International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 05 | May 2022 www.irjet.net p-ISSN: 2395-0072

Partial Replacement of Cement with brick Dust in concrete

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Abstract - *Construction is the key for the development of any Nation. Cement is the most widely used construction material on the earth after water. The production of one thousand Kg of cement releases approximately 870Kg of CO_2 in the atmosphere. This further pollutes the environment .It contributes about 4% of global total CO_2 emissions from fuel use and industrial activities[6]*

Some of the pozzolonic materials viz. fly–ash, brick powder, marble dust etc. are found to be possessing cementitious properties, hence the use of these waste materials can replace the cement by some percentage without compromising the strength and workability of cement. The reduction in the quantity of cement will reduce CO_2 content in the atmosphere, thereby saving the environment and our mother earth.

The aim of this research is to investigate the feasibility of using Waste brick powder (WBP) [4] successfully in concrete as a substitute of cement. The replacement levels were kept at 5%, 10% and 15%, compared to the reference concrete. The tests on concrete include slump and compressive strength tests. Results show an increase in workability and decrease in compressive strength after certain percentage of brick dust

Key Words: **Brick dust, Workability, Compressive strength , Binder , Aggregates**

1 INTRODUCTION

As an estimate 11 billion metric tonnes of concrete is produced per year with the quantity of aggregates covering 70– 75%, water15%, and about10–15% of the cementitious binder in one volume of concrete. As an estimate, the production of cement has increased nearly four times from the year1970. The emission of CO_2 from the production of cements causes air pollution. Further more heat of hydration produced during mixing of water with cement may destroy ozone layer. Hence to reduce air pollution, we have tried brick dust as supplementary material

2 MATERIALS & METHODOLOGY

The materials used in our project work are mentioned below

2.1 CONCRETE

Freshly mixed concrete can be moulded into any shape. The various ingredients of concrete are the cement, water aggregate mixed together in a particular proportion to control the properties of concrete in the wet as dry state. The obtained result is a hardened mass with filler and pores

2.2 CEMENT: Cement in general sense is a cohesive as well as adhesive material which binds together particles of solid matter into a compact durable mass. For our project work, 43-grade Ordinary Portland Cement (OPC) was used.

2.3 BRICK DUST: The brick dust was collected from the dressing unit of our college. The brick dust thus collected was sieved by 600 micron.

Fig. 1. BRICK DUST

2.4 AGGREGATE: The important constituents in concrete are aggregate which reduce shrinkage. Aggregates are used for providing bulk to the concrete. Both coarse and fine aggregate were used in our work.

2.4.1 Coarse Aggregate: The coarse aggregates are retained on 4.75 mm IS sieve .Coarse aggregates provide strength to concrete. In our research works the aggregates passing through 16mm IS sieve and retained on 12 mm IS sieve were used[1]. The aggregate thus used in project consist both angular and rounded grains

2.4.2 Fine Aggregate: The aggregates which passes through 4.75mm IS sieve are fine aggregates. Fine aggregates assist in producing workability and uniform mixture. For our project work, the sand passing through 4.75 mm IS sieve was used.

3 METHODOLOGY

In this research it was tried to replace the cement by equivalent fine BD (Passing through 90 micron sieve). To achieve this we have carried out various tests including workability[2] and compressive strength[3].

The various combinations for replacement of cement with brick dust were tried as under:

1. 5% brick dust
2. 10% brick dust
3. 15% brick dust

In these experimental trials, efforts were made to replace the cement with brick dust. Brick dust is disposed off as waste, resulting in soil erosion and pollution. For the study of compression and workability the values were noted before and after adding the admixture.

4 RESULTS AND DISCUSSION

27 cube specimen is of size 150mm were casted and the results thus obtained are shown in Bar charts for the comparative study and conclusion

4.1 Workability test

Table -1: Workability of concrete

% Replacement of cement with Brick dust	Workability of Normal concrete	Workability of concrete with brick dust
5%	25	28
10%	25	28.5
15%	25	29

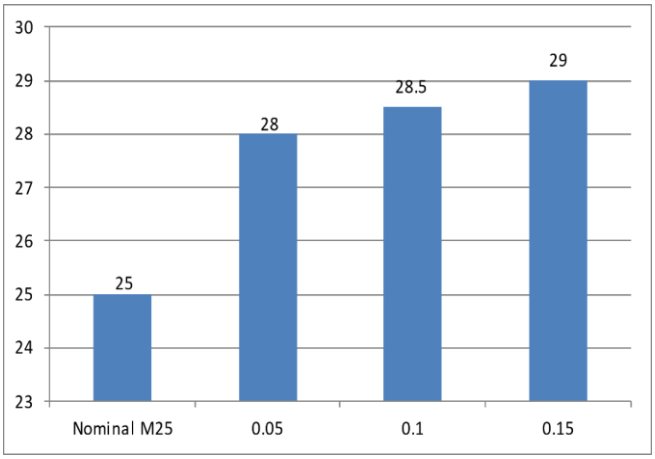

Fig.2 Comparison of workability between nominal M25 Grade concrete and concrete with brick dust5%, 10% and 15% using Bar Chart

As far as workability of concrete is concerned it was observed that the slump was about 28mm for nominal M25 grade mix. When cement was replaced by brick dust 5%, the slump was increased to 28.5mm i.e. an increase in slump as compared to nominal mix & when further it was increased to 10% the slump was29 mm i.e. an increase of slump, indicating more workable concrete[5].

