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EFFECT OF BRICK DUST ON SOME PROPERTIES OF CONCRETE

Abdikafi Elmi Abdishakur, Abdirahim Salad Hussein, Abdullahi Mohamed Sheikh Ali*, Ahmed MohamedHassan

Department of Civil Engineering Mogadishu University.

Department of Civil Engineering, College of Engineering and Technology, Abrar University.

Tell 252615762605 PO Box 25, km6 Hodan district, Mogadishu, Somalia.

*E-mail: marwaanka9@gmail.com

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Abstract
In today's world, concrete is the most durable and widely utilized construction material. Efforts have been made to boost some unique features of concrete by adding pozzolanic elements to improve its strength characteristics and other properties for different uses. Some of the materials have been effectively used to improve concrete's fresh properties, such as consistency, workability, bleeding and settlement, plastic shrinkage, and so on, as well as its hardened properties, such as durability, strength, density, porosity, thermal and acoustic insulation, impact resistance, and so on. As a result of increased demand, natural assets have become exceedingly expensive as building materials, raising the project's overall cost. Efforts are being made to incorporate waste components into concrete, which are environmentally detrimental, readily available, and reduce the project's overall cost. The use of these waste elements in concrete reduces waste in the environment while also lowering the overall cost of structures without compromising concrete quality.Brick dust can be replaced with cement up to a certain proportion without compromising the concrete's qualities. The goal of this research is to see if brick dust may be used as a cement substitute in concrete production. In varying quantities, brick dust was used in place of cement in concrete. The performance of concrete containing brick dust was compared to the control samples developed for this investigation. In all concrete samples, the water-cement ratio was standardized at 0.65.To fulfill the study's goal, brick dust was crushed and added to the concrete mixture to substitute cement in varying proportions of 0%, 5%, 10%, and 15%. Workability and compressive strength testing were carried out in the laboratory for 7, 14, and 28 days. The results show that a 10% replacement proportion of brick dust in concrete over 28 days of curing enhanced the compressive strength of the concrete when compared to control specimens and laboratory testing. The workability of the concrete increases with the addition of brick dust to the mix. As a result, it has been established that substituting brick dust in the concrete production process is suitable.

Keywords: Effect of brick dust, compressive strength, Workability, properties of Concrete, Sustainability.

1. Introduction
Concrete is a man-made substance in which fine and coarse particles are bonded together by cement when combined with water. The process of determining the proportions of cement, water, and aggregate is known as mix design. Concrete cannot be made without cement, water, and aggregates. Mixed design must meet four criteria: strength, workability, durability, and cost. Concrete is made up of two major

components: aggregate and cement paste. Because of the chemical interaction between cement and water, the paste hardens, binding the aggregates together to form a stony mass.**(Osore & Mwero, 2019)**

A cementation material is any material that can be rendered flexible and progressively hardens to form an artificial rock-like substance. Cement, as the most expensive and active ingredient in concrete, necessitates a thorough investigation to determine the best specifications. When things go wrong and strength does not grow as planned, the cement is frequently held responsible, properly or wrongly. Cement only contributes directly to the problem about one out of every three times, and it's usually one of several contributing causes..**(Yusuf, 2018)**

Portland cement is the most common form of cement used in many parts of the globe as a basic ingredient in concrete, mortar, stucco, and most non-specialty grouts. It's a fine powder formed by grinding Portland cement clinker (more than 90%), a maximum of 5% gypsum (to shorten the setting time), and up to 5% minor components (as allowed by various standards). **(Rankin, 1916).**

Home ownership has been hampered by the high cost of construction materials.Finding alternate construction materials to traditional ones is one approach to saving costs. Brick dust is one such alternate substance. A vast number of studies have been conducted on the use of waste materials in the building sector, as well as the creation and application of blended cement.(**Yusuf, 2018)**

It is impossible to stress the importance of choosing the right aggregate type and quality. Fine and coarse aggregates account for 60 to 75 percent of the volume (70 to 85 percent by mass) of concrete and have a considerable influence on the concrete's newly mixed and cured properties, combination proportions, and economy. Fine aggregates are made up of natural sand or shattered stone with most particles less than 5 mm (0.2 in.). Coarse aggregates are made up of one or more gravel or crushed stone particles that are generally greater than 5 mm (0.2 in.) in diameter and range in size from 9.5 mm to 37.5 mm in diameter (38 in. to 112 in.). Pit-run gravel is a natural aggregate deposit made up of gravel and sand that may be utilized in concrete with very little preparation. The bulk of natural gravel and sand comes from a pit, river, lake, or seabed, and is mined or dredged. Crushed stone is made by crushing quarry rock, boulders, cobbles, and large-sized gravel. Crushed and cooled blast-furnace slag can also be used as a fine or coarse aggregate.**(Brown, 1998).**

2. Methodology

2.1 Materials used for the study

The purpose of this research study is to investigate the compressive strength of concrete using brick dust as a partial cement substitute. To assess the materials' physical and chemical qualities, they were put through a series of experiments.

2.1.1Ordinary Portland cement

The most common type of cement used as a basic element in concrete, mortar, stucco, and non-specialty grout is Portland cement. It was invented in England in the early 1800s by Joseph Aspdin from various forms of hydraulic lime, and it's mostly made of limestone. It's a fine powder formed by kilning clinker limestone and clay minerals, crushing the clinker, and adding 2–3% gypsum.

2.1.2Fine aggregate

Fine aggregates are any natural sand particles that have been mined from the ground. Fine aggregates made of natural sand or crushed stone particles with a diameter of 14 inches or less are called fine aggregates. Because of the size, or grading, of the aggregates, this product is commonly referred to as 1/4" minus.

2.1.3Course aggregate

Coarse aggregates are any particles larger than 0.19 inch in diameter, but most commonly between 3/8 and 1.5 inch. The bulk of coarse aggregate in concrete is crushed stone, with gravel accounting for the majority of the rest.

2.1.4 Water

Groundwater is preferred over other sources of water because it is available all year, is easily accessible, and does not easily deteriorate due to contamination.**(Abdikafi Elmi Abdishakur, Abdullahi Mohamed Sheikh Ali, 2022).**

We examined the water we utilized for this experiment for bacterial infection (total coli form) as well as physiochemical properties (PH, turbidity, electrical conductivity, total dissolved solids, smell, and color). **(Mohamed Sheikh Ali, Mohamed Ahmed, Warsame Hassan Arale, & Abdullahi Di, 2021).**

Workability, compressive strengths, permeability and water tightness, durability and weathering, drying shrinkage, and cracking potential are all affected by the amount of water in fresh and hardened concrete.

2.1.5 Brick dust

Brick dust is a lavish material that, when dumped, not only takes up space but also causes environmental issues that are detrimental to human health. This waste is produced by brick kilns, brick masonry construction sites, and transportation. The problem could be partially alleviated by recycling brick dust.

2.2Determination of Physical Properties of the Constituent Materials.

Several experiments were used to determine the physical qualities of the aggregates, including:

1. Specific gravity test
2. Unit weight and voids of aggregate
3. Sieve analysis test

2.2.1 Particular gravity

The specific gravity of a substance is the ratio of its mass to the mass of the same volume of water at the same temperature. The specific gravity of a material is determined by the number of voids and the specific gravity of the components that comprise it.The specific gravity results were presented in Table 2.2.1.

Figure 2.2.1.a specific gravity testfigure 2.2.1.b specific gravity test

2.3 Sieve analyze test

Sieve analysis is the process of separating a sample of aggregate into fractions of the same particle size in order to assess the aggregate's grading or size distribution. A sample of air-dried aggregate is graded by shaking or vibrating a nest of stacked sieves for a set amount of time, with the biggest sieve on top, such that the material remaining on each sieve indicates the percentage coarser than the sieve in question but finer than the sieve above.

