International journal of basic and applied research
www.pragatipublication.com
ISSN 2249-3352 (P) 2278-0505 (E)
Cosmos Impact Factor-5.86

SUTABILITY OF BRICK BATS AS COARSE AGGREGATES IN CONCRETE

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ABSTRACT

Concrete is a versatile engineering material consisting of cementing substance, aggregates, water and often controlled amount of entrained air. It is initially a plastic, workable mixture which can be molded into a wide variety of shapes when wet. The strength is developed from the hydration due to the reaction between cement and water.The products, mainly calcium silicate, calcium aluminates and calcium hydroxide are relatively insoluble which bind the aggregate in a hardened matrix. The primary goal of the research is to investigate and evaluate the feasibility of employing crushed over burned brick aggregate as an alternative to costly traditional stone aggregate in concrete in order to minimize production costs, construction costs, and dead weight of a building structure. The research was conducted to study the suitability of crushed over burnt bricks as alternative coarse aggregates for concrete production. Tests were carried out to determine the physical properties of the crushed over burnt bricks aggregates. Values of 0%, 25% 50%, 75% and 100% were obtained for aggregate crushing value, aggregate impact value and aggregate water absorption respectively

Keyword: Coarse-aggregates, Concrete, Crushed over burnt bricks, Suitability, ANSYS

brick etc. For this work select a jhama class brick as

1. INTRODUCTION

Concrete is produced by mixing cement, sand, coarse aggregate and water to produced material that can be molded into almost any shape. The major volume concrete is filled with aggregate. The inclusion of aggregate in concrete reduces its drying shrinkage properties and improves many other properties such as compressive strength etc. But it is costly to transport, so local sources are needed to reduce the cost of transport, but due to geographical constraints this is not available at all places, therefore it necessitates finding other sources and alternative from local sources.

The many materials are used as a alternative source for natural coarse aggregate such as recycled low quality crushed brick, recycled coarse aggregate, coconut shell, recycled plastic aggregate, well burnt

alternative source for course aggregate. This material was chosen because in brick making, a large number of bricks are rejected duet non conformity is the distorted form of brick produced due to high temperature control in the kiln. These rejected bricks can also be potential source of coarse aggregate. According to general definition concrete is a composite material so by taking advantage of thesituation for the people, this paper presents the research that is carried out on the concrete when natural coarse aggregate is partially replaced by Jhama Class brick aggregate.

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The aims of the study are:-

To develop a mixture proportioning process to manufacture Jhama class brick based concrete.

To identify and study the effect of salient parameters that affects the properties of Jhama class brick based concrete.

To study the short- term engineering properties offers hand hardened Jhama class brick based concrete.

Concrete is one of the oldest and the most widely used construction material in today's world. It is easily obtainable, relatively cheap, strong, and durable. On the other hand, the concrete industry is one of the major consumers of the natural resources.

The annual concrete production is estimated as 11 billion metric tons, 70–75% of the number isaggregate (mostly natural rock); 15% is water; and 10–15% is cementations binder. The demand for aggregate is enormous in liberalization, privatization and globalization, and in the construction of important infrastructure projects like Expressways,Airports, nuclear plants etc.

The increased extraction of coarse and fine aggregate from the natural resources is required to meet this high demand. The increasing use of natural fine aggregate creates an ecological imbalance. Thus, partial replacement of fine aggregate is vital in construction industries. Researcher and Engineers have come out with their own ideas to decrease or fully replace the use of river sand and use recentinnovations such as M-Sand (manufactured sand), robot silica or sand, stone crusher dust, filtered sand, treated and sieved silt removed from reservoirs as well as dams besides sand from other water bodies Now a day's sustainable infrastructural growth requires the alternative material that should satisfy technical requisites of fine aggregate as well as it should be available locally with large amount.

Objectives of the Study: – To evaluate the utility of crushed brick as a partial replacement of sand in

concrete. – To study and compare the performance conventional concrete.– To understand the effectiveness of brick as in strength enhancement.

Scope of the Study: This paper presents a comprehensive study on the use of brick powder produced from clay brick demolition wastes in concrete industry. The main focus of the research is to present additional information in the field of recycling clay masonry rubbles in order to explore the possible uses of these recyclable materials in structural applications. The assessment of different properties of cement paste and concrete is presented. The current work concludes performance-based guidelines that are imperative from the cost and environmental aspects and that also can be recycled powder in concrete. Brick powder reduces weight of the concrete. With the increase in constructionactivities, there is heavy demand on concrete andconsequently on its ingredient like aggregate also. So crushed brick waste can be used as an alternative to this demand.

