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PARTIALLY REPLACEMENT OF COARSE AGGREGATE BY JHAMA BRICKS

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Abstract: The use of concrete is truly large and day by day the cost of the conventional material cost is also rising. So, it is beneficial to use the optional materials for making the concrete. The project focuses on coarse aggregate in concrete. In this project work, the study has been done on the replacement of coarse aggregate with demolished brick aggregate known as jhama brick. The optional source is jhama brick as a coarse aggregate. Jhama brick produced due to over burning. The brick has irregular shape and it is also used as coarse aggregate in some places where the stone aggregate is not effortlessly available or if available its cost is high. These rejected bricks can also be an implicit source of coarse aggregate. It's partly or completely a replacement of the conventional material. We replaced the coarse aggregate in ratios of 15%, 25% and 35% in M25 grade of concrete. A complete thirty-eight numbers of concrete samples are cast with and while not crushed jhama bricks. Tests are conducted on fresh and hardened cement concrete, for example, compressive strength test, split tensile tests and flexural test at 7 days and 28 days of curing period. The 25% replacement of jhama brick is considered as the best because of strength and economy, hence we use it in enough loaded structures the result shows that the aggregate that concrete derived from jhama brick aggregate attained lower strength than the regular concrete

Index Terms - Jhama brick, Compressive strength test, Split tensile test and Flexural strength

I. INTRODUCTION

oncrete is one of the most extensively used construction materials in ultramodern days. The raw materials from which it's prepared; cement and aggregates, affect both the quality and cost of construction. Aggregates are generally cheaper than cement and constitute over 70% of the volume of concrete. It has attained the status of the most favoured material in ultramodern constructions. Whenever there's a demand for Strength, Fire resistance, and endurance, concrete is always preferred and considered the best material. The availability and nearness of aggregate to the construction locality also affect the cost of construction. Bricks are adaptable and durable edifice and construction materials, with good load-bearing properties. Various studies have been carried out on the porosity, permeability, and absorption of bricks. It's reported that the properties of concrete which use crushed bricks as a natural coarse aggregate partial substitute. An experimental study has also been done to achieve progressive strength concrete using crushed brick aggregate. It has been found that even recycled brick can also be a substitute for coarse aggregate in concrete. It has shown that concrete can be successfully produced by using recycled aggregates that have been produced from obliteration and construction waste. In numerous countries, the need for locally manufactured building materials can hardly be overemphasized because there's an imbalance between the demands for housing and pricey conventional building materials coupled with the reduction of traditional building materials. To address this situation, attention has been concentrated on low-cost volition building

materials. This material was prioritized because, in brick making, a large number of bricks are repudiated due to nonconformity the deformed form of brick produced due to high-temperature control in the kiln.

These rejected bricks can also be an implicit source of coarse aggregate. According to the general description, concrete is a composite material so by taking advantage of the situation for the people, this paper presents the exploration that's carried out on the concrete when natural coarse aggregate is partly replaced by jhama brick aggregate. The ambitions of the study are-

To determine the optimum dosage of jhama bricks as partial replacement of coarse aggregate independently

1. To know about a mix proportioning process to manufacture jhama brick-based concrete.
2. To study and determine the effect of salient parameters that affect the properties of jhama brick-based concrete.
3. To study the engineering properties of jhama brick-based concrete.

1.2 Over Burnt Brick Bats

Over burnt bricks are produce by burning the raw material along with the good quality brick due to its distorted shape over burnt brick are considered as wastage but there is a scope of using the over burnt brick as a source of aggregate for construction. the over burnt brick aggregate can solve the problem of shortage of aggregate.

1.3 Brick Aggregates

Natural crushed twenty-millimeter single sized granite mixture was utilized in the investigation so comparisons might be created with the over burn brick crushed brick mixture. The collected over burn brick area unit crushed to twenty millimeter and 10mm mixture manually.

1.4 Over Burnt Brick Coarse Aggregate.

Over burnt brick used in this research were obtained from local manufacturing kiln located in Gida (Gorakhpur). First, we crushed the brick in small form in average size. After crushing over burnt brick, the resulting material was sieved through a set of sieves. Particles which size was less than 4.75mm were used as coarse aggregate replacement. These over burnt brick are also known as jham brick because size and shape of this brick are also different from standee bricks. The bricks are burnt up to temperature of 800-900C in the brick kiln. If the temperature in the brick kiln is uncontrolled then the bricks are burnt excessively up to the temperature 1100-1200C. Due to this the bricks are sold at cheaper rate as they become out of shape. Therefore, this type of brick is known as over burnt brick. These bricks are also known as Jhama bricks.

