JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Experimental Determination of Effect of Brick Dust on Strength and Workability of Concrete

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Abstract : Construction work is now being done on a large scale, cement concrete is in high demand. Cement concrete will be mixed with Brick Dust based on the topic. The purpose of this study was to determine the best replacement level of waste brick powder (WBP) as a partial replacement for cement. The purpose of this study is to investigate the properties of fresh and hardened states of M20 grade concrete using brick powder as a partial replacement of cement at 0%, 5%, 10%, 15%, and 20%. Cement is replaced in various proportions up to 20% by weight by waste brick powder. The benefits of using brick dust include cost savings and a reduction in the total amount of cement used in concrete. Experimental results indicate that brick dust could be used as a partial replacement for cement in concrete. The compressive strength of concrete cubes prepared with 10% cement replaced by brick powder is comparable to that of conventional concrete cubes.

IndexTerms **– Brick dust, Brick, Cement, Workability, strength.**

I. INTRODUCTION

The increasing population requires the construction of new buildings and infrastructure. This, in turn, tends to raise the rate of cement consumption, especially given the need for long-lasting buildings. Concrete production consumed a large amount of raw materials such as sand, gravel, cement, and water, some of which are considered nonrenewable resources, and cement production also results in a high CO2 emission, which causes serious environmental pollution.

Concrete is made up of cement, fine aggregates (sand), coarse aggregates and water. It is the only construction material used throughout the world in most construction works because it is the basic engineering material used in most civil engineering structures. Concrete mix design is the science of the deciding relative proportions of ingredients of concrete, to achieve the desired properties of cement concrete.

[1] Objective of the Study

[2] To assess the utility of brick powder as a partial replacement for cementitious in concrete.

[3] To investigate and contrast the performance of traditional concrete and brick powder concrete.

[4] Determine the efficiency of brick powder in increasing strength.

II. LITERATURE REVIEW

Abdelghani Naceri1 explored towards using leftover brick powder as a partial replacement for cement in cement mortar manufacture. The mechanical strength of mortar was improved by replacing 10% of the cement with discarded brick. The investigation's findings confirmed that this waste material can also be used to make pozzolanic cement.

Paulo B. Cachim investigated the properties of concrete made with crushed bricks instead of natural aggregates. The observed results indicate that ceramic residuals could be used as a partial replacement of natural aggregates in concrete without limiting concrete properties by 15% and with reductions of up to 20% for 30% replacement.

Ge. presented a study that looked at the effect of clay-brick powder (CBP) on the mechanical properties of concrete, such as compressive strength, static elastic modulus, and flexural strength. The results of the experiments showed that recycled CBP could be used as a partial replacement for cement in concrete.

Kamal Uddin studied the physical and chemical properties of brick dust as a mineral admixture (BDMA), which is considered waste from brick and tile factories in Bangladesh. Several properties of brick dust have been investigated. Concrete made with 20% cement replaced by BDMA is also resistant to chemical attack, particularly sulphate attack.

III. MATERIALS USED

- *Cement, water and Aggregates*

Concrete is made by combining a variety of economical materials such as cement, aggregates, and water. Ordinary Portland cement of IS 8112 grade 43 was utilised throughout the project. The fine aggregate used in this study was Kanhan river sand with a maximum size of 4.75 mm and grading zone II. The materials' properties are shown in Table.

S.No	Parameter	OPC used	Brick Powder	Fine Aggregate	Coarse Aggregate
1	Normal Consistency	29%	-	-	-
2	Fineness by Sieving (%) 90 micron	80	85	-	-
3	Initial Setting Time (minutes)	38	-	-	-
4	Final Setting Time(minutes)	300	-	-	-
5	Specific Gravity	3.15		2.55	2.69
6	Bulk density	-	2000	1747	1590
7	Fineness modulus	-	-	2.81	7.16
8	Water Absorption	-	-	1%	0.52%

I. *B. Brick powder*

Locally available waste brick powder, which has been sieved and grains passing through 90 microns was the primary material used. Before adding brick powder in the concrete it has to be powdered to desired size. The chemical composition of brick powder are presented in the Table.

