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Research Article

Comparative Analysis of Properties of Conventional Concrete & Light Weight Concrete Mixed With Brick Aggregate

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Abstract

The increasing value of conventional construction materials needs more research and implementation of different alternative materials in civil engineering construction. By far the required coarse aggregate which was used in concrete is obtained from crushed natural rock, but this type of rock which is suitable for concrete making is not accessible everywhere. In a north-eastern state of India brick aggregate concrete are used conservatively for ordinary concrete due to shortage of aggregate from natural resource. Due to development of concrete technology and to complete the resilience necessity it necessitated to use standard concrete, for which only stone aggregate is used, as a result, cost of construction has been skyrocketed as these are transported from other states. A mid this study, brick aggregate is utilized as light weight mix in concrete. The undertaking paper goes for examining compressive strength characteristics with complete replacement of coarse combination with brick aggregate to supply light weight concrete with completely different percentage (0%, 15%, and 30%) to urge smart strength like standard concrete. Concrete 18 cubes are casted with mix proportion (1:1:2) and their mechanical properties are determined and compared with standard concrete. The employment of brick aggregates as for standard aggregates ought to be inspired as an environmental protection and construction value reduction measure.

Keywords: *Light weight Concrete, Brick aggregate, Partial Replacement.*

1. Introduction

Lightweight concrete is the type of concrete which includes an expanding agent in that it increases the volume of the mixture and lessened the dead weight. It is lighter than the conventional concrete. Lightweight concrete or reduced density concrete, is defined as a cement based slurry, with a minimum of 20% (per volume) foam entrained into the plastic mortar. The density of this concrete usually varies from 400 kg/m^3 to 1600 kg/ m^3. Although lightweight concrete has so many advantages and superiorities over ordinary concrete, thus, the usage of this type of concrete is not as common as ordinary concrete. The reasons for low usage of lightweight concrete are the high prices of aggregates in countries whose lightweight aggregate resources are poor, lack of experience, and knowledge of workers about lightweight concrete

In this Study an attempt has been made to compare the conventional concrete and light weight aggregate concrete using different mix design. This study is focused to determine the strength parameters of light weight aggregate concrete and to find the favorable replacement of materials of conventional concrete with light weight aggregates.

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1.1 Advantages

- Addition of different light weight aggregates helps in reducing the density and to increase the thermal insulation.
- More environmental and economic benefits can be achieved if waste materials can be used.
- Using light weight natural and artificial materials is an effective solution in order to reduce the dimensions of the supporting structure.
- The risk of losses and damages resulting from earthquake.
- Other advantages of the light weight material includes its greater fire resistance, low thermal conductivity.
- Larger volume of concrete can be handled by lighter Equipment with less wear and tear on the equipment.

1.2 Disadvantages

- Difficult to place and finish because of the porosity and angularity of the aggregate.
- In some mixes the cement mortar may separate the aggregate and float towards the surface.
- Mixing time is longer than conventional concrete.

- One of the major disadvantages of lightweight concrete has been the inability to provide consistent compressive strengths and density throughout the entire area.

2. Scope of work

- To know the effect on workability, strength properties of lightweight concrete mix with varying percentage replacement of aggregates by other low density materials.
- To compare the variation of compressive strength of different material used at 7 days and 28 days curing strength with conventional cube.
- The effect of materials on compressive strength of lightweight concrete as partial replacement of fine aggregates can be analyzed.

3. Literature review

P.C.Taylor, presently a professor at Wuhan University of Technology has said that mineral admixtures affect the physical and mechanical properties of High Strength Structural Light Concrete. Addition of Fly Ash enhances the Compressive strength when fly ash was more than 20% in cementations materials.

N.P. Rajamani and P.S. Ambily, scientist, SERC, Chennai carried out the research work on "Selection of mortar for light weight aggregate concrete made with fly ash based aggregate". They concluded that conversion of fly ash with aggregate is technically feasible and are found to be light weight in nature. They found fly ash aggregate concrete up to 20Mpa can be used for production of concrete blocks for masonry construction in structures.

Prof. Jayeshkumar Pitroda, Dr. L.B.Zala, Dr.F.S.Umrigar carried out the research work on "Experimental investigations on partial replacement of cement with fly ash in design mix concrete". They found that Compressive strength reduces when cement replaced fly ash. Use of fly ash in concrete can save the coal & thermal industry disposal costs and produce a 'greener' concrete for construction.