Fig 1 : Over Burnt Brick

Fig 2 : Over Burnt Brick Coarse Aggregate

1.5 Jhamma class brick.

Bricks are a versatile and durable building and construction material with good load bearing properties. Various researchers have been carried out in porosity, permeability and absorption of brick. The traditional clay bricks are manually produced by pressing clay with certain amount of sand in the wooden mould. Then the wet bricks are first dried in the sun and air and then transported to the brick kiln for subsequent burning process. The bricks are burnt up to temperature of 800-900C in the brick kiln. If the temperature in the brick kiln is uncontrolled then the bricks are burnt excessively up to the temperature 1100-1200C. Due to this the bricks are sold at cheaper rate as they become out of shape. Therefore, this type of brick is known as over burnt brick. These bricks are also known as Jhama bricks.

These bricks, however, possess higher strength than the normal burnt clay bricks. Therefore, one of the cheaper alternatives for brick foundation, floors, roads etc. because of the fact that the over burnt bricks 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/cm2. 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 also become curved. It is not used in brick work of building main wall, partition wall and some other purposes.

Bricks are a versatile and durable building and construction material with good load bearing properties. The bricks are burnt up to temperature of 800-900 degree centigrade in the brick kiln. If the temperature in the brick kiln is uncontrolled then the bricks are burnt excessively

up to the temperature 1100-1200 degree centigrade. Due to this the bricks are sold at cheaper rate as they become out of shape. Therefore, this type of brick is known as over burnt brick. These bricks are also knownasJhamabricks'

1.6 Why over burnt brick bats?

Over burnt bricks are produced by burning the raw materials along with good quality bricks. Due to its distorted shape, over burnt bricks are considered as wastage. But there is a scope of using the over burnt bricks as a source of aggregate for construction. The over burnt brick aggregate can solve the problem of shortage of aggregate. Over burnt bricks are produced by burning the raw materials along with good quality bricks. Due to its distorted shape, over burnt bricks are considered as wastage. These over burnt brick bats mixed in cement slurry after 7 days curing these brick bats used as aggregate.

For this study secondary data has been collected. From the website of KSE the monthly stock prices for the sample firms are obtained from Jan 2010 to Dec 2014. And from the website of SBP the data for the macroeconomic variables are collected for the period of five years. The time series monthly data is collected on stock prices for sample firmsand relative macroeconomic variables for the period of 5 years. The data collection period is ranging from January 2010 to Dec 2014. Monthly prices of KSE -100 Index is taken from yahoo finance.

II.LITRATURE REVIEW

1.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 conventional concrete about 2.55%, 3.8% for 7 days, 0.68%, 2.47% for 14 days and 1.51%, 3%, for 28 days.

2.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 the utilization of normally.accessible sand for sustainable and waste management of resources.

3.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 having brickbats 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.

4.Ashit Kumar (2016) In this research, they use Jhama Brick Dust as an alternative material for the fine aggregate. The Jhama Brick Dust a partial replacement of the sand from 0%, 10%, 20%, 30%, 40%, and

50%. The various tests are carried out such as Compressive strength, Flexural Strength, and Split Tensile Test at an age of 7, 14, and 28 days of curing. And the Grade of 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.

5.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 hardened state properties. For checking the mechanical properties of over burnt brick bat-based concrete used partially replaced overburnt brick bat with coarse aggregate.

6.Sonu Kumar Gupta (2020) In this project, they replace the coarse aggregate with jhama class bricks bats up to 20% and 40% for M20 grade concrete. It is observed that workability decreased with the replacement of coarse aggregate. One main thing is that weight of concrete is decreased by the use of jhama brick and the cost of concrete is also decreased due to the use of jhama brick. And in a result, they found that there is no difference in the strength of concrete due to the use of jhama class brick.

7.Nilesh Kumar (2017) The concrete cube beams and cylinders of M-25, M30, and M-35 grades were thrown in this trail to explore work and try to analyze different properties of concrete with crushed over burnt bricks as an alternative material. They found that the aggregate concrete derived from Over Burnt bricks aggregate attained lower strength than the regular concrete.