1) Aggregate

A set of sieve sizes, an electronic weighing balance, a brush, a sample tray, a motorized sieve shaker, and a pan are among the tools used. Each sieve's retained sample was weighed, measured, and documented. Tables 3.1.1 and 3.1.2 demonstrate this.

Figure 2.3 sieve analyze test

Summery

a. SIEVE SAMPLE 1

From particle size distribution curve we obtained these results

D60=15.24038 D30=12.12625 D10=10.05016

CO-EFFICIENT OF UNIFORMITY, CU=$\frac{D60}{D10}=\frac{15.24038}{10.05016}$=1.516

Co-efficient of curvature =$\frac{D30^2}{D60xd10}=\frac{(12.12625)^2}{15.24038x10.05016}$=0.96

b. SIEVE SAMPLE 2

From particle size distribution curve we obtained these results

D60=30.89791 D30=24.53377 D10=20.29101

CO-EFFICIENT OF UNIFORMITY, CU=$\frac{D60}{D10}=\frac{30.89791}{20.29101}$=1.522

Co-efficient of curvature =$\frac{D30^2}{D60xd10}=\frac{(24.53377)^2}{30.89791x20.29101}$=0.96

2) Brick dust

First we broke the brick dust and put in machine to make it dust after that we applied sieve 150 micron.

Figure 2.4 Brick dust

2.4 Unit weight and void of aggregate

This test process determines whether fine and coarse material is compacted or lose by unit weight. The aperture was made with a tamping rod and a balance.

Procedure: Three different processes are frequently employed to determine unit weight. The shoveling method, the roping process, and the jigging procedure are as follows: a) the shoveling technique; b) the roping procedure; and c) the jigging procedure.

The shoveling method for loose unit weight should only be used when specifically requested. Otherwise, for aggregates having a nominal maximum size of 1.5 in (37.5mm) or less, the compact unit weight should be determined by rodding, and for aggregates with a nominal maximum size of more than 1.5in (37.5mm) but not exceeding 6 in, the compact unit weight should be determined by jigging (150mm).

Figure c jigging

1.5 Mix Design

When designing a concrete mix, we used a specified standard mix "1:2:4" to ensure the proper ratio or mix so that an economical concrete mix may be manufactured that meets its required strength, durability, uniformity, and appearance. In this study, aggregates are divided into coarse gravel aggregates and fine sand aggregates. Despite the fact that there are numerous different varieties of cement available, this research concentrates on common Portland Cement (OPC). The most prevalent component in a basic concrete mix is gravel. Gravel is used to help strengthen concrete while also providing cement and brick dust to the mix. Before casting the concrete, we prepared the necessary components.

2.6 Methods

2.6.1 Mixing

The aggregate is dampened in water first, then cement, sand, water, and brick dust are mixed together. The water/cement ratio has an inverse relationship with the strength of concrete. In general, the more water is used to mix the concrete (the more fluid the mix), the weaker the concrete mix becomes. The stronger the concrete mix is, the less water is necessary to mix it (dry yet workable). By weighing dry components in kilos, precise concrete mixing ratios were obtained. And keeping track of the mixing ratios to maintain a consistent concrete mix throughout the project.

After preparing the essential materials, concrete is mixed using a pan mixer, first mixing aggregates, cement, and sand, then gradually adding brick dust, and finally mixing water into the blended materials. A typical 1:2:4 mix ratio was utilized. This is because it is the most widely employed reinforced concrete ratio on construction sites.

Figure 2.6.1 mixing of concrete

2.6.2 Workability

i. Slump test

Tests on workability of the concrete are preformed


Figure 2.6.2.i slump test figure2.6.2. I slump test

The findings of the slump test are as follows:

a. If the concrete settles uniformly, it's known as a "TRUE SLAMP," and its volume may be estimated.

b. SHEAR-SLUMP: Shear-slump occurs when one-half of a cone slips down and is difficult to quantify. It can be found in severe mixtures (mixes deficient in fine aggregate).

c. COLLAPSE-SLUMP: When the mold is removed, concrete collapses and slumps. It happens in extremely damp environments.

Table 2.6.2
I slump test value

Very low	0-25	Very dry mixes used in road making roads vibrated in machine
Low	25-50	Low workability mixes used for foundation with light reinforcement
Medium	50-100	Medium workability mixes manually compacted flat slaps with crushed aggregates
High	100-175	High workability concrete for sections with congested reinforcement

ii. Vee bee test

The Vee-Bee test indicates the mobility and compatibility of freshly mixed concrete. The vee-bee test measures the relative effort required to alter the mass of concrete from one form to another. That is, according to the test, by vibrating from the conical shape to the cylindrical shape. The effort is measured in seconds by measuring the time. The remolding effort is the amount of work measured in seconds.

Figure 2.6.2.ii vee bee test

iii. Compaction factor test

The compaction factor test is the workability test for concrete conducted in a laboratory. The compaction factor is the ratio of the weights of partially compacted to fully compacted concrete. It was developed by the Road Research Laboratory in the United Kingdom and is used to determine the workability of concrete.

Figure 2.6.2.iii compaction factor test

2.6.3Casting

The casting of all specimens was carried out under the same different conditions due to the different percentages of 0 percent, 5 percent, 10 percent, and 15 percent of brick dust added to the volume of the cement. The necessary sample was taken from fresh concrete. The test was carried out, and then the utilized amount of concrete was poured back to the source, blended once more to make a homogeneous mix, and concrete was poured into the molds. The steel cube molds for the test specimens were properly cleaned and lubricated on the internal sides.

Figure 2.6.2 casting

1.6.4 Compaction

Three layers of mixed concrete were poured into the mold. Each layer of concrete was crushed with at least 25 strokes of a 25mm steel rod until complete compaction without segregation was achieved. The top surface was completed with a hand trowel after the last layer was compacted.

2.6.5 Curing

The specimens were remained in the cube mold for 24 hours.

After that we removed the molds with care so that no edges were broken and were placed in the tank for curing. After that the specimen by removing them out of the cube molds, the cubes were placed in the water for 7 days, 14 days, and 28 days.

Figure 2.6.2curing

2.7Compressive strength test

A compressive strength test is a mechanical test that determines how much compressive stress a material can withstand before cracking. A progressively applied load compresses the test item, which is common in the shape of a cube, prism, or cylinder, between the platens of a compression-testing machine. Compressive strength tests were used to assess the compressive strength of concrete cubes on the 7th, 14th, and 28th days of the casting period. For the concrete cylinder to pass, the test result must be greater than the standard stipulated strength. The compressive strength of concrete ranges from 15 MPa (2200 psi) to 30 MPa (4400 psi) residential concrete and is high in commercial structures. Some applications use forces greater than 10,000 psi (70 MPa).

