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Use of Recycled Aggregate in Construction

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Abstract: *The use of waste materials in building is being progressively promoted to lessen environmental effect because sustainability is now a necessity for the construction sector globally. Many new materials and technologies have been developed for the purpose of testing their suitability for the design, construction, and upkeep of these pavements in the highway system. Concrete scraps are one of them. The primary goal of this study is to utilise the readily accessible waste and recycled concrete that may be utilised in a cost-effective and practical manner. These materials are inexpensive and environmentally benign when used in proper proportions in building. Waste concrete can be utilised as aggregate in the construction of buildings and pavements, taking the place of natural aggregate.*

Keywords: Sustainability, pavement, recycled concrete, aggregate.

I. INTRODUCTION

The most valuable way to reuse old concrete is to use it as aggregate in fresh concrete. This old concrete is frequently left in unattractive mounds, dumped, or used as random fill or sub-base material. On the other hand, natural aggregates, which are made of sand, crushed stone, or gravel, make up the majority of the volume of concrete mixtures and are used to make pavement. Natural aggregate resources are abundant but limited, and they are being used up, particularly close to urban areas. The opening of new quarries and the expansion of current aggregate quarries are further constrained by environmental rules and land use policies. Costs of natural aggregate are anticipated to increase because to a lack of suppliers and rising transportation cost. This might be done by substituting recycled concrete aggregate (RCA) for natural aggregates, which could help with both the economic and environmental issues.

II. LITERATURE REVIEW

J. Lavado, J. Bogas. J. De Brito, A. Hawreen "Fresh properties of recycled aggregate concrete"10 February 2020: Construction and Building Materials The experimental results showed that mixes with coarse recycled aggregates (CRA)and water to cement (w/c) ratios 0.55 tend to have a similar behavior. This is mainly because in this type of concrete the cement paste plays the dominant role in terms ofworkability. In mixes with lower w/c (0.35 and 0.45), the shape and texture of CRA became more relevant, leading to less fluidity and consistency. The mixes also showed small scatter of their fresh- state properties for small variations of cement paste volume.

Bassam A. Tayeh, Doha M. Al Saffar, Rayed Alyousef The utilization of recycled aggregate in high performance concrete July–August 2020Journal of Material Research and Technology Using Recycled Aggregate (RA) in concrete production is an environmentally friendly solution to the continuous depletion of natural aggregates. RA could improve the cement matrix mechanical properties. RA increases compressive strength of high performance concrete (HPC). Due to the porosity of RA, they have lower unit weight than natural aggregates. For the same reason, RA can significantly decrease the workability of concrete. Splitting and flexural strengths are increased with RA.

Sepani Senaratne, Gregory Lambrousis, Olivia Mirza, Vivian W. Y.Tam, Won- Hee Kang Recycled concrete in structural applications for sustainable construction Practices in Australia Journal of Science Direct Recycling old concrete is a major practice that the construction industry must focuson to led to a sustainable future. Further, entry of such material to the market could be through precast panel construction as quality and consistency could be closely monitored. The building could potentially gain a higher green rating with the many green-rating systems. Most engineers suggested its use favorable in marine construction and high weather exposed environment.

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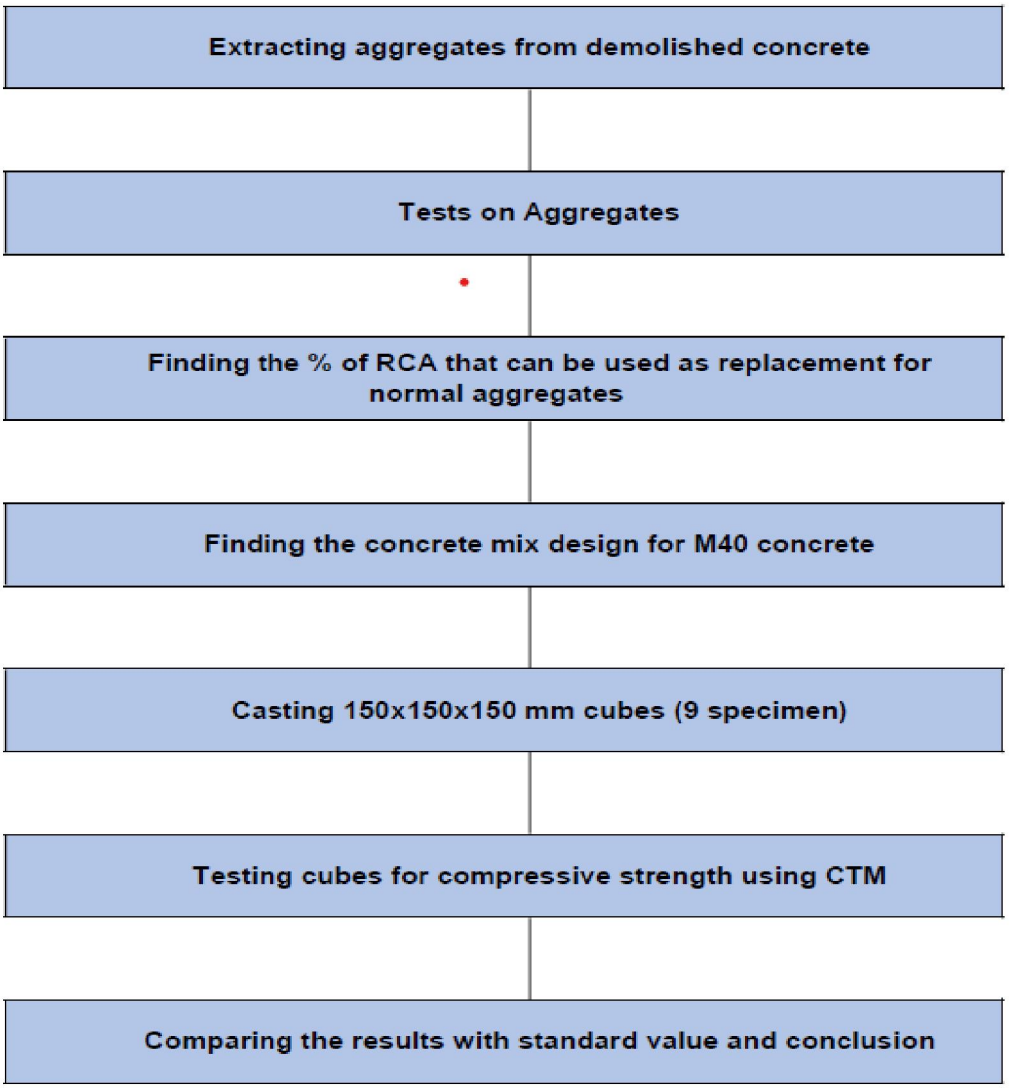
III. METHODOLOGY