III.OBJECTIVES

In this research study main objective is to find out the properties of concrete by replacing the percentage of over brunt bricks to natural occurring coarse aggregate in concrete.
1.To identify and study of the effects of replacement percentage 15%, 30%, 45% and 60% of over brunt bricks and comparing the result with conventional concrete.
2.To study the economic feasibility of concrete by replacing the over brunt brick in concrete.
3.To identify and study the properties of hardened concrete of replacement percentage of over brunt bricks such as compressive strength test, split tensile strength test and water absorption.

IV. MATERIALS AND METHODOLOGY

4.1 Materials used

4.1.1 Material Properties.
Here, in this project we are using the material which is locally available in and all the laboratory tests regarding the material and to know their properties before using it in preparation of concrete for making the samples to be tested were done in concrete and road material lab,
4.1.2 Cement Ordinary Portland cement was using for preparation of concrete.Cement plays a vital role in the manufacturing of concrete it binds the fine aggregate and coarse aggregate together. In this work locally available cement is used which is Portland Pozzolana Cement (fly ash based) brand name is Lafarge confirming to the IS: 1489 (Part-I)
– 1991 having the specific gravity 3.14 and normal consistency 32%.

4.1.3 Fine aggregate. The fine aggregate using natural sand passing through 4.75mm sieve and sand was collected from local source.
We were used the river sand which is locally available in near-by of as fine aggregate and it contains these following properties are mention below.

Properties	Results
Specific gravity	2.67
Unit weight	1.671 gm/cc
Fineness modulus	2.60
Water absorption	0.44 %
Bulking of sand	25 %

To know the grading of sand, we have to do the sieve analysis and then after doing of sieve analysis, we get to know that the sand we have, it was of Zone-II as per IS 383 – 1970. Here is the data of sieve analysis shown below in tabular form.

4.1.4 Brick as Coarse aggregate. Brick coarse aggregate obtaining from brick industry at the size of 20mm. For the coarse aggregate we were used the locally available black crushed stone. The size of this aggregate was of between 20mm to 10mm mainly of coarse aggregate as per IS 2386 – 1963 which give us following values of test and their respective results.

In this research work we use the coarse aggregate of two different sizes 20 mm and 10 mm. The coarse aggregate was collected from local market which is from Pakur District, Jharkhand. The coarse aggregate is free from any impurities and having the specific gravity

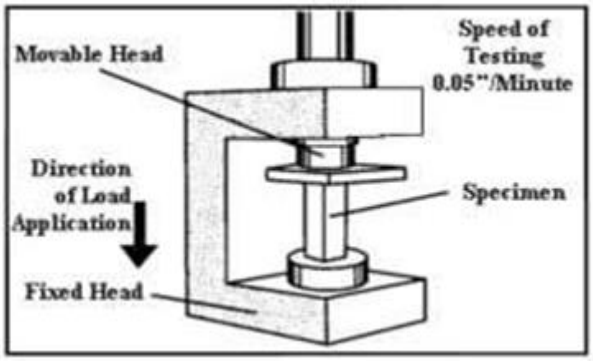
2.72 for both of the sizes. The sieve analysis was carried out for both the sizes which are given in the table below. The 20 mm and 10 mm aggregates were mixed in the ratio of 60:40. The coarse aggregates were confirming to IS 383:1970. The fineness modulus of 20 mm aggregate is 6.97 and for 10 mm aggregate are 6.31. Which are shown in table 2 and 3 respectively.

4.1.5 Water. (Chemical formula H2O) is an inorganic, transparent, tasteless, odorless, and nearly colorless chemical substance, which is the main constituent of Earth's hydrosphere and the fluids of all known living organisms (in which it acts as a solvently). It is vital for all known forms of life, even though it provides neither food, energy, nor organic micronutrients. Its chemical formula, H, O, indicates that each of its molecules contains one oxygen and two hydrogen atoms, connected by covalent bonds.The hydrogen atoms are attached to the oxygen atom at an angle of 104.45°[2] "Water" is also the name of the liquid state of H,O.

