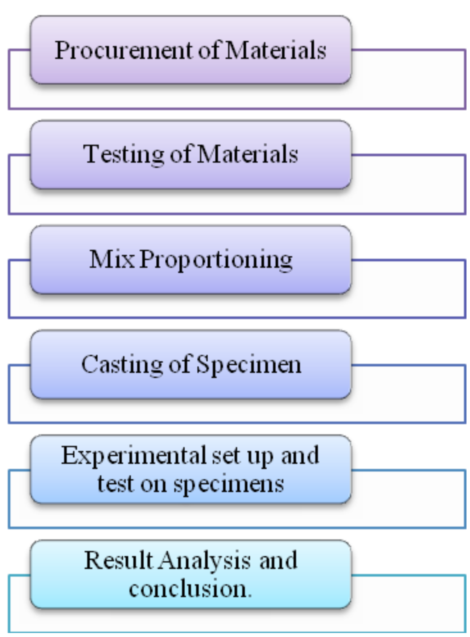
Sagar Dhengare et.al (2015) Conducted study on, "utilization of sugarcane bagasse ash as a supplementary cementitious material in concrete and mortar - a review" In developing countries, accumulation of unmanaged agricultural waste has resulted in an increased environmental concern. Recycling of such agricultural wastes is the viable solution not only to pollution problem, but also the problem of land filling. In view of utilization of agricultural waste in concrete and mortar, the present paper reviews, utilization of sugarcane bagasse ash (SCBA) in different compositions that were added to the raw material at different levels to develop sustainable concrete and mortar. Various physico-mechanical properties of the concrete and mortar incorporating sugarcane bagasse ash are reviewed and recommendations are suggested as the outcome of the study. The study in turn is useful for various resource persons involved in using SCBA material to develop sustainable construction material.

J Payá, et.al (2002) Conducted study on, "Sugar-cane bagasse ash (SCBA): studies on its properties for reusing in concrete production" Sugar cane bagasse is an industrial waste which is used worldwide as fuel in the same sugar-cane industry. The combustion yields ashes containing high amounts of unburned matter, silicon and aluminium oxides as main components. These sugar-cane bagasse ashes (SCBA) have been chemically, physically and mineralogically characterized, in order to evaluate the possibility of their use as a cement-replacing material in the concrete industry. Determination of parameters such as carbon content (by thermal analysis methods), presence of crystalline material granulometric distribution (by laser diffraction in water suspensions), morphology of particles (by scanning electron microscopy) and reactivity towards lime (pozzolanic activity by thermogravimetric monitoring in lime/SCBA and cement/SCBA pastes) have been carried out.

A.Bahurudeen et.al (2014) Conducted study on, "Influence of different processing methods on the pozzolanic performance of sugarcane bagasse ash" Sugarcane bagasse ash is obtained as a by-product from cogeneration combustion boilers in sugar industries. Previous studies have reported that the use of sugarcane bagasse ash as supplementary cementitious material in the concrete can improve its properties. The utilization of bagasse ash has been constrained because of inadequate understanding of the material and lack of suitable processing methodology for use in a large scale. Processing methods significantly influence the pozzolanic activity of any supplementary cementitious material. Proper assessment of pozzolanic activity and processing methodology of bagasse ash were not investigated in earlier research studies. This paper describes a study that involves pozzolanic performance evaluation and microstructural characterization of sugarcane bagasse ash for use as pozzolanic material in concrete.

III. METHODOLOGY

DETAILS	SAMPLE-1	SAMPLE-2
Weight of empty pychnometer with cap (m1)	**458 gm**	**458 gm**
Weight of pychnometer with 1/3rd of fly ash (m2)	**587 gm**	**583 gm**
Weight of pychnometer with fly ash and water (m3)	**1315**	**1316**
Weight of pychnometer filled with water (m4)	**1252 gm**	**1252 gm**



3.1 Materials

3.1.1 Cement

Ultra Tech 53 grades Ordinary Portland cement is used for this study. This cement is the most widely used one in the construction industry in India

3.1.2 Course and fine aggregates

Maximum size of Coarse aggregates is 20 mm used for this study which taken from Mhasrul-Nashik, Maharashtra, and natural sand of river bed is used confirming to grading Zone –II of table 4 of IS 383 were procured from Maharashtra.

