NOVATEUR PUBLICATIONS
JournalNX- A Multidisciplinary Peer Reviewed Journal
ISSN No: 2581 - 4230
VOLUME 11, ISSUE 11, November – 2025

"PARTIALREPLACEMENTOFCOARSEAGGREGATEBYJHAMA BRICK"

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Abstract:
The increasing demand for construction materials necessitates the exploration of alternative and sustainable materials to supplement conventional resources. This study investigates the feasibility of partially replacing coarse aggregate in concrete with Jhama bricks, a type of over- burnt brick that is abundantly available in certain regions. The objective is to evaluate the mechanical and durability properties of concrete while promoting waste utilization and reducing dependency on natural aggregates.

Theres earch involves preparing concrete mixtures with varying percentages (e.g., 10%, 20%, 30%) of Jhama brickaggregatesasa substitutefor conventionalcoarse aggregates. Experimental tests are conducted to assess key properties such as workability, compressive strength, tensile strength, and water absorption. Additionally, a comparative analysis is performed to evaluate the environmental and economic benefits of using Jhama brick aggregates.

Preliminary results indicate that Jhama bricks exhibit sufficient mechanicalstrengthandbondingpropertiesto serve as a viable partial replacement. Concrete with a 20% substitution shows promising compressive strength, making it suitable for certain structural and non- structural applications. The study concludes with recommendations for practical implementation and furtherresearchtooptimizemixdesignandaddresslong- term performance.

INTRODUCTION:

Concrete is produced by mixing cement, sand, coarse aggregate and water to producedmaterialthatcanbemoldedintoalmostany 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, thereforeitnecessitatesfindingothersourcesandalternativefrom local sources.

JhamaClassBrick:

Bricks are a versatile and durable building and construction material with good load bearingproperties. Various researchers havebeencarriedoutinporosity,permeabilityandabsorptionof

brick. The traditional clay bricks are manually produced by pressingclaywith certainamountofsandinthewooden mould. Then the wet bricks are first dried in the sun and air and then transportedtothebrickkilnforsubsequentburningprocess.The bricks are burntuptotemperatureof800-900Cin thebrick kiln. If the temperature in the brickkilnisuncontrolledthenthebricks areburnt excessivelyuptothetemperature1100-1200C. Dueto this the bricks are sold at cheaper rate as they become out of shape.Therefore,thistypeofbrickisknownasoverburntbrick. These bricks are also known as Jhama bricks.

LITERATUREREVIEW:

Bidve Ganesh Shivkant (2019) This project presents the effects of over burnt brick bat inclusion on the mechanical properties of concrete matrix in wet and hardenedstateproperties. For checking the mechanical properties of over burnt brick bat-based concrete used partially replaced overburnt brick bat with coarse aggregate.

Buddhi Raj Joshi (2020) investigated the use of ova burned bricka courseaggregate in concrete. The study aimed toseehowcrushed bricksarecompared toburnt bricks coarse aggregate in traditional concrete. The results of 28 days of compressive strength of natural stone aggregate a 0.45 and 0.5 Water-cement ratios were 21. 1.9Mpa and 20.2Mpa,respectively, for M20. The compressive strength of crushed over burnt brick aggregate after 28 days was 24.9 Mpa and 22.4 Mpa, respectively, at 0.45 and 0.5 Water-cement ratios.

Proof, G.N. Shete and Bidve Ganesh Shivkanth 2019) described the usage of OVER BURNT brickbus as coarse aggregate for concrete. The study aimed to see how crushed brick bats compared to burnt brickhats as course material in conventional concrete.With7and28daysofOVERBURNTbrick hat waste, the compressive strength increases from 0% to 20%, but after subsequent increases in the percentageofoverburntbrickbutwaste,compressive strength decreases.

1.1 MATERIALS

- **Cement**

Cementisdefined asabinding agentthatisusedto bind various construction materials. Given its adhesive and cohesive properties,itisanessentialingredientofconcreteandmortar. Cement is mixed with water to form a paste that binds aggregateslike sand or crushedrocks. Calcium, silicon, iron and aluminum compounds are closely ground to form a fine powderedproduct-cement.

