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# Partially replacement of sand with crushed brick masonry in concrete

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## ABSTRACT

Huge quantities of construction and demolition wastes are generated every year in developing countries like India. The disposal of this waste is a very serious it requires huge space for its disposal and very little demolished waste is recycled are reused. This study is a part of comprehensive program where experimental investigation have been carried out to assess the effect of partial replacement of fine aggregate by demolished waste on workability and compressive strength of recycle concrete for the study at 7,14 and 28 days. Test results showed that the compressive strength of recycle concrete up to 20% fine aggregate replacement (F.A.R) by demolished waste at the end of 28 days has been found to be compared with the conventional concrete.

**Keywords:** Compressive Strength, Tensile Strength, Crushed Brick, Artificial Aggregates.

## INTRODUCTION

Aggregates are considered as one of the main constituents of concrete since they occupy more than 70% of the concrete matrix. In many countries there is scarcity of natural aggregates that are suitable for construction whereas in other countries the consumption of aggregates has been increased, in recent years, due to increase demand by the construction industry. In order to reduce dependence on natural aggregate as the main source of aggregates in concrete, artificially manufactured aggregates and artificial aggregates from construction wastes provide an alternative for the construction industry. Therefore the utilization of aggregates from the construction wastes can be alternative to the natural and artificial aggregates. Crushed masonry wall is derived from the construction waste. Due to the process of demolish or unanticipated conditions (earthquake) the huge quantity of brick masonry walls are available. This masonry wall is involved in crushing process then the crushed powder of the wall is obtained. We use this powder is the alternative material for the fine aggregate. Bricks manufactured from the clay particle, but the clay content is adverse to the strength of concrete. However bricks manufacture from clay soil, bricks disappear the properties of clay by the action of heating. In this process clay components are converted in to mullets. Mullet is the hard one.

## OBJECTIVES

### The objective of this crushed masonry wall is

- To replace natural sand with materials like crushed masonry wall.
- To study the workability and strength of M20 grade concrete by partial replacement of river sand by crushed masonry wall at 10%, 15% and 20%.
- To reduce the production cost of concrete.

### Testing of materials used cement

The physical properties of the cement as determined from various tests conforming to Indian Standard IS: 8112-1989 are listed in Table

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4.1. The results of above said tests are given below in table.

## FINE AGGREGATE

### Fineness modulus of the aggregate

The aggregate those fraction from 4.75mm to 150 micron are termed as fine aggregate. Fineness modulus of fine sand as 2.2 to 2.6 and fineness modulus of medium sand as 2.6 to 2.9 and fineness modulus of coarse sand as 2.9 to 3.2.

f modulus of this sand is 2.95. It lies between the values of 2.9 to 3.2. Hence it is coarse sand.

### Specific gravity for fine aggregate

The normal value of specific gravity of sand is 2.65. The specific gravity less than 2 is porous particle and the presence of organic matter and more than 3% should have the heavy substances such as iron may present.

### Course aggregate

This analysis is conducted to determine the particle size distribution is a sample of aggregate, which e call gradation. The aggregate fractions from 80mm to 4.75mm are termed as coarse aggregate.

### Fineness modulus coarse aggregate of 20mm size

The fineness modulus of coarse aggregate 20mm size is tested by sieve analysis test. The total cumulative percentage retained for coarse aggregate is 387.4 and the Fineness modulus of coarse aggregate is 3.874.

### Crushed masonry wall

Crushed masonry wall powder is derived from the construction waste. The properties of the Crushed masonry wall powder is shown in table below

**Table:1 Fineness modulus crushed brick masonry wall aggregate**

| Sieve Size | Weight Of Retained (Kg) | Cumulatie Wt. Retained (Kg) | % of Retaining | Cumulative % Of Wt. Retained (Kg) |
|---|---|---|---|---|
| 4.75mm | 0.003 | 0.003 | 0.15 | 0.15 |
| 2.36mm | 0.004 | 0.007 | 0.2 | 0.35 |
| 1.18mm | 0.836 | 0.843 | 41.8 | 42.15 |
| 600 micron | 0.542 | 1.385 | 27.1 | 69.25 |
| 300 micron | 0.489 | 1.874 | 24.45 | 93.7 |
| 150 micron | 0.106 | 1.98 | 5.3 | 99 |
| Pan | 0.02 | 2 | 1 | 100 |

**Table: 2 Physical properties of crushed masonry wall**

| S. No | Property | Value |
|---|---|---|
| 1. | Specific gravity | 3.54 |
| 2. | Fineness Modulus | 5.66 |

### Concrete test

The workability is defined as the property of concrete which determines the amount of useful internal work necessary to produce full compaction.

