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# Strength Characteristic of Construction Waste Recycled Concrete

Mr. A.S.Gadewar

Asst. Prof. Mauli Group of Institution, College of Engg. & Tech., Shegaon
gadewar_anil@rediffmail.com

***Abstract***— Using a construction waste material for new products is a global trend undergoing rapid development. Recycled material allows for more efficient life cycle and contributes to environmental protection. In present, construction industries facing problems in storing or disposing these waste material. In many of time they used these waste as a filling material without taking the benefit of their strengt h characteristics. This situation has level to the search for new application for their waste materials as an alternative to conventional aggregates. In this article, some of the characteristics of recycled aggregates have been studied for flooring waste materials (marble, ceramic, granite and kota) and their effect on strength characteristics if they were used in M20 grade concrete by replacing conventional coarse aggregate by 20% and 30%. It has been observed that up to 30% replacement does not affect considerably on strength characteristics.

***Keywords-*** *Concrete, Recycled aggregate, Properties of recycled aggregate, Compressive strength, Flexural strength.*

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## I. INTRODUCTION

Using different types of a waste material for new products is growing trend in construction industries. There is broad range of possibilities to reuse this type of waste in a sustainable way, although not all of them are totally successful applications, regarding its grade level for reuse: land filling, landscaping, road pavement bases or recycling itself. Recycling material allows two important purposes one is to minimize the amount of waste to be deposited and other to preserve the natural resources.

Recycling materials allows for higher efficiency throughout their life cycle and is consistent with environmental support. When the any conventional material is to be transformed into a new material to be used in other structural application is termed as recycled material

Present scenario of construction industries shows the

problems of shortage in natural or conventional resources (aggregates) due to increase in demands of raw materials and environmental pollution caused by construction and demolition waste sites. Therefore they are looking for new techniques to reuse the demolish material in construction practice to bridge their demand and supply of materials. In construction industries nearly 20 to 30% of required or supplied material has been waste in the form of demolish. Therefore it is need to reutilize these wastes by recycling and use in another structural application.

Number of studies has been reported that waste

recycled material shows highly satisfactory results regarding their strength properties. 1% of total carbon dioxide emission in India is from stone crushers. By using recycled material, demand can be reduced and supports to environment by reduction in CO2 emission. Concrete production is emphasis here, since it is likely to be one which takes better advantage of the waste. Study illustrates the characteristic of recycled flooring waste as coarse aggregate and its effective used in concrete. For this study flooring waste such as marble, ceramic, granite and kota has been collected from different construction sites and transformed them into required size for using as a partially replacement to conventional coarse aggregate by 20% and 30% in M20 grade concrete mix. It has been examined that up to 30% replacement of conventional aggregate by this recycled waste material shows enhancement in long term durability of concrete and their strength characteristics.

II. Literature Review

A literature reveals the relevance of the studies reported by G. Murali, et-al used manually crushed, well burnt bricks, marble and granite as coarse aggregates and tested four grades of concrete made with these construction waste as aggregate to determine their physical and mechanical properties. For all the grade of concrete, the modulus of elasticity of the concrete produced with recycled aggregates was about 30% lower, the tensile strength was about 11% higher and the unit weight was about 17% less than that of natural aggregate normal concrete. Empirical equation predicating the modulus of elasticity and the tensile strength of recycled aggregate concrete have been derived. J.Alexandre Bogas, et-al, used expanded clay aggregates to produce self compacted lightweight concrete for compressive strengths between 37.4 and 60.8 MPa and promising results were obtained. Sudhir Patil, et-al founds that the recycled aggregates that are obtained from concrete specimen make good quality concrete. The compressive strength of recycled coarse aggregate (RCA) is found to be higher than the compressive strength of normal concrete when used upto a 25 %.

2. Experimental Methodology:

a) To collect and classify flooring waste from different construction sites.

b) To reformed waste material to be used as coarse aggregate in concrete.

c) To study characteristics of recycled material.

d) To perform M20 grade of concrete mix design using I.S.Code method.

e) To study strength characteristics of conventional and recycled concrete.

3. Materials:

a) Cement: OPC 53 Grade Fineness Modulus = 5.33 Normal Consistency =26.25%

Compressive strength = 54.18 N/mm2

b) Coarse Aggregates: Locally available basalt aggregate of size 10 – 12.5 mm.

c) Fine Aggregate: Locally available clean river sand is used as fine aggregate passing through 4.75mm I.S.Sieve. The specific gravity and fineness modulus were found to be 2.73 and 2.63 respectively.

d) Recycled Aggregate: Marble, Ceramic, Granite and kota flooring waste collected from different construction sites and recycled in required form so that they do not become flaky or elongate.

