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PERFORMANCE OF CONCRETE REPLACING COARSE AGGREGATE WITH CRUSHED BONES AND CEMENT WITH GGBS AND SILICA FUME

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ABSTRACT

In this rapidly growing era of science and technology the construction and structures are also taking new mode in the way of infrastructure and mobilization in working and advancement of development leads to perform the new research on concrete. The aim of research is to make the concrete light weight as compared to normal M25 grade specimen, to increase the strength of concrete and to make it eco-friendly and economical. Coarse aggregate is substitute with dead animal crushed bone and cement is substitute with silica fume and GGBS. While performing the project the cubes, cylinder and beams is casted. The coarse aggregate is replaced by animal crushed bones and the silica fume and GGBS is replaced by cement in appropriate proportion. Animal crushed bone was replaced by 10%, 15%, 20% and silica fume and GGBS was replaced by 5% respectively. In the experiment total 36 cubes is casted, 24 cylinders is casted and 16 beams was casted. The casted mould was tested on 7 days, 21 days, 28 days, and 52 days. In this project the compression test, split tensile test and flexural strength test was performed. The compressive strength is maximum at the replacement of 10% of animal crushed bone and 5% of silica fume and GGBS in the specimen. The split tensile strength of concrete is maximum at the replacement of 20% of dead animal crushed bone and 5% of silica fume and GGBS. The flexural strength of specimen is maximum at the replacement of 20% of dead animal crushed bone and 5% of silica fume and GGBS.

KEYWORD

Animal Crushed Bones, GGBS, Silica Fume, Compression Test, Split Tensile Test, Flexural Test.

INTRODUCTION

Cement, Fine and Coarse aggregate are the raw materials of concrete use to construct components of any concrete structure in this world. The process of making cement is very expensive and the high pollution produces in Cement industries. The pollution generate from the cement industries is harmful for all living things in biosphere. To reducing the pollution and prices we use the waste materials. GGBS is the best waste material to use in substitute of cement. The percentage 0%, 5%, 10%, and 15% on which the cement replace with the GGBS. The Optimum value is obtained on 10%. It increases the durability and

stability of specimen with increase in time. GGBS increase the strength also after some time. Silica Fume is also good substitute of cement; it helps in to increase the strength of specimen. The maximum substitute of Silica fume with cement is up to 30%. Coarse aggregate is also important material for construction. It increase strength of specimen and also increases the weight of construction. The Boulder Size of dead animal Bones can use as a substitute of coarse aggregates. The dead Animal bones aggregate decrease the weight of specimen and also increase the flexibility of concrete structure. The maximum percentage as substitutes of coarse aggregate with the bones are 30%, on further Increase in amount of animal bones decreases the strength. Mixture of GGBS, Silica Fume and Dead Animal Bones decrease the weight and gives optimum strength and durability.

LITERATURE

- **Beulah.M and J.Dayalan(2014),** had completed a investigation on substitute of cement, fine and Coarse aggregates .Ceramic tiles waste is used as fine aggregates and dead animal bones as coarse aggregates, silica fume is substitute of cement .this investigation shows that the mixture of silica fume, ceramic tiles and dead animal bones not change the property of specimen, it decreases the strength as compared to normal specimen.

- **Gupta Gorav , Verma Nalin and Gaur Lovekesh (2017)**, had completed their investigation on GGBS and Silica fume in Concrete. GGBS and silica fume is used as substitute of Cement, percentage of GGBS 5%, 10%, 20% and silica fume in percentage of 5% and 6%. Compressive strength is more when replacing 5% of GGBS and 5% of silica fume in specimen, gained more strength as compare to normal specimen. The strength was decrease in specimen after replacing 10% of GGBS and 5% of Silica fume. The specimen gained strength after 28 days .