What Is a Brick Bat Coba?

Index in Cosmos
Jan 2017 Volume 7 ISSUE 1
UGC Approved Journal

International journal of basic and applied research
www.pragatipublication.com
ISSN 2249-3352 (P) 2278-0505 (E)
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2. LITERATURE REVIEW

Apebo, N. S., Agunwamba, J. C., Ezeokonkwo, J.

C:The research was conducted to study the suitability of crushed over burnt bricks as alternative coarse aggregates for concrete production. Tests werecarried out to determine the physical properties of thecrushed over burnt bricks aggregates. Values of 22.8%, 28.2% and 4.4% were obtained for aggregate crushing value, aggregate impact value and aggregate water absorption respectively. The concrete mixes were prepared using crushed over burnt bricks ascoarse aggregates at water – cement ratios of 0.40, 0.50, 0.55 and 0.60. Cubes of concrete were prepared and tested to study the compressive strength.

The results were compared with concrete made with river wash gravel as coarse aggregates which at present is the only coarse aggregate in Makurdi, Nigeria and its environs. The results indicate thatcrushed over burnt bricks – sand concrete is medium light weight concrete having a density between 2000-2200 kg/m3 and compressive strength of up to 29.5 N/mm2 compared to grave l – sand concrete having density between 2300-2400 kg/m3 and compressive strength of up to 30.8 N/mm2 . It can be concluded that by reducing the water-cement ratio from 0.60 to 0.40 the compressive strength of crushed over burnt bricks – sand concrete and gravel – sand concrete increase by more than 30%. Use of broken over burntbricks as coarse aggregate for structural concrete is recommended when natural aggregate is not easily available, high strength of concrete is not requiredand the bearing capacity of the soil is low.

AKSHAY N. KADU (2020) In this research, it is observed that workability decreases with increasing percentage replacement of coarse aggregate. The Compaction factor observed as 0.91, 0.901, 0.89, 0.86, and 0.84 with the ratio of percentage

replacement of coarse aggregate by over brunt brick & demolish brick bat in concrete. The compressive strength of over brunt & demolish brick concrete increases the strength by partial replacement of over brunt & demolish brick to coarse aggregate ratios 15% and 30% increases over the conventionalconcrete about 2.55%, 3.8% for 7 days, 0.68%,

2.47% for 14 days and 1.51%, 3%, for 28 days. Nitesh Bhardwaj (2020) In this investigation distinctive cement blends were set up by supplanting sand with jhama brick powder from 10% to 30%. The evaluation of cement utilized in this examination is M25 according to IS arrangement. The fundamental goal behind this work is to utilize squander material for casting concrete specimens and decrease theutilization of normally accessible sand for sustainable and waste management of resources.

N.S. Apebo (2013) In this research cubes of concrete were prepared and tested to study the compressive strength. The result indicates that the concrete havingbrickbats as aggregates may be termed medium- lightweight concrete having a density between 2000- 2200 kg/m3. To produce the same workability, the brick aggregates concrete requires a greater proportion of water than the normal gravel aggregate concrete. Use of broken over burnt bricks as coarse aggregate for structural concrete is recommended when natural aggregate is not easily available, high strength of concrete is not required and the bearing capacity of the soil is low.

Ashit Kumar (2016) In this research, they use Jhama Brick Dust as an alternative material for the fine aggregate. The Jhama Brick Dust a partialreplacement of the sand from 0%, 10%, 20%, 30%,

40%, and 50%.

The various tests are carried out such as Compressivestrength, Flexural Strength, and Split Tensile Test at an age of 7, 14, and 28 days of curing. And the Gradeof the concrete is M25 and the mix design is carried out as per IS provision. The main purpose of this research is to use the waste material for making concrete.

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TABLE:-II Properties of Fine Aggregate

3. METHODOLOGY

MATERIALUSED: -

Materials: -

Cement:

cement, in general, adhesive substances of all kinds, but, in a narrower sense, the binding materials used in building and civil engineering construction. Cements of this kind are finely ground powders that, when mixed with water, set to a hard mass.