Figure 2.7.0 compressive strength figure 2.7.1 compressive strength

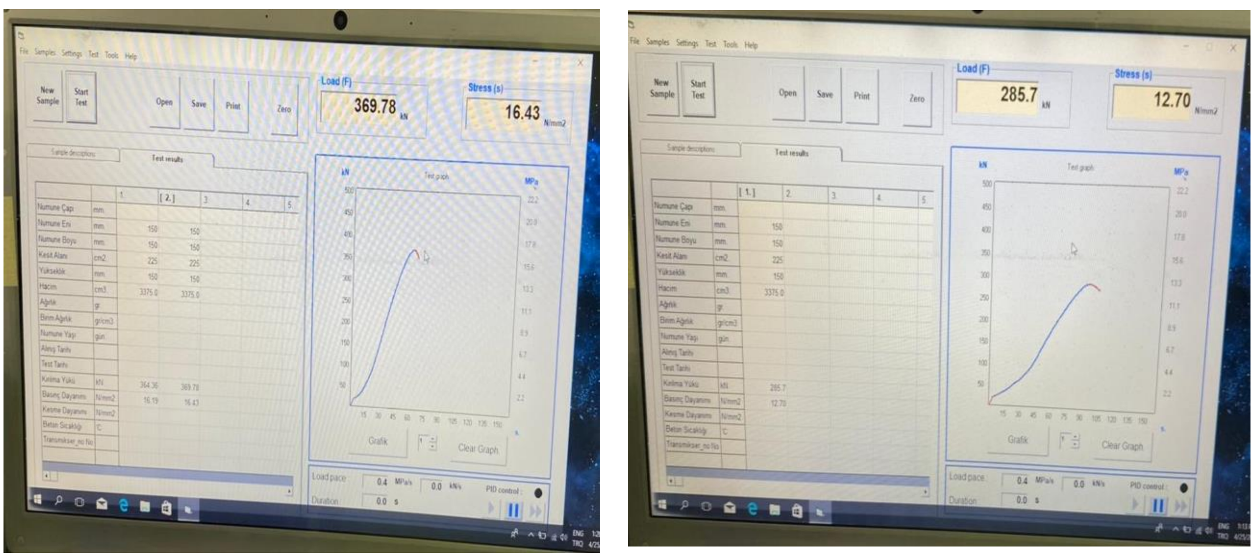

Figure 2.7.2 Compressive strength crushing load.

2. Data Analysis

The following tables and graphs show the findings of laboratory work on the chemical composition of brick dust, specific gravity, water absorption, bulk density of aggregates, sieve analysis of aggregates, and compressive strength after 7, 14, and 28 days of curing:

3.1sieve analyses

Sieve sample 1

500 g of aggregate (sample 1) is taken from a bag full of aggregate and poured into a sieve shaker after that sieve shaker is turned on for 3 minutes.

Table 3.1.1 indicates the material retained in each sieve, the percentage of materials retained in each sieve, the cumulative percentage retained, and the percent finer. And finally, to find the fines modulus (FM), which is an index number that represents the mean size of the particles in sand. It is calculated by performing sieve analysis with standard sieves. The cumulative percentage retained on each sieve is added and subtracted by 100, giving the value of the fineness modulus.

Table 3.1.1 Sieve analyses

Sieve Number	Sieve Opening mm)	Materials Retained (gm.)	% Materials Retained	Cumulative % Retained	% Finer
3 inch	76.2	0	0	0	100
1.5 inch	38.1	0	0	0	100
¾ inch	19.05	33	3.30	3.30	96.7
3/8 inch	9.5	920	92	95.3	4.7
# 4	4.75	25	2.50	97.8	2.2
#8	2.36	0	0	97.8	2.2
#16	1.19	1.5	0.15	97.95	2.05
#30	0.59	1.5	0.15	98.1	1.9
#50	0.30	3.5	0.35	98.45	1.55
#100	0.15	12	1.2	99.65	0.35
Pan	-			-	
Total	-	999			-
FM	$FM=\frac{0+0+3.30+95.3+97.8+97.8+97.95+98.1+98.45+99.65}{100}=6.9$				

Particle size distribution curve of sieve sample 1

Figure 3.1.1 depicts the particle size distribution curve, which is a graph that is constructed to depict the average particle size, the smallest particle size, and the greatest particle size from the preceding table (3.1.1). The amount of material that goes through or is kept on each sieve is depicted by the curve. The amount of material that goes through or is kept on each sieve is depicted by the curve. In general, a good sample should follow the same particle size distribution curve every time it is run.

D60=15.24038 D30=12.12625 D10=10.05016

CO-EFFICIENT OF UNIFORMITY =1.516

Co-efficient of curvature =0.96

From the graphs plotted in figures 3.1.1. Of sieve analysis based on the data obtained from tables 3.1.1, for sample 1 of aggregates, it can be deduced that up to a reasonable extent; the particles are uniformly graded.

A value of Cu greater than 4 to 6 classifies the soil as well graded. When Cu is less than 4, it is classified as poorly graded or uniformly graded aggregate

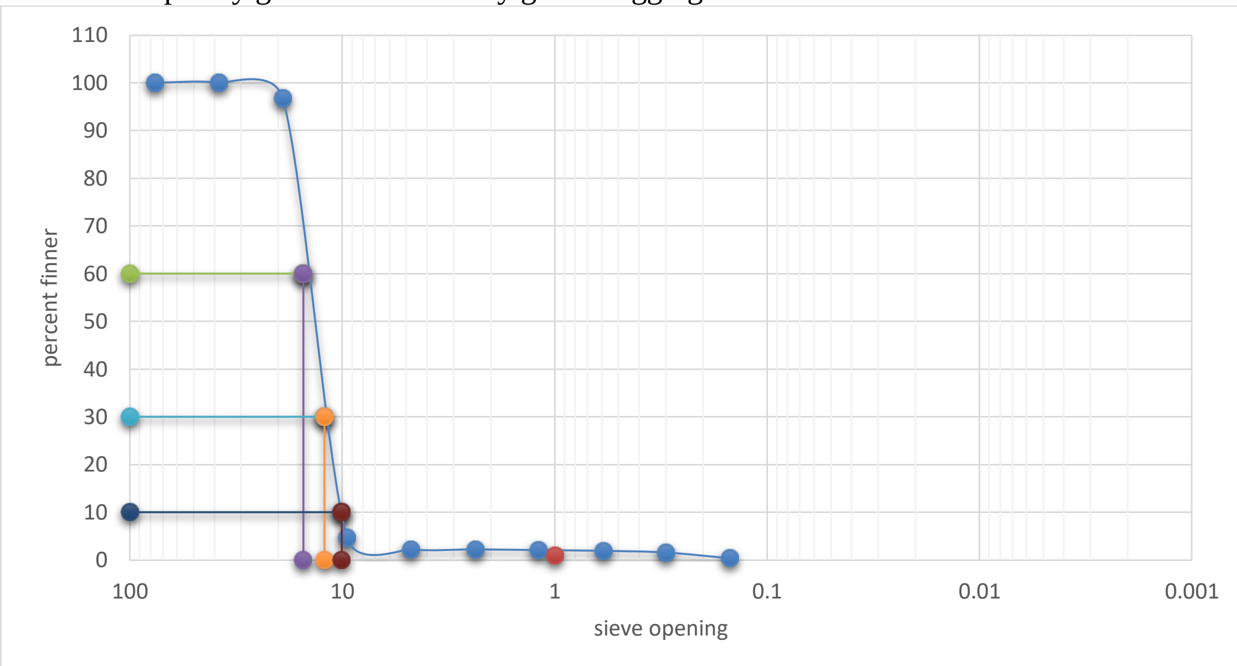

Figure 3.1.1 particle size distribution curve

Sieve sample 2

500 g of aggregate (sample 2) is collected from a full bag of aggregate and poured into a sieve shaker, which is then turned on for three minutes. The material retained in each sieve, the percentage of material retained in each sieve, the cumulative percentage retained, and the percent finer is all listed in Table 3.1.2. Finally, the fines modulus (FM), which is an index value that measures the mean particle size in the sand, must be determined. Sieve analysis with conventional sieves is used to compute it. The fineness modulus is calculated by adding and subtracting the cumulative percentage retained on each filter by 100.