- **S D Geetha, M P Kavyashree, H K Krupaksha, K A Sthuthi and A R Viksheetha (2018)**, had completed investigation on dead animal bones aggregate and tiles waste in substitute of sand, course aggregate. They used ACC cement of 43 grade. For fine aggregate, sand used, animal bones obtained from animals were also used. Coarse aggregate of 20mm down size, cubical and angular aggregate were used. Mangalore tile waste replaces the coarse aggregate by 10% and potable water was used. From there project, they concluded that Mangalore tiles can be used as replacement to coarse aggregate and bone aggregate as fine aggregate. In concrete mix resulted in decrease in strength compare to that of normal concrete. The max. Strength was obtained when 8% of coarse aggregate and 4% of natural sand replaced by Mangalore tiles waste and bone aggregate.

OBJECTIVE

- To prepare the fresh and good concrete by using the animal crushed bone and waste material like silica Fume and GGBS.

- To replace the coarse aggregate and cement with crushed bone and silica fume, GGBS respectively.

- To achieve the strength of the concrete by replacing waste resource.

- To make the concrete economical and durable by using animal crushed bone and GGBS, silica

- To obtain the light weight of concrete by mixing the admixtures like crushed bones and silica fume, GGBS
- To complete the experiment in eco-friendly way.

SCOPE OF STUDY

- Investigation on concrete by substitute of Cement with GGBS and Silica Fume.
- Investigation on concrete by substitute of coarse aggregate with dead animal bones.
- To develop of eco-friendly alternative binding material
- To achieve economy and durability in concrete construction.
- To achieve compression strength of a concrete.
- To achieve tensile strength of a specimen.
- To achieve flexural tensile strength of a specimen.

MATERIAL AND METHODOLOGY

- **Animal Crushed Bone**

The dead animal crushed bone was used in a legal way it is the bone of the dead animal which is available in the industries in a legal way. In this investigation the waste dead animal bones are used.

Sr. No.	Parameter	Experimentally Obtained Value
1	Water Absorption	3%
2	Bulk Density	21kg/m
3	Sinews	1% Max.
4	Grease	2.5% Max.
5	Hard Bone Ratio	70% Min.
6	Moisture	7-8% Max.
7	Specific Gravity	1.7
8	Nitrogen	4%

- **GGBS**

GGBS is the by-product of iron industry. GGBS is grind in the form of fine powder. It is widely used in the Europe and USA. GGBS is highly reactive with concrete which leads to concrete free from chemical attacks.

Sr. No.	Parameter	Experimentally Obtained Value
1	Color	Grey
2	Density	900-1100
3	State	Powdered
4	Application	Concrete

- **SILICA FUME**

Silica fume is a waste material of wood chips and coal' it is easily available and it is economic also. Silica fume is added in the concrete to increase the strength of the concrete and silica also makes the concrete durable.

Sr. No.	Parameter	Experimentally Obtained Value
1	Moisture	0.25%
2	Specific Gravity	2.2
3	Bulk Density	200kg/m^3
4	Purity	90%
5	Color	Solid Grey
6	Form	Powder

- **CEMENT**

Cement is the binding material used with concrete and mortar for constructing the all infrastructure. Cement hardens the concrete and adheres to other material to bind them together.

Sr. No.	Parameter	Experimentally Obtained Data
1	Specific Gravity (S.G.)	3.15
2	Soundness	3
3	Initial Setting time(minutes)	50
4	Final Setting time(minutes)_	300

- **COARSE AGGREGATES**

The coarse aggregate is the broken stone in the small size. The size of coarse aggregate varies for 4.74mm to 40mm. It is used in concrete to bind and it provides strength.

Sr. No.	Parameter	Experimentally Obtained Value
1	Water Absorption	0.19
2	Shape	Angular
3	Fineness Modulus	2.74
4	Specific Gravity (S.G)	2.66