4.2 METHODOLOGY

4.2.1 Compressive Strength Test: -

The cube specimens of size 150mm X 150 mm X 150 mm were tested on compression testing machine. The bearing surface of machine was wiped off clean and sand or other material removed from the surface of the specimen. The specimen was placed in machine in such a manner that the load was applied to opposite sides of the cubes as casted that is, not top and bottom. The load applied was increased continuously at a constant rate until the resistance of the specimen to the increasing load breaks down and no longer can be sustained. The maximum load applied on specimen was recorded. Compressive strength is calculated using the formulae fc = p/A, Where, p is the maximum load A is the cross-sectional area.



4.2.2 Split Tensile Test

Test The cylinder specimens of size 150 mm diameter and 300 mm height were tested on universal testing machine and the load is applied until the failure of cylinder along the vertical diameter. When the load is applied along the generatrix an element on the vertical diameter of the cylinder subjected to a horizontal stress and found the split tensile strength using subsequent formulae. Split tensile strength is calculated using the formulae $fct=2P/\pi dl$ Where P= maximum load in Newton applied to the specimen l = length of the specimen (in mm), d = cross sectional dimension of the specimen (in mm) Flexural Strength Test Flexural strength is the ability of beam or slab to resist failure in bending. The beam specimens of size 100 mm X 100 mm X 500 mm were tested on compression testing machine. The flexural strength is expressed as modulus of rupture in N/mm². The load applied was increased continuously at a constant rate until the resistance of the specimen to the increasing load breaks down and no longer can be sustained. The maximum load applied on specimen was recorded. Flexural strength is calculated using the formulae $fb= pl/bd^2$ Where p = maximum load l= length of the specimen b= breadth An Experimental Investigation of Self-Curing Concrete.

It is method consists of a applying a diametric compressive force along the length of a concrete cylindrical specimen. This loading induces tensile stresses on the plane containing the applied load. In this test the tensile failure occurs rather than compressive failure. The maximum load is divided by approximate geometrical factors to obtain the splitting tensile strength of concrete. A compressive load is then applied along the length of the cylinder specimen until it fails because Portland cement concrete is much weaker.

Split Tensile Strength (T) = 2P/πLD Where,
T = Split tensile strength in N/mm²
P = Maximum load at failure in N.
L = length of the cylindrical specimen in mm.
D = diameter of cylindrical specimen in mm.

4.2.3 Water Absorption.

Water absorption test of concrete cube will be conducted on 150mm×150mm cube immersed in water for 24 hours before keeping in water dry weight of cube are rewarded as(W1) after 24 hours cube are removed from water and left for air drying for 30 min to 1hour then wet weight of cubes are recorded as (W2) water absorption is given by Percentage of water absorption=w2-w1/w1×100

4.3 Mix Design.

In this work we have select the M20 grade of concrete. The mix design is carried out as per the IS 10262:2009. The three trails have been prepared and finally we find the proportion for M20 grade is 1:1.5:3.05 by weight and their water cement ratio is 0.45.

Concrete grade	Mix design	Compressive Strength (mpa)	N/mm2	group
M20	1:1.5:3	20	2900	

4.3.1 Proportioning, Mixing and Casting of sample.

The proportioning was done as per the IS provision and proper care has taken while mixing and casting the sample. All materials were weighted properly and mixed in the laboratory concrete mixing machine. The water is added when all the materials are properly mixed. The cubes, beams and cylinder were casted and using the table vibrator for compacting the sample. The molds were leveled properly and after 24 hours of casting it is kept in curing tank till the date of testing the sample. The samples were tested.

Mixing process was carried out in an electrically driven rotary mixer. The batching of ingredients was carried by weight to high precision. The sand dried before use. The mixer drum was damped on inner side with water before pouring of concrete ingredient into the mixer. The dried aggregates of each batch were mixed initially in mixing machine until a homogeneous mix were achieved. After drying mixing, cement was poured into the mixer and water was introduced slowly into the mixer as per water cement ratio. After all the ingredients were in the mixing drum, the mixing drum was carried out for at least 3minutes.

V.RESULTS AND DISCUSSION

The check results obtained from concrete cube It is observe that with increase in percentage of over burnt brick bat waste workability decreases. Obtained results are tabulated in table 6 and also in graph format.

