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Utilization of Demolished Concrete and Construction Waste as Coarse Aggregate in Concrete

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Abstract

In the construction field of the world, use of construction & demolished waste as alternative of coarse aggregate plays an vital role to save natural resources and economically good for us. In present days for human, environmental issue is very important thus it seeks to improve construction & demolished waste material for construction. The use of construction and demolition waste is giving a prospective application in construction and gave an alternative to natural coarse aggregate. In the laboratory the construction & demolished waste has been tried as replacement substitute to natural coarse aggregate in concrete making of cubes, beams. These were cast and tested for compressive strength and flexural strength after a curing period of 7, 14, 28 days. The results indicate effectiveness of construction & demolished waste as partial replacement of natural coarse aggregate up to 15 percent, without affecting the design strength.

Keywords: recycled aggregate, construction & demolished waste etc.

Introduction

There are some legislation is introduced by governments of different countries to improve the percentage of use of recycled aggregates in newly constructed building and structures for protection of environment and promotion of the principles of economical development. There is a good method to improve this is to lower the selling price of recycled aggregates with comparatively to natural aggregate, and this is very simply done by increasing landfill costs. In present days construction and demolition and restoration sites are a big source of large amounts of construction and demolition waste, which is in now days simply being used in the land filling.

In India, and other developing countries where low income communities are present there is the use of recycled aggregate made from the waste recovered from the construction and demolition sites in new construction and other renovation projects is very economical after the global economic crises.

In India, due to industrial development a serious problem is increases that is depletion of natural aggregates and creates a large amount of waste materials available from construction and demolition activities. One of the ways to reduce these problems is to utilize construction and demolition waste as a coarse aggregate in the new construction concrete.

Objective

The objectives of this research are following as-

1. To use of the demolished and construction waste aggregate in the new concrete as the recycled concrete aggregate reduces the environmental pollution as well as providing an economic value for the waste material.
2. To study the utilization of demolished and construction waste as a replacement of natural coarse aggregate.
3. To study the mechanical and physical properties of demolished and construction waste aggregate by conducting experimental work.

Materials

A. Cement:

The cement used in all mixtures was commercially available Ordinary Portland cement of 43 grade manufactured by ACC cement company confirming to IS 8112:1989 was used in this study. The compressive strength of cement was 45 MPa. The initial and final setting time were found as 65 minutes and 385 minutes respectively.

B. Fine aggregate:

Locally available sand confirming to grading zone III as per IS 383:1970. The sand was air-dried and sieved to eliminate any foreign particles before

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mixing. Sand passed through 4.75mm IS sieve is used as fine aggregate. The specific gravity of sand is 2.64 and fineness modulus of 2.45. The loose and compacted bulk density values obtained are 1530 Kg/m^3 and 1600 Kg/m^3.

C. Coarse aggregate:

The coarse aggregate with a maximum size 20mm having a specific gravity 2.85 and fineness modulus of 7.25.The loose and compacted bulk density values obtained are 1480Kg/m^3 and 1610 Kg/m^3 respectively, and water absorption of 0.24%.the aggregate crushing value (%) and aggregate impact value (%) of coarse aggregate is 17.29 and 13.31 respectively.

D. Construction and Demolition Waste:

The construction and demolition wastes are obtained from a local building that has been demolished and constructed. The aggregates passing through IS sieve 20mm and retained on 12.5mm are taken. The specific gravity of tile aggregates is 2.64 and fineness modulus of 7.358. The loose and compacted bulk densities are 1356Kg/m3 and 1510Kg/m3 respectively , and water absorption of 0.55%.the aggregate crushing value (%) and aggregate impact value (%) of coarse aggregate is 29.58 and 18.36 respectively.

Experimental Program

The mix design is produced for maximum size of aggregate is 20mm conventional aggregate and construction and demolition waste aggregate. The variation of replacement of construction and demolition waste as partial replacement of conventional aggregate is studied by casting cubes, and beams until 25%. The concrete was prepared in the laboratory using manually. The cement, fine aggregate and coarse aggregate and construction and demolition waste are mixed in dry state and then the desired water quantity is added and the whole concrete is mixed for 10 minutes, the concrete is filled in the moulds which are
screwed tightly. The concrete is filled into the moulds in 3 layers by poking with tamping rod for cubes of 150mmX150mmX150 mm size and beams of 150mmX150mmX700mm size were tested for compression, and flexural strengths. The cast specimens are removed after 24 hours and these are curing in a water tank. After a curing period of 7, 14, 28 days the specimens are removed and these are tested for
compression, and flexural strengths and the results are compared with conventional concrete.

Results and discussions

For cubes the maximum density of 2607.40 kg/m^3 was attained at the replacement of 0%, while the minimum density of 2391.11 kg/m^3 was attained at 25% replacement. Therefore density of cubes of concrete decreases as increases the replacement. For prisms the maximum density of 2490.52kg/m^3 was attained at the replacement of 0%, while the minimum density of 2340.33 kg/m^3 was attained at 25% replacement. Therefore density of prism of concrete decreases as increases the replacement.

The maximum compressive strength of 42.81 N/mm^2 was attained at 0% replacement, while the minimum strength of 19.40 N/mm^2 was attained at 10% replacement. At 15% replacement, concrete attained 36.37 N/mm^2, the minimum suggested for use as structural concrete according to the requirements of BS 8110 – Part1 [7]. The strength reduced as the percentage of replacement increased. The surface area increased as the Construction and demolished waste increased, thus requiring extra amount of cement for proper bonding. As cement content was constant, so there was no extra bonding hence strength reduced.

The maximum flexural strength of 5.03 N/mm^2 was attained at 0% replacement, while the minimum strength of 2.37N/mm^2 was attained at 10% replacement. At 25% replacement, concrete attained 4.00N/mm^2 marginally less than 5.03N/mm^2.

Conclusion

There are several conclusions from above study:

I. Construction and Demolished waste is used as the coarse aggregate in new concrete.

II. In research, it is shows that 0 to15% replacements of recycled aggregate as natural aggregate gives a good comparatively result**.**

III.Construction and Demolished waste concrete may be an alternative to the conventional concrete

IV. Water required producing the same workability increases with the increase in the percentage of demolished waste..

V. Use of the waste aggregate in the new concrete as the recycled concrete aggregate reduces the environmental pollution as well as providing an economic value for the waste material.

VI. Usage of recycled aggregates can not only preserve the finite raw materials, but also reduce energy consumption and overall construction costs

VII. Density of the concrete will be decreases as the percentage of replacement of demolished and construction waste aggregate increases from 0% to 25 %

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