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EFFECT OF BRICK CHIPS AGGREGATE AND CURING CONDITION ON THE SRENGTH OF CONCRETE

A.Vinodhini,
M.E-Structural engineering
Oxford Engineering College,
Trichy-09, India.
Anbu71426@gmail.com

Dr.G.Dhanalakshmi (Prof & Head)
Department of Civil Engineering,
Oxford Engineering College,
Trichy-09, India.
civil.oxford09@gmail.com

Abstract

This study considered the effect of brick aggregate and curing condition on compressive strength of concrete. Ordinary Portland Cement, coarse sand, silica fume and brick chips/stone were used as a binder, fine aggregate and coarse aggregate respectively. Concrete cube and cylinder specimens of mix 1:1.5:3 were prepared with water-cement ratio of 0.5. Three different curing conditions namely, Water Curing (WC), Self Curing (SC), Air Dry Curing (ADC) are used in this project. Two types of concrete are prepared in this study such as concrete C1 (brick chips as coarse aggregate) and C2 (crushed gravel as coarse aggregate). The concrete made with the partial replacement of brick chips as coarse aggregate and the cement replacing by silica fume at 5%. Cube and cylinder specimens prepared from two batches of concrete were subjected to different sequences of interrupted curing and were tested for compressive strength and flexural strength. Results have been compared with those of stone aggregate concrete. The rate of strength gain of the continuously cured specimen beyond 28-day was also found to be significant.

Keywords

Brick chips, Silica fume, curing period, concrete, physical and mechanical properties.

I. INTRODUCTION

Concrete properties are considerably dependent of temperature and humidity especially during the curing period. The objectives of curing are to keep concrete saturated or nearly saturated to get the products of hydration of cement. The temperature of curing and the duration of curing are the key factors for proper curing. The relative humidity within capillaries drops below 80%. Under an efficient curing method such as water curing, the relative humidity is above 80%, enabling the hydration of cement to continue. It also acts as a porosity reducer and thereby results in a dense microstructure in concrete. Conversely, the concrete specimens lose water or moisture through evaporation and become dry in the absence of proper curing. Therefore, an efficient curing is inevitable to prevent the moisture movement or evaporation of water from concrete surface. This can be accomplished by keeping the concrete element completely saturated.

II. MATERIALS USED

A. Cement

OPC used in this project. Cement is a binding material that sets and hardens independently, and can bind fine and coarse aggregate together. At ordinary temperature to form compounds possessing cementitious properties. It chemically react with calcium hydroxide Portland cement shall comply the requirements of IS 12269-1987. 53 grade OPC

B. Fine Aggregate

The sand is collected from the local area. The sand sieved in 1.18mm (passed) and retained in 600µ. After that the retained sand was weighted. The procedure was continued to find out the fineness modulus of sand. Fine aggregates filled the gap between coarse aggregate to increase bonding between cement and coarse aggregate.

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C. Coarse Aggregate

Coarse Aggregate basic material of the concrete. Aggregate shall comply the requirements of IS 383. As far as possible, preference shall be given to natural aggregates. The nominal size of coarse aggregate should be large as possible within the limits specified. 20mm size respectively was selected as coarse aggregate. Crushed stone or gravel used in concrete are called coarse aggregate.

D. Brick Aggregate

The bricks are crushed to using this experimental investigation. The standard size of brick is 19cm x 9cm x 9cm. and the modified size of brick is 20cm x 10cm x 10cm. It is used for in this study partial replacement of crushed stone aggregate.

Fig. 1 Brick chips

III. MATERIAL PROPERTIES

A. *Cement Properties*

The property of the cement is tabulated below,

Table 1 – Cement Properties

Properties	Cement
Initial setting time	31 min
Final setting time	155 min
Consistency	33%
Specific gravity	3.15

B. Fine Aggregate Properties

The property of the river sand is tabulated below,

Property	Value
Specific gravity	2.62
Water absorption	4.16

Table II – Fine aggregate properties

Property	Value
Specific gravity	2.66
Water absorption	0.53
Free moisture content	0

C. *Coarse aggregate Properties*

The property of the coarse aggregate is tabulated below,

Table III – Coarse Aggregate Properties

D. Brick aggregate Properties

The property of the Brick aggregate is tabulated below,

Table IV – Brick Aggregate Properties

Property	Value
Specific gravity	2
Water absorption	14.88
Fineness Modulus	6.58

E. Mix proportions

Table V – Mix Proportion of concrete

Materials	Mix proportion
Cement	1
Fine aggregate	2.39
Crushed stone aggregate	2.18
Brick chips aggregate	2.18
W/C Ratio	0.5

