AN EXPERIMENTAL STUDY ON PARTIAL REPLACEMENT OF FINE AGGREGTATE WITH CRUSHED SPENT FIRE BRICKS AND ALUMINIUM DUST IN CONCRETE

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ABSTRACT

Fine aggregate is a widely used construction material all over the world. Various researches have been done for the replacement of the construction materials for efficient purposes of which crushed spent fire bricks is one of them. This project explains about the replacement of fine aggregates by partially crushed spent fire bricks. Therefore, varying percentage of fine aggregates by crushed spent fire bricks and aluminium dust with varying percentage of 10%, 15%, 20% & 25% and optimum percentage of replacements is made and strength and workability parameters are studied. The workability of concrete gets decreased with the addition of the crushed spent bricks. From the test results, crushed spent fire bricks replaced for fine aggregates give a maximum strength at 20% when compared to conventional concrete. Then the optimum percentage of replacement of fine aggregates by crushed spent fire bricks are used in combination as partial replacement in concrete and the optimum percentage of the combination is obtained.

Keyword: *Fine aggregate, Bricks, Spent Fire Bricks, aluminum dust, coarse aggregate.*

1. INTRODUCTION

1.1 GENERAL

River sand is most common fine aggregates are used in concrete. River sand is most suitable fine aggregates in concrete. Due to the excessive production of the river sand is banned by government in India. Thus, replacement of sand becomes need in last two decays. Number of researches occurring in world on replacement of sand by number of materials like waste glass powder, spent fire bricks, crushed brick fine aggregates, crushed coarser aggregates, fly ash, etc. Brick aggregates are very easily available at very low cost. It may be recycled from destroyed buildings, bridges, and any other destroyed structures.

People from 7000 BCE have been using bricks. Turkey is that country where first brick is found. On that time bricks were dried in sun light. This sun-dried brick is not sufficient strength. But fired brick were very high resistance. In any condition fire brick gave very suitable results. That is why it used in permanent structures. In the construction of buildings, bricks are generally used more than wood than other materials. Now these days many types of machineries are available. With the help of these machineries many types of these bricks are made with different shapes and with different materials. But clay is the first preference for fire bricks. Apart from this, materials such as calcium silicate and concrete are also used much more. Many materials are available now but most using is clay on industry level. In 2007 bricks made with fly ash. And fly ash is using for making roads on footpath and residential areas. Fly ash are taken from thermal power plants. Bricks are the common building materials which are used in construction these days. Crushed bricks in the form of aggregates finer or coarser are called crushed brick aggregates. Bricks are very easily available material. Because natural sand is limited natural

resources thus a replacement need occurred. Brick aggregates are very low and its result in concrete is very good. Researcher has tested the aggregates bricks the got the higher compressive strength at 20% partially replaced the fine aggregate of bricks with fine aggregates of concrete. But some researcher found the decrease in the strength up to 40%. That is why is its great success to find the advantage of brick aggregates in concrete. Bricks are found in number of types because it is common usable material. The types of bricks aggregates like common burnt clay bricks aggregates, calcium silicate bricks aggregates, engineering bricks aggregates, concrete bricks aggregates, fly ash clay bricks aggregates, crushed spent fire bricks aggregates, fired brick aggregates, recycle bricks aggregates. Brick aggregates directly affects the concrete properties when concrete is in fresh state and hardened state. Fire bricks are used for inner lining of kiln meant for firing. Due to continuous exposure to high degrees of temperature about 1,800 to2,100ºC for twelve to eighteen days, if any brick keeps less strength or low strength which desired then let it out and put a new brick. The usage or replacement of fire bricks is periodical in nature in metallurgical based industries. The fire bricks disposed of after use are called as Spent Fire Bricks. The Spent Fire Brick which are the waste should be through properly without causing environmental problems in the vicinity of dump. Usually the waste materials are disposed by land filling. In the similar manner the spent fire bricks are also used as land filling material

1.2 OBJECTIVE OF THE INVESTIGATION

The main objective of this investigation is to conduct an experiment on partial replacement of fine aggregate with CSFB and aluminum dust in concrete in the proportions of 0,10%,20%,30%. And to study the strength parameters of compressive strength and flexural strength by,

1. Compression test
2. Flexural strength test

2. SPENT FIRE BRICKS

Spent fire bricks are the type or the modification of fire bricks which are withstands for higher degree temperature. The metal wastes including steel, aluminum or others are to be mixed with the crushed spent fire bricks. It is mainly to increase the strength and durability of the structure. The brick bats crushed in coarse powder form were used as a fine aggregate for making concrete. The crushed spent fire brick which is passed through 4.75mm IS sieve and retained on 75micron (0.075mm) sieve to get the grading of fine aggregate. The crushed spent fire bricks are satisfying the zone II gradation.