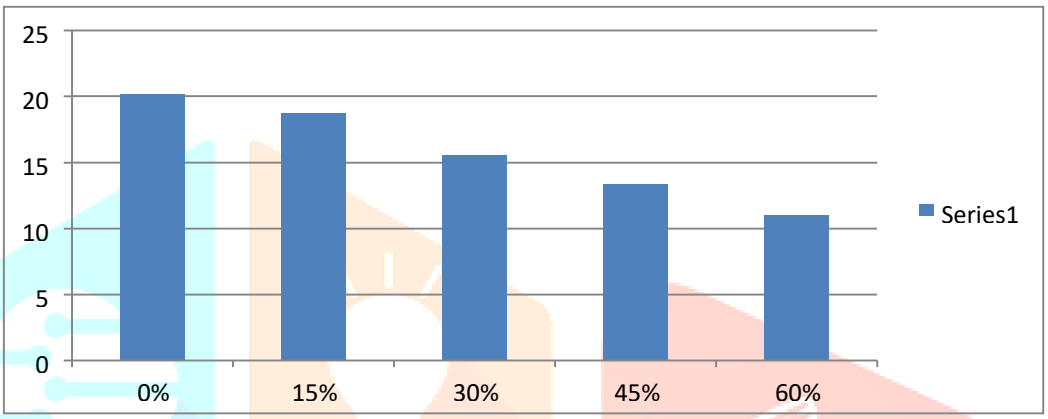
5.1 Compressive Strength Test

The result of the compressive strength with partial replacement of the Jama brick and their graphical representation.

The result of compressive strength After 21 days are recorded. Result indicates that as we increase percentage of over burnt brick bat waste from 0% to 60% its compressive strength increases but after further increment in percentage of over burnt brick bat waste there is lossin compressive strength.

S L No	Replacement	Compressive load (N)	Compressive strength in (N/mm^2)
1	**0%**	**453.5**	**20.15**
2	**15%**	**420.8**	**18.70**
3	**30%**	**350.1**	**15.56**
4	**45%**	**299.7**	**13.32**
5	**60%**	**247.3**	**10.99**

Table 1: - Result of Compressive strength



Graph 1: Result of Split Compressive strength

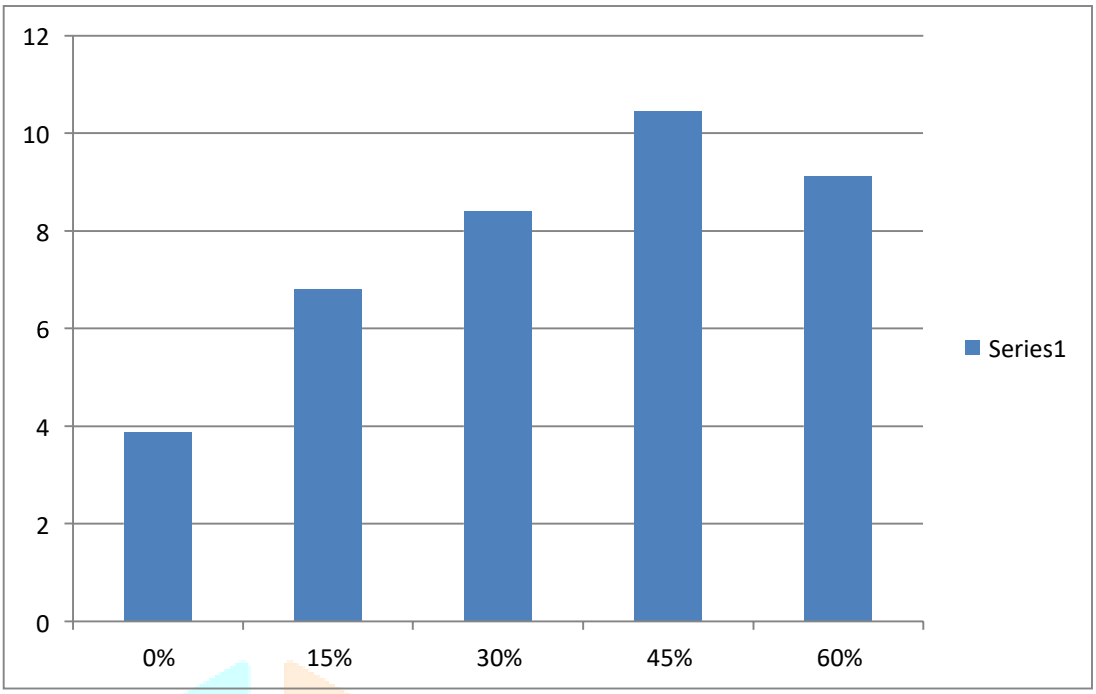
5.2 Split tensile Strength Test

The Split Tensile Strength is shown in the table percentage of with different the Jhama Brick and their graphical representation.