TABLE:-I Properties of cement

Coarse Aggregate:

Coarse aggregates are any particles greater than 0.19 inch, but generally range between 3/8 and 1.5 inches in diameter. Gravels constitute the majority of coarse

Sr. No.	Characteristics	Value
1.	Type	Uncrushed
2.	Specific Gravity	2.68
3.	TotalWater	1.02%
4.	FinenessModulus	2.507
5.	GradingZone	II

Sr. No.	Characteristics	Values obtained	Tandard values
1	Normal consistency	33%	
2	Initial Setting Time	48min	Not less than 30min.
3	Final Setting Time	240min.	Not Greater Than 600min.
4	Sp.Gr.	3.09	
5	Fineness	4.8	

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FineAggregate:

Fine aggregates are essentially any natural sand particles won from the land through the mining process. Fine aggregates consist of natural sand orany crushed stone particles that are ¼" or smaller. This product is often referred to as 1/4"' minus as it refers to the size, or grading, of this particular aggregate.

aggregate used in concrete with crushed stonemaking up most of the remainder.

TABLEIII:- Properties of CoarseAggregate

Sr.No.	Characteristics	Value
1.	Type	Crushed
2.	Maximum Size	20mm
3.	Specific Gravity (20mm)	2.825
4.	Total Water Absorption Absorption(20mm)	0.995%

Jhama Class Brick

These bricks,however, possess higherstrength than the normal burnt clay bricks. Therefore one of the cheaper alternative for brick foundation, floors, roads etc. because of the fact that the over burntbricks have a compact structure and hence they are sometimes found to be stronger than even the first class brick. Over burnt bricks have high compressive strength between 120 to 150 Kg/cm^2. However they have very poor shape. Brickwork using these bricks utilizes 40% of more mortar than traditional brickwork. However this cost is offset by the price at which over burnt bricks are available. Due to over burnt, the bricks become black and its edges alsobecome curved. It is not used in brick work of building main wall, partition wall and some otherpurposes.

TABLEIV:-Comparison between CoarseAggregate and Jhama Brick Aggregate

Properties	Coarse Aggregate	Hama class brick bats
Aggregate Impact Value	7.24	19.35
Aggregate CrushingValue	16.85	32,2
Specific Gravity	2.83	2.67
Water Absorption	0.995%	11.08%

A) Mix Ratio:-

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The mix designed was prepared according to the IS-10262:2009 recommendation for concrete mix design. 1:1.54:2.08 mix proportioning ratio was determined for targeted strength of 48 MPaFor all cases 0.38 water/cement (w/c) ratio was used. Andgot a quantity of material for this mix ratio:-

TABLEV:-Quantity of Material per Cubic Meterof Concrete.

Material	Proportion by Weight	Weight in kg/m^3
Cement	1	375
F.A.	2.26	849.02
C.A.	3.04	1139
W/C	0.38	150 lit.

For 50kg cement, found the quantity of material

TABLEVI:-QuantityofMaterialper50kgCement

Material	Proportion by Weight	Weight in kg/m^3
Cement	1	50
F.A.	1.54	113
C.A.	2.08	152
W/C	0.38	19lit.

GENERAL:-

This presents the details of development of the process of making Jhama class brick bat based concrete.The materials that are required for making the Jhama class brick bat based concrete, coarse aggregates, sand and the Jhama class brick coarse aggregate as per design of mix proportion M40 are clearlymentioned in a tabular format as per IS 1026-2008.

1. Mix Preparation:-

The batching of all the ingredients was performed by weight. The sand was air dried in the laboratory before mixing. First the surface wasdamped with water then all the aggregates (Natural
Coarse Aggregate, Fine Aggregateand Jhama class brick coarse Aggregate) were spread

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on the surface area till the aggregates. After thorough mixing of aggregates cement was introduced on the ground surface and water were added slowly as per W/C ratio. The concrete was mixed for approximately three minutes after the water was added.

Mix Casting:-

It is found that the Jhama brick- bats based Concrete is dark in color and is cohesive. The amount of water in the mixture plays an important role on the behavior of fresh concrete. When the mixing time is long, mixtures with high water content bled and segregation of aggregates and the paste occurred. This phenomenon is usually followed by low compressive strength of hardened concrete. From the preliminary work, it was decided to observe the following standard process of mixing in all further studies,

2. Curing:-

b) Compressive Strength Test

All the moulds were cured by immersing in a curing tank in the lab. The specimens were brought out from water approximately 24 hours before testing and kept at room temperature till testing.