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IV. RESULTS AND DISCUSSIONS

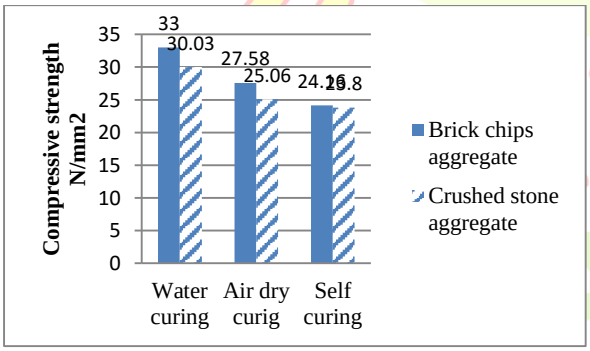
The results and discussions about the various tests are as follows

A. *Compression test on cubes*

The results of compressive strength were presented in Table VI. The test was carried out conforming IS 516-1965 to obtain compressive strength of concrete at the ages of 7 days, 14 days and 28 days.

Table VI – Compressive Strength Results

Types of curing	%of replacement			Compressive strength N/mm²		
	Brick chips	Silica fume	Crushed stone	7th day	14th day	28th day
Water curing	0%	5%	100%	21.66	26.03	30.03
	50%	5%	50%	20.21	27.81	33
Air dry curing	0%	5%	100%	19.46	23.83	25.06
	50%	5%	50%	18.55	24.27	27.58
Self curing	0%	5%	100%	18.03	20.54	23.8
	50%	5%	50%	17.6	20.92	24.16

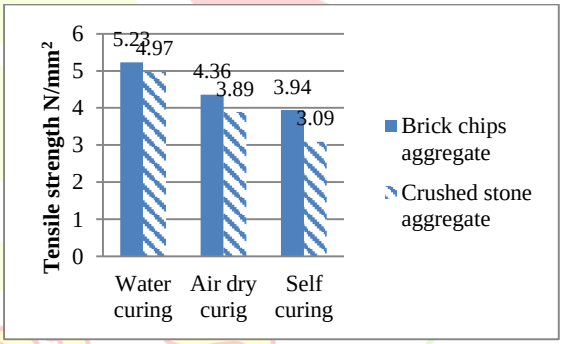


B. *Split tensile test on cylinders*

The result of split tensile strength was presented in Table VII. Size of the cylindrical specimens are 15cm in diameter and 30cm long. The test is done on 7 days , 14 days and 28 days of curing to determine their split tensile strength.

Table VII – Split tensile Strength Results

Types of curing	%of replacement			Tensile strength N/mm²		
	Brick chips	Silica fume	Crushed stone	7th day	14th day	28th day
Water curing	0%	5%	100%	2.3	3.38	4.97
	50%	5%	50%	1.97	3.67	5.23
Air dry curing	0%	5%	100%	2.07	3.16	3.89
	50%	5%	50%	1.6	3.23	4.36
Self curing	0%	5%	100%	1.81	2.62	3.09
	50%	5%	50%	1.27	2.82	3.94



Discussion

- The compressive and tensile strength of brick chips concrete specimen under WC, ADC and SC is lower compared to the Crushed stone concrete at 7 days.
- The results of highest compressive strength and tensile strength value was found from WC condition at 28 days. The compressive strength of specimens under Air dried curing and Self curing are lower compared to specimens under WC condition, especially at the earlier ages.
- With inclusion of 50% replacement of concrete specimen under WC condition is 20.3% increase in compressive strength is observed for 28 days compared to ADC condition.
- With inclusion of 50% replacement of concrete specimen under WC condition is 26.2% increase in tensile strength is

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observed for 28 days compared to SC condition.

- With inclusion of 50% replacement of concrete specimen under ADC condition is 18.6% increase in compressive strength is observed for 28 days compared to SC condition.
- The strength of brick chips concrete specimens are gradually increase compared to the Crushed stone concrete.

V. CONCLUSION

Compare the two materials through its strength properties Brick chips aggregate concrete have higher strength compared to the Crushed stone aggregate concrete. The compressive and tensile strength of the brick chips 10% greater than Crushed stone. Both materials are have good durability to withstand corrosive and acid attack. The strength improve at water curing condition compared to the other types of curing condition. It is one of the light weight concrete. So it is suitable for non load bearing wall construction.

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