3.1.3 Baggash Ash

Baggash Ashis obtained from Nashik Sakar Kharkhana , Nashik city in Maharashtra.

3.1.4 Water

Drinking water is used for casting and currying of the concrete mould.

3.1.5 Self Curing Compound.

Product name	Emcoril White
Type	Membrane forming Curing Compound as per ASTM C309
Colour	White
Curing Efficiency	80%
Consumption	150-250 g/m2
Coverage	approx. 4.5 to 6.5 m2 /kg

Specific Gravity Test - Sand.

The results are listed below: -

DETAILS	SAMPLE-1	SAMPLE-2
weight of empty pychnometer with cap (m_1)	458 gm	458 gm
weight of pychnometer with 1/3rd of sand (m_2)	580 gm	578 gm
weight of pychnometer with sand and water (m_3)	1331gm	1329 gm
weight of pychnometer filled with water (m_4)	1252 gm	1250gm

FORMULA

$G = M_2-M_1 / [(M_2-M_1)-(M_3-M_4)]$
=2.8

CALCULATIONS

1) G1= 2.8
2) G2=2.92

MEAN= 2.86

RESULT:

The specific gravity of sand was found to be **2.86**

3.2 Specific Gravity - Fly Ash.

The results are listed below

FORMULA:

G = M2-M1 / ((M2-M1)-(M3-M4))

CALCULATIONS:

1) G1= 1.95
2) G2=2.04

MEAN= **1.995**

RESULT

The specific gravity of FLY ASH was found to be **1.995**

3.3 Concrete Mix Design

B-1 Stipulations for Proportioning

a) Grade designation	M20
b) Type of cement	OPC 53 grade of cement
c) Maximum nominal size of aggregate	20 mm
d) Minimum cement contentment	300 kg/m3
e) Maximum w/c ratio	0.35
f) Workability	100 mm (slump)
g) Exposure condition	severe (for reinforced concrete)
h) Degree of supervision	good
i) Type of aggregates	crushed angular aggregate
j) Maximum cement content	450 kg/m3

B- 2 Test Data for Materials

a)	Cement used	OPC 53 grade conforming to IS 8112
b)	Specific gravity of cement	3.15
c)	Fly ash :	conforming to IS 3812
d)	specific gravity of Fly ash :	1.995

B-3 Target Strength for Mix Proportion

STEP I:

$f'_{ck} = f_{ck} + 1.65 \times s$
$= 20 + 1.65 \times 4$
$= 26.60$ N/mm^2

STEP II:

W/c ratio = 0.35

STEP III:

Selection of water content:
For 20mm Maximum Water Content = 186 Liter For 25 To 50 Mm Slump
Estimated water content for 100 mm slump = 186 + (6/ 100) × 186
= 197.16 liter

STEP IV:

Calculation of Cement And Fly ash Content Content:
W/C ratio =0.35
Cementations material (cement + Fly ash) = (197.6 / 0.35) = 563 kg/m^3
From table 5 of IS 456, minimum cement content for moderate exposure = 300 kg / m^3
395.2 kg/ m3 > 300 kg / m^3……………………………….. Ok
Cementations material content =395.2 x 1.10 = 434.72 kg / m^3
Water content = 197.16 lit.
W.C. ratio = 0.35
Fly ash about 20% of total cementitrious material content = 563 x 0.2
= 113 = Kg / m^3
Cement (OPC) = 563-113 = 450 kg / m^3
Fly ash being utilized = 113 kg / m^3

STEP V:

proportion of volume of coarse aggregates and fine aggregates content
From the table 3, of IS 10262- 2009; the volume of coarse aggregates corresponding to 20 mm size aggregates and fine aggregates conforming to zone II ; and for w /c ratio of 0.5 to 0.62
In this case w /c ratio is taken as 0.5
As w/c ratio lowered by 0.10; the proportion of volume of coarse aggregates is increased
by 0.02[at the rate of± 0.01 for every ± 0.05 changing in w/c ratio] Therefore, Corrected
volume of coarse aggregates for water cement ratio 0.5=0.62
Therefore, volume of coarse aggregate = 0.62
Volume of fine aggregates content 1- 0.62=0.38

