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# EXPERIMENTAL INVESTIGATION ON PARTIAL REPLACEMENT OF COARSE AGGREGATES BY DEMOLISHED CONCRETE

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**Abstract--Concrete is the main component of construction. Concrete comprises cement, fine aggregates, coarse aggregates, and water, the straightforward access to those construction resources has little question boosted the development throughout the planet. But the rapid depletion of those resources and therefore the increasing cost is emerging as an attention-seeking issue, thanks to which construction industries face crises for the straightforward availability of those resources but we might wish to make prime emphasis on coarse aggregate as our research moves that way. this is often the rationale why various alternatives are being adopted to counter this problem like reuse and recycling of construction waste. So, keeping all the facets in our mind we start with our project of reuse of recycled demolished concrete. during this project, we replaced coarse aggregates with the demolished concrete within the range 0%, 5%, 10%, 15%, 20% using M25 grade concrete. The prepared concrete mix is compared and would be tested in terms of compressive strength, workability test, etc. to standard concrete. The test is going to be performed at 7,14 and 28 days to gauge the strength properties.**

***Keywords--compressive strength, slump cone test, recycled demolished concrete***

## I. INTRODUCTION

As we know the present world is heavily feeding on concrete to huge content, the demand for the construction aggregates has increased. So, to catch up with demand natural resources are reducing at a very fast rate so to substitute the resources some recycled resources are used such as demolished concrete.
Demolished concrete is produced when structure made up of concrete is demolished and the amount of waste concrete left after demolition is named as demolished concrete. We can use this product waste in a very beneficial way of doing recycling. As we know, recycling and reusing waste products always proved to be eco-friendly and economic. Waste products can add advantage in the construction work if used according to their potential. Demolished concrete is available at various construction sites in huge quantities which are now posing a serious problem of disposal. Nowadays these materials are being used in construction work to meet the resource requirement.
The volume of demolished concrete is increasing because of the following factors:

- demolishing the structure for the construction of new ones.
- destruction of structures due to natural calamities.

These are some factors due to which billions of tons of waste got produced every year.
The paper is based on evaluating the compatibility of productive waste (DEMOLISHED CONCRETE) in concrete production.

## II. LITERATURE REVIEW

### 1)"Use of demolished concrete waste in partial replacement of coarse aggregates in concrete" SSRG International Journal of Civil Engineering (SSRG-IJCE)-volume 3

In this paper, it is discussed that there is a large amount of demolished waste generated every year in India and other developing countries. This study is a part of a comprehensive program wherein experimental investigations have been carried out to evaluate the effect of partial replacement of coarse aggregate by demolished waste on compressive strength and workability of (DAC) demolished aggregate concrete.
For the study 3,7- and 28-days compressive strengths were recorded. In this study, we have taken the demolished concrete aggregate 10%,20%,30% by weight of the conventional course aggregate and the concrete cubes were cast by that

demolished concrete aggregate then further tests conducted such as workability, compressive strength for that DAC and the result obtained are found to be comparable with the conventional concrete.

**2) "Demolished waste as coarse aggregate in concrete." J. Acad. Indus. Res. Vol. 1(9) February 2013.**

This study is part of a compressive program wherein experimental investigations have been carried out to assess the effect of partial replacement of coarse aggregate by demolished waste on workability and compressive strength of recycled concrete for the study at 7 and 28 days. The compressive strength thus, observed was compared with the strength of conventional concrete. Test results showed that the compressive strength of recycled concrete up to 30% coarse aggregate replacement (C.A.R) by demolished waste at the end of 28 d is comparable to the conventional concrete.

**3) "Use of Building Demolished waste as coarse aggregate in Porous Concrete" IJRET: International Journal of Research in Engineering and Technology.**

In this experimental study, the utilization of building demolished waste in the manufacturing of porous concrete as a replacement of coarse aggregate. Various proportions of cement, water, and percentage of coarse aggregates and building demolition waste are used. In this paper 40:60, 50:50 and 60:40 ratio of coarse aggregate and building demolition wastes are used with the water-cement ratio 0.4 to 0.48. 28 days cube compressive strength from 5.22 MPa to 8.32 MPa are observed as per IS 12727: 1989 for the ratio 1:10 and 1:12 respectively. By the investigation, it is found that the porous concrete results are encouraging to use as a porous material for the drain ability is comparable to the conventional concrete.

