AN EXPERIMENTAL STUDY ON PARTIAL REPLACEMENT OF CRUSHED SPENT FIRE BRICKS AS FINE AGGREGATE

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ABSTRACT

To bring out the new material for the replacement of the fine aggregate in the field of civil engineering, this project was attempted to find viability of the crushed spent fire bricks as fine aggregate this project was done. Fire Bricks industry in good performing industry in the field of the civil engineering and also other engineering like mechanical engineering. Because this industry doesn't get any substitute material for competition. But the only drawback in this industry is the spent brick, which doesn't have any good market values. So this project can have two chance that if the viability of the material is very good for fine aggregate, this project can give new fine aggregate and market value for spent bricks.

Keyword: *Fine aggregate, Bricks, Spent Fire Bricks, Fire Bricks, Refractory Bricks.*

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1. INTRODUCTION

1.1 GENERAL

To reduce shrinkage and to impart economy in concreting the role of aggregates is important. Most of the aggregates used are naturally occurring aggregates, such as crush rock, gravel and sand which are usually chemically interactive or inert when bonded together with cement. On the other hand, the modern technological society is generating substantially high amounts of solid wastes both in municipal and industrial sectors; posing an engineering challenging task for this effective and efficient disposal. Hence, partial or full replacement of fine aggregates by the other compatible materials like sintered fly ash, crushed rock dust, quarry dust, glass powder, recycled concrete dust, and others are being researched from past two decades, in view of conserving the ecological balance.

Even though, use of several types of industrial solid wastes like metallurgical waste, glass pieces, fly ash, quarry dust, tyre and rubber waste, crushed concrete waste, sludge and others in making good field concrete is being effectively done at European countries, U.S.A., U.K., and Australia; Asian countries could not gear up to that level to match with those countries. Therefore resource exploitation and waste disposal problems are currently rocking the sustainable development in India.

1.2 OBJECTIVE OF THE INVESTIGATION

The main objective of this investigation is to examine the properties of concrete, which is produced by adding CSFB in the concrete in various proportions. M30 grade of concrete is designed as per IS-10262-2009. Conventional concrete is taken as control mix CSFB is to be added in 0, 10, 20, 30, and 40 percentage.. Conventional concrete specimens are also to be casted for comparison. Various tests for hardened concrete such as,

1. Compression test
2. Split tensile test
3. Flexural strength test

2. FIRE BRICKS

Fire bricks are the products manufactured (as per IS: 6 and IS: 8 specifications) from refractory grog, plastic, and non-plastic clays of high purity. The different raw materials are properly homogenized and pressed in high capacity presses to get the desired shape and size. Later, these are fired in oil-fired kiln at a temperature of 1300°C.

3. SPENT FIRE BRICKS (SFB)

Due to the exposure to continuous high temperature (i.e. 1000-1200ºC) for a period of 10 to 15 days, they lose some of the physical and mechanical properties and need to be replaced by fresh fire bricks, and is being done usually done once in fortnight. Then, the SFB is an industrial solid waste to be disposal off properly and Fig.2 shows the broken SFB. They were physically cleaned and mechanically crushed to a size gradation conforming to fine aggregates.

Fig – 1: Fire Brick Samples

In this project we have used the spent fire bricks as fine aggregate by crushing and grading it.

4. RESULTS AND DISCUSSIONS

The results of compressive strength, split tensile strength, discussed as follows.

4.1 COMPRESSIVE STRENGTH

The compressive strength of concrete is one of the most important and useful properties of concrete. In most structural applications concrete is used primarily to resist compressive stress. In those cases where strength in tension or in shear is of primarily importance, the compressive strength is frequently used as a measure of these properties the compressive strength of concrete cubes with 0%, 10%,20%,30%,and40%, of replacements were determined.

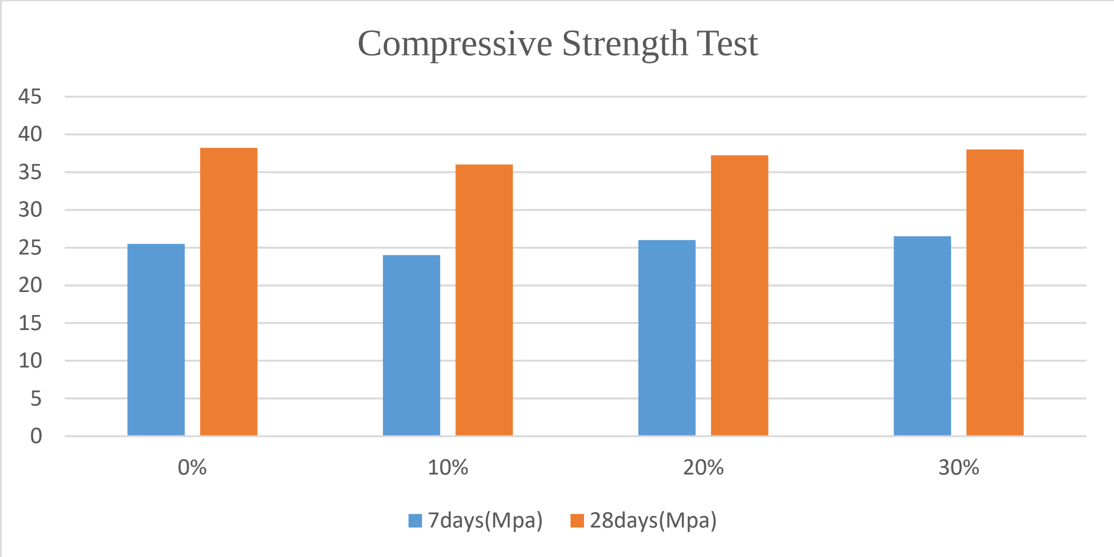

Fig - 2: Comparison of Strength

Discussion:

