Experimental Study on Replacement of Coarse Aggregate Partially by Recycled Broken Brick Aggregate

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Abstract— By for the most common coarse aggregate used in concrete is obtained from natural rock, the type of rock suitable for concrete making is not available everywhere. In Tripura a northern-eastern state of India brick aggregate concrete are used conventionally for ordinary concrete due to scarcity of aggregate from natural source. Due to advancement of concrete technology and to fulfill the durability requirement it is necessary to use standard concrete. The stone aggregate is used; cost of construction has been sky rocked as there is transported from other states. Due to lack of availability of stone aggregate in Bangladesh, most of the old structures are constructed with brick chips as coarse aggregate, therefore the recycled aggregate investigated in the study is different from the recycled aggregate investigated in other countries which are mostly made of stone chips. The properties of recycled aggregate, such as specific gravity, absorption capacity were tested water-to-cement ratio 0.4 and 0.45 concrete specimens were tested at 7 and 28 days compressive strength. This paper presents an experimental investigation on the properties of concrete obtained by replacing stone aggregate (partly) crushed clay-brick. In this study, the coarse aggregate was partially replaced (5%, 7.5%, 10%, 20% and 30%) by brick aggregate as replacement of stone aggregate. Different relations for determination of compressive strength. Admixture Mapie is used to increase the workability, and compressive strength of concrete.

Keywords: Durability, Compressive Strength, Workability, Mapie

I. INTRODUCTION

Concrete is produced by mixing cement, sand, coarse aggregate and water to produce a material that can be moulded into almost any shape. The major volume of concrete is filled with aggregate. Aggregate inclusions in concrete reduce its drying shrinkage and improve many other properties.

In eastern and northern state of India and Bangladesh where natural rock deposits are scarce, burnt clay brick are used alternative sources of coarse aggregate .in these places of India brick aggregate are traditionally used as coarse aggregate. The use and performance of coarse aggregate are quite extensive and satisfactory for ordinary concrete. Clay and silt along with appropriate quantity of sand can be burnt in its natural from as is done in brick –making and the product may be a sources of coarse aggregate concrete.

It consist about 60 to75 percent of concrete production coarse aggregate comes from particles greater 4.75 mm but commonly in a range between 9.5mm to 3.75 mm. Therefore, the selection of coarse aggregate is vital for a good concrete mix such as it need to be clean, tough, and strong particle that free from room absorbing chemicals .the properties will affect the modulus of elasticity.

Mechanical properties brick aggregate concrete by partial replacement of natural stone aggregate by brick aggregate and it was found up to 10% replacement there is no reduction strength and by replacing coarse aggregate by brick aggregate and reduce water content up to 5-10% by replacing admixture and it was found up to 20% replacement there is no reduction strength.

Admixture MAPIE is used to increase the workability, and compressive strength of concrete up to 25%. And also reduce the initial setting time of concrete.

It is possible to produce the concrete containing crushed bricks with characteristics similar to those natural aggregate concrete provided that the percentage of brick aggregate limited to 0%, 5%, 7.5%, 10%, 20% and 30% for the coarse aggregate respectively.

II. LITERATURE REVIEW

Concrete consumption in the world is estimated at two and a half tons per capita per year (equivalent to 17.5 billion tons for seven billion population in the world) (CAMBUREAU 2008;METHA 2009) to make this huge volume of concrete , 2.62 billion tons of cement 13.12 billion tons of aggregate ,1.75 billion tons of water are necessary.

Generally, aggregate are collected by cutting mountains or breaking river gravels or boulders, or by breaking clay bricks. A significant amount of natural resources can be saved if the demolished concrete recycled for new construction. in addition to the saving of natural resources , recycling of demolished concrete will also provided other benefits ,such as creation of additional business opportunities ,saving cost of disposal , saving cost of disposal ,saving money for ;local government and other purchaser , the helping local government to meet the goal of reducing disposal. At, present, the amount of global demolished concrete is estimated at 2-3 billion tons (Torring and lauritzen 2002). Sixty to 70 percent of demolished concrete is used as sub base aggregate for road construction. (Akhtaruzzaman and Hasnat)[1] investigated the various engineering properties of concrete using crushed brick as coarse aggregate. (Khaloo) [2] studied the properties of concrete using crushed clinker brick as coarse aggregate. In both the above-mentioned studies, investigations were also done by comparing the properties of brick aggregate concrete with those for stone aggregate concrete.