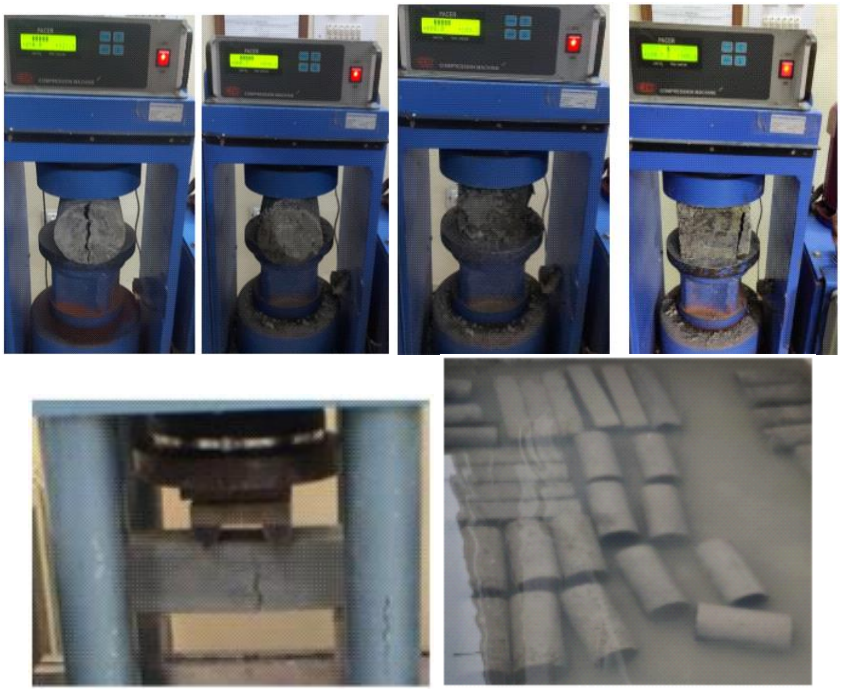
- **FINE AGGREGATES**

The fine aggregates are small and tiny particles of stone. The size of fine aggregate is upto 9mm. It is used in concrete to mix with cement and aggregate and it provides strength to concrete.

Sr. No.	Parameter	Experimentally Obtained Value
1	Water Absorption %	0.81%
2	Specific Gravity	2.70
3	Bulk Density	1474 Kg/m^3

METHODOLOGY

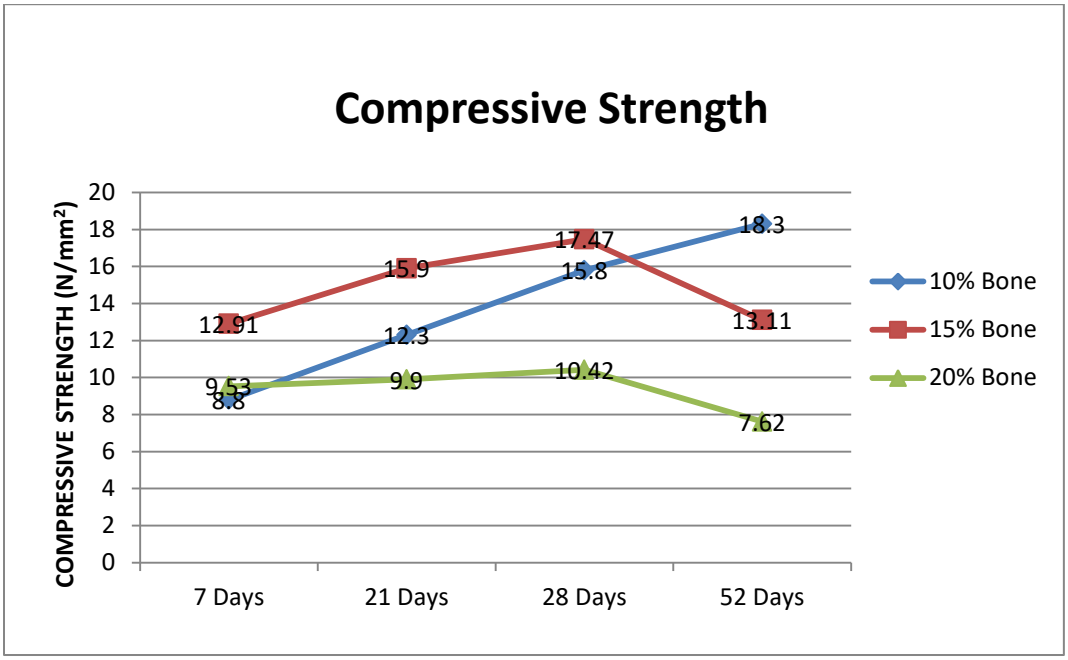
- In the experiment the cubes, cylinder and beams is casted of the grade M25 concrete and the ratio was 1:1:2.
- In the concrete, the coarse aggregate was Substitute with animal crushed bone percentage are 10%, 15%, 20%.
- In the concrete, the cement was substitute with silica fume and GGBS in the proportion of 5% respectively.
- The cubes, cylinder and beams were tested on 7, 21, 28, and 52 days.
- The compressive strength test was on cubes, tensile strength test on cylinder and the flexural strength test on beams.
- Dimension of the cube mound is 150*150*150mm
- Dimension of the cylinder mould is 300mm height and diameter was 150mm
- The dimension of the beam mould is 500*100*100mm0
- The compressive strength was maximum at the 10% substitute of coarse aggregate with dead animal crushed bone and 5% of the substitute of cement with silica fume and GGBS
- The split tensile strength was maximum at the 20% substitute of coarse aggregate with dead animal crushed bone and 5% substitute of cement with silica fume and GGBS
- The flexural strength was maximum at the 20% substitute of coarse aggregate with dead animal crushed bone and 5% substitute of cement with silica fume and GGBS.