4.2 Compression Test[7]

Table 2 Compressive strength of concrete (7days)

% Replacement of cement with Brick dust	Compressive strength of Normal concrete in MPa	Compressive strength of concrete with brick dust in MPa
5%	20.5	20.2
10%	20.5	19.3
15%	20.5	15.4

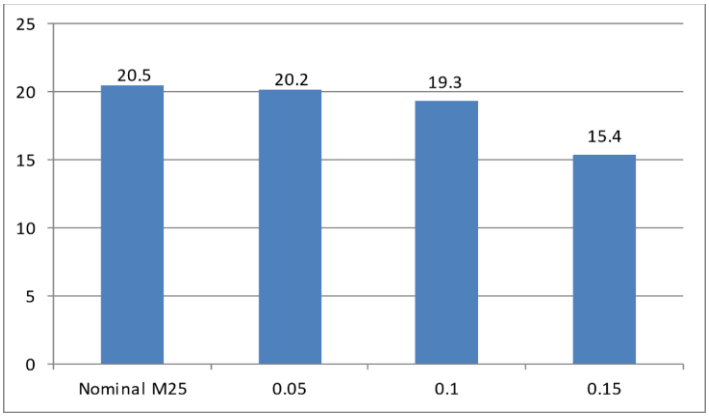

Fig.3 Compressive strength of the concrete (7 days) with brick dust 5%, 10% and 15% using Bar Chart

Table 3 Compressive strength of concrete (28 days)

% Replacement of cement with Brick dust	Compressive strength of Normal concrete in MPa	Compressive strength of concrete with brick dust in MPa
5%	31.6	31.58
10%	31.6	31.3
15%	31.6	26.23

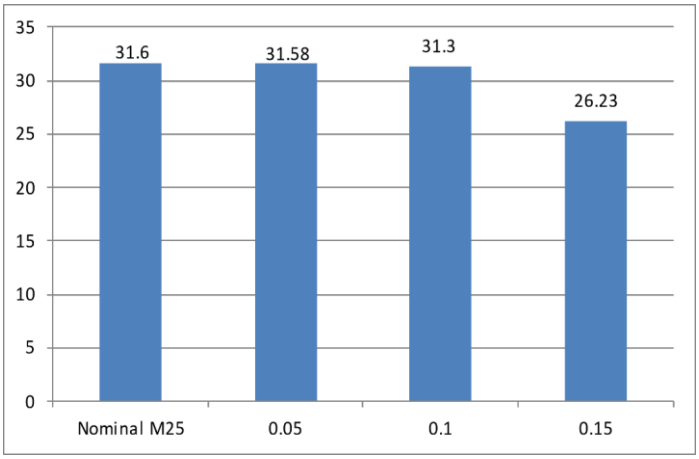

Fig.4 Compressive strength of the concrete with brick dust (28 days) using Bar Chart

5 CONCLUSIONS

The compressive strength of concrete is the most important and the sections of various structural members depend upon compressive strength of concrete. Higher the compressive strength, the lesser cross sectional required for the same amount of loading. As far as compressive strength is concerned cement was replaced by using Brick Dust in various combinations of various percentages for Brick Dust. When cubes of nominal mix were casted and tested for 7 and 28 days the strength was 20.5 MPa and 31.6 MPa respectively.

When the quantity of cement with respect to nominal mix was replaced with 5% Brick Dust, the strength of cubes was 20.2 MPa and 31.58 MPa for 7 and 28 days respectively.

When the quantity of cement with respect to nominal mix was replaced with 10% Brick Dust, the compressive strength was 19.3 MPa and 31.3 MPa for 7 days and 28 days respectively.

When the quantity of cement with respect to nominal mix was replaced with 15% Brick Dust, the compressive strength was 15.4 MPa and 26.23 MPa for 7 days and 28 days respectively.

With brick dust replacement of 5% the compressive strength of concrete was found to be nearly same for 7 and 28 days strength but at the same time more workable concrete was obtained

With the increase in percentage of brick dust to 10% for replacement of cement there was slight drop in strength by 5.85 % for seven days and 0.94% which is very negligible

With the increase in percentage of brick dust to 15%, there was drop in strength by 24.87 % for seven days and 17 % which is on higher side

Hence it can be concluded that the brick dust can be replaced up to or less than 10% for better results of compressive strength and at the same time enhanced value of workability can be obtained

Better workability will provide better compaction and lesser voids and cracks leading to increased life of structure

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