FIGURE 1. Crushed spent fire brick

3.ALUMINIUM DUST

Aluminium dust is obtained from the industrial wastes. It is widely used in fireworks. And a major part of the aluminium dust being a non-degraded waste and it need to be disposed properly. Since the replacement of fine aggregate with the aluminium dust may help to waste minimization and also for the efficient consumption of the natural resources. The aluminium dust combined with spent fire bricks results into the production of high strength concrete. Hence, we replace the aluminium dust with fine aggregates in 5%, 10%, 15%.

Figure 2 Aluminium dust

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, Flexural test are discussed as follows.

4.1 COMPRESSIVE STRENGTH

The compressive strength of concrete is given in terms of the characteristics Compressive Strength of 150 mm size cubes tested after 28 bays of curing. The cubes are tested as per the guidelines given in IS 516-1979. The tests are done on an electro hydraulically operated compression testing machine.

The specimen is placed in the bearing surface of the compression testing machine and compressive load is applied on opposite faces axially, slowly at the rate of 14 MPa/minute, and the result of the tested specimens are shown below,

After 24 hours, cubes extracted from forms and stored in water (curing phase) up to the time of test. Before testing, specimens were air dried for 10 to 15 minutes. The compressive strength of the specimen, σ_{Comp} (in MPa), is calculated by dividing the maximum load carried by the cube specimen during the test by the cross-sectional area of the specimen.

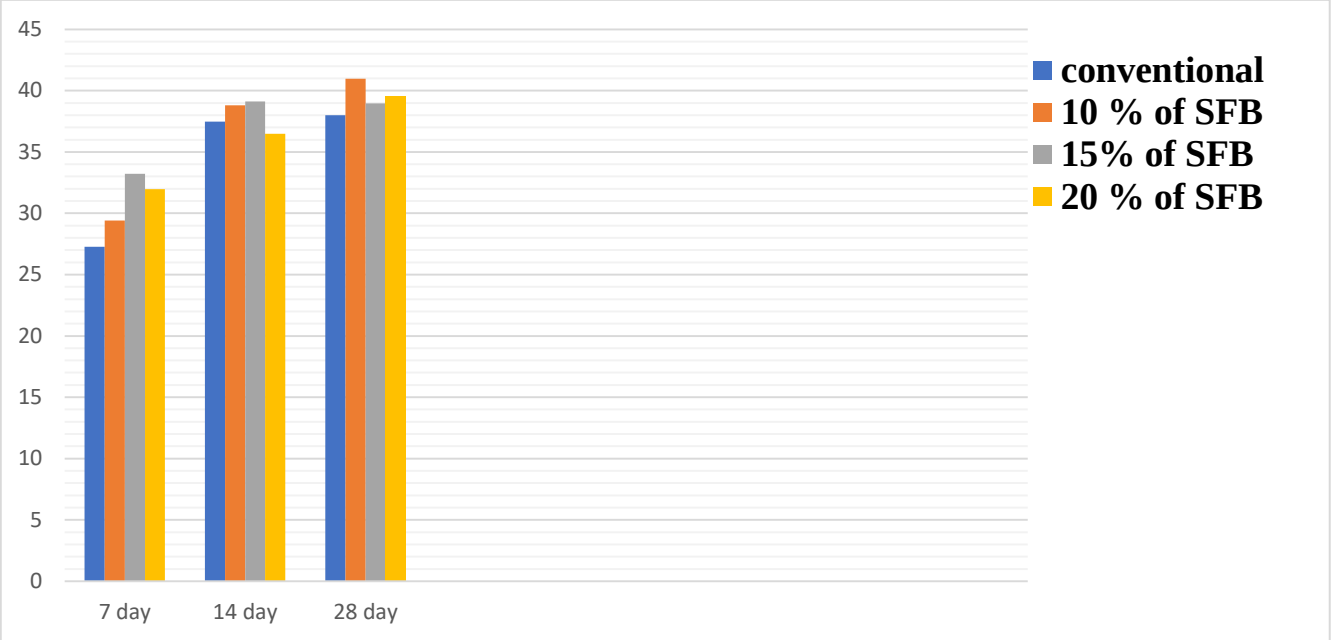

Figure 3 compressional testing values

4.2 FLEXURAL STRENGTH

The Flexural strength is one measure of the tensile strength of concrete. It is a measure of an unreinforced concrete beam or slab to resist failure in bending. After the curing period the specimen is taken out from the curing tank and wipes it clean. The dimensions of the specimen and the weight of the specimen were noted down with accuracy.