Process Flow Chart



Primary Test

Tests on Aggregate

As per our project objective, we have to find optimum percentage of RCA to be used. Hence, we have selected 7 combinations of RCA and natural aggregate for few of the following tests on aggregate as mentioned in their observation tables.

1 Impact value of aggregate
2 Crushing value of aggregate
3 Abrasion value of aggregate
4 Specific gravity of fine and coarse aggregate
5 Water absorption of aggregateegular font.

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Tests on Cement

1 Standard Consistency of Cement
2 Initial and Final Setting Time
3 Fineness of Cement
Concrete mix design

TABLE-I: Concrete Mix Design Proportions for 100% Replacement with RCA

Sr. No.	Water(m3)	Cement(kg/m3)	Fine Aggregate(kg/m3)	Coarse Aggregate(kg/m3)
Content	157	392	753	1228
Proportion	0.4	1	1.92	3.13

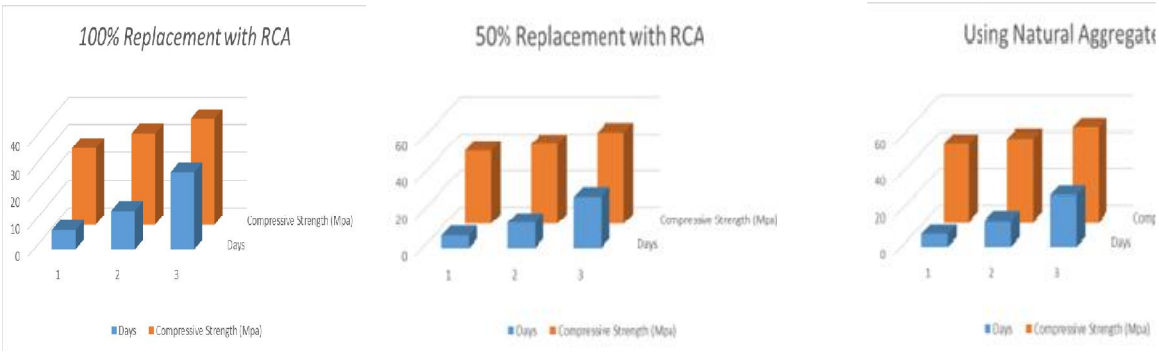
TABLE-II: Concrete Mix Design Proportions for 50% Replacement with RCA

Sr. No.	Water(m3)	Cement(kg/m3)	Fine Aggregate(kg/m3)	Coarse Aggregate(kg/m3)
Content	157	392	715	1186
Proportion	0.4	1	1.824	2.97

IV. RESULT

Standard metallic cube molds (150*150*150 mm) were casted for compressive strength. Compaction of the hand filled concrete cubes was done. The specimens were demolded after 24 hours and subsequently immersed in water. We have casted total nine cubes (three cubes for each type of RCA proportion) and tested them periodically after 7 days, 14 days and 28 days. The test was performed on Compressive Testing Machine (CTM).

Compressive Strength



V. CONCLUSION

For grade of concrete M40, hybrid mix (natural aggregate and recycled aggregate) replacement with natural aggregate gives the design strength at 28 days. Hybrid mix (natural aggregate and recycled aggregate) samples up to 50% replacement gains required compressive strength at 28 days and beyond 50%, there is reduction in strength. The most suitable mix proportion is 50% replacement of recycled aggregate and 50% natural aggregate which provides satisfactorily results. The compressive strength obtained for M40 grade of concrete for 50% replacement with RCA does satisfy the requirement led down by IS code. Extraction of earthen materials to produce natural aggregate can be reduced resulting in prevention of harm to environment to some extent. This research concludes that using natural aggregate and recycled aggregate can be innovative supplementary construction material but judicious decisions shall be taken by authorized engineer in-charge

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