### Measurement of Workability

Some of the tests measure the parameters very close to workability and provide useful information. The following tests are commonly employed to measure workability.

### Slump Cone Test

Slump cone test is the most commonly used method of measuring consistency. It doesn't measure all factors contributing to workability. It is used as a control test and gives an indication of uniformity of batches.

Slump Value = 80 mm

### Mix Proportio

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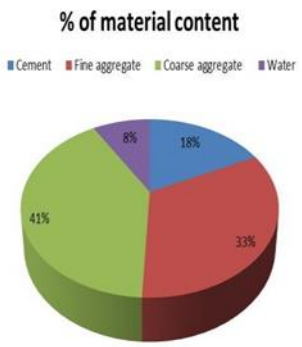



**Fig 1: Mix proportion of concrete**

This is the graphical representation of mix proportion of cement, fine aggregate, coarse aggregate and water.

## TEST RESULTS

### Compressive strength of concrete cubes

The compressive strength of hardened concrete is considered one of the most important properties and is often used as an index of the overall quality of concrete. The 10%,

15% and 20% replacement of natural sand with CBMW slightly affect the compressive strength of concrete. The effect of CBMW substitution as a fine aggregate on compressive strength of concrete is given in below.

This table shows the load at failure for the various mix proportion of specimen at the age of 7 days, 14 days and 28 days. This result clearly show that the concrete get reduce the compressive strength slightly.

**Table: 3 Compressive strength of concrete cube specimen at 7 days**

| % of Cbmw Repla Cement | Sample No | Strength N /mm$^2$ | Avg ssive N/mm$^2$ | Compre Strength |
|---|---|---|---|---|
| CC | 1/CC | 15.80 | 15.92 | |
| | 2/CC | 16.04 | | |
| 10 | 1/10 | 15.82 | 15.70 | |
| | 2/10 | 15.58 | | |
| 15 | 1/15 | 15.20 | 15.34 | |
| | 2/15 | 15.48 | | |
| 20 | 1/20 | 14.80 | 14.72 | |
| | 2/20 | 14.44 | | |

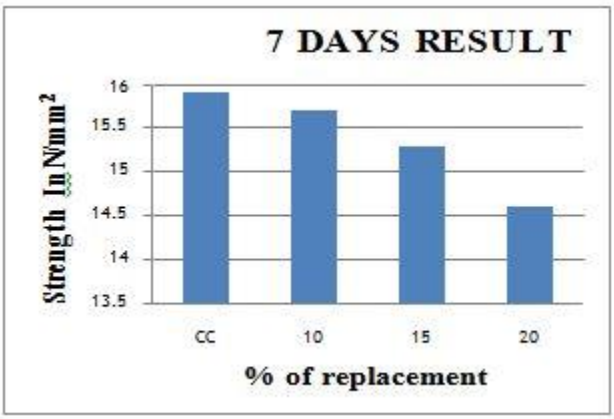



**Fig 2: Compressive strength versus percent of replacement at 7 days**

**Table 4: Compressive strength of concrete cube specimen at 14 days**

| % Of Cbmw Replacement | Sample No | Strength N /mm$^2$ | Avg Compressive Strength N/mm$^2$ |
|---|---|---|---|
| | 3/CC | 21.60 | |
| CC | 4/CC | 21.30 | 21.45 |
| | 3/10 | 21.04 | |
| 10 | 4/10 | 21.08 | 21.06 |
| | 3/15 | 20.65 | |
| 15 | 4/15 | 20.83 | 20.74 |
| | 3/20 | 20.70 | |
| 20 | 4/20 | 20.54 | 20.62 |

