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Experimental Investigation of beam with Partial replacement of Press mud.

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Abstract: Durability of concrete and economy has made it the world's most used construction material. It is basically consists of four components: cement, water, aggregates and admixture. Due to development of infrastructure, necessity of producing large quantities of cement is required and usage of natural resources is required. Initiatives are emerging worldwide to strike a balance between the developments in infrastructure and prevention of the environment from contamination by reusing the industrial wastes. Thus, requirements for more economical and environmental-friendly cementing materials have extended interest in partial replacement of cement in infrastructure development. In this research work, M25 grade of concrete beam with partial replacement of cement by sugarcane bagasse ash at 5%, 10% and 15% specimens were casted and tested for flexural behaviour at 28 days.

Keywords-sugarcane bagasse ash, flexural strength, Reinforced cement concrete,

I. INTRODUCTION:

Cement is the binder material used in the concrete to bind fine aggregate and coarse aggregate together to act them as homogeneous material. This is done because of its pozzalonic property. The materials which has pozzolonic property may be used as replacing material for cement. The material should not be replaced fully but it can be done by partially. The waste industrial byproducts such as fly ash, blast furnace slag, silica fume and sugarcane bagasse has this pozzalonic property and so the above waste materials should be used in concrete as replacing material for cement. In this proposed project we focused on to find the optimum percentage of addition of sugarcane bagasse ash in reinforced cement concrete. The addition of this SBA should not affect the workability, setting time, strength and durability of concrete. The standard fabricated steel mould are used to caste the beams of size 1000mm x 150mm x 100mm of length, breadth and depth respectively. Four NOS of beams are casted at varying percentage of SBA by 0%, 5%, 10% and 15%. A linear compaction should be done during the time of casting to ensure the density of concrete. The reinforcement used is Fe415 grade and thermo mechanically treated bars. The beams are cured for 28days in order to obtain the maximum flexural strength.

II. MATERIALS USED IN CONCRETE:

Reinforced cement concrete is made up of cement, fine aggregate, coarse aggregate, water and reinforcement bars. In this study we used sugarcane bagasse ash as replacing material for cement.

1) Cement

A cement is a binder, a substance used for construction that sets, hardens, and adheres to other materials to bind them together. Cement is seldom used on its own, but rather to bind fine aggregate (sand) and coarse aggregate (gravel) together**.** Cement mixed with fine aggregateproducesmortar for masonry, or with sand and gravel produces concrete. Cement is most widely used material in existence and is only behind water as the planet's most consumedresources.

2) Fine aggregate

Fine aggregates are those whose size was in between 2mm – 4.75mm. Sand falls in this range and thus it's called as fine aggregate. It may be classified into three types such as find sand, medium sand, and coarse sand and their sizes are 0.075 – 0.425mm, 0.425 – 2.00mm and 2.00 – 4.75mm respectively.

3) Coarse aggregate

Typically, coarse aggregate sizes are larger than 4.75mm, while fine aggregates from the portion below 4.75mm. a maximum size up to 40mm is used for coarse aggregate in most structural applications, while for mass concreting purposes such as dams, sizes up to 150mm may be used. The size of coarse aggregate must be depend upon the type of work should be done. For mass concreting more than 50mm aggregates are used.

4) Water

The water used to make concrete must be clean and free from organic matter. Water acceptable for drinking is preferable for making concrete. Salt water may be used if fresh water is not readily available, but it will reduce strength of concrete by about 15%. Enough water is needed for hydration reaction too much water leads to reduction in strength. Hence only the quantity of water needed is to be added. During the current research, cement was replaced with SBA.