Table 3.1.2 Sieve analyses

Sieve Number	Sieve Opening (mm)	Materials Retained (gm)	% Materials Retained	Cumulative % Retained	% Finer
3 inch	76.2	0	0	0	100

1.5 inch	38.1	60	6.05	6.05	93.95
¾ inch	19.05	890	89.8	95.85	4.15
3/8 inch	9.5	22.5	2.27	98.12	1.88
# 4	4.75	0	0	98.12	1.88
#8	2.36	0	0	98.12	1.88
#16	1.19	0	0	98.12	1.88
#30	0.59	0	0	98.12	1.88
#50	0.30	3.5	0.35	98.47	1.53
#100	0.15	3.5	0.35	98.82	1.18
Pan	-	11.5	1.16		
Total	-	991			-
FM	$\frac{6.05+95.85+98.12+98.12+98.12+98.12+98.12+98.47+98.82}{100}=7.89$				

Particle size distribution curve of sieve Sample 2

The particle size distribution curve of the aggregate of the preceding table (3.1.2) is depicted in Figure 3.1.2, which is a graph that shows the average particle size, smallest particle size, and greatest particle size. The amount of material that goes through or is kept on each sieve is depicted by the curve. The amount of material that goes through or is kept on each sieve is depicted by the curve. In general, a good sample should follow the same particle size distribution curve every time it is run.

D60=30.89791 D30=24.53377 D10=20.29101

CO-EFFICIENT OF UNIFORMITY, =1.522 Co-efficient of curvature =0.96

From the graphs plotted in figures 4.1.1.1 and 4.1.2.1 of sieve analysis based on the data obtained from tables 4.1.1, and 4.1.2 for sample 1 and sample2 of aggregates, it can be deduced that up to a reasonable extent; the particles are uniformly graded.

A value of Cu greater than 4 to 6 classifies the aggregate as well graded. When Cu is less than 4, it is classified as uniformly graded soil

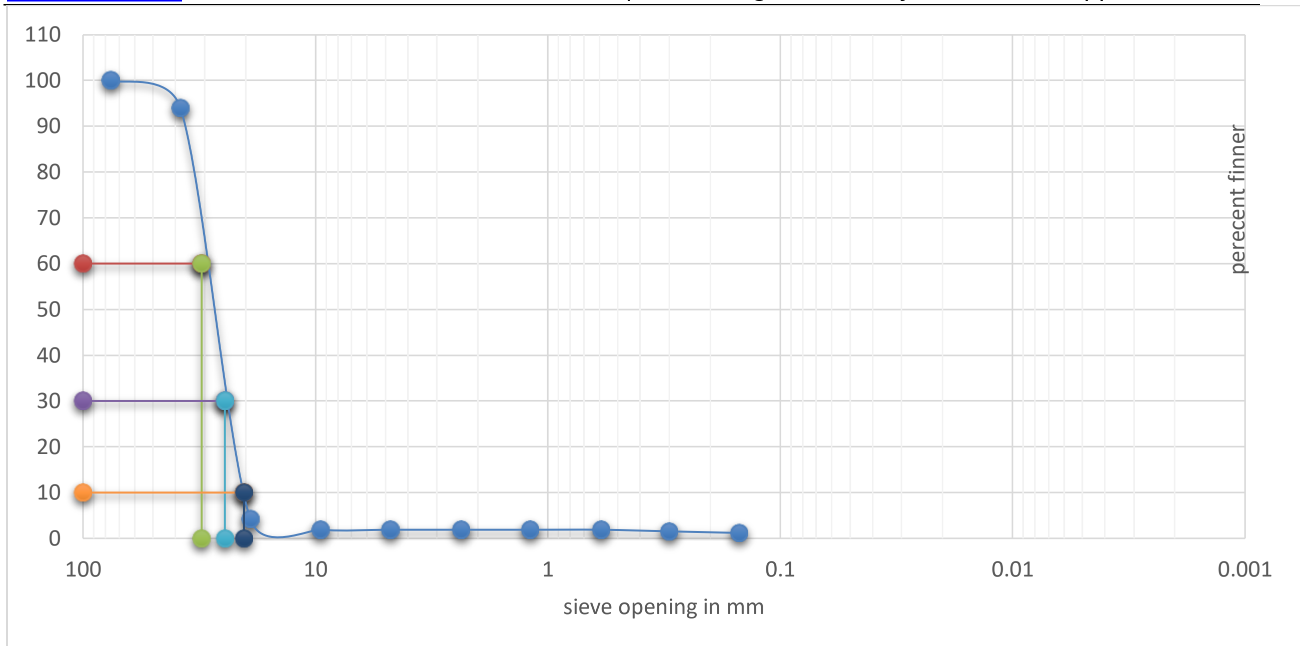

Figure 3.1.2. Particle size distribution curve

3.2 specific gravity

Table 3.2.1 describes specific gravity and absorption capacity of course aggregate.
Figure 4.2.1 shows the relationship between specific gravity (Gsb, Gsb SSD, Gsa) and course aggregate absorption capacity. Because the volume computed contains voids permeable to water, the Gsb (bulk specific gravity) will always be the lowest number in terms of specific gravity. Because the volume determined only contains the "solid" aggregate particle, the Gsb SSD (bulk specific gravity at SSD) will always be the intermediate value, and the Gsa (apparent specific gravity) will always be the greatest (does not include those voids permeable to water). When it comes to comparing specific gravity and absorption capacity, absorption has the highest value. When performing this test, double-check that the estimated numbers make sense in respect to one another.

Table 3.2.1 specific gravity

Test No.	Wt of CA in air (SSD) B (g)	Wt of CA in water (SSD) C (g)	Wt of CA in air (OD) A (g)	Bulk Sp.Gravity (SSD)	Avg. Bulk Sp.Gravity (SSD)	Bulk Sp. Gravity (OD)	Avg. Bulk Sp. Gravity (OD)	Apparent Sp. Gravity	Avg. Apparent Sp. Gravity	% of Absorption	Avg. % of Absorption
1	1.05	0.52	0.99	1.98	1.78	1.86	1.67	2.1	1.88	6.01	6.64
2	0.59	0.22	0.55	1.59		1.48		1.66		7.27	

Result:

Tests	Results
Bulk Specific Gravity (S.S.D. Basis), Ss	1.78
Bulk Specific Gravity (Oven-Dry Basis), Sd	1.67
Apparent Specific Gravity, Sa	1.88
Absorption Capacity, A (%)	6.64

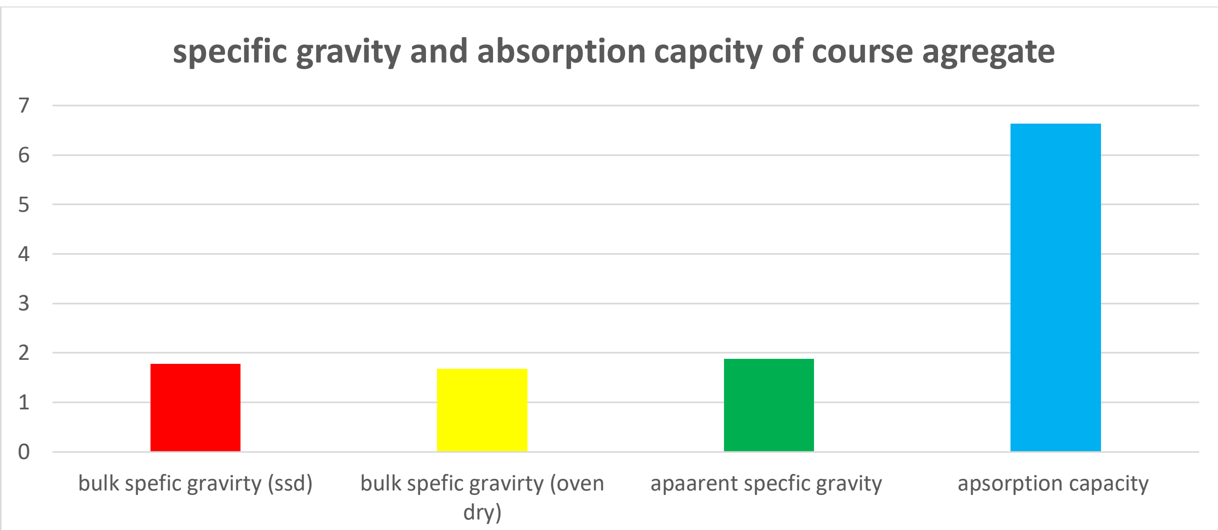

Figure 3.2.1. Specific gravity chart

3.3Unit weight and voids of aggregate

The unit weight and voids of aggregate are described in Table 3.3.1 using three alternative processes.