(Rashid et al.) [3] Investigated the properties of higher strength concrete with brick aggregate. On the other hand, studies were done by Mansur et al. [4] comparing the properties of stone aggregate concrete with those of equivalent brick aggregate concrete obtained by replacing

stone with an equal volume of crushed brick, everything else remaining the same.

III. METHODOLOGY

Concrete specimens are casted with using of crushed bricks. The specimens considered in this study consist of 20 no's of 150mm size cubes. The specimens were cast with M30 grade concrete using 0%, 5%, 7.5%,10%,20% and 30%.partial replacement of brick aggregate as coarse aggregate.

A. Experimental Work:

1) Materials Used:

– Cement
– Fine aggregate
– Coarse aggregate
– Brick aggregate

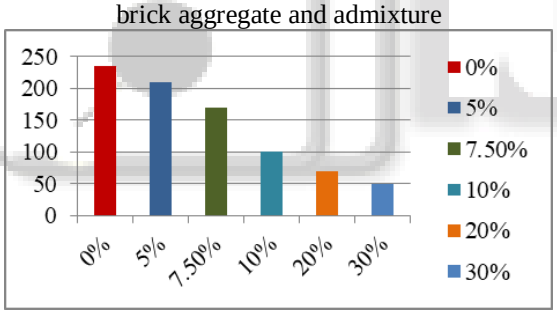
2) Test Conducted On:

– Compressive strength
– Workability

IV. RESULTS AND DISCUSSION

PERCENTAGE	SLUMP VALVE in mm	SLUMP
5%	200	High
7.5%	175	High
10%	150	High
20%	80	medium
30%	60	medium

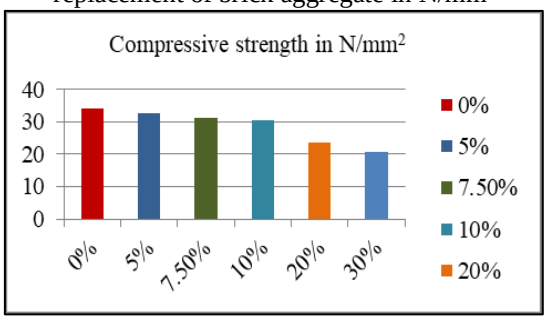
Table 1: Result on workability of partial replacement of brick aggregate and admixture



Graph 1:

PERCENTAGE	7DAYS	28DAYS
0%	18.77	34.05
5%	17.05	32.5
7.5%	13.23	31.05
10%	12.10	30.5
20%	10.03	23.4

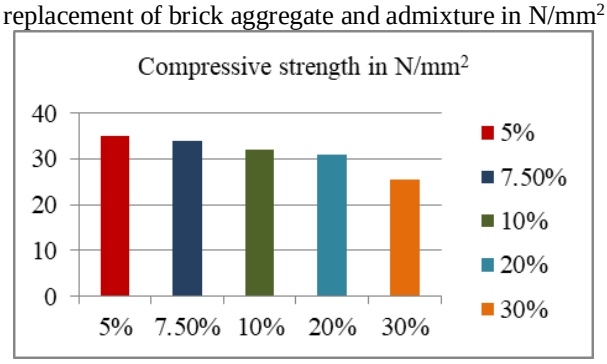
Table 2: Result on compressive strength of partial replacement of brick aggregate in N/mm^2



Graph 2:

PERCENTAGE	7DAYS	28DAYS
5%	18.91	35.05
7.5%	16.91	33.09
10%	14.23	32.01
20%	12.09	30.9
30%	9.56	25.6

Table 3: Result on compressive strength of partial replacement of brick aggregate and admixture in N/mm^2



Graph 3:

V. CONCLUSION

Crushed bricks can be used satisfactorily to produce M30 concrete keeping water cement ratio in the range of 0.40 to 0.45. This study has found that crushed bricks can be used satisfactory as coarse aggregate for making concrete of acceptable strength characteristics up 10% replacement of coarse aggregate by brick aggregate. And also found that 20% of coarse aggregate and water by brick aggregate and 5-10% of admixture. By using admixture the water content is reduce up to 5-10% and also the initial setting time is low.

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