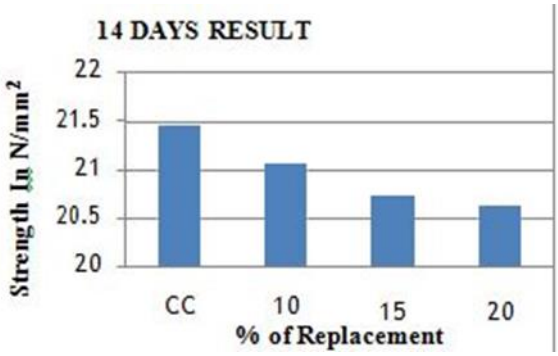



**Fig:3 compressive strength versus percent of replacement at 14 days**

**Table 5: compressive strength of concrete cube specimen at 28 days**

| % Of Cbmw Replacement | Sample No | Strength N /mm$^2$ | Avg Compressive Strength N/mm$^2$ |
|---|---|---|---|
| | 5/CC | 27.46 | |
| CC | 6/CC | 26.90 | 27.18 |
| | 5/10 | 26.82 | |

| | | | |
|---|---|---|---|
| 10 | 6/10 | 26.44 | 26.63 |
| | 5/15 | 25.74 | |
| 15 | 6/15 | 26.18 | 25.96 |
| | 5/20 | 25.30 | |
| 20 | 6/20 | 24.80 | 25.05 |

This result clearly show that the concrete get reduce the compressive strength slightly. The variation of the compressive strength in the specimen 10%, 15%, and 20% with respect to the conventional concrete. From the comparison of compressive strength between the specimen at the age of 7 days, 14 days and 28 days clearly indicate that the crushed masonry wall slightly affect the initial strength of concrete.

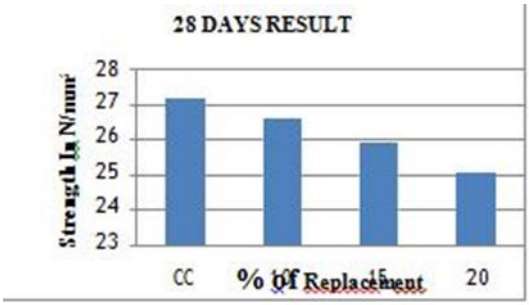



**Fig 4: compressive strength versus percent of replacement at 28 days**

This graph is explain the comparison between the compressive strength of concrete at the age of 7 days, 14 days and 28 days with respect to the % of replacement of the fine aggregate in the concrete by the crushed masonry wall.

## Flexural strength of concrete beam

The flexural strength of hardened concrete is considered one of the most important properties and is often used as an index of the overall quality of concrete. The 10%, 15% and 20% replacement of natural sand with CBMW slightly affect the flexural strength of concrete. The effect of CBMW substitution as a fine aggregate on flexural strength of concrete is given in below.

This table shows the load at failure for the various mix proportion of specimen at the age of 7 days, 14 days and 28 days. This result clearly show that the concrete get reduce the flexural strength slightly Graphical representation of flexural test result at the age of 7 days is shown in below

**Table 6: Flexural strength of concrete specimen at 7 days**

| % Of Cbmw Replacement | Sample No | Strength N /mm$^2$ | Avg Flexural Strength N/mm$^2$ |
|---|---|---|---|
| | 1/CC | 3.80 | |
| CC | 2/CC | 3.66 | 3.73 |
| | 1/10 | 3.60 | |
| 10 | 2/10 | 3.62 | 3.61 |
| | 1/15 | 3.40 | |
| 15 | 2/15 | 3.28 | 3.34 |
| | 1/20 | 3.04 | |
| 20 | 2/20 | 3.14 | 3.09 |