Figure 3.3.1 shows the unit weight and voids of course aggregate using three different procedures: shoveling, rodding, and jigging. It also shows that the jigging procedure has the highest unit weight and voids because it fits in the ground 50 times, which equals 150, causing the aggregate to compact densely. It also mentions that the rodding method is more difficult than shoveling.

Table 3.3.1 unit weight and voids of aggregate

Test #	Test Method	T (kg)	G(kg)	V (m3)	M (kg/m3)	Avg. M (kg/m3)	Mssd (kg/m3)	% Void
1	Shoveling	5.02	9.01	0.0041	973	970	1037	41.73
2		5.02	8.99	0.0041	968		1032	42.035
3								
4	Rodding		9.59	0.0041	1114	1099	1187	33.29
5			9.47	0.0041	1085		1157	35.02
6								
7	Jigging		9.69	0.0041	1139	1128	1214	31.79
8			9.6	0.0041	1117		1191	33.11

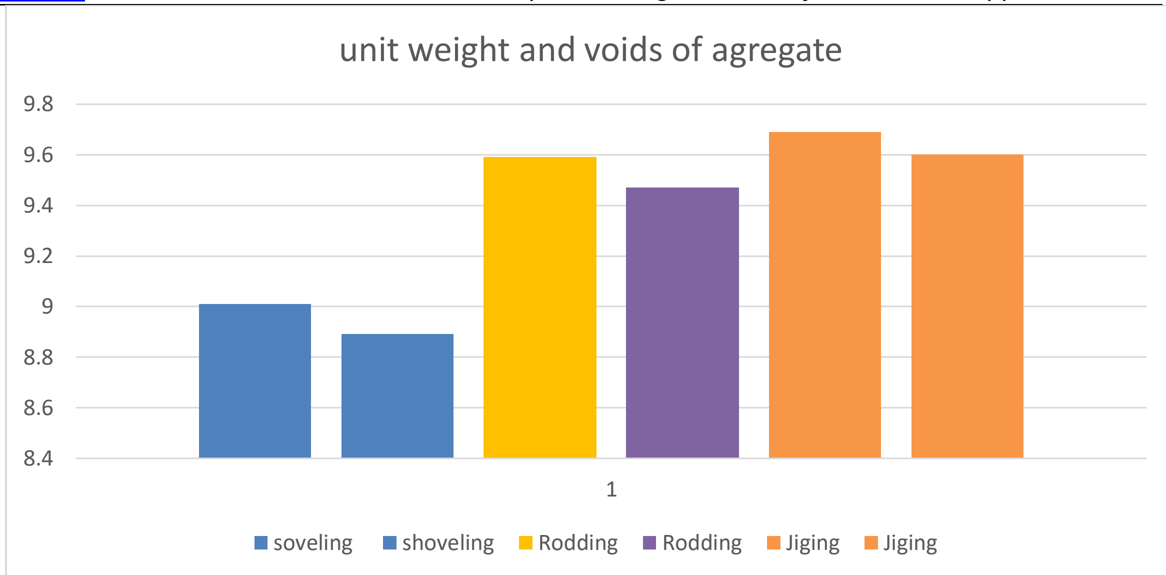

Figure 3.3.1.unit weight chart

3.4 Workability test

3.4.1slump test

Table 3.4.1 depicts The slump height attained with a 0% cement replacement is 20mm, a 5.0 percent cement replacement is 23mm, a 10.0 percent cement replacement is 33mm, and a 15% cement replacement is 44mm. The water/cement ratio affects slump, and the concrete is workable based on the above-mentioned numbers since the slump did not collapse. As a result, brick dust absorbed more water than cement.

When cement is partially replaced by brick dust, the workability values are shown in Figure 3.4.1. The results demonstrate that 5 percent, 10%, and 15% of the samples are more workable than the control samples, with 15% being the most workable of all.

Table 3.4.1 slump test values for different concrete mixes

Mix ratio	Brick dust %	Slump(mm)
1:2:4	0%	20
1:2:4	5%	23
1:2:4	10%	33

1:2:4	15%	44

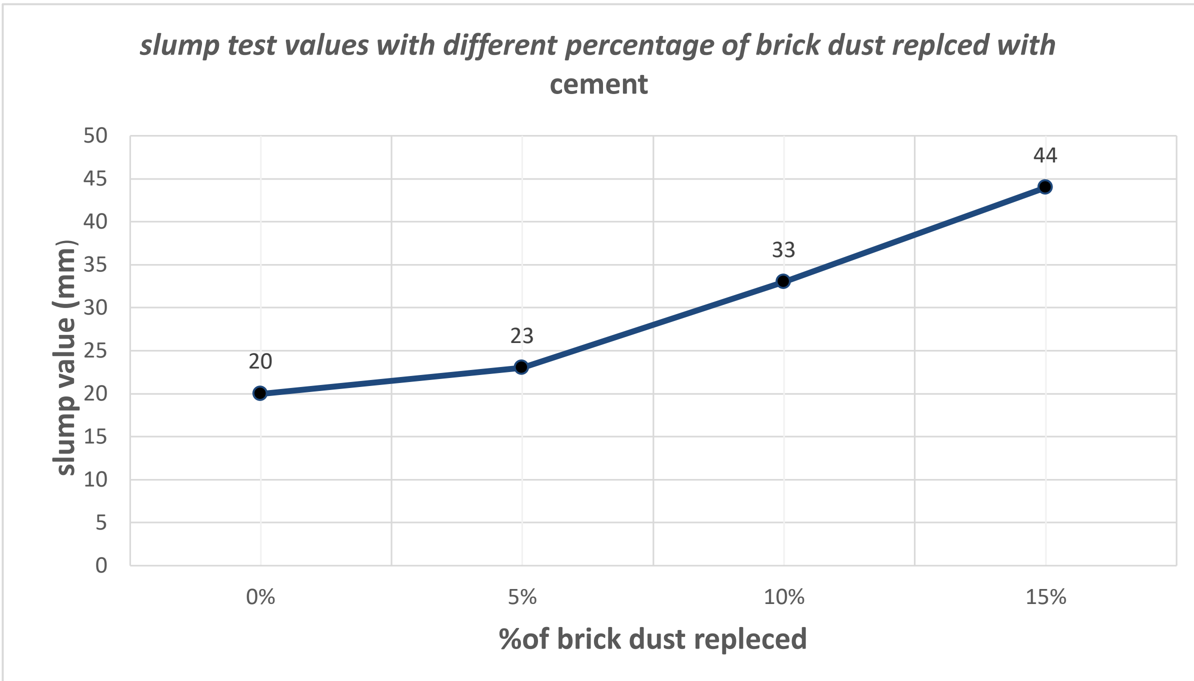

Figure4.4.1 **3.4.1 slump test value**

3.4.1Vee-bee test

Table 3.4.2 describes the workability using the vee-bee test. When concrete is poured into the cone in three layers and lifted, the type of slump was shear and the time that concrete levelled up was four seconds, so the degree of workability is plastic.