RESULT

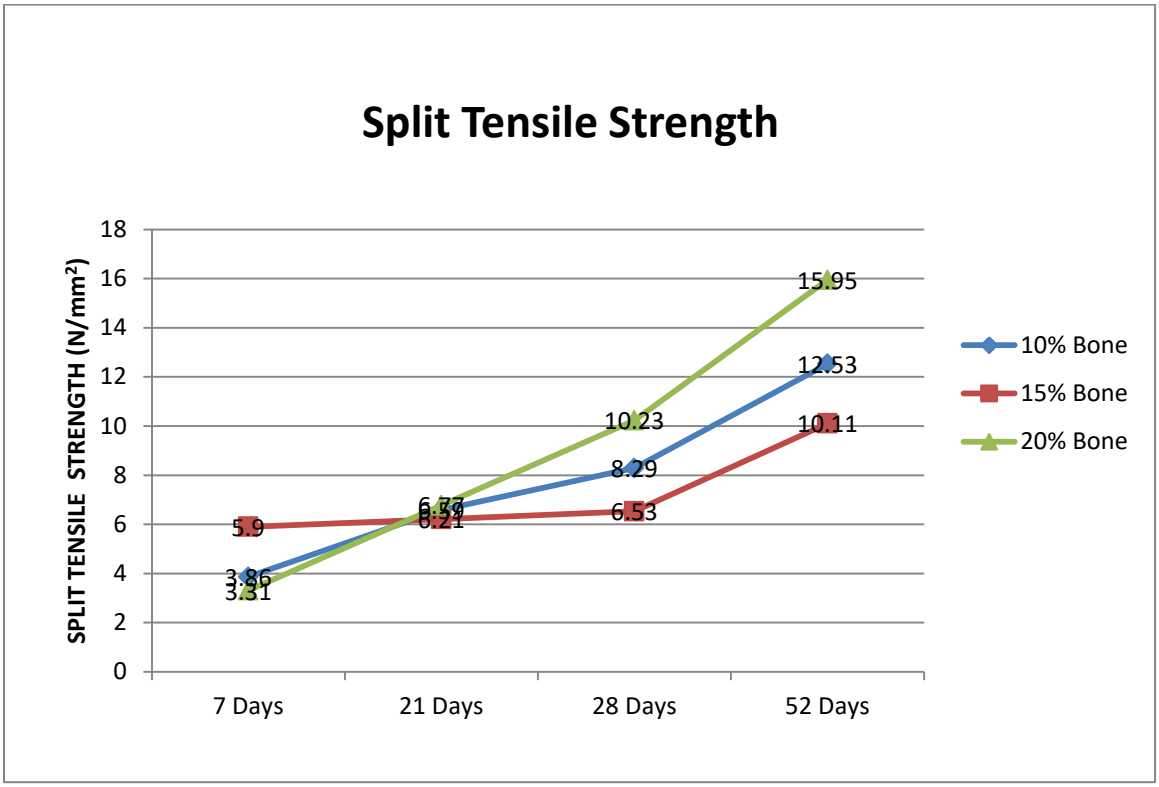
- **COMPRESSIVE STRENGTH**

Sr. No.	BONE%	7DAYS	21DAYS	28DAYS	52DAYS
1	10%	8.8	12.3	15.8	18.03
2	15%	12.91	15.9	17.47	13.11
3	20%	9.53	9.9	10.42	7.62