Sr.No	Properties	TestResult
1	SpecificGravity	3.15
2	InitialSettingTime	30Min
3	FinalSettingTime	490Min
4	Soundness	10mm

- **FineAggregate**

Fine aggregates are small-sized particles, each with a specific fine aggregate size classification, used extensively in construction. They typically consist of sand, crushed stone, or crushed slag with a diameter of less than 9.5 mm. These aggregatesare essential in mixing concrete and mortar togive themixturesasmootherconsistency.Fineaggregatesalsohelp fill thetiny gaps between larger stones in concrete, improving thestructure'soverallstabilityandappearance.Theyarecrucial for achieving the right texture and strength in various construction projects

Sr.No	Properties	TestResult
1	SpecificGravity	2.74
2	FinenessModulus	2.85
3	GradingZone	2
4	Density	717 Kg/M3

- **CoarseAggregate**

Coarse aggregates are irregular broken stone or naturally- occurringroundedgravelused for making concrete.Materials whicharelargetoberetainedon4.7mmsievesizearecalled coarseaggregates,anditsmaximumsizecanbeupto63mm.
Coarseaggregatesaregenerallyobtainedbyblastinginstone quarriesorbybreakingthembyhandor bycrushers.Machine crushed stones consist of stones of various sizes whereas Hand broken aggregates consist of only single size.

Sr.No	**Properties**	**TestResult**
1	ImpactTest	39%
2	AbractionTest	40%
3	SieveAnalysis	3.75
4	WaterAbsorpition	2%
5	Shape	Anngular

- **JhamaBricks**

Jhamabricksareover-burntorexcessivelyfiredclaybricks,often discardedaswasteduringproduction.Theyarecharacterizedby theirhard,dense,darkcolor,andirregularshapes,makingthem stronger than regular burnt clay bricks. Jhama bricks are often usedascoarseaggregateinconcreteorasalow-costalternative for foundations and

road bases.

Over-Firing: Jhama bricks are produced when clay is fired at temperatures exceedingthenormalrange(1100-1200°C),causing them to be over-burnt and sometimes melt.

- **Water:**

Generally, quality of water for construction works are same as drinkingwater.Thisistoensurethatthewaterisreasonablyfree from such impurities as suspended solids, organic matter and dissolvedsalts, whichmayadverselyaffectthepropertiesofthe concrete,especiallythesetting,hardening,strength,durability,pit value, etc.

Thewatershallbecleanandshallnotcontainsugar,molassesor Gur ortheirderivatives, or sewage, oils, organic substances.

TESTPERFORMEDONMATERIAL:

SieveAnalysis

This test determines the distribution of particle sizes within a sample of Jhama brick.

Ithelpsunderstandthebrick'sgradation, which can influenceits strength, durability, and suitability for different construction purposes.

Sieve Size	Weight Retained	%Retained	Cummulative % Retained
40	416	20.26	20.26
25	485	24.25	44.51
20	417	20.55	65.06
12.5	260	13	78.06
10	105	5.11	83.17
4.75	18	0.87	84.04

- Cumulative%Retained= 375.1
- FinenessModulus=Cumulative%Retained/100

=375.1/100=3.75

ImpactTestonJhamaBrick:

DeterminationofAggregateImpactValueImpactTeston Aggregates is done to carry out to:

- Determinetheimpactvalueoftheroadaggregates.
- Assesstheirsuitabilityinroadconstructiononthebasis of impact value.
- Thepropertyofamaterialtoresistimpactisknownas toughness. Due to movement of vehicles on the road the aggregates are subjected to impact resulting in their breaking down into smaller pieces.
- The aggregates should therefore have sufficient toughnesstoresisttheirdisintegrationduetoimpact.This characteristic is measured by impact value test.