STEP VI:

Mix calculations:

A) Volume of concrete = 1 m^3
B) Volume of cement = (mass of cement / specific gravity of cement) × (1/1000)
= (450 /3.15) X (1/1000)
= 0.1428 m^3

C) Volume of Baggash Ash = (mass of Fly ash / specific gravity of Fly ash) × (1/1000)
= (113 /1.995) X (1/1000)
= 0.0566 m^3

D) Volume of water = (mass of water/ specific gravity of cement) × (1/1000)
= (197.6 / 1) × (1/1000)
= 0.1976 m^3

E) Volume of all in aggregates
= [A – (B + C +D)]
= [1 – (0.1428+0.0566+0.1976)]
= 0.5836 m^3

F) Mass of coarse aggregates
volume of coarse aggregates × specific gravity of coarse aggregates × 1000]
= 0.5836 X 0.62 X 2.726 × 1000
= 1008 kg

G) Mass of fine aggregates
= [(E) × volume of fine aggregates × specific gravity of fine aggregates × 1000
= 0.5836 X 0.38 X 2.86 × 1000
= 634 kg

Mix proportion for trial number 1(Baggash Ash =20%): -

Cement:	450 Kg/M3
Fly ash:	113 kg/ M3

Water: 197.16 kg/M3
Fine Aggregate: 634 Kg/M3
Coarse Aggregate: 1008 Kg/M3
Water-Cement Ratio: 0.35

Mix design proportions:(Baggash Ash 20%)-2.1M &2.1S

water	Cement+ fly ash	Fine aggregates	Coarse aggregates
197.16	450 + 113	634	1008
0.35	1	1.12	1.79

Mix design proportions :(Baggash Ash 25%)- 2.2 M &2.2S

water	Cement+ fly ash	Fine aggregates	Coarse aggregates
197.16	423 + 140	628	1000
0.35	1	1.11	1.77

Mix design proportions :(Baggash Ash 30%)-2.3 M &2.3S

water	Cement+ fly ash	Fine aggregates	Coarse aggregates
197.16	394 +169	623	990
0.35	1	1.11	1.76

Mix design proportions:(Baggash Ash 20%)-2.4 M &2.4S

water	Cement+ fly ash	Fine aggregates	Coarse aggregates
197.16	351 + 87	682	1084
0.45	1	1.94	3.08

Mix design proportions :(Baggash Ash 25%)-2.5 M &2.5S

water	Cement+ fly ash	Fine aggregates	Coarse aggregates
197.16	328 + 110	677	1077
0.45	1	2.06	3.28

Mix design proportions :(Baggash Ash 30%)-2.6 M &2.6S

water	Cement+ fly ash	Fine aggregates	Coarse aggregates
197.16	307 +131	674	1072
0.45	1	2.19	3.49

IV. EXPERIMENTAL SET UP

4.1 Scope

This test method is used to measure the rate of water absorption (sorptivity) by hydraulic cement concrete by measuring the change in mass of a specimen as a function of time when only one surface of the specimen is exposed to water. The exposed surface of the specimen is immersed in water, and water infiltration of unsaturated concrete during initial contact with water is dominated by capillary suction. The values given in SI units are to be considered the standard.

4.2 Significance and use

The performance of concrete subjected to many aggressive environments is a function, to a large extent, of the penetrability of the pore system. In unsaturated concrete, the rate of ingress of water or other liquids is largely controlled by absorption due to capillary rise. This test method is based on that developed by Hall3 who called the phenomenon "water sorptivity." The water absorption of a concrete surface depends on many factors including:

(a) concrete mixture proportions
(b) the presence of chemical admixtures and supplementary cementitious materials
(c) the composition and physical characteristics of the cementitious component and of the aggregates
(d) the entrained air content
(e) the type and duration of curing;
(f) the degree of hydration or age;
(g) the presence of micro cracks
(h) the presence of surface treatments such as sealers or form oil; and
(i) placement method including consolidation and finishing. Water absorption is also strongly affected by the moisture condition of the concrete at the time of testing.

