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Partial Replacement of Course Aggregate with Demolished Waste along with Adding of Admixture

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ABSTRACT

Demolition of old structures to make way for new and modern ones is common features in metropolitan areas due to rapid urbanization. However, very little demolished concrete is recycled or reused. The strict environmental laws and lack of dumping sites in urban areas, on one hand, are making the disposal of demolition wastes problematic while, on the other hand, the quarrying of raw materials is becoming difficult. The present work presents the results of experimental investigations carried out to evaluate the effect of partial replacement of cement, fine aggregate and coarse aggregate by different parts of demolished wastes on strength and workability of concrete made. For the study, design mix concrete of grade M25 (Referral concrete) 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 sieved fractions of crushed demolition waste. The compressive strength at 7, 14 and 28 days and workability in terms of slump value were measured. The compressive strength of these mixes was measured on 100mm cubes. Test results show that the behaviour of recycled waste concrete and the adding of Ad-mixture. The compressive strength of recycled concrete (FAR concrete) with 10%, 15% and 20% fine aggregate replacement by demolition waste coarse aggregate at 7,14 and 28 days is comparable to that of referral concrete. The compressive strength of recycled concrete (CAR concrete) made using 10% of demolition waste coarse aggregate is almost similar to referral concrete. Further, the results indicate that still higher replacement of the constituent materials is possible without much compromising the 28 days strength and workability.

Keywords: *Demolition Waste Aggregate, Demolition Waste Fine Aggregate, Demolition Waste Powder, Concrete.*

1. INTRODUCTION

Over the years there has been a change in the use of building materials. Cheap and locally available materials such as moulded earth bricks, stones, timber, steel, aluminium, plastics and fibres of various types and forms have replaced the traditional and costly materials. However, all these materials have been developed to meet specific requirements of climate, availability of skilled labour and specific raw materials to effect the desired economy.

Demolition wastes obtained from a structure predominantly consists of concrete, foreign matter such as various type of finishes, dirt, steel, hardware's, woods, plastics etc. The process of removal of impurities and crushing of rubble into suitable and desired aggregate particle size can be carried out in a continuous and sequential manner using appropriate mechanical devices such as jaw crushers, impact crushers, swing hammer crushers etc. The three processes used for processing of demolition waste are (i) Dry, (ii) Wet, and (iii) Thermal - which are used either individually or in combination. The most marked difference in physical properties of recycled concrete aggregate compared with conventional aggregate lies in its higher water absorption.

Advantages

1. Economical for poor areas unable to afford hauling costs for coarse aggregates from other locales
2. Reduce landfill tipping fees paid
3. Provide a cost saving
4. Reduce landfill input

Disadvantages

1. Excess amount of adding of demolished concrete waste cannot attend the strength
2. Separation of the coarse aggregate from demolished waste takes time and labour.

2. LITERATURE REVIEW

1. "Use of demolished concrete waste in partial replacement of coarse aggregate 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. Since the very small amount of this waste is recycled or reused. So, disposing of this waste is a very serious problem because it requires a large amount of space. This study is a part of 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. The previous study on this project shows that the compressive strength of the DAC (Demolished Aggregate Concrete) somehow resembles with the conventional concrete if used in a proper amount up to 30%. So in this study we have taken the demolished concrete aggregate 10%, 20%, 30% by weight of the conventional coarse aggregate and the concrete cubes were casted 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.

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 problem because it requires huge space for its disposal and very little demolished waste is recycled or reused. This study is a part of comprehensive 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 d. 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 has been found to be comparable to the conventional concrete.

3. "Use of Building Demolished Waste as Course Aggregate in Porous Concrete" IJRET: International Journal of Research in Engineering and Technology.