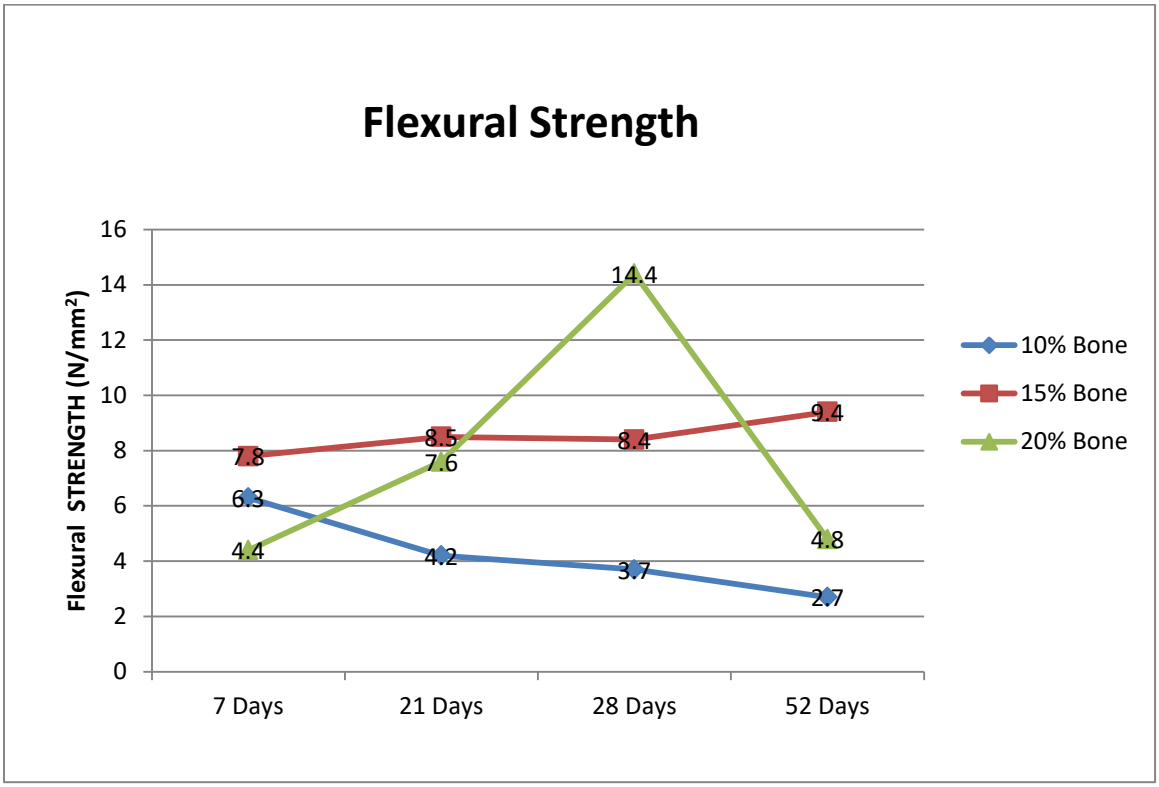
- **SPLIT TENSILE STRENGTH**

Sr. No.	BONE%	7DAYS	21DAYS	28DAYS	52DAYS
1	10%	3.86	6.59	8.29	12.53
2	15%	5.9	6.21	6.53	10.11
3	20%	3.32	6.77	10.23	15.95