4. 3Apparatus

1. Pan, a watertight polyethylene or other corrosion resistant pan large enough to accommodate the test specimens with the surfaces to be tested exposed to water.

2.Support Device, rods, pins, or other devices, which are made of materials resistant to corrosion by water or alkaline Solutions, and which allow free access of water to the exposed surface of the specimen during testing. Alternatively, the Specimens can be supported on several layers of blotting paper or filter papers with a total thickness of at least 1 mm.
3. Top-pan Balance, complying with Specification C 1005 and with sufficient capacity for the test specimens and accurate to at least 0.01 g.
4. Timing Device, stop watch or other suitable timing device accurate to 1 s.
5. Paper Towel or Cloth, for wiping excess water from specimen surfaces.
6. Oven

4.4 Reagents and Materials:

1. Sealing Material strips of low permeability adhesive sheets, epoxy paint, vinyl electrician's tape, duct tape, or aluminum tape. The material shall not require a curing time longer than 10 minutes.
2. Plastic Bag or Sheeting, any plastic bag or sheeting that could be attached to the specimen to control evaporation from the surface not exposed to water. An elastic band is required to keep the bag or sheeting in place during the measurements.

4.5 Test Specimens:

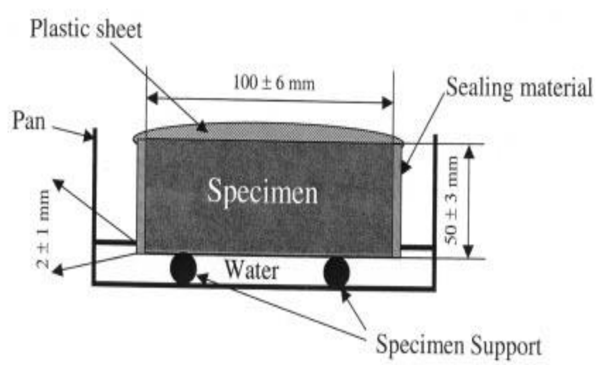
7.1 The standard test specimen is a 110 mm diameter disc, with a length of 50+/-2 mm. Specimens are obtained from either molded cylinders according to Practices C 31/C 31M or C 192/C 192M or drilled cores according to Test Method C 42/C 42M. The cross sectional area of a specimen shall not vary more than 1 % from the top to the bottom of the specimen. When cores are taken, they should be marked so that the surface to be tested to the original location in the structure is clearly indicated.

4.6 Sample Conditioning

These specimens are dried at hot roomTemprature for 24 hr. and then the specimens were left to cool in dry conditions for the following dry condition

4.7 Procedure

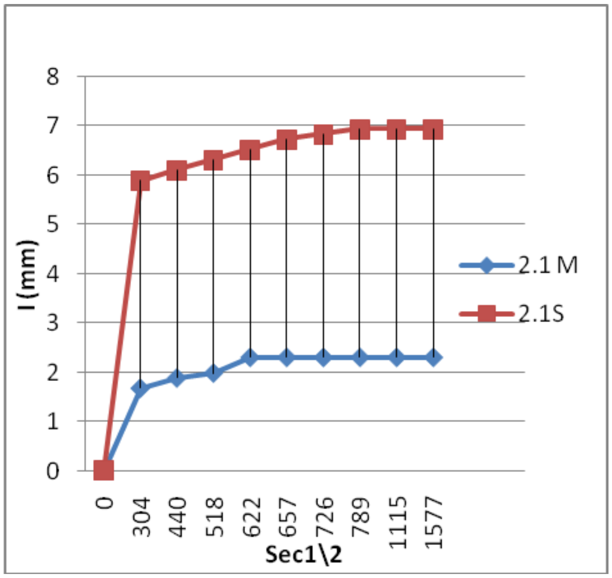
1. Remove the specimen from the storage container and record the mass of the conditioned specimen to the nearest 0.01 g before sealing of side surfaces.
2. Measure at least four diameters of the specimen at the surface to be exposed to water. Measure the diameters to the nearest 0.1 mm and calculate the average diameter to the nearest 0.1 mm.
3. Seal the side surface of each specimen with a suitable sealing material. Seal the end of the specimen that will not be exposed to water using a loosely attached plastic sheet The plastic sheet can be secured using an elastic band or other equivalent system .
4. Use the procedure below to determine water absorption as a function of time. Conduct the absorption procedure at 23 + 2°C with tap water conditioned to the same temperature.
5. Seal the side of each specimen with the right kind of sealant. Use a loosely attached plastic sheet to seal the end of the specimen that will not be in water. The plastic sheet can be held in place with an elastic band or something similar.