Titanic quantities of construction and demolition wastes are generated every year in developing countries like India. The disposal of this waste is a very serious problem because it requires huge space and very little demolished waste is recycled or reused. In this experimental study, the utilization of building demolished waste in the manufacturing of Porous concrete as a replacement of coarse aggregate. The mechanical properties of the concrete have been investigated for nominal mix and mix design as per the mix design codes IS 10262-2009 and IS12727:1989. Porous concrete is no fines concrete with the desired degree of compressive strength with high porosity to allow permeability. Various proportions of cement, water, and percentage of coarse aggregates and building demolition wastes are used. In this paper 40:60, 50:50 and 60:40 ratio of coarse aggregate and building demolition wastes are used with water cement ratio 0.4 to 0.48. 28 days cube compressive strength of an average of three samples are determined. During the study, lesser density by weight and 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 and has been found to be 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. In the recent decade's demolition of old buildings, renovation of construction gave rise to gargantuan amounts of construction and demolition waste. Even the waste produced by industries and households got amplified. 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 resultant concrete thus produced was tested on the following parameters like compressive strength, workability, flexural strength. The results thus obtained are compared with a plain cement concrete. By using low weight materials like plastic debris we got a light weight concrete. The workability of concrete produced with construction waste when compared with plain cement concrete is not reliable but it produced a considerable increase in the compressive strength. So we have increased the quantity of plastic debris and deducted some quantity of other waste, by this the workability standards are maintained. Hence by using required quantities strength and workability are acquired. The economy plays an imperative role in any construction, by partially replacing of coarse aggregate with construction and demolition waste, plastic waste the cost of construction can be reduced. These wastes can cause pollution that effects human health. Using these wastes effectively in construction activities the rate of pollution can also be controlled. Even the properties of concrete can also be improved.

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

Use of recycled aggregate in concrete can be useful for environmental protection. Recycled aggregates are the materials for the future.

The application of recycled aggregate has been started in a large number of construction projects of many European, American, Russian and Asian countries. Many countries are giving infrastructural laws relaxation for increasing the use of recycled aggregate. This paper reports the basic properties of recycled fine aggregate and recycled coarse aggregate & also

compares these properties with natural aggregates. Basic changes in all aggregate properties are determined and their effects on concreting work are discussed at length. Similarly, the properties of recycled aggregate concrete are also determined. 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 concreting work. In general, the present status of recycled aggregate in India along with its future need and its successful utilization are discussed here.

6. **"Use of demolished concrete wastes as coarse aggregates in high strength concrete production." IJRET: International Journal of Research in Engineering and Technology.**

Construction and demolition wastes constitute one of the major components of wastes generated worldwide. Very large quantities of aggregates are used in concrete production and in construction. When the useful life of the structure is over it will be demolished and all the demolished wastes just find their way to landfills. Finding large areas of landfills is becoming very difficult. On the other hand, continuous extraction and quarrying of natural aggregates for construction are causing depletion of natural resources. The recycling of demolished construction waste in to aggregates to be used in new engineering application provides a promising solution to both the problems. In this work the usability of concrete with the aim of producing high strength concrete. The results of this experimental study are aimed at examining the properties and strength of recycled aggregate concrete made from different replacement ratios of recycled aggregates from natural aggregates and to evaluate the strength of recycled aggregate concrete to check its usability as structural concrete. The properties and results of recycled aggregate concrete are found and compared to that of natural aggregate concrete and reported in this paper. Thus from the results of compressive strength, flexural strength and split tensile strength it can be concluded that though the strength of recycled aggregate concrete is lower than that of the natural aggregate concrete, it still lies within the usable range and hence can be used in structural concrete. Demolished waste as coarse aggregates in new concrete are attempted. This experimental investigation involves evaluating the properties of the constituents of concrete including the demolished concrete wastes which shall be used as coarse aggregates in new.

7. Compressive Strength

The compressive strengths for the cubes which are added with 10% of the demolished waste are determined by universal testing machine and the strengths are taken for each cube for 7 days, 14days and 28 days of curing.

