

# Performance Evaluation of Cement Mortar Bricks with Waste Glass Bottles

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**ABSTRACT:** The growth in various types of industries has resulted in enormous increase in production of various types of waste material. These creating pollutions to environment, it makes the effect to our day to day life. To reduce this problem, Glass bottles are used in our project. The present study investigates the potential use of waste glass bottles with cement mortar to deal the problem as a strength modified in cubical cement mortar brick. The glass bottles filling with cement mortar can be used for bricks manufacture. Our study evaluates the compressive strength comparison of cement mortar brick with glass bottles to conventional cement mortar brick. The work consistent of one experiment approach towards waste glass bottles & use the material in mortar bricks. To simulate with the field crediting compressive strength test is carried out by taking number of sample. The result shows better compressive strengths with substantial saving in cost.

**Keywords:** Cements mortar (1:6), Cubical cement mortar bricks, Solid waste management, Waste glass bottles filled with cement mortar.

## I. INTRODUCTION

One of the main components in cement-mortar is cement, sand. Now a day's most commonly using mortars are cement mortar, lime mortar etc. To increase the strength of mortar we can use different components like lime, fly ash, and stone powder etc in mortar. Mortar is used in many of civil engineering works like masonry, mortar bricks in wall construction, mortar cubes in road constructions etc. Now a day's a solid waste management is a trust areas in that, the solid waste glass bottle are apart the glass bottles are not degradable materials, its creates environmental pollutions. It is the one of the problem in our daily life. To reduce the problem we are utilizing the waste glass bottles as a strength modifier in mortar brick.

In our project we are using glass bottles in mortar bricks by preparing cubes. We used the glass bottles in a cubical bricks manufacture. By using glass bottles with mortar in construction we can increase the strength in cubical mortar bricks and at the same time we should decrease the environmental pollution causing by glass.

## II. LITERATURE REVIEW

- 1) Ann's bottle in tuesday, Arizong.
- 2) The bottle chaped at Airlie gardens, north caroline attribute to minnieevane bottle.
- 3) Earth ship home, note tires and cans as well.
- 4) In taos, another earth ship, bright light but private.
- 5) Kawakawa, new zeland men's public toilet close up design by austrian artist and architect friedens riech fluender waste.

## III. METHODOLOGY

The scope of present investigation is to study and evaluate the effect of glass bottle bricks in cement mortar. Cube of standerd size 150mmx150mm x150mm (length x width x depth) were cast tested for 7,14,28 days compression te

### A. Steps Involved in Methodology

1. Identification of problem.
2. Literature review.
3. Material collection.
4. Preparation of glass bottle with cement mortar.
5. Study on properties of cement mortar and glass.
6. Tests on material used.
7. Sample preparation for glass brick.
8. Casting and testing of specimen.
9. Result analysis.
10. Report preparation and submission.

## IV. THE HIGHLIGHTS OF STUDY

- 1) To evaluate, the properties of cement mortar bricks with glass bottles.
- 2) To evaluate the performance tests of cement properties like fineness, initial setting time, final setting time, soundness and specific gravity.
- 3) To evaluate the performance tests of sand properties like fineness modulus by sieve analysis.
- 4) To know the compressive strength of cubical glass bricks.
- 5) The debate on the use and abuse of waste glass bottles vis-à-vis environmental protection can go on, without yielding results until.

## V. ADVANTAGES OF WASTE GLASS IN CONSTRUCTION

1. The waste glass materials will available low in cost.
2. It is non-brittle material.
3. It absorbs abrupt shock loads- since they are not brittle, they can take up heavy loads without fail.
4. The material is bioclimatic.
5. It is reusable material.
6. It is less cost of construction material
7. Easy to built construction by waste glass. No special specifications are required.
8. it is green construction.

## VI. MATERIALS USED

**A. Cement Type:** OPC Cement of 53 grades was used.

**B. Cement Brand:** Nagarjuna cement.

**C. Fine Aggregate:** Zone – I was used as fine aggregate.

**D. Waste Glass Bottles:** It is obtained from the company of, which is located at Nava bhara t Jn. Near NH-5, Srikakulam, District.

**E. Water:** Potable fresh water, which is free from concentration of acid or organic substances, was used for mixing the concrete.

**F. Admixture:** No admixture is used.

## VII. PREPARATION OF GLASS BOTTLE WITH MORTAR

- 1) Select the proffered size of waste glass bottles& clean the glass bottles and dry it.
- 2) After then prepare cement mortar by mixing cement, sand and water homogenously.
- 3) Now fill the glass bottle with cement mortar and cap it tightly.



