International
Journal
Of Advanced Research in Engineering& Management (IJAREM)
ISSN: 2456-2033 || PP. 31-33

Effect of Broken Brick Aggregates on Strength Properties of Concrete

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Abstract: In this paper, an experimental investigation was carried out to examine the strength properties of broken brick aggregate concrete in which coarse aggregates are replaced with broken brick aggregates in the range of 0%,25%,50% and 100%. M30 grade mix was taken. A total of 24 specimens are casted. Out of which 12 are cubes of size 150mm*150mm*150 mm and other 12 are prisms of 100mm*100mm*500mm size. These specimens are tested for compressive and flexural strengths after28 days. The results showed that both compressive and flexural strength values are reduced when compared with the controlled concrete mix and 25% replacement just reached the targeted strength.
Keywords: Broken brick aggregate, Compressive strength, flexural strength

I. INTRODUCTION

Concrete is one of the most consumable materials in the world. It is made my mixing cement, sand, coarse aggregates and water. Out of these ingredients of concrete, aggregates which constitute around 75 percent of total volume of concrete which imparts higher strength to the concrete. These aggregates are obtained from natural resources. Because of continuous growth of population the requirement of infrastructures and constructions and demolitions of existed buildings are also increased which results in usage of naturally obtained aggregates abundantly. So, these naturally obtained materials may become scarcity in future. During last two decades, several studies have been carried out on replacements of aggregates by different waste products as partially or full replacement.

In this present study, broken brick aggregates are taken as the replacement of coarse aggregates which are obtained construction and demolition waste. Due to modern requirements for living and developed construction industries, the old buildings (usually constructed with brick masonry) are demolished and are replaced with new modern buildings. Demolition of buildings results in waste materials which can create waste related problems and environmental issues[1].Recently, it has been taken into consideration the use of the recycle aggregate from old concrete, clay brick and waste materials, the recycle concrete is considered as one of the most important materials in the special concrete groups[2].

II. EXPERIMENTAL METHODOLOGY

The experimental methodology involves the mix design of M30 grade of concrete. The materials used are cement of 53 grade, River sand ,Coarse aggregates of size 20mm and water. The broken bricks are collected from demolition waste in several areas at Ongole. These bricks are broken down and sieved and those aggregates of required size were collected. Several tests are conducted on broken brick aggregates as per IS 3868-1986[4]. Based on the test results the properties of collected broken brick aggregates are shown in Table 1.

The casting was done for 12 cube specimens of size 150mm*150mm*150mm and 12 specimens of prisms of size 100mm*100mm*500mm. The coarse aggregates are replaced with 0%, 25%,50% and 100% of broken brick aggregates. All the casted specimens are cured in water for 28 days. And these specimens are tested for compressive and flexural strength values on universal testing machine. The tested specimens are shown in Fig.1.

Table 1: Properties of Broken Brick Aggregates

Sl. No	Properties	Test Results
1	Bulk density, kg/m^3	1021.66
2	Aggregate Impact Value, Percent	30
3	Water Absorption,,Percent	13.84
4	Specific Gravity	2.30
5	Fineness Modulus	7.59

Fig 1: Tested Specimens

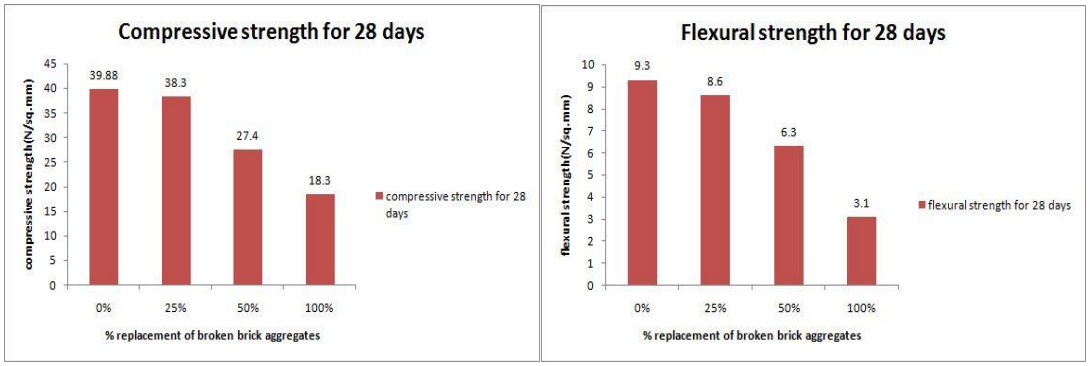
III. RESULTS

Table 2: Values of Compressive Strength for 28 days

S. No	% Replacement of broken brick aggregate	Flexural strength (28days)N/mm^2
1	0%	9.3
2	25%	8.6
3	50%	6.3
4	100%	3.1

Table 3: Values of Split Tensile Strength for 28 days

S. No	% Replacement of broken brick aggregates	Compressive strength (28days)N/mm^2
1	0%	39.88
2	25%	38.3
3	50%	27.4
4	100%	18.3



Graph 1: Variation of Compressive and flexural Strengths with % replacement of broken brick aggregates

IV. CONCLUSIONS

Based on the test results the following conclusions are given:

- This study has found that broken brick aggregates can be used satisfactory as a replacement of coarse aggregates upto 25% for making concrete of acceptable strength characteristics.
- The target compressive strength for plain concrete at 28 days was found to be 39.88 N/mm^2, for M30 grade of concrete.
- For 25% replacement of broken brick aggregates, the strength properties was resulted in almost same when compared with the results of plain concrete.
- As the percentage of broken brick aggregates increased to 50% the coarse strength was decreased by 31.29% and flexural strength is also decreased by 32.25% when compared with plain concrete.
- There is drastic decrease in the compressive and flexural strength of concrete when coarse aggregates was replaced by broken brick aggregates completely (i.e. 100%)
- The reduction in strength may be attributed to two reasons:

  (i)The crushed bricks failed to develop proper / adequate bond with concrete and cement matrix.

  (ii)Because of high porosity of the surfaces of the crushed bricks, the mixture need more water to get the required slump.

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