- Jhama brick-bats based Concrete Following test were conducted for this experimental work,

a) Workability test

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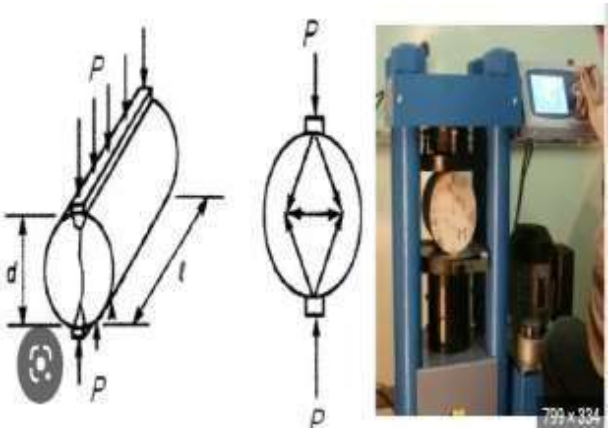
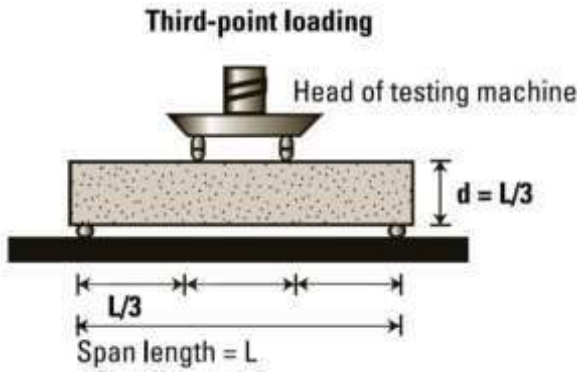
Split Tensile Strength Test



Flexural Strength Test



c) Mass Density Test

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RESULTS

Calculation of Mix proportions

- Volume of the concrete (a) = $1m^3$
- Volume of cement (b) = mass of the cement/specific gravity of the cement) x (1/1000)
- Volume of water(c) = (mass of water/specific gravity of water)

  x (1/1000)
- Volume of all in aggregate (d) = [a - (b + c)]
- Mass of coarse aggregate = *d* x volume of coarse aggregate x specific gravity of coarse aggregate x 1000
- Mass of fine aggregate = *d* x volume of fine

aggregate x specific gravity of fine aggregate x 1000Table 1 Mix proportions of all Mixes

Grade of concrete	Cement (kg/m^3)	Fine aggregate (kg/m^3)	Coarse Aggregate (kg/m^3)	Water(Lt)
M25	385	578	1155	212

Density of concrete

Concentration of concrete, also known as the weight of a cubic meter of concrete, is necessary to determine the strength of the concrete in advance. As the concrete density decreases, so do the voids and, consequently, the strength. Immediately after mixing the layers, the scale is filled with freshly mixed concrete.

Density = Weight of the Measure / Volume of the measure

Table 2 Results For Density of concrete

Percentage Replacement	0%	25%	50%	75%	100%
M25 (Kg/m^2)	2746	2682	2591	2400	2274

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Compressive strength of concrete

The concrete was filled into the mould in layers approximately of 5cm thick. Each layer was compacted by vibrating with a vibrating table till the desired compaction was achieved.

Fck = P/A

Where, P = Maximum load applied on the specimen A = area of cross-section of the specimen on whichthe load isapplied.

Table 3 Compressive strength of concrete

Percentage Replacement	0%	25%	50%	75%	100%
M25 (N/mm^2)	31.71	31.61	22.04	13.98	10.21

CONCLUTION

On the basis of the result obtained during the experimental investigation, following conclusions were drawn,

1. The compaction factor decreased as the percentage ofJhama class brick increases and increased in comparison with the conventional concrete.
2. The unit weight also decreased as the percentage of Jhama class brick and decreased in comparison with the conventional concrete.
3. Concrete made by using jhama class brick as acoarse aggregate, initially it gives the higher compressive strength for the replacement 20% and 40% after that it was to decrease for 60% and 80%.
4. The compressive strength was found 6.08%, 10.02% higher than that of conventional concrete when the coarse aggregate is replaced by 20% and 40% by Jhama class brick aggregate respectively for the age of concrete 3 days.
5. The compressive strength was found 3.73%, 8.16% lower than that of conventional concrete when the coarse aggregate is replaced by 60% and 80% byJhama class brick aggregate respectively for the age of concrete 3 days.
6. The compressive strength was found 9.23%, 12.08% higher than that of conventional concrete when the coarse aggregate is replaced by 20% and 40% byJhama class brick aggregate respectively for the age of concrete 7 days.
7. The compressive strength was found 5.69%, 9.25% lower than that of conventional concrete when the coarse aggregate is replaced by 60% and 80% by Jhama class brick aggregate respectively for the age of concrete 7 days.
8. Compressive strength of Jhama class brick based concrete was higher by 10.02% and 11.95% than that of conventional concrete for the replacement of 20% and 40% at the age of concrete 28 days. For further increased in the percentage of replacement up to 60%and 80%, the compressive strength was decreasedby2.72% and 6.87% respectively.

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