Fig.1: Glass bottle with cement

## VIII. CEMENT MORTAR MIX PRAPORTIONS (1:6)

### A. Design Stipulations:

Characteristic compressive strength required in the field at 28 days 3.0mpa

Maximum size of fine aggregates is 2mm.

### B. Test Data for Materials:

1. Specific gravity of cement is 3.15.
2. Compressive strength of cement at 7 days satisfies the requirement of IS: 269-1989 is 3.0 Mpa.
3. Specific gravity of fine aggregate is 2.7.
4. Water absorption in fine aggregate is 1.0%
5. Free (surface) moisture in fine aggregate is 2.0%.

## VII.MIX PROPORTION QUANTIES FOR 1:6 RATIO MORTAR (CEMENT+SAND):

STEP 1:Volume of mortar= $0.003375\text{m}^3$ .

STEP 2:Dry volume of mortar = $4.286 \times 10^{-3}$ .

STEP 3:Mix ratio of mortar 1:6=1+6=7.

Cement required = $6.123 \times 10^{-4}\text{m}^3$ .

Sand required = $3.673 \times 10^{-3}\text{m}^3$ .

STEP 4:Weight of cement = 0.98kg.

Weight of sand = 5.87kg.

STEP 5:Weight of water =1.35 liters .

## VIII.MATERIAL PROPERTIES:

Table I:Cement Properties

S.NO.	PROPERTY	VALUES
01	Specific gravity	3.15
02	Fineness of cement by sieving	2.5%
03	Normal consistency	31%
04	Setting time Initial setting time Final setting time	164 min 278 min
05	Soundness	6mm
06	Compressive strength 7days 14 days 28 days	7 N/mm <sup>2</sup> 19.2N/mm <sup>2</sup> 35N/mm <sup>2</sup>

Table II:Glass Physical Properties

S.NO.	PROPERTY	VALUES
01	Colour	-
02	Types of glass	Non porous
03	Size of glass	155x50mm (length xdia.)

Table III: Chemical Properties of Glass

S.NO.	PROPERTY	VALUE
1	Sand	74%
2	Soda ash	16%
3	Limestone	10%

Table IV: Sand Properties

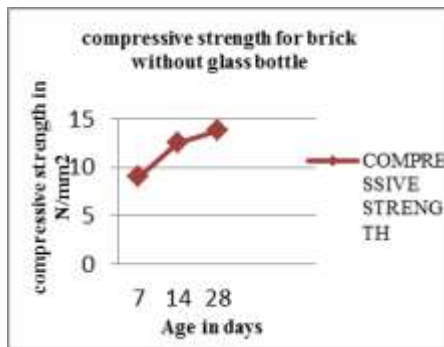
S.NO	PROPERTY	VALUE
1	Grading of Sand	Zone I as per IS 383
2	Specific Gravity	2.79
3	Bulk Density a) Loose state b) Compacted State	1555.56 Kg/m <sup>3</sup> 1717.11 Kg/m <sup>3</sup>

**IX.RESULT ANALYSIS OF COMPRESSIVE STRENGTH FOR CUBICAL BRICKS:**

**A.Compressive strength for brick with glass bottle**

Table V: C.S with out glass bottle

S.No.	Age in days	C.S. in N/mm <sup>2</sup>
1	7	9
2	14	12.5
3	28	13.8



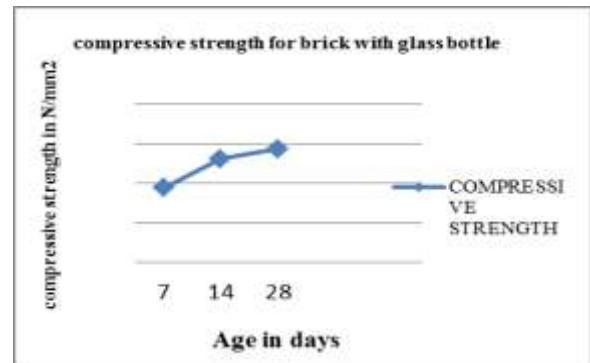
Graph no.1 C.S without glass bottle

- 1)In the above graph,age in days on x-axis & compressive strength on y-axis.
- 2)The graph shows that the compressive strength values for 14days is increased 25% compared to 7days strength(9N/mm<sup>2</sup>).
- 3)The graph shows that the compressive strength values for 28days is increased 9% compared to 14days strength(12.5N/mm<sup>2</sup>).

