

Renewable aggregates: The plausible and defiance for natural aggregate conservation

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Abstract—Disposal of Construction and Demolition (C&D) waste in the recent times has become a matter of concern, as it requires a large area as a landfill, causing an adverse effect on environment. Recent study shows the depletion of natural aggregate which is in an alarming situation. Central Pollution Control Board has estimated that waste from construction industry only accounts for more than 25%. Management of such high quantum of waste puts enormous pressure on solid waste management system. 3R concept (Reduce, Reuse and Recycle) can help to meet the requirements of Construction industry at a lower cost and reduce the unused disposal of C & D waste. Using C&D wastes as recycled aggregates reduces the impact on landfill, conserves natural aggregates, reduces energy consumption and can be cost effective. Recycled aggregates obtained by crushing, screening of different C&D wastes like bricks, reinforcement, plastics etc. into different sizes to form coarse and fine aggregates. In this paper, the properties of recycled aggregates and its comparison with the natural aggregates mentioned. The objective is to find out the percentage use feasible for construction. Tests carried out on recycled aggregate and natural aggregate and their results compared.

Index term —Recycled Aggregates, Concrete, C&D wastes management, Compressive strength, environment, water absorption.

1. INTRODUCTION

The requirements of natural aggregates are not only required to fulfil the demand for the upcoming projects, but also are the needs of the extensive repairs or replacements required for the existing infrastructure and dilapidated buildings built few decades back. Generation of C&D wastes in recent days is in huge quantity. A metropolitan city like Delhi alone produces more than 4000 tonnes of C&D Waste and due to improper disposal; this waste is choking storm water drains and polluting the Yamuna riverbed. Disposal of such a huge quantity of wastes is a major challenge. Recycling this C&D waste to form recycled aggregates is an effective way of managing this waste. Using recycled aggregates not only helps in managing C&D wastes but also reduces the demand of virgin aggregates.

Recycled aggregates have a great potential of becoming a viable alternative to virgin aggregates. In this study, replacing virgin aggregates by 100% recycled aggregates shows comparative result for medium strength concrete.

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The strength of concrete formed by recycled aggregates improves by using some admixture and substituting some amount of fine aggregates by substance like MS chips etc.



Recycled coarse aggregate



Recycled fine aggregate

2. PAST STUDIES ABOUT RECYCLED CONCRETE AGGREGATES

1. Nelson, Shing Chai NGO in 2004[4] stated that the workability was good and can be satisfactorily handled for 0% recycled aggregate to 80% recycled aggregate and with more percentage replacement of recycled aggregate used in the concrete specimen, the percentage of tensile strength remained gradually decreasing.
2. Concrete results showed that 25MP and 30MP strength can be reached using recycled aggregate as a coarse material. Using more than 35% of fine recycled aggregate causes an obvious weakness in the concrete strength.[6]
3. The test results showed that the flexural, compressive and split tensile strength of the recycled aggregate concrete is found to be lower than the natural aggregate. However the strength of recycled aggregate concrete can be improved by the water and acid treatments. [7]

3. EXPERIMENTAL PROCEDURE

A. Testing of Recycled Aggregates

S.NO	Name of Experiment	Result
1	Aggregate Crushing value	29.27
2	Aggregate Impact value	25.86
3	Bulk Density (C.A)	1.46
4	Specific Gravity	2.56
5	Water absorption	3.52%

B. Mixed Proportions

I. MIXED DESIGN OF CONTROL BLOCK

S.No.	Material	Quantity (Kg/m ³)
1.	Water	128.7
2.	Cement	234
3.	Fine Aggregate (Sand)	507
4.	Coarse Aggregate	824

II. MIXED DESIGN OF RECYCLED CONCRETE BLOCK

S.No.	Material	Quantity (Kg/m ³)
1.	Water	128.7
2.	Cement	234
3.	Fine Aggregate (Sand)	507
4.	Coarse Aggregate	824
5.	Admixture	2.4

1. Testing on Concrete cubes

The entire experimental process consist of two parts, the preliminary testing using control cubes and testing done on cubes made of 100% recycled aggregates

a) Preliminary Testing of control block

Testing consists of casting of batches of cubes of dimensions 15x15x15 mm of mixed design with each batch containing 3 cubes. Each of the three cubes were cured for 7 Days, 14 Days and 28 Days respectively and the tested for compression on the Universal Testing Machine (UTM). The obtained results versus the standard results are specified in table III.

III. CUBE TESTING RESULTS UNDER COMPRESSION WITH UNIVERSAL TESTING MACHINE (UTM)

No. of Days	Strength (N/mm ²)
7 Days	12.8
14 Days	18.9
28 Days	24

b) Testing of recycled concrete block

Testing consists of casting of batches of cubes of dimensions 15x15x15 mm of recycled concrete with each batch containing 3 cubes. Each of the three cubes were cured for 7 Days, 14 Days and 28 Days respectively and the tested for compression on the Universal Testing Machine (UTM). The obtained results versus the standard results are specified in table IV.

IV. CUBE TESTING RESULTS UNDER COMPRESSION WITH UNIVERSAL TESTING MACHINE (UTM)

No. of Days	Strength (N/mm ²)
7 Days	11.6
14 Days	18
28 Days	23.4

4. CONCLUSION

- The strength of concrete produce from recycled aggregates is comparable to that produced by virgin aggregates for medium grade concrete
- The crushing value and impact value of aggregates is suitable for road surfacing
- Recycled aggregates has high water absorption and hence needs some special admixtures to reduce the water demand

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