Results obtained are tabulated in below table. increment in the tensile strength is found for 15% replacement of coarse aggregate by over burnt brick bat waste and for 45% and 60%replacement of brick bat waste strength decreases.

SL No	Replacement	Load (N)	Split Tensile Strength
1	**0%**	**80**	**3.55**
2	**15%**	**90**	**4**
3	**30%**	**97**	**4.31**
4	**45%**	**87**	**3.86**
5	**60%**	**83**	**3.68**

Table 2:- Result of Split Tensile strength



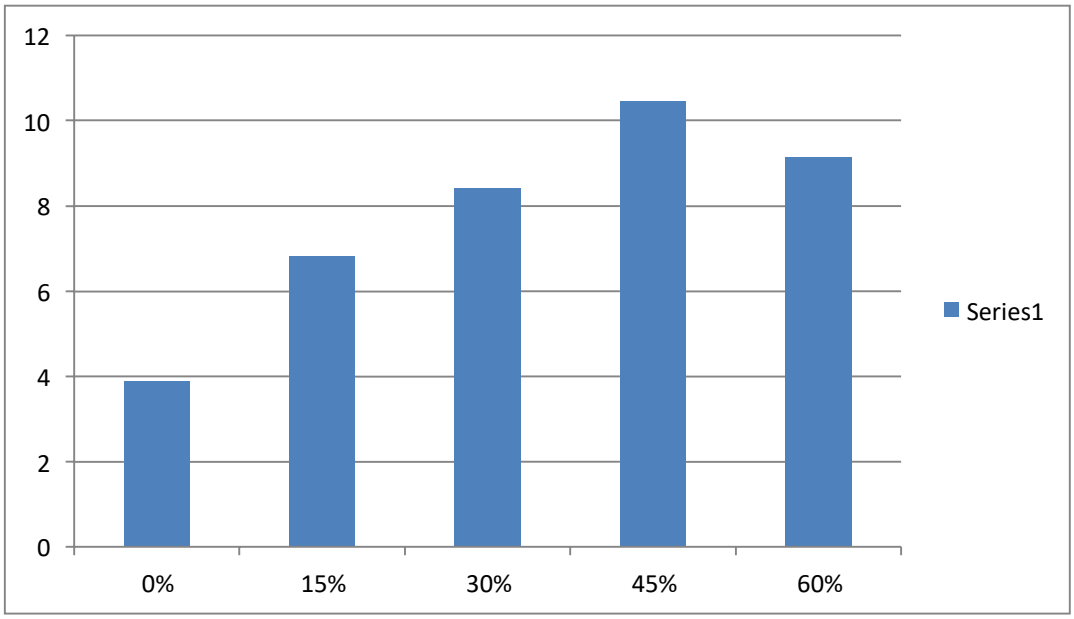
Graph 2: Result of Split Tensile strength

5. 3 Water Absorption Test

The result of water absorption test After 21 days are recorded. Result indicates that as weincrease percentage of over burnt brick bat waste from 0% to 60% its water absorption increases but after further increment in percentage of over burnt brick bat.

SLNo	Dry weight w1	Wet weight w2	Water absorption W2-w1/w1x100
1	926	962	3.88
2	882	942	6.80
3	810	876	8.14
4	720	796	10.5
5	690	753	9.130

Table 3: Water Absorption Test



Graph 3 : Water Absorption Test

CONCLUSION

The following inferences are drawn based on the experimental investigation of the strength and workability of concrete with partial replacement of coarse aggregates by 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 because of strength and economy, hence we use it in moderately loaded structures.
4) This study has found that crushed bricks will be used satisfactorily as a coarse combination for creating concrete of adequate strength characteristics.
5)Before the recommendation for use in the field, several tests should be conducted for the concrete with replaced coarse aggregates of different proportions.

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