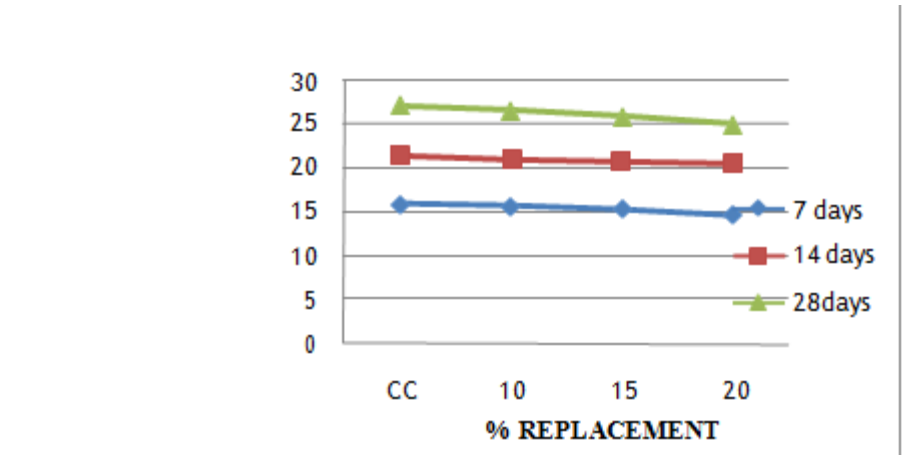
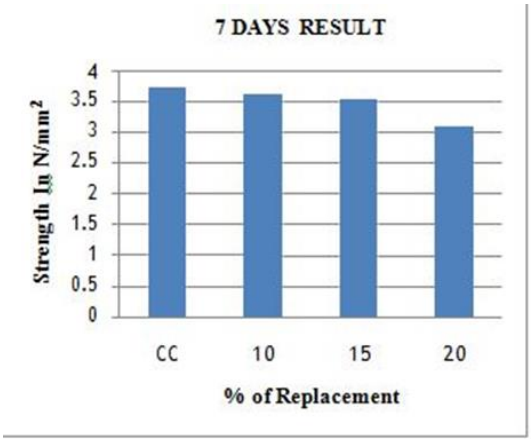



**Fig 5: comparison between the compressive strength of concrete at the age of 7 days, 14 days and 28 days**



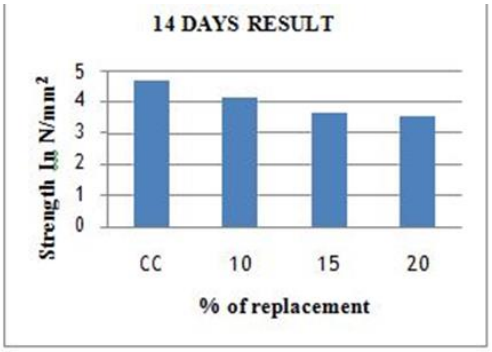




**Fig 6: Flexural strength versus percent of replacement at 7 days**
**Fig 7: Flexural strength versus percent of replacement at 14 days**

**Table 7: Flexural strength of concrete specimen at 14 days**

| % Of Cbmw Replacement | Sample No | Strength N /mm$^2$ | Avg Flexural Strength N/mm$^2$ |
|---|---|---|---|
| | 3/CC | 4.67 | |
| CC | 4/CC | 4.73 | 4.70 |
| | 3/10 | 4.34 | |
| 10 | 4/10 | 3.96 | 4.15 |
| | 3/15 | 3.75 | |
| 15 | 4/15 | 3.53 | 3.64 |
| | 3/20 | 3.59 | |
| 20 | 4/20 | 3.46 | 3.52 |

**Table 8 : Flexural strength of concrete specimen at 28 days**

| % Of Cbmw Replacement | Sample No | Strength N /Mm$^2$ | Avg Flexural Strength N/Mm$^2$ |
|---|---|---|---|
| | 5/CC | 8.86 | |
| CC | 6/CC | 5.44 | 5.65 |
| | 5/10 | 5.14 | |
| 10 | 6/10 | 5.34 | 5.24 |
| | 5/15 | 4.98 | |
| 15 | 6/15 | 4.74 | 4.86 |
| | 5/20 | 4.40 | |
| 20 | 6/20 | 4.28 | 4.34 |

Table 6.6 shows the load at failure for the various mix proportion of specimen at the age of 28 days. This result clearly show that the concrete get reduce the flexural strength slightly. The variation of the flexural strength in the specimen 10%,15%, and 20% with respect to the conventional concrete. From the comparison of flexural strength between the specimen at the age of 7 days, 14 days and 28 days clearly indicate that the crushed masonry wall slightly affect the initial strength of concrete.