Table 3.4.2 Vee-bee test

1	Vee bee testing	Pure aggregate
2	Type of slum	Shear

3	Vee bee time	4 seconds
4	Degree of workability	Plastic

3.4.2 Compaction factor test

The compaction factor test, which is the ratio of partially compacted to fully compacted, is used to define workability in Table 4.4.3. The cylinder is considered partially compacted when concrete is put into the top hobber in three layers, every 25 times compacted to the lower hobber, and full compacted when the cylinder is poured with concrete by hand into three layers, each layer 25 times compressed.

Table 3.4.3 Compaction factor test

SL	Description	w/c =0.65
01	Mix design Ratio	1.2.4
02	Weight of cement	4.2kg
03	Weight of sand	8.4kg
04	Weight of aggregate	16.8kg

05	Weight of water	2.73kg
06	Weight of empty cylinder (W1)	3.42kg
07	Weight of cylinder + Weight of partially compacted concrete (W2)	15.66kg
08	Weight of partially compacted concrete (W3)	12.24kg
09	Weight of cylinder + Weight of fully compacted concrete (W4)	17.22kg
10	Weight of fully compacted concrete (W5)	13.8kg
11	Compaction factor W5 = W3 / W5	0.88
12	Compaction factor in %	88%
13	Acceptance of the result	Semi plastic

3.5compressive strength test

The most extensive excrement was the compressive strength test. During this study, the employed mold was a cube (150150150) mm.

The brick dust reinforced concrete was added to the concrete at varying proportions of 5%, 10%, and 15% of the weight of the cement water-cement ratio of 0.65.

Table 3.5.1, describes 12 cubes cast with concrete with 7day curing 3 of the 12 cubes are pure, but the others are partially replaced with brick dust. The 12 cubes are put in the compressive strength machine to know the compressive strength of each cube.

Table 3.5.2 describes 12 cubes cast with concrete with 14day curing 3 of the 12 cubes are pure, but the others are partially replaced with brick dust. The 12 cubes are put in the compressive strength machine to know the compressive strength of each cube after we measure their mass.
Table 3.5.3 describes 12 cubes casted with concrete with 28day curing 3 of 12 cubes are pure ones but others they are partially replaced with brick dust .the 12 cubes are put in the

compressive strength machine to know the compressive strength of each cube after we measure their mass .

Figure 3.5.1 indicates the comparison between compressive strength and the percentage of brick dust replaced by 7-day curing concrete cubes.

The figure indicates that pure concrete has the highest compressive strength of those which are partially replaced with brick dust.

10%brick dust replaced is higher with 10.45n/mm2 than those with 5% that have 10.08n/mm2 and 15%brick dust replaced that have 7.83n/mm2 .this figure shows us the compressive strength will decrease when we add 15% brick dust to the cement.

Since compressive strength is decreased by 15%, there is a possibility that the compressive strength will be lower if we add 20% or 30% brick dust with cement.

Figure 3.5.2 indicates the compressive strength of 14-day days curing concrete cubes and pure concrete is the highest in compressive strength with 10.79 N/MM2 than those that are partially replaced with brick dust.

The 5%brick dust replaced has a higher N/mm2 than the 10% and 15%brick dust replaced, which have 9.93N/mm2 and 8.93N/mm2 respectively. This figure indicates the compressive strength will decrease when we add 15% brick dust replacement.

Since compressive strength is decreased by 15%, there is the possibility that the compressive strength will be lower if we add 20% or 30% brick dust with cement.

Figure 3.5.3 indicates the compressive strength of 28-day curing concrete cubes and shows us that 10% of brick dust replacement gets the highest compressive strength with 14.26 N/mm2 higher than pure concrete with 13.84N/mm2 and 5% with 14.11N/mm2. That means that there is a possibility that the compressive strength will be lower if we add 20% or 30% brick dust with cement.

Table 3.5.1 compressive strength of control sample at 7days curing

Cubes	Mass	Crashing load	Binding materials		Compressive strength	Average compressive strength	Age of specimen
			Cement %	Brick dust %			
Cube 1	7.23	249.25	100	0	11.08	12.93	7days
Cube 2	7.28	333.57	100	0	14.83		7days
Cube 3	7.39	289.74	100	0	12.88		7days
Cube 1	7.15	215.69	95	5	9.59	10.08	7days
Cube 2	7.18	250.06	95	5	11.11		7days
Cube 3	7.20	215	95	5	9.56		7days
Cube 1	7.20	271.51	90	10	12.07	10.45	7days
Cube 2	7.21	242.91	90	10	10.80		7days
Cube 3	7.16	191.24	90	10	8.50		7days
Cube 1	6.87	172.56	85	15	7.67	7.83	7days
Cube 2	6.89	180.4	85	15	8.02		7days
Cube 3	6.86	175.78	85	15	7.81		7days