4. Properties of Material used for testing

Cement, sand, coarse aggregate, brick aggregate, water has been used in the study. Physical properties of these materials are studied before casting if the specimen is carried out. The test results are summarized below:

4.1 Cement

The most common cement used is an Ordinary Portland Cement (OPC). The Ordinary Portland cement of 43 grade is used. Many tests were conducted on cement; some of them are specific gravity, consistency tests, setting time tests, compressive strengths, etc.

Table 1 Properties of Cement

S.no.	Test of cement	Results
1.	Initial Setting Time	32 minute
2.	Consistency	600 minute
3.	Fineness Modulus	3.5%

4.2 Fine Aggregate

Those fractions from 4.75 mm to 150 micron are termed as fine aggregate. The river sand and crushed sand is used in combination as fine aggregate conforming to the requirements of IS: 383. The river sand is washed and screened, to eliminate deleterious materials and over size particles.

Table 2 Properties of Fine Aggregate

S.no.	Test of fine aggregate	Results
1.	Sieve Analysis	2.582%
2.	Specific Gravity	2.6
3.	Water absorption	0.79%

4.3 Coarse aggregate

The fractions from 20 mm to 4.75 mm are used as coarse aggregate. The Coarse Aggregates from crushed Basalt rock, conforming to IS: 383 are used.

Table 3 Properties of Coarse Aggregate

S.no.	Test of coarse aggregate	Results
1.	Sieve Analysis	3.85
2.	Aggregate Impact Value	18.46%
3.	Specific Gravity	2.64
4.	Water absorption	0.81%

4.4 Brick aggregate

Bricks were crushed according to the specifications, maximum size were 20mm whereas the minimum size was 2.36mm.Brick chips were washed to make it clean from dust and dirt. Washed brick chips were kept until it attained the Surface Saturated Dry (SSD) condition.

Table 4 Properties of Brick Aggregate

S.no.	Characteristics	Value
1.	Max. size	20
2.	Min. size	10
3.	Specific gravity	1.96
4.	Water absorption	9.04%
5.	Fineness modulus	6.38

5. Results of Compressive Tests performed on Various Concrete Mix

This test is carried out to get compressive strength at the age of 7 and 28 days. The cubes were tested in compression testing machine of capability 1000KN.
For this purpose 18 concrete cubes were casted. For this cubical moulds of size 15 cm x 15cm x 15 cm are

used. These specimens are tested by compression testing machine after 7 days curing or 28 days curing. 6 numbers of cubes for conventional M20 concrete were casted while 6 were of 15% replacement of coarse aggregate with brick aggregates and 6 were of 30% replacement of coarse aggregate with brick aggregates. Results of these tests are shown in following table.

Table 5 Comparison of compressive strength of concrete mix (in N/mm^2)

Age of concrete	Conventional concrete	15% replacement of coarse aggregate	30% replacement of coarse aggregate
7 days	16.64	18.51	19.47
28 days	25.5	26.88	29.40

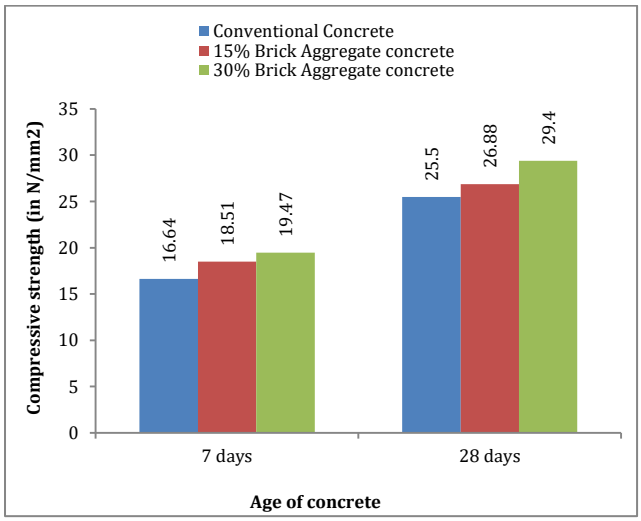

Figure1 Comparison of Compressive strength of concrete mixes

Conclusions

- The 7 days compressive strength of brick concrete was found to be 18.51 N/mm^2 for 15% replacement and 19.47 N/mm^2 for 30% replacement of brick aggregates as compare to conventional concrete which was 16.64 N/mm^2
- The 28 days compressive strength of brick concrete was found to be 26.88 N/mm^2 for 15% replacement and 29.4 N/mm^2 for 30% replacement of brick aggregates as compare to conventional concrete which was 25.5 N/mm^2
- Brick aggregates can be used as partial replacement of coarse aggregate to produce light weight concrete but bricks are more porous then conventional coarse aggregates so these mix requires higher amount of water to produce a workable concrete so water cement ratio should be kept higher.

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