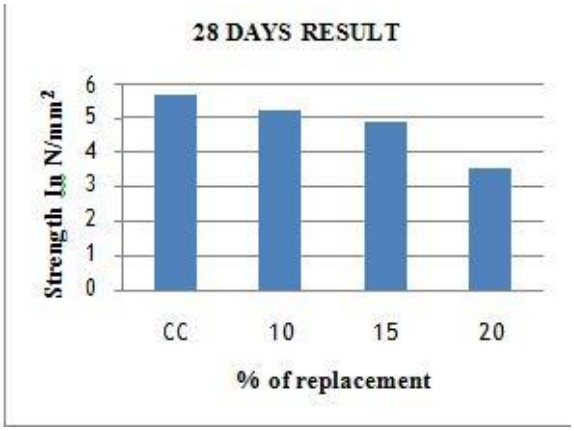



**Fig 8: flexural strength versus percent of replacement at 28 days**

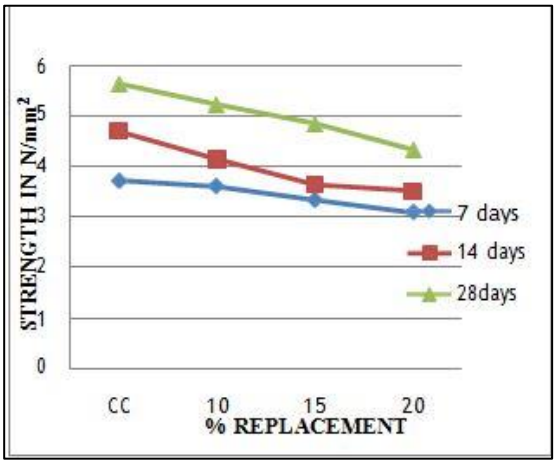



**Fig 9: comparison between the flexural strength of concrete at the age of 7 days, 14 days and 28 days**

## SPLITTEN SILE STRENGTH OF CONCRETE CYLINDER

The split tensile strength of hardened concrete is considered one of the most important properties and is often used as an index of the overall quality of concrete. The 10%, 15% and 20% replacement of natural sand with CBMW slightly affect the split tensile strength of concrete. The effect of CBMW substitution as a fine aggregate on split tensile strength of concrete is given in below.

This table shows the load at failure for the various mix proportion of specimen at the age of 7 days, 14 days and 28 days. This result clearly show that the concrete get reduce the split tensile strength slightly

**Table 9: split tensile strength of concrete specimen at 7 days**

| % Of Cbmw Replacement | Sample No | Strength N /Mm$^2$ | Avg Split Tensile Strength N/Mm$^2$ |
|---|---|---|---|
| CC | 1/CC | 1.98 | 1.97 |
| | 2/CC | 1.96 | |
| 10 | 1/10 | 1.86 | 1.74 |
| | 2/10 | 1.62 | |
| 15 | 1/15 | 1.70 | 1.49 |
| | 2/15 | 1.28 | |
| 20 | 1/20 | 1.34 | 1.24 |
| | 2/20 | 1.14 | |