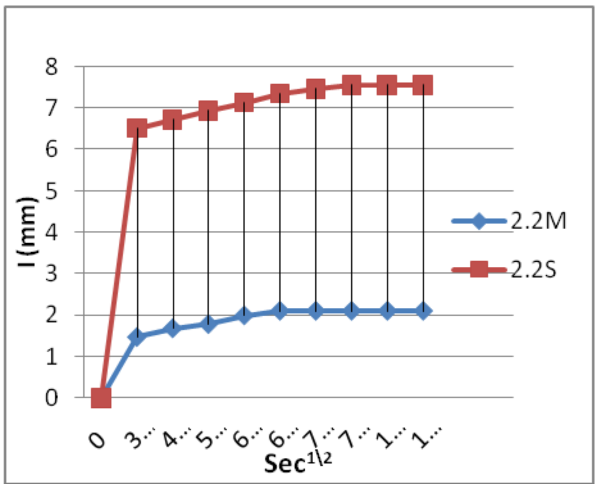
Schematic of the Procedure

V. RESULT ANALYSIS

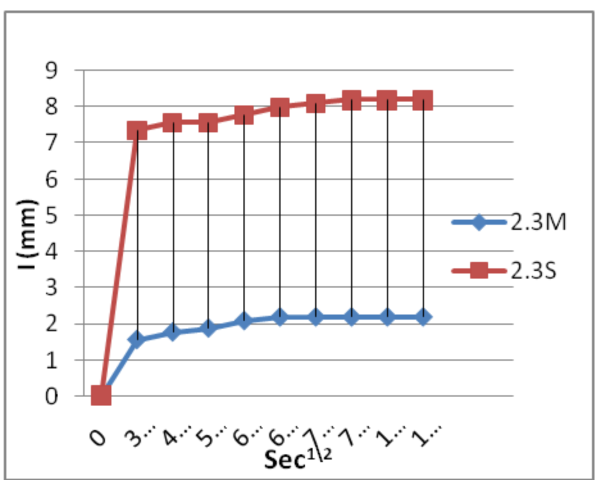
Graph showing comparison between moisture curing concrete and self-curing concrete