3. RESULTS

Results were arrived having conducted experiments in 36 cubes with different mix ratios and curing have been done for 7 days and 14 days and 28 days for all those different ratios. All the demolished waste added cubes are added with the admixture ie: 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 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

Compression Test Results

Compressive Strength of 10% DM Added Concrete Load for 7, 14 And 28 Days

Table-1 Compressive Strength For 15% DM Added Concrete Load for 7, 14 And 28 Days

S. No	Type of Concrete	Type of Specimen	7 Days (N/mm^2)	14 days (N/mm^2)	28 Days (N/mm^2)
1	15% DM	Cube	25.22	28.65	31.50

Table-2 Compressive Strength For 20% DM Added Concrete Load for 7, 14 And 28

S. No	Type of Concrete	Type of Specimen	7 Days (N/mm^2)	14 days (N/mm^2)	28 Days (N/mm^2)
1	20% DM	Cube	20.45	24.35	26.56

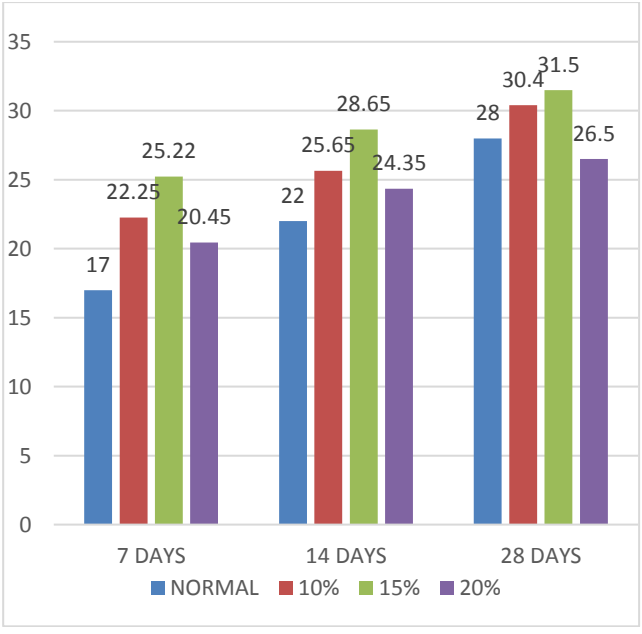
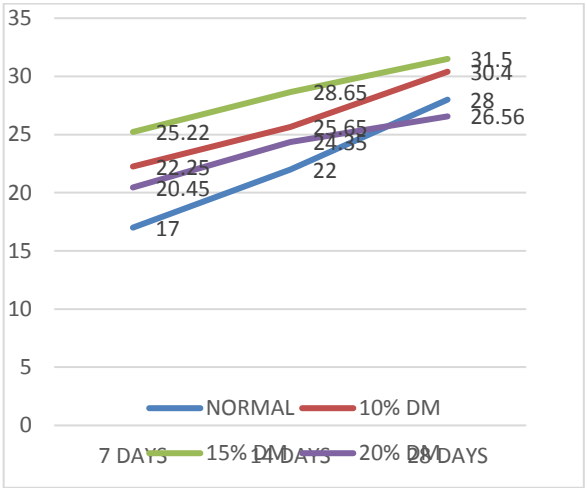


Fig: Analysis of Compression Test Results (CS Bar Graph of 0%, 10%, 15%, 20% for 7, 14, 28 days)



4. CONCLUSION

1. Demolished aggregate possess relatively lower bulk crushing, density and impact standards and higher water absorption as compared to natural aggregate.
2. Tests conducted on demolished aggregates and results compared with natural coarse aggregates are satisfactory as per IS 2386.
3. The compressive strength of demolished aggregate concrete is relatively lower up to 15% than natural aggregate concrete.
4. Using demolished aggregate concrete as a base material for roadways reduce the pollution involved in trucking material.

5. FUTURE SCOPE

1. Sustainable development of structures can be achieved by using waste demolished concrete aggregate.
2. We can use the plastic waste also as coarse aggregate in concrete.
3. Fine aggregate in the demolished concrete can also be utilized in future.
4. Demolished bricks and stones possess the same properties as coarse aggregates.

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