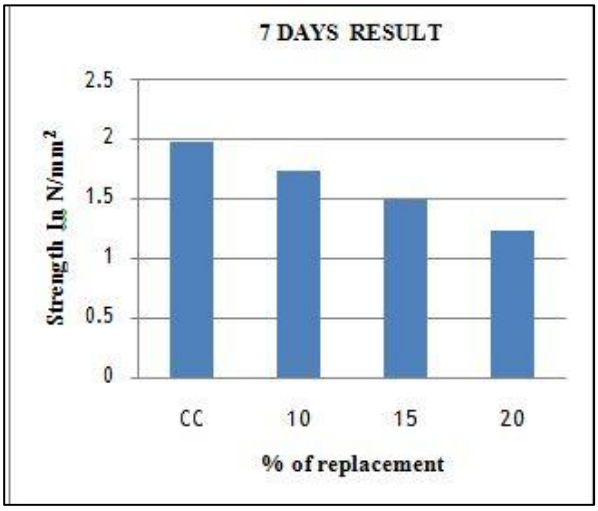



**Fig 10: split tensile strength versus percent of replacement at 7 days**

**Table 10: Split tensile strength of concrete specimen at 14 days**

| % Of Cbmw Replacement | Sample No | Strength N /mm$^2$ | Avg Split Tensile Strength N/mm$^2$ |
|---|---|---|---|
| CC | 3/CC | 2.30 | 2.46 |
| | 4/CC | 2.62 | |
| | 3/10 | 2.36 | |

| | | | |
|---|---|---|---|
| 10 | 4/10 | 2.12 | 2.24 |
| | 3/15 | 2.10 | |
| 15 | 4/15 | 1.98 | 2.04 |
| | 3/20 | 1.88 | |
| 20 | 4/20 | 1.96 | 1.92 |

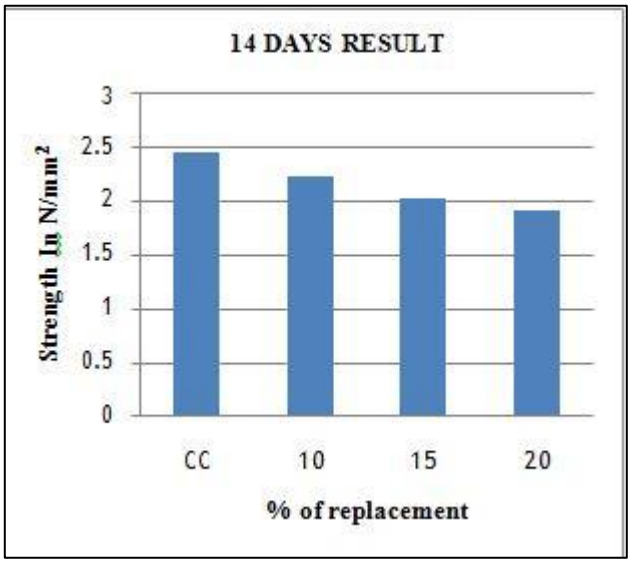



**Fig 11: Split tensile strength versus percent of replacement at 14 days**

**Table 11 ; Split tensile strength of concrete specimen at 28 days**

| % Of Cbmw Replacement | Sample No | Strength N /mm$^2$ | Avg Split Tensile Strength N/mm$^2$ |
|---|---|---|---|
| | 5/CC | 2.86 | |
| CC | 6/CC | 2.78 | 2.82 |
| | 5/10 | 2.56 | |
| 10 | 6/10 | 2.68 | 2.62 |
| | 5/15 | 2.37 | |
| 15 | 6/15 | 2.29 | 2.36 |
| | 5/20 | 2.16 | |
| 20 | 6/20 | 2.08 | 2.12 |

Table 6.9 shows the load at failure for the various mix proportion of specimen at the age of 28 days. This result clearly show that the concrete get reduce the split tensile strength slightly. The variation of the split tensile strength in the specimen 10%, 15%, and 20% with respect to the conventional concrete. From the comparison of split tensile strength between the specimen at the age of 7 days, 14 days and 28 days clearly indicate that the crushed masonry wall slightly affect the initial strength of concrete. However strength of the concrete by using crushed masonry wall is attain the full strength at the age of 28 days

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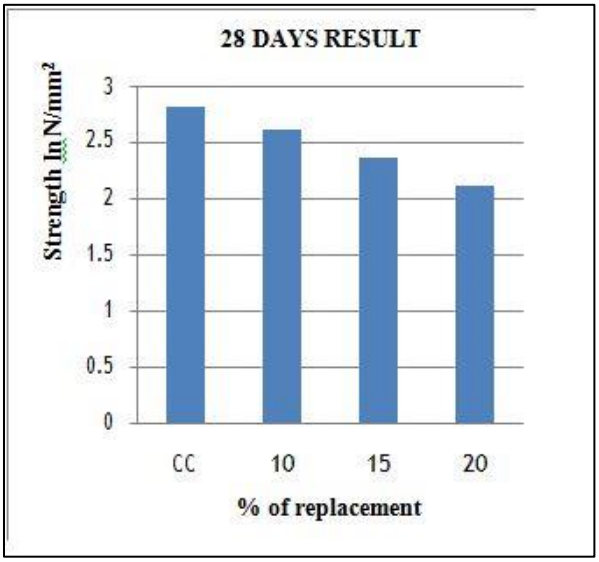