RESULT :

- Weight=300gm(A)
- Passingweight=118gm(B)
- Retainedweight=233gm
- Aggregateimpactvalue= B/A*100
- 118/300*100=39%
- StandardResult =
- Forordinaryconcrete<45%
- FORwearingsurface<30%

AbrasionTestonJhamaBrick:

To determine the abrasion value and hardness property of aggregatesasperIS:2386(PartIV)-1963.Duetothemovements of traffic, the road stones used in the surfacing course are subjected to wearing actions at thetop. When trafficmoves on theroadthesoilparticle(sand)whichcomesbetweenthewheel and road stone. Abrasiontestarecarriedouttotestthehardness propertyofstonesandtodecidewhethertheyaresuitableforthe different road structure.

Result

- WeightofBricks= 5kg
- Ovendrybricks= 4.995kg(A)
- Retainedweightonsieve=2.953kg(B)
- Abrasiontestvalue=A-B/A*100
- 4.995-2.953/4.995*100=40%
- Standardresult=
- ForordinaryConcrete=45%

METHODOLOGY

1. Atfirst,collectedthematerialsthatarerequiredformakingthe Jhama class brick bat-based concrete. Collected coarse aggregates,sandandtheJhamaclassbrickcoarseaggregateasper design of mix proportion M20.
2. Then performed various tests on those material such as, impact test , abrasion test and sieve analysis etc. to know the characteristic strength of those material.
3. ThenmixdesignpreparationaccordingtotheIS10262-2009. Prepared 6 samples by taking class brick to coarse aggregate ratios 0%,5%, 10%, 15%, 20%, 25% .
4. Afterthatperformedcastingoperationtomaketheconcrete.
5. After mixtures get hardened perform the following test on every sample to their engineering properties, • Compressive strength.
6. Then, compared the results obtained for each sample in the above test, and find out which composition yields better concrete.

RESULTSANDDISCUSSION

Compressivestrengthtest

The compressive strength of any material is defined as the resistance to failure under the action of compressive forces. Especially for concrete, compressive strength is an important parameter to determine the performance of the material during service conditions. Concrete mix can be designed or proportioned to obtain the required engineering and durability propertiesasrequiredbythedesign engineer. Someoftheother engineering properties of hardened concrete includes Elastic Modulus, Tensile Strength, Creep coefficients, density, coefficient of thermal expansion etc.

SR.NO	%OF JHA MA BRIC K	WEIG HTIN GRAM	COMPRESS IVE STRENGTH IN N/MM2		
		14DAYS	28DAYS	14DAYS	28 DAYS
1	0%	8110	8100	24.44	31.13
2	5%	7980	8000	22.30	25.50
3	10%	7940	7970	20.00	23.00
4	15%	7927	7950	19.00	22.50
5	20%	7915	7935	18.40	21.95
6	25%	7904	7910	17.40	21.08

Procedure:

Place the prepared concrete mix in the steel cube mould for casting.

Once it sets, after 24 hours remove the concrete cube from the mould.

Keepthetestspecimenssubmergedunderwaterforstipulated time.

Asmentioned,thespecimenmustbekeptinwaterfor7or14 or 28 days and for every 7 days the water is changed.

Ensurethatconcretespecimenmustbewelldriedbefore placing it on the UTM.

Weight of samples is noted in order to proceed with testing and it must not be less than 8.1Kg.

Testing specimens are placed in the space between bearing surfaces.

Care must be taken to prevent the existence of any loose material or grit on the metal plates of machine or specimen block.

The concrete cubes are placed on bearing plate and aligned properly with the center of thrust in the testing machine plates.

Theloadingmustbeappliedaxiallyonspecimenwithoutany shock and increased at therate of 140kg/sq. cm/min. till the specimen collapse.

Due to the constant application of load, the specimen starts crackingatapoint&finalbreakdownofthe specimen must be noted.