4. Experimentation:

a) To examine the characteristics of coarse aggregates tests has been carried out as per IS383:1970 on conventional and recycled aggregates. Their results are summarized in table 1.

Table1. Characteristics of Conventional and Recycled Aggregates.

| Sr. No. | Aggregate | Sp. gravity | % water absorption | Crushing Value | Impact Value |
|---|---|---|---|---|---|
| 1 | Basalt | 9.01 | 3.02 | 3.44 | 7.02 |
| 2 | Marble | 11.36 | 1.39 | 28.94 | 21.81 |
| 3 | Ceramic | 14.28 | 12.46 | 24.63 | 15.26 |
| 4 | Granite | 18.26 | 1.6 | 9.83 | 5.8 |
| 5 | Kota | 9.8 | 1.55 | 18.83 | 9.21 |

b) A concrete mix design has been performed for M20 Grade by I. S. Method (IS10262-1982) and the proportion of different ingredients used is given in table 2.

Table2. Mix Design for M20 Grade By I. S. Method (IS10262-1982) by Proportion

| Sr. No. | Concrete | W/C ratio | C | FA | Conventional Coarse aggregat | | Recycled Coarse aggregate | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 12.5 mm | 10 mm | 12.5 mm | 10 mm |
| 1 | C.C. | 0.45 | 1 | 1.25 | 1.64 | 1.09 | 00 | 00 |
| 2 | R.C.2 | 0.45 | 1 | 1.25 | 1.31 | 0.87 | 0.33 | 0.22 |
| 3 | R.C.3 | 0.45 | 1 | 1.25 | 0.65 | 0.44 | 0.49 | 0.33 |

C.C.- Conventional Concrete; R.C.2- Recycled Concrete obtained from replacing conventional coarse aggregate by 20%. and R.C.3- Recycled Concrete obtained from replacing conventional coarse aggregate by 30%.

c) To study the performance of wet concrete, Slump test

and Compaction Factor tests has been carried out with respect to its workability and their results are summarized in table 3.

Table3. Results of Slump Test and Compaction Factor Test

| Sr. No. | Concrete | Recycled Aggregate | Slump | C.F. |
|---|---|---|---|---|
| 1 | C.C | --- | 10 | 0.75 |
| 2 | R.C.2 | Marble | 17 | 0.83 |
| | | Ceramic | 19 | 0.74 |
| | | Granite | 15 | 0.755 |
| | | Kota | 14 | 0.75 |
| 3 | R.C.3 | Marble | 16 | 0.83 |
| | | Ceramic | 19 | 0.73 |
| | | Granite | 20 | 0.82 |
| | | Kota | 19 | 0.81 |

d) To study strength characteristics of conventional and recycled harden concrete Compressive test and Flexure test has been carried on 9 samples of each proportioned concrete. The result results are summarized in table 4.

Table4. Compressive and Flexure Strength of Conventional and Recycled Concrete

| Sr. No. | Concrete | Recycled Aggregate | Compressive strength after 7 days of curing N/mm$^2$ | Projected Compressive strength on 28 days strength N/mm$^2$ | Flexural strength N/mm$^2$ |
|---|---|---|---|---|---|
| 1 | C.C | --- | 18.22 | 27.41 | 3.8 |
| 2 | R.C.2 | Marble | 16.16 | 24.31 | 3.97 |
| | | Ceramic | 15.92 | 23.95 | 3.35 |
| | | Granite | 21.85 | 32.87 | 3.84 |
| | | Kota | 18.28 | 27.50 | 3.84 |
| 3 | R.C.3 | Marble | 20.44 | 30.75 | 3.26 |
| | | Ceramic | 17.08 | 25.69 | 3.00 |
| | | Granite | 21.70 | 32.64 | 3.43 |
| | | Kota | 18.89 | 28.42 | 3.36 |

## 5. Result and Discussion:

a) Impact value and Crushing value of natural basalt aggregate is found lower than all other recycled aggregates implies these materials can be effectively used in road construction.

b) The specific gravity is also higher than natural basalt aggregate indicates strength characteristics gets enhance if these recycled material may used in appropriate quantity or proportion with natural basalt aggregate.

c) Better Workability of concrete may obtained by using recycled aggregates.

d) For M20 mix design it can clearly observed that upto 20% replacement natural aggregate can effectively used in concrete without any considerable reduction in strength.

## 6. Conclusion:

The construction waste can effectively used in concreting by recycling them up to 20% of natural basalt aggregate. This recycled concrete can be effectively used in bed concreting, plinth protection so that waste can be reused. Thus the problem of disposing these materials does produce further side effects on environment and also demand in natural aggregate can be reduce in some extent.

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