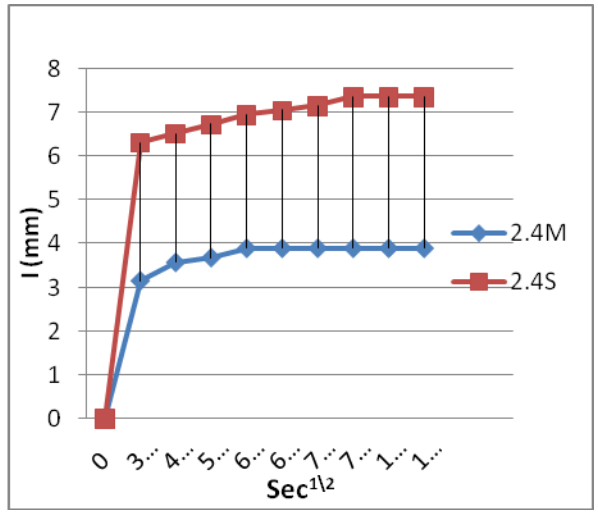
GRAPH 1



GRAPH 2



GRAPH 3



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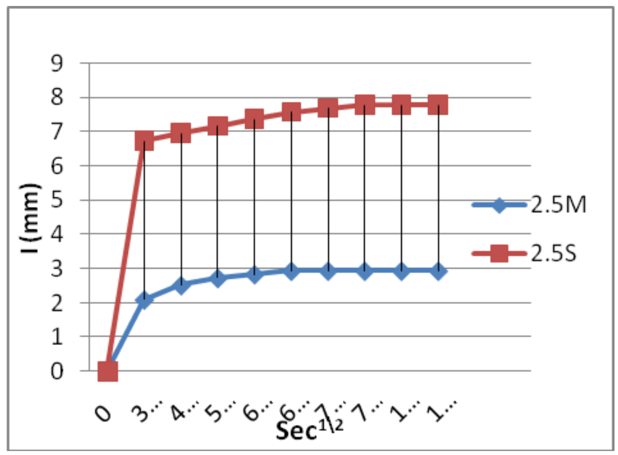
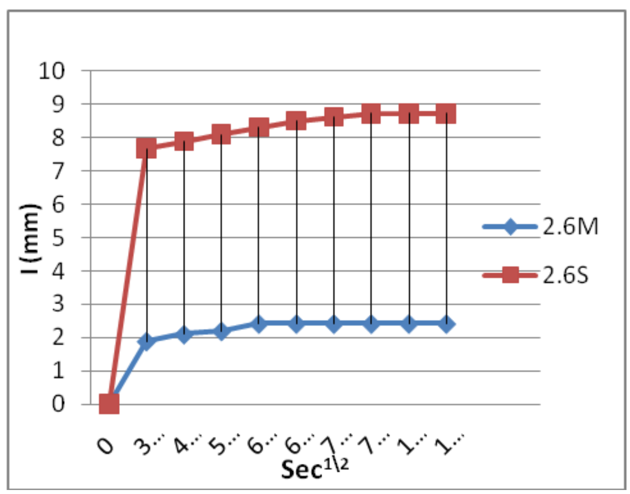


GRAPH 5



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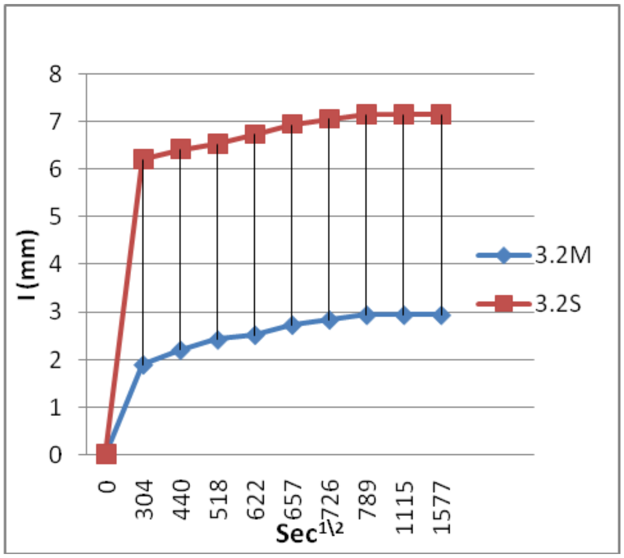

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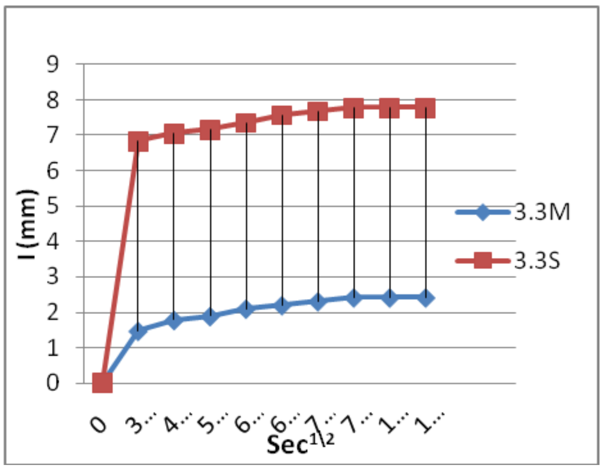