5) Sugarcane baggase Ash

Bagasse is a by-product from sugar industries which is burnt to generate power required for different activities in the factory. The burning of Bagasse leaves Bagasse ash as a waste, which has a pozzolonic property that can potentially be used as a cement replacement material. The Bagasse ash was found to improve some properties of the paste, mortar and concrete including compressive strength and water tightness in certain replacement percentages and fineness. The higher silica content in the Bagasse ash is the main cause for these improvements. Although the silicate content may vary from ash to ash depending on the burning conditions and other properties of the raw materials including the soil on which the sugarcane is grown, it has been reported that the silicate undergoes pozzolonic reaction with the hydration products of the cement and results in a reduction of the free lime in the concrete.

III. DESIGN OF BEAMS:

Design of Rectangular Reinforced concrete Beam. Reinforced concrete beams are structural elements that designed to carry transverse external loads. The load cause bending moment, shear force and in some cases torsion across their length. Moreover, concrete is strong in compression and very weak in tension.

Specifications of Beam:

Width of beam, b = 100mm

Depth of beam, D = 150mm

Length of beam, l = 1000mm

fck = 25 N/mm^2

fy = 415 N/mm^2

Ultimate Load = 17 KN

Mu = Px (Two point load condition)

Mu = 16.142 x 0.33

Mu = 5326767.188 Nmm

Mu = 0.87xfyxAstxd [1-(fyxAst) / (fckbd)]

5326767.188 Nm = 0.87x415xAstx120 [1- (415xAst)/ (25x100x120)]

Ast =157.0796mm^2

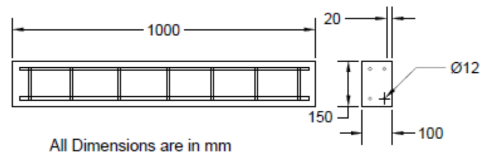

Fig. 1 Plan of beam

IV. MIX DESIGN:

In this investigation concrete mix design M25 was designed based on IS 10262 – 2009. This code presents a generally applicable method for selecting mixture proportion. Mix Design are given below in table 1. The quantity of material used in this study details are given below in table.

1. Mix proportions

Table 1 Mix Proportion

Cement (kg)	Fine Aggregate (kg)	Coarse Aggregate (kg)	W/C
9.56	9.56	19.12	0.45

2. Material calculations

Unit weight = weight/volume

25kN/m3 = weight/ (1x0.15x0.10)

Weight = 25x0.015kN

= 25x0.015x1000 N

= 375 N

= 375/9.81

= 38.226 kg

To find the requirements of (C: FA: CA)

Mix ratio for M25 Grade of Concrete = 1:1:2

= 38.226/4

= 9.557 kg

We require 9.56kg, 9.56kg, 19.12kg of Cement, Fine aggregate and Course aggregate respectively.

3. Notations of specimens

Table 2 Notations of specimens

specimens	Percentage of replacement Of SBA with cement	Cement (kg)	Press mud (kg)	Fine aggregate (kg)	Coarse aggregate (kg)
Specimen 1	0%	9.56	0	9.56	19.12
Specimen 2	5%	9.083	0.478	9.56	19.12
Specimen 3	10%	8.604	0.956	9.56	19.12
Specimen 4	15%	8.126	1.434	9.56	19.12

V. CASTING OF SPECIMENS:

Steel moulds are used to cast the beam specimens of size 150mm x 100mm x 1000mm. Four different specimens were casted according to the percentage of addition of replacement material. Proper compaction has been done and the specimens were casted. The casted specimens were cured properly to get required strength.

1. mixing

The materials of concrete should be mixed properly to get good specimens. Mixing may be done with man mix or machine mix. Proper mixing of concrete material leads to get required strength.

2. placing

Placing of concrete also affects the strength attainment if they are not properly placed. The concrete should be placed properly without causing segregation. Improper placing leads to weak specimen casting.

3. compaction

Compaction is defined as the process which expels entrapped air from the freshly placed concrete and also packs the aggregate particles together so as to increase the density of concrete. This may be done with by man or done by using vibrating machines. To use the material properly proper compaction should be done.