Material	OPC	Brick Powder
SiO2	21.4	46.52%
Al2O3	5.3	10.62%
Fe2O3	3.2	4.29%
CaO	61.6	24.48%
Na2O	-	1.02%
K2O	-	1.84%
MgO	0.8	8.56%
TiO2	-	0.514%
MnO	-	0.079%
P2O5	-	0.199%
SO3	2.2	0.895%
LOI	-	0.66%
Cl	-	108 ppm

IV. Mix design proportion

Five sets of combinations were created: a standard mix without waste brick powder (WBP) and four other mixes with varied amounts of WBP replacing cement (0, 5, 10, 15, 20 percent from the cement weight). The proportions of the mix is shown in Table.

Mix proportion for using material per cubic meter.

No. of mix	Cement (kg)	Brick powder	Sand (kg)	Water/ cement	Aggregate
MWBP 0	1.32	0	1.98	0.55	3.96
MWBP 5	1.25	66.15	1.98	0.55	3.96
MWBP 10	1.18	132.3	1.98	0.55	3.96
MWBP 15	1.12	198.45	1.98	0.55	3.96
MWBP 20	1.05	264.6	1.98	0.55	3.96

V. METHODOLOGY

II. *Casting of the Specimens:*

To study the impact of replacing cement with brick powder in various ratios 36 numbers of cube of 150mm size, were cast and used as test specimens to determine the compressive strength at the age of 7,14 and 28 days. Every time three specimens were tested on the specified days, the mean value was calculated. Slump values were used to determine the workability of fresh concrete. The concrete materials were properly mixed until they had a homogeneous consistency. The cubes were compacted on a vibrating table.

VI. RESULTS AND DISCUSSION

Compressive strength test results obtained on 7^{th},14^{th} and 28^{th} day is shown in the below table:

S.No.	Brick Dust content	Compressive Strength of cubes in N/mm^2		
		7^{th} Day	14^{th} Day	28^{th} Day
1.	0%	12.88	14.52	17.48
2.	5%	13.77	15.99	17.62
3.	10%	15.10	17.63	19.55
4.	15%	12.29	14.51	17.33
5.	20%	9.31	10.37	12.30

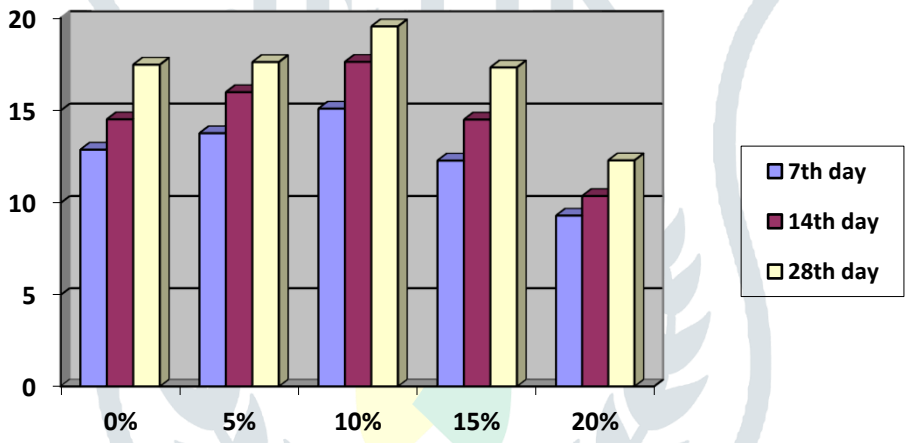

Figure1. Graph representing the result of compressive strength

From the above graph it is shown that the compressive strength is increasing till 10% brick dust and starts decreasing after that.

VII. CONCLUSION

From the result it is clear that addition of brick dust is less expansive is possible and with positive results.

By using brick dust resulted increase of compressive strength till 10% and decrease after that. The maximum compressive strength attained by concrete cubes is 19.55 N/mm^2 that is at 10% and minimum compressive strength attained by concrete cubes is 12.30 N/mm^2 at 20%.

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