In this research the values of compressive strength for different replacement levels of CSFB (0%, 10%,20%,30% and 40%) at the end of the curing periods (7 days and 28 days) are taken. These values are plotted in figs. This shows the variation of compressive strength with fine aggregate replacement at different curing ages respectively.

It is evident from figure, that compressive strength increases upto 30% replacement of sand to CSFB. The compressive strength will be decreased in 40% replacement.

4.2 SPLIT TENSILE STRENGTH

Direct tensile strength of concrete cannot be determined owing to difficulty in preparation of test specimen and applying a truly axial tensile load. This test is an indirect method of finding out the tensile strength of concrete.

The split tensile strength is determined using cylinders of 150mm diameter and 300 mm long. The test results of various proportions at 7 and 28 days are given below.

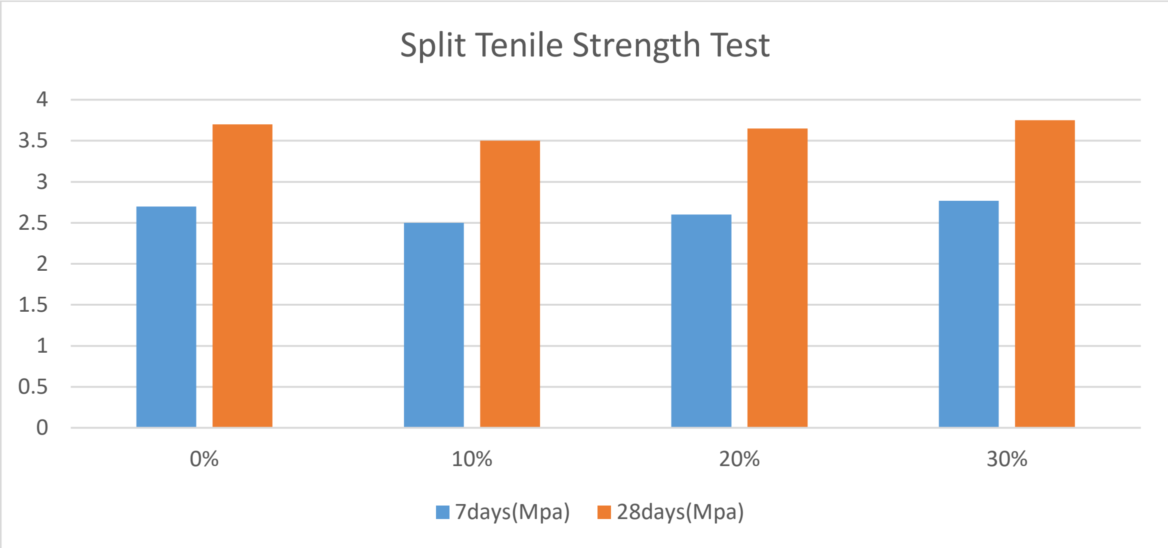

Fig – 3: Comparison of Split Tensile Test

Discussion:

In this research the values of split tensile strength for different replacement levels of CSFB (0,10,20,30 and 40%) at the end of the curing periods (7 days and 28 days) are given in the above chat. This shows the variation of split tensile strength with fine aggregate replacement at different curing ages respectively

It is evident from figure that split tensile strength increases up to 30% replacement of sand to CSFB. The split tensile strength decreased in 40% replacement of sand.

5. CONCLUSION

Based on experimental investigation on the compressive and split tensile strength and Flexural strength of concrete the following observations are made

1. The SFB is a locally available, low cost, and inert industrial solid waste whose disposal is a matter of concern likes construction waste, on an overall, the CSFB is comparable to natural river sand.
2. The CSFB satisfies the zone II gradation for not only to partially replace the sand, but for making good. The SFB is locally available, low cost, and inert industrial solid waste whose concrete,
3. Unit weight of CSFB is higher than that of river Fine aggregate in dense condition which, in turn contributes to the increase in the unit weight of concrete containing CSFB as a fine aggregate.
4. From the results we observe that the maximum strength and durability is achieved by 30% of CSFB replacement in concrete. The 40^{th} % of CSFB replacement in concrete indicates there is no strength gaining after increasing the proportion,
5. The compressive strength of partial replacement of CSFB aggregate concrete is marginally higher than that of the river sand aggregate concrete at age 7 days, and 28 days respectively,

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