**Fig 12: split tensile strength versus percent of replacement at 28 days**

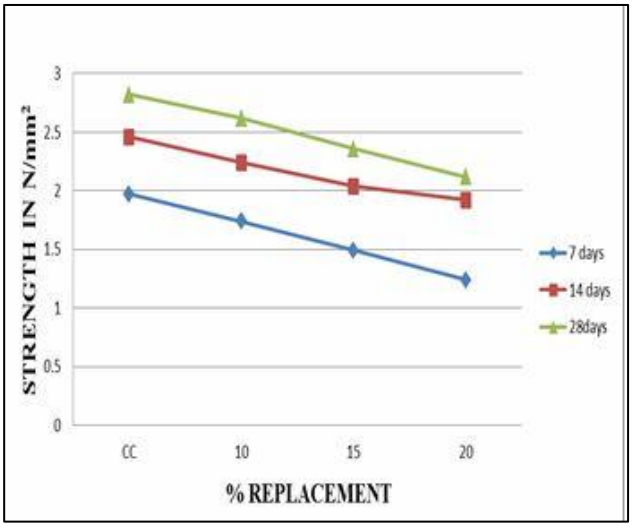


**Fig 13: comparison between the split tensile strength of concrete at the age of 7 days, 14 days and 28 days**

## PHOTOGRAPHY

**Fig1-Crushed brick masonry wall**

**Fig 2-Impact test**

**Fig 3-Particle size distribution test**

**Fig 4-Slump cone test**

**Fig 5-Specimen preparation**

**Fig 6-Curing of concrete specimens**

**Fig 7-Split tensile test**

**Fig 8-Compressive test**

**Fig 9-Flexural test**

## CONCLUSION

This work relates to the utilization of the construction waste (demolished masonry walls) .The following conclusions was drawn based on the experimental investigations carried and the results obtained from those tests, which are as follows: The results of strength of concrete are slightly decrease with increase the content of crushed masonry wall .The utilization of construction waste is avoid the scarcity of nonrenewable resources. At the same time it reduce the cost of construction. The workability of the concrete is increases significantly with the increase the percent of crushed masonry wall are used. Because the crushed masonry wall powder is containing more fine particles, it leads to increase the paste phase of the concrete. Paste phase of the concrete is the responsible for the workability. Initial and final setting time of crushed masonry wall power concrete is higher than the conventional concrete. Engineers and specialist have come out with their own ideas to minimize the use of river sand and use recent innovations such as Eco-sand, M-sand, stone crusher dust, treated and sieved silt removed from reservoirs as well as dams besides sand from other water bodies.

## REFERENCES

[1]. A.E. and Murray, A.M. "Pull-off test for in-situ concrete strength," Concrete, 1981, 23-24.
[2]. International journal of science and research K.Gunasekaran, P.S.Kumar, 'Mechanical and bond properties of recycle aggregate concrete'2011.
[3]. IS, "MIX DESIGN" Bureau of Indian Standard, New Delhi, 10262-1982
[4]. IS, 'specification for coarse and fine aggregate from the natural sources for concrete' Bureau of Indian Standard, New Delhi, 383-1970.
[5]. IS 'Plain and Reinforced concrete code of practice' Bureau of Indian Standard, New Delhi, 456-2000,
[6]. IS, 'Method of tests for strength of concrete', Bureau of Indian Standard, New Delhi, 516-1999.
[7]. International journal of science and research Masafumi Kikuchi and Takeshi Mukai "application of recycled aggregate concrete", 1980.
[8]. Liedi Bernucci, "Feasibility of using (RCDW) in pavement applications". 2011