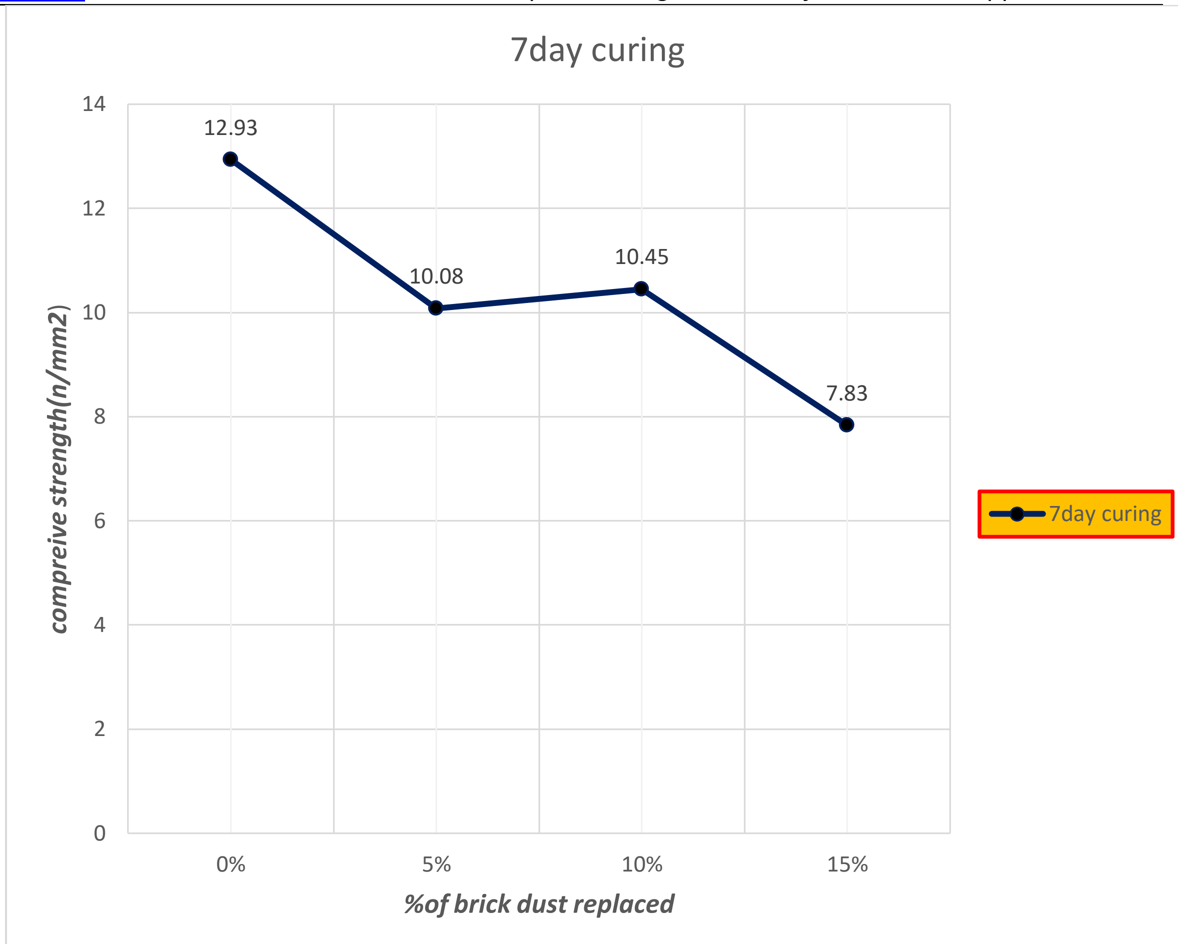

Figure 3.5.1 compressive strength of control sample at 7days curing

Table 3.5.2 compressive strength of control sample at 14days curing

Cubes	mass	Crashing load	Binding materials	Compressive strength	Average compressive	Age of specimen

			Cement %	Brick dust %		strength	
Cube 1	6.89	176.02	100	0	8.1	10.79	14days
Cube 2	7.05	280.39	100	0	12.46		14days
Cube 3	7.04	266.08	100	0	11.83		14days
Cube 1	7.03	316.6	95	5	14.07	10.39	14days
Cube 2	6.94	156.4	95	5	6.95		7days
Cube 3	6.91	228.48	95	5	10.15		14days
Cube 1	6.93	219.26	90	10	9.74	9.93	14days
Cube 2	6.97	257.66	90	10	11.45		14days
Cube 3	7.14	193.65	90	10	8.60		14days
Cube 1	6.88	232.3	85	15	10.32	8.93	14days
Cube 2	7.00	193.66	85	15	8.61		14days
Cube 3	6.92	177.06	85	15	7.87		14days

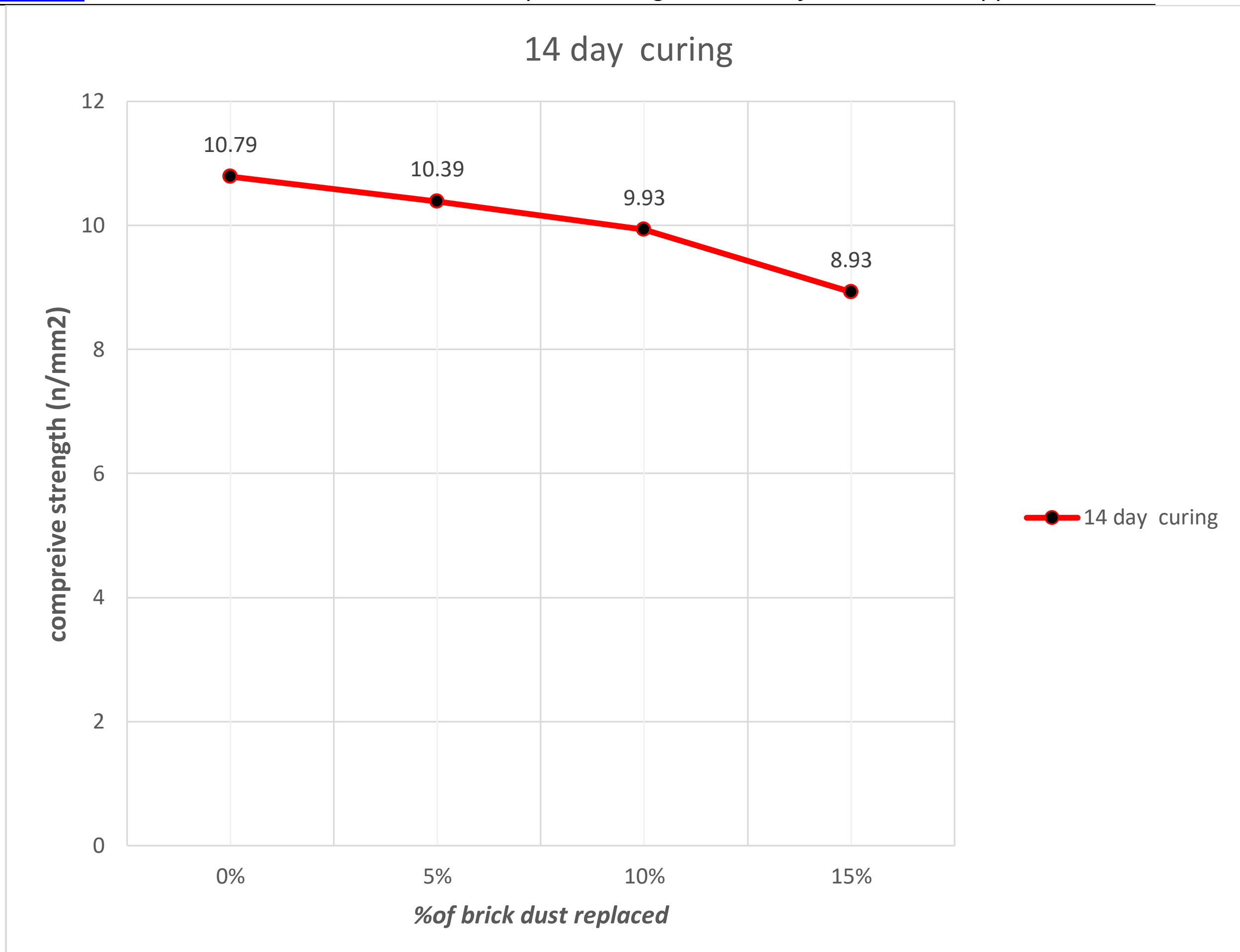

Figure 3.5.2 compressive strength of control sample at 14days curing

Table 3.5.3 compressive strength of control sample at 28days curing

Cubes	mass	Crashing load	Binding materials		Compressive strength	Average compressive strength	Age of specimen
			Cement %	Brick dust %			

Cube 1	7.03	268.4	100	0	11.93	13.84	28 days
Cube 2	7.00	285.7	100	0	12.70		28 days
Cube 3	7.04	364.36	100	0	16.91		28 days
Cube 1	6.99	369.78	95	5	16.43	14.11	28 days
Cube 2	7.08	226.3	95	5	10.06		28 days
Cube 3	7.07	356.52	95	5	15.85		28 days
Cube 1	7.16	334.49	90	10	14.87	14.26	28 days
Cube 2	6.87	257.44	90	10	12.24		28 days
Cube 3	7.14	352.6	90	10	15.67		28 days
Cube 1	6.92	293.2	85	15	13.03	10.97	28 days
Cube 2	6.91	262.3	85	15	10.76		28 days
Cube 3	6.892	205.31	85	15	9.12		28 days