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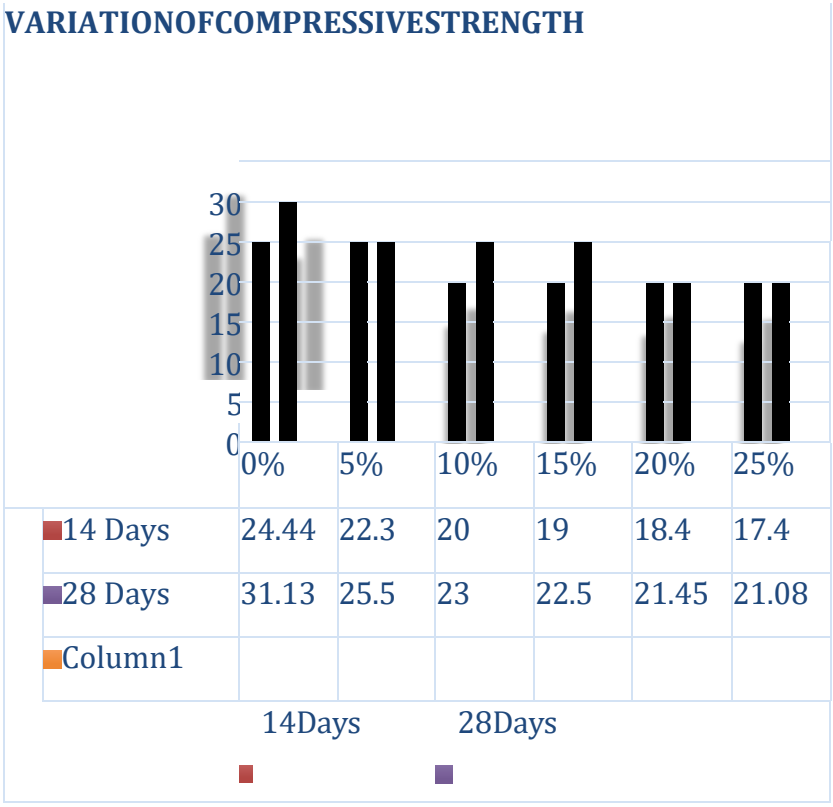

CONCLUSION:

The following inferences are drawn based on the experimental investigation of the strength and workability of concretewithpartialreplacementofcoarseaggregatesby brick ballast.

1) The 15% replacement of jhama brick is considered the best because of strength and economy, hence we use it in loaded structures.

2) Up to 15% of coarse aggregates may be replaced with brick ballasts.

3) The 25% replacement of jhama brick is considered as good replacement becauseofstrengthandeconomy, hence we use it in moderately loaded structures.

4) This study has found that crushed bricks will be used satisfactorilyas a coarsecombination for creating concrete of adequate strength characteristics.

5) Before therecommendation for use in the field, several tests should be conducted for the concrete with replaced coarse aggregates of different proportions.

REFERENCES:

1. Bazaz J.B., Khayati M., (2012) —Properties and Performance of concrete made with recycled low quality crushed brick||, Journal of Material in Civil Engineering. Vol.-24., pp.330-338.
2. Chi-Sun Poon, Dixon Chan., (2005), —Effects of Contaminants on The Properties of Concrete Paving Blocks Prepared with recycled concrete aggregate. Construction And Building Materials., pp.164-175

3. EldinN.N.,AhmadB.,(1993),—RubbertireParticleas concrete aggregate. Journal of Material in Civil Engineering., Vol.- 5,pp.478-496.
4. Gopinandan Roy, Jayanta pal, (2012), —Use ofBrick AggregateinStandardConcreteandItsPerformancein Elevated Temperature. International Journal of Engineering and Technology, Vol. 5, No. 4IS10262-2009.
5. Khalaf F.M., Devnny A.S., (2002), —New test for porosity and water absorption of fired clay brick Journal of Material in Civil Engineering, Vol.-17, pp 456-464.
6. KhalafF.M.,DevannyA.S.,(2004),—Recyclingof demolished masonry rubble as coarse aggregate in concrete review. Journal of Material in Civil Engineering., Vol.-16, PP.331-340.
7. KhalafF.M.,DevannyA.S.,(2005),—Propertiesof newandrecycledclaybrickaggregatefor usein concrete. JournalofMaterialinCivilEngineering.,Vol.-17,pp.456- 464.
8. Khaldoun Rahal, (2005), —Mechanical Properties of Concrete withRecycledCoarseAggregate||,Buildingand Environmental Science, pp 407-415.
9. Khaloo.A.R.(1994).—Propertiesofconcreteusingclinker brick as coarse aggregate.