The testing machine should be provided with two rollers of 38 mm diameter on which the specimen is placed and the rollers are spaced that the between two rollers. If full contact is not obtained between the specimen and the load applying or the support blocks so that there is a gap, the contact surface of the specimen are capped. The specimen is loaded continuously and without shock at until rupture occurs. The maximum load indicated by the testing machine is recorded.

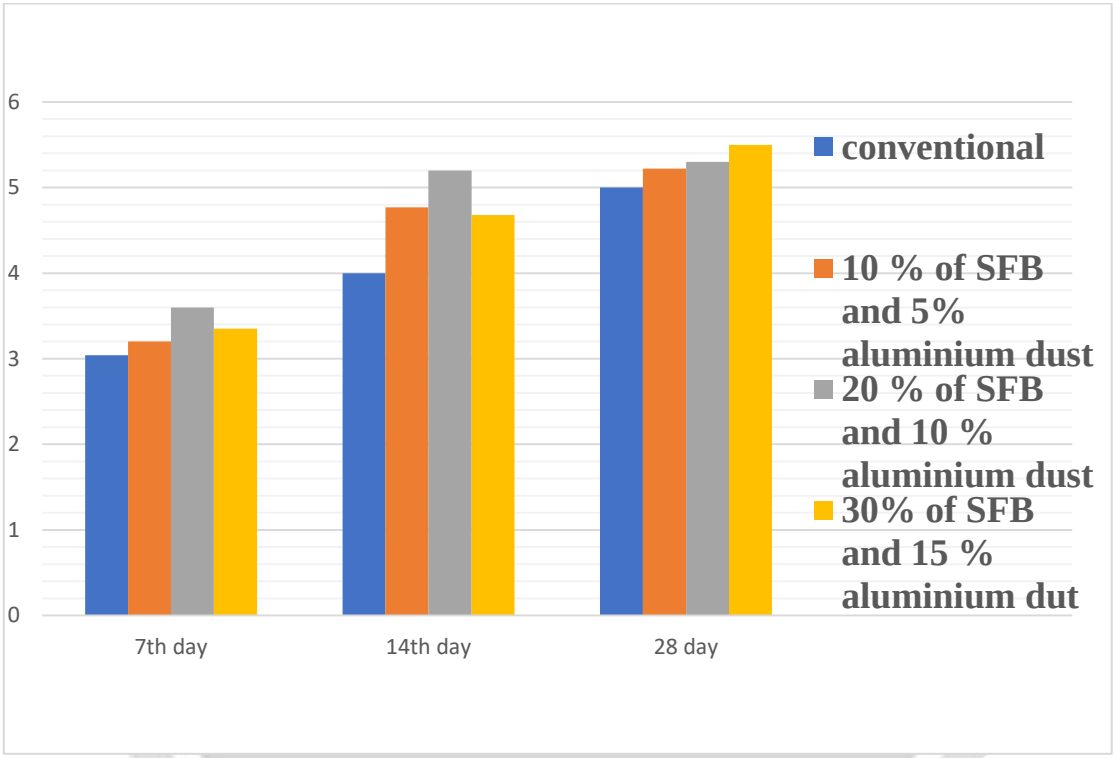

figure 4 flexural strength values

Discussion:

In this research the values of compressive strength for different replacement levels of CSFB (0%, 10%,20% and 30%) at the end of the curing periods (7 days,14 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 up to 30% replacement of sand to CSFB. The flexural strength will be decreased in 40% replacement.

5.CONCLUSION

From the test results observed, the following conclusion have been drawn:

1.The maximum size of aggregates should not be greater than 10 mm to 20 mm.

2.Angular shapes of coarse aggregates are used.

3.Slump of concrete is 70 mm.

4.Flexural strength is increased when 25% to 31% replacement is done. Optimum split tensile strength of M25 is achieved at 28% replacement

5.All procedures are done as per Indian standards.

6.Water absorption for coarse aggregates and fine aggregates are less than 2%.

7.Both fine aggregates are satisfying Zone-II.

8. From this experimental investigation, the crushed spent fire bricks would appear to be low cost materials which would help to resolve solid waste problems and preventing soil pollution.

9. It can be identified from test results that development in strength was higher for aspect ratio 33 crushed spent fire bricks increased both ductility and energy absorption of the axially compressed concrete samples.

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