**4) "Use of construction renovation and demolition waste in Partial replacement of coarse aggregate in M20 Concrete". IJRET: International Journal of Research in Engineering and Technology.**

Concrete is a pourable mix of cement, water, sand, and gravel that hardens into a super-strong building material. So, experiments were carried out in the laboratory to scrutinize a concrete made of partial replacement of coarse aggregate with construction and demolition waste materials like ceramic tiles waste, plastic debris, crushed bricks. The resulting concrete thus produced was tested on the following parameters like compressive strength, workability, flexural strength. The results thus obtained are compared with plain cement concrete. By using low weight materials like plastic debris, we got lightweight concrete. We have increased the quantity of plastic debris and deducted some quantity of other waste, by this the workability standards are maintained. Wastes can cause pollution that affects human health. Using these wastes effectively in construction activities the rate of pollution can also be controlled.

**5) "Use of recycled aggregate concrete". IOSR Journal of mechanical and civil engineering (IOSR-JMCE)**

This paper reports the basic properties of recycled fine aggregates and recycled coarse aggregate & also compares these properties with natural aggregates. Basic concrete properties like compressive strength, flexural strength, workability, etc. are explained here for different combinations of recycled aggregate with natural aggregate. Code guidelines of recycled aggregates concrete in various countries are stated here with their effects on concrete work. In general, the present status of recycled aggregates in India along with its future need and its successful utilization are discussed here.

**6) "Partial Replacement of Coarse aggregate with Demolished waste along with adding admixture." IJARIIT: International Journal of Advance Research, Ideas and Innovations in Technology.**

In this experimental study, the design mix concrete of grade M25 was prepared using IS 10262-2009. Thereafter, the replacement of different constituents of concrete, one at a time was carried out by replacing these with the different sieve fractions of crushed demolition waste. The compressive strength at 7,14 and 28 days and workability in terms of slump value were measured. Test results show that demolished aggregate possess relatively lower bulk crushing, density and impact standards and higher water absorption as compared to natural aggregate. Tests conducted on demolished aggregates and results compared with natural coarse aggregates satisfactory as per IS 2386. The compressive strength of demolished aggregate concrete is relatively lower up to 15% than natural aggregate concrete. All the demolished waste added cubes are added with the admixture i.e.; sodium naphthalene formaldehyde

The compression strength of the different proportions are taken and the results are clear that the constant of adding superplasticizer and 10% of adding demolished waste shows the difference in a graph and at the 15% of adding demolished waste to the concrete attains the maximum strength but at the 20% of adding demolished waste the strength has been reduced and it didn't attend the required strength.

## III. MATERIALS & METHODOLOGY

### A. Materials used

- Ordinary Portland Cement 53 grade
- Fine aggregates
- Coarse aggregates
- Recycled aggregates

**B. Material properties:**

The specific gravity of cement: 3.15

The specific gravity of fine aggregates: 2.69

**TABLE 1: Test on coarse aggregates**

| Property | Natural aggregates | Recycled aggregates |
|---|---|---|
| **Specific gravity** | **2.74** | **2.32** |
| **Impact test** | **7.89%** | **38.46%** |

## C. CASTING & TESTING

### ➢ CUBE CASTING & CURING

Initially, the constituent materials were weighed and dry mixing was carried out for cement, sand and coarse aggregate. Mixing is done by a drum mixer. The mixing duration was 2-5 minutes and then the water added as per the mix proportion. The mixing was carried out for 3-5 minutes. Then the mix poured into the cube molds of size 150×150×150mm and then compacted manually using a tamping rod as in fig 2.

The cubes are demolded after 1 day of casting and then kept in respective water for curing at room temperature the cubes are taken out from curing after 7, 14, & 28 days for testing. The demolished concrete has been collected from the Global Lab, NH 48, Golani Naka, Vasai East, Waliv, Maharashtra.

**FIG-1: CASTING OF CUBES**

### ➢ SLUMP CONE TEST

A slump test is the most commonly used method of measuring the consistency of concrete which can be employed either in the laboratory or at site work. For the present work, slump tests were conducted. The apparatus for conducting the slump test essentially consists of a metallic mold in the form of a frustum of a cone having the internal dimensions as under:

Bottom diameter: 20cm

Top diameter :10cm

Height :30cm

The mold is placed on a smooth, horizontal, rigid and non-absorbent surface. The mold is then filled in three layers, each approximately 1/3rd of the height of the mold. Each layer is tamped 25 times by a tamping rod. After the top layer has been compacted, the concrete is struck off level with a trowel and tamping rod.