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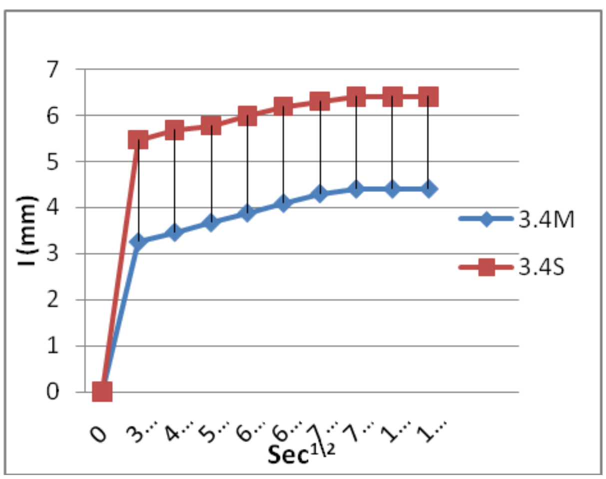
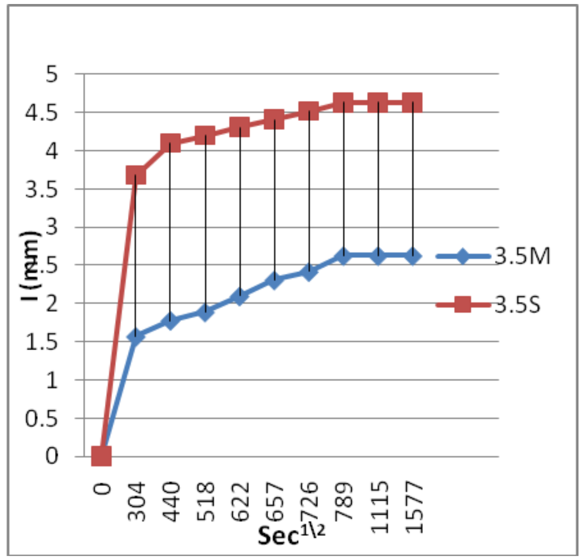
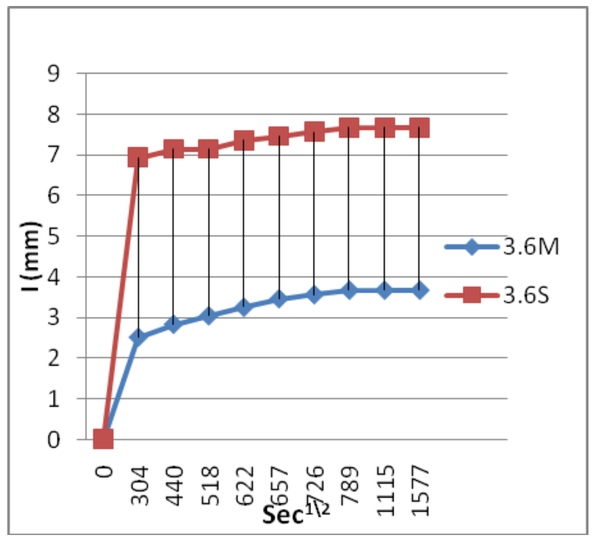


GRAPH 9



GRAPH 10



GRAPH 11

VI. CONCLUSIONS

The results show that the combined SCBA & fly ash in blended concrete gives higher compressive strength as compared to that of the conventional concrete. It is found that the cement could be advantageously replaced with combined SCBA & fly ash, up to maximum limit of 15%. Although, the optimal level of SCBA content was achieved with 15% replacement. Partial replacement of cement by SCBA increases workability of fresh concrete. Low weight concrete produced in the society with waste materials (SCBA). The results of compression test are in the form of the maximum load the cube can carry before it ultimately fails. The compressive stress can be found by dividing the maximum load by the area normal to it. The results of compression test and the corresponding compressive stress is shown in table. India has a vast resource of fly ash across the country. This material if collected and used properly can solve the major problem of fly ash disposal and will reduce the use of cement, which consumes lot of energy and natural resources and finance. in India many organizations are putting their efforts to promote the awareness of fly ash concrete and its advantages. Based on the studies conducted by authors following conclusion are drawn on the fly ash concrete.

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