- **FLEXURAL STRENGTH**

Sr. No.	BONE%	7DAYS	21DAYS	28DAYS	52DAYS
1	10%	6.3	4.2	3.7	2.7
2	15%	7.8	8.5	8.4	9.4
3	20%	4.4	7.6	14.4	4.8



SUMMARY

The concrete cubes, cylinder and beams is casted at various different proportion by mixing different admixtures like animal crushed bone, silica fume, GGBS etc. The concrete was made up of grade M25 and the coarse aggregate is replaced by animal crushed bone and the cement is replaced by silica fume and GGBS. The animal crushed bone is taken 10%, 15%, 20% of coarse aggregate and the silica fume and GGBS is taken 5%, 5% respectively. The cubes, cylinder and beams are tested on 7, 21, 28 and 52 days. The compression strength test was on cubes, split tensile test was on cylinder and flexural test was on beams. Before casting the specimen the slump test was done in every mix. The dimension of cube mould was 150mm*150mm*150mm and the dimension of cylinder was 300mm height and 150mm diameter and the dimension of beam was 500mm*100mm*100mm. The cubes, cylinder, and beams was tested on different days and the strength of cube at 10% replacement of bone and 5% silica fume and GGBS respectively is:-

- 7 Days- 8.8
- 21 Days- 12.3
- 28 Days-15.8
- 52 Days- 18.3

The strength of cube at 15% replacement of bone and 5% silica fume and GGBS respectively is:-

- 7 Days- 12.91
- 21 Days- 15.9
- 28 Days- 17.4
- 52 Days- 13.1

The strength of cube at 20% replacement of bone and 5% silica fume and GGBS respectively is:-

- 7 Days- 9.53
- 21 Days- 9.9
- 28 Days- 10.42
- 52 Days- 7.62

The strength of cylinder at 10% replacement of bone and 5% silica fume and GGBS respectively is:-

- 7 Days- 3.86
- 21 Days- 6.59
- 28 Days- 8.29
- 52 Days- 8.59

The strength of cylinder at 15% replacement of bone and 5% silica fume and GGBS respectively is:-

- 7 Days- 5.9
- 21 Days- 6.21
- 28 Days- 6.53
- 52 Days- 5.42

The strength of cylinder at 20% replacement of bone and 5% silica fume and GGBS respectively is:-

- 7 Days- 3.32
- 21 Days- 6.77
- 28 Days- 5.5
- 52 Days- 7.13

The strength of Beam at 10% replacement of bone and 5% silica fume and GGBS respectively is:-

- 7 Days- 6.3
- 21 Days- 4.2
- 28 Days- 3.7
- 52 Days- 2.7

The strength of Beam at 15% replacement of bone and 5% silica fume and GGBS respectively is:-

- 7 Days- 7.8
- 21 Days- 8.5
- 28 Days- 8.4
- 52 Days- 9.4

The strength of Beam at 20% replacement of bone and 5% silica fume and GGBS respectively is:-

- 7 Days- 4.4
- 21 Days- 7.6
- 28 Days- 14.4
- 52 Days- 4.8

CONCLUSION

- The compressive Strength of concrete mix with dead animal crushed bones, GGBS, Silica as cement and coarse aggregate is maximum at 10% of bones replacement with coarse aggregate and 5% GGBS, 5% Silica with cement .

- Split Tensile Strength of specimen mix with dead animal crushed bones, GGBS, Silica as cement and coarse aggregate is maximum at 20% of bones replacement with coarse aggregate and 5% GGBS, 5% Silica with cement .

- The Flexural Strength of concrete mix with dead animal crushed bones, GGBS, Silica as cement and coarse aggregate is maximum at 20% of bones replacement with coarse aggregate and 5% GGBS, 5% Silica with cement

FUTURE SCOPE

- In future we can replace Cement with Marble Powder for more strength.
- We can replace ceramic tiles with coarse aggregate for strength.
- We can increase the Percentage of Silica and GGBS in this mixture with different material.
- We can replace fine aggregate with nylon fiber.
- We can replace the cement with fly ash.
- We can replace bagasse ash with cement.
- We can also add steel slag in this admixture.

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