The mold is removed from the concrete immediately by raising it carefully in a vertical direction. This allows for concrete subside. The subsidence is referred to as a slump of the concrete. The difference in level between the height of the mold and that of the highest point of the subsided concrete is measured. The difference in height in mm is taken as a slump of concrete.

### ➢ COMPRESSIVE STRENGTH TEST OF CONCRETE

By this single test, one judge whether concreting has been done properly or not. For cube test size 150mm x 150mm x 150 mm are commonly used. This concrete is poured in the mold and tempered properly so as not to have any voids. After 24 hours these molds are removed and test specimens are put in

water for curing. The top surface of this specimen should be made even and smooth. This is done by putting cement paste and spreading smoothly on the whole area of the specimen.

These specimens are tested by a compression testing machine after 7 days curing, 14 days curing and 28 days curing. Load at the failure divided by area of specimen gives the compressive strength of concrete.

## IV. RESULTS

**TABLE 2: SLUMP CONE TEST RESULTS**

| SR.NO | % Usage of recycled aggregates | Workability(mm) |
|---|---|---|
| 1 | 0% recycled aggregates | 130mm |
| 2 | 5% recycled aggregates | 175mm |
| 3 | 10% recycled aggregates | 150mm |
| 4 | 15% recycled aggregates | 100mm |
| 5 | 20% recycled aggregates | 20mm |

**TABLE 3: COMPRESSIVE STRENGTH TEST RESULTS**

| S. No | Usage of recycled aggregates | Compressive strength (N/mm$^2$) | | |
|---|---|---|---|---|
| | | 7 days | 14 days | 28 days |
| 1 | 0% of recycled aggregates | 22.22 | 28 | 32.44 |
| 2 | 5% of recycled aggregates | 20 | 20.89 | 21.78 |
| 3 | 10% of recycled aggregates | 22.66 | 32.44 | 36.44 |
| 4 | 15% of recycled aggregates | 21.33 | 26.22 | 28.44 |
| 5 | 20% of recycled aggregates | 17.33 | 25.78 | 27.11 |

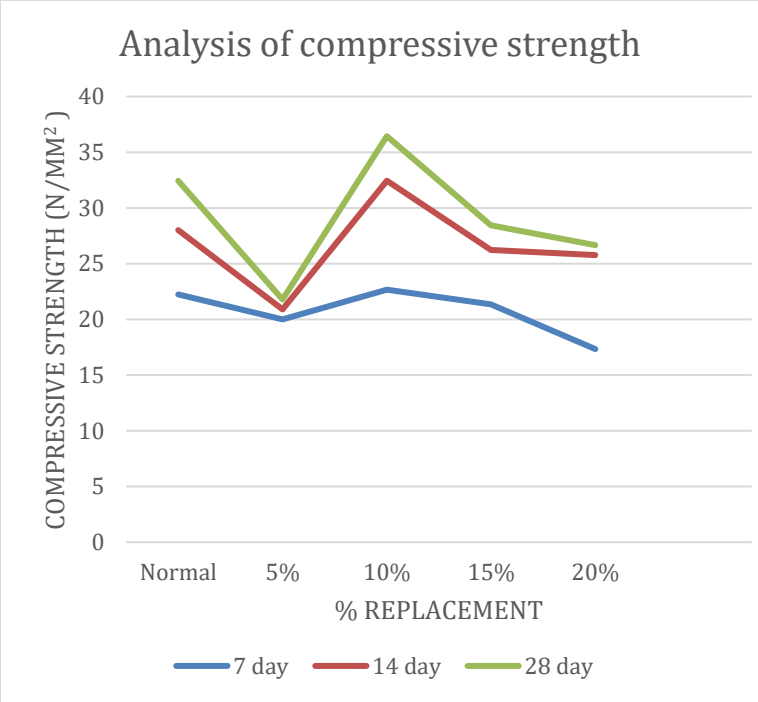


**FIG 2: Compressive strength of cubes**

## V. CONCLUSION

- The test values of compressive strength of cubes of demolished concrete aggregate for 7days, 14days, 28days are obtained and the values are compared with standard concrete.
- The test values of compressive strength 10% and 15% of demolished concrete aggregates are near to the value of standard concrete or conventional concrete.
- From the above investigations, it can be hence concluded that the optimum replacement for this particular mix for high strength concrete is 10%. Up to this replacement, good compressive strength can be achieved using recycled aggregates.
- Beyond this replacement, the strength acquired reduces gradually and does not cross the target strength and to overcome this problem, a suitable adjustment in mix design is required.

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