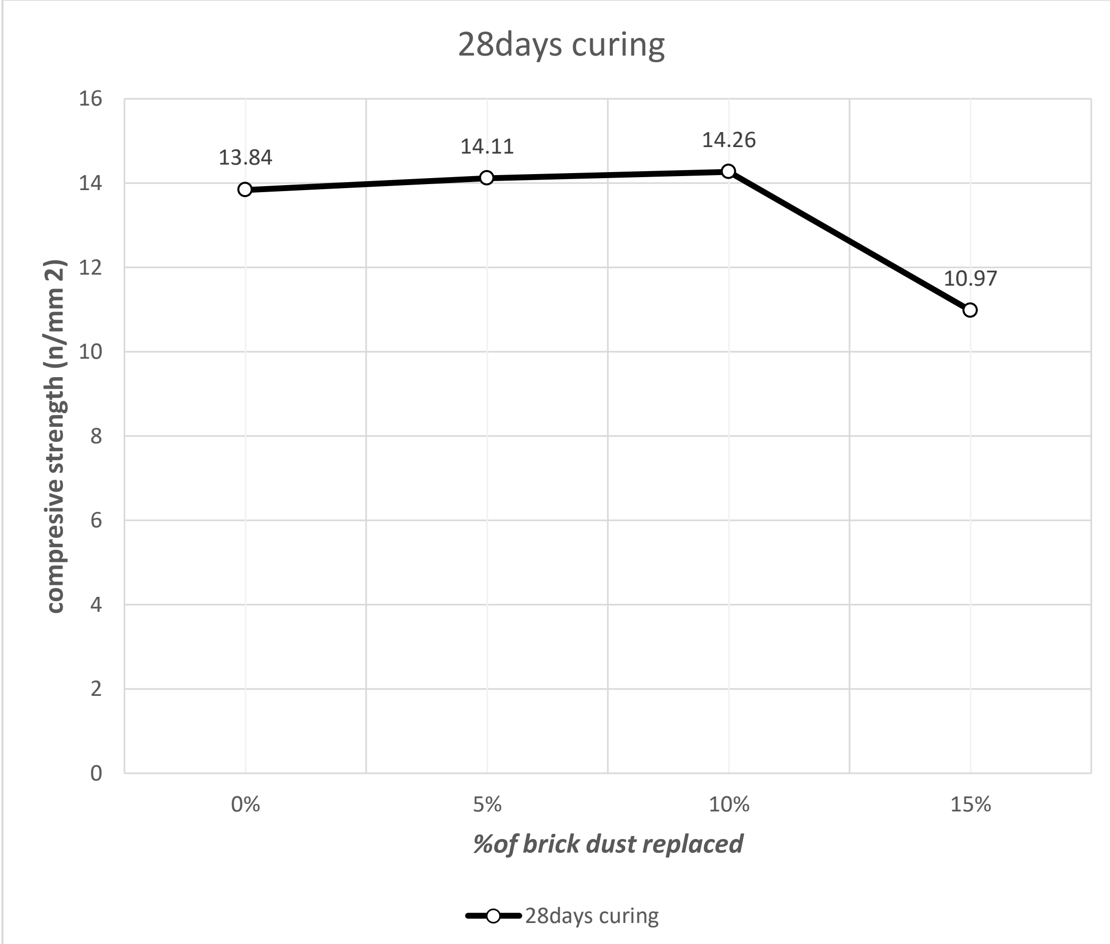

Figure 3.5.3 compressive strength of control sample at 28days curing

3.6 Comparison between 7day, 14 day and 28day curing

Figure 3.6 shows the compressive strength of 7-day, 14-day, and 28-day curing concrete cubes and shows us that the highest compressive strength was reached at 28-day curing in all percentages: 0%, 5%, 10%, 11%, and 15%.

This figure also showed us that 10% of 28-day curing reaches the highest compressive strength with 14.26 N/mm2, which is good because our main objective was to know the compressive strength when we partially replaced cement with brake dust. And the lowest compressive strength was reached at 15%.

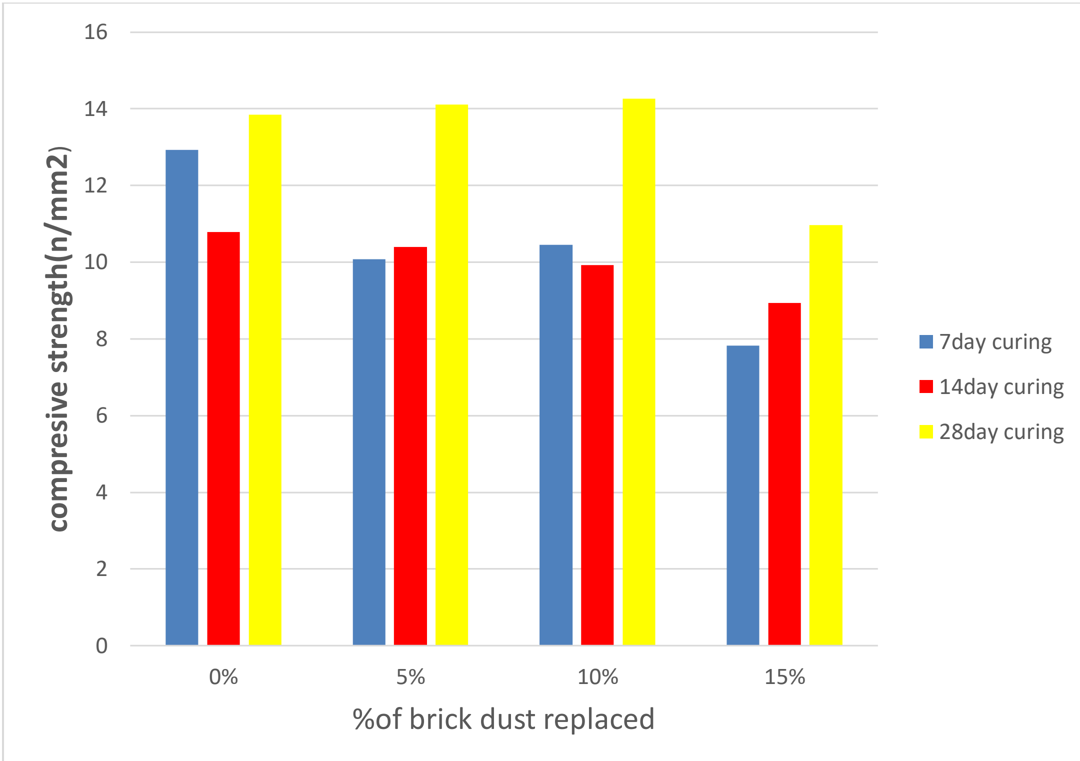

Figure 3.6 comparison between 7day, 14 day and 28day curing

4. Conclusion and Recommendations

This study gives an understanding of the sound knowledge of the cube's compressive strength when cement is partially replaced with brick dust. A conclusion will be presented along with a recommendation for future study.

SUMMERY

The following conclusion may well be derived from the test findings.

1) We can make an eco-friendly mortar by partially replacing cement with brick dust. Subsides the stagnation of demolished brick waste by consuming it properly.

1) 2) Even though the surface area grows as the amount of brick dust increases, the W/C ratio has remained constant. This helps to reduce undesirable concrete bleeding and segregation.
2) 3) The maximum compressive strength was achieved after 28 days of curing when 10% of the cement was substituted with brick dust (14.26n/mm2), compared to the control Specimen, and dropped as the quantity of brick dust was increased to 15%.
3) The pure concrete compressive strength at 7days and 14 days increases 12.93%, 10.93 then those that are partially replaced with brick dust.

5) When brick dust was partially replaced with cement at 7 and 28 days, the curing compressive strength was lower than when the cement was pure (100 percent).
6) As the amount of Brick Dust grows above 10%, compressive strength values fall.
7) Increasing the proportion of brick dust replacement in concrete enhances workability, with 15% replacement of cement yielding the most workable concrete of 40mm when compared to the other substitutes for brick dust.

4.1Recommendations

The following recommendations for additional research are made based on the findings of this study.

1) Additional specimens might be considered.
2) Various w/c ratios might be used in different tests.
3) Various casting ratios might be examined.
4) Cylinder specimens can potentially be used for additional research.

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