4. curing

Curing of concrete is defined as the process of providing adequate moisture, temperature and time to allow the concrete to achieve the desired strength and properties for its desired use. The strength of concrete is directly proportional to the curing period. In this investigation the specimens are cured for 28days in order to attain its total strength.

VI. PROCEDURE OF TESTING:

The beam after curing for 28 days are taken to test. A strong steel frame (loading frame) was used to test the specimens. The two static point loads with equal spacing of l/3 from the ends of the beam was applied at the top surface by using hydraulic hand pump of capacity 500 kN. The load was first applied to the beams up to its initial cracking and the values are noted. And then loading process were continued on the beam to get second crack and the values are noted.

Fig 2. Test setup.

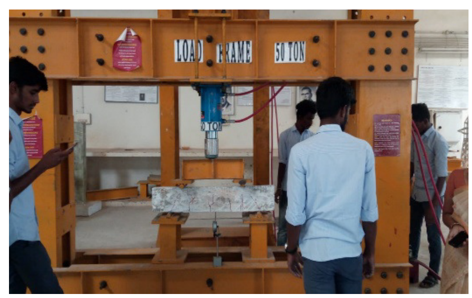

Fig 3. Testing of Specimen

1. load calculations:

For calculating load applied on beam,

We know that

1pascal = 0.001kN/m^2& 1000kg/cm^2 = 98066.5 Pascal

We have to convert the load in pressure into load in kN

= 98066.5 x 0.001

= 14.7099kN

VII. RESULT AND TABULATION:

specimens	Percentage of replacement of %	Load at initial cracking kN	Load at second Cracking kN	Ultimate load kN
Specimen 1	0	3.9	7.012	11.12
Specimen 2	5	4.118	7.06	11.77
Specimen 3	10	4.413	7.354	12.503
Specimen 4	15	4.413	8.82	14.71

Table 3Tabulation of comparison of loads at first and second cracking

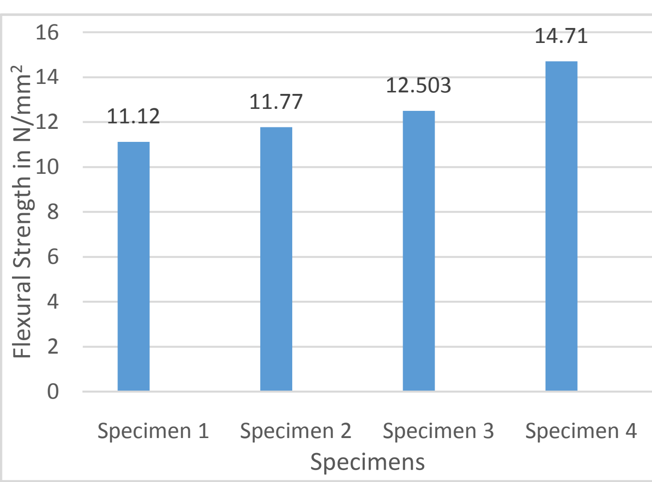

Fig 4. Comparison of flexural strength of beams

VIII. CONCLUSION:

The test results shows that

- ✓ The results shows that the addition of SBA in RCC concrete increases the load carrying capacity of beams because it contains large amount of amorphous silica having pozzolonic properties.
- ✓ The optimum percentage of addition of SBA in RCC beam is 15%.
- ✓ The percentage in increase of flexural

= 98.0665 kN/m^2

= 98.0665 x 100 x 15 x 10 ^-4

strength when 15% of replacement of SBA is 31% when comparing to conventional concrete.

IX. SUMMARY:

Due to the pozzolonic character of sugarcane bagasse ash it can be used as a replacement material for cement with certain percentage. 5% addition of SBA cannot have better improvement in Flexural property but with 10 and 15% replacement have good improvements in flexural strength of beams. This shows that sugarcane bagasse ash must be used as a replacement material for cement for 15%.

X. SCOPE FOR FUTURE WORKS:

The future study can be done by using other materials in the place of SBA as binding material like Pulverized fuel ash, etc.

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