**B.Compressive strength for brick with glass bottle**

Table VI: C.S with glass bottle

S.No	Age in Days	C.S in N/mm <sup>2</sup>
1	7	9.4
2	14	13.1
3	28	14.4

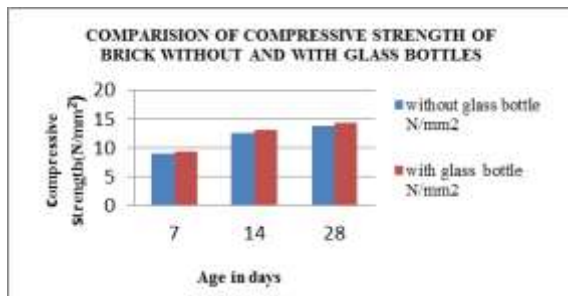


Graph no.2 C. S with glass bottle

- 1)In the above graph,age in days on x-axis & compressive strength on y-axis.
- 2)The graph shows that the compressive strength values for 14days is increased 25% compared to 7days strength(9.4N/mm<sup>2</sup>).
- 3)The graph shows that the compressive strength values for 28days is increased 9% compared to 14days strength(13.1N/mm<sup>2</sup>).

Table VII: Compressive strength With & without glass bottle

S.no.	Age in days	Without glass bottle. In N/mm <sup>2</sup>	With glass bottle In N/mm <sup>2</sup>
1	7	9	9.4
2	14	12.5	13.1
3	28	3.8	14.4



Graph no.3, C.S. with & without glass bottle

1. In the above graph, age in days on x-axis & compressive strength on y-axis.
2. The graph shows that the compressive strength values for 7 days cement mortar glass cubical brick is increased 4.44% compared to 7 days strength (9 N/mm<sup>2</sup>) of conventional brick.
3. The graph shows that the compressive strength values for 14 days cement mortar glass cubical brick is increased 4.8% compared to 14 days strength (12.5 N/mm<sup>2</sup>) of conventional brick.
4. The graph shows that the compressive strength values for 28 days cement mortar glass cubical brick is increased 4.3% compared to 28 days strength (9 N/mm<sup>2</sup>) of conventional brick.

#### X. CONCLUSIONS:

From the preliminary studies of cement mortar bricks without and with glass bottle, the following conclusion are drawn.

1. By using glass bottle as a strength modifier, the properties of cement mortar brick are improved.
2. By using glass bottle with filling of cement mortar, the geological properties have been improved. There is an increase in the strength of brick.
3. The compressive strength of the cement mortar brick with glass bottle are increased when compared with conventional cement mortar brick.
4. The glass bottle increases the properties of cement mortar.
5. Compressive strength of cement mortar brick with glass bottles can be improved.
6. It is economically good.
7. Research can control the environmental pollution.

#### XI. SCOPE AND FURTHER STUDY

1. The study can take up with different types of admixture in cement mortar & compression can be done among the admixture strength properties.
2. A study can be done for different types of cement mortar mix, like 1:3, 1:6, by using different types of glass bottles.

3. A study can be done by different types of mortar like lime mortar.

#### A. Glass bottle construction in India

1. First glass bottle house was constructed in 1902 by William F. Peck in Tonopah, Nevada.
2. Around 1905, Tom Kelly built his house in Rhyolite, Nevada, using 51,000 glass bottles masonry.

#### ACKNOWLEDGMENT:

This piece of work would never be accomplished without God Almighty. For it is under His grace that I live, learn and flourish. This report owes its existence to hard work of me and my colleague. I also owe this research report to my family members, through all over endeavours, their love, support, guidance and endless patience have truly inspired. "Thanks will never suffice."

I am grateful to all involved persons for their help and support.

#### REFERENCE

- [1] IS:1077:1992-Resource of brick..
- [2] IS:2212(1991):Code of practice for brickwork..
- [3] Compressive strength of brick (IS:3495-part-1-1992).
- [4] "Concrete technology" Theory and practice, A text book by Ms. Shetty, 2005.
- [5] Around 1905, Tom Kelly built his house in Rhyolite, Nevada, using 51,000 beer bottles Masonic with adobe. Kelly chose bottles because trees were scarce in the desert. Most of the bottles were Busch beer bottles collected from the 50 bars in this Gold Rush town. Rhyolite became a ghost town by 1920.
- [6] Another famous bottle house site was built by the self-taught senior citizen Tressa "Grandma" Prsbrey. Located in Simi Valley, California, Bottle Village is lauded by art scholars, The State of California, The National Register of Historic Places and in exhibitions, as a major artistic achievement. Beginning construction in 1956 at age 60.

#### PROJECT WORK AT LABORATORY



Fig 2: Cubes at laboratory



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