Development of Recycled Aggregate Concrete and Check its Structural Stability

Vikash Aggarwal [1], Dipak Thakare[2], Shivani Gonnade [3], Mrunal Walke[4], Rohit Ukey[5], Ritika Kaswate[6]

[1]Assistant Professor, Civil Engineering, Priyadarshini College of Engineering & Technology, Nagpur

[2]Student, Civil Engineering, Priyadarshini College of Engineering & Technology, Nagpur

[3]Student, Civil Engineering, Priyadarshini College of Engineering & Technology , Nagpur

[4]Student, Civil Engineering, Priyadarshini College of Engineering & Technology, Nagpur

[5]Student, Civil Engineering, Priyadarshini College of Engineering & Technology, Nagpur

[6]Student, Civil Engineering, Priyadarshini College of Engineering & Technology, Nagpur

Abstract:- The growing demand for sustainable construction materials has led to increased research on recycled aggregate concrete (RAC) as an alternative to conventional concrete. This study explores the development of RAC by replacing natural aggregates with recycled aggregates derived from construction and demolition waste. Various mix designs, treatment methods, and admixtures are analyzed to enhance the mechanical & durability properties of RAC.

The structural stability of RAC is assessed through compressive strength, tensile strength, flexural strength, and durability tests. Additionally, factors such as water absorption, shrinkage, and bond strength are examined to evaluate its long-term performance. Finite element modeling (FEM) and experimental investigations are employed to

compare RAC's behavior with traditional concrete under different loading conditions.

Results indicate that with proper treatment and mix proportioning, RAC can achieve mechanical properties comparable to conventional concrete while promoting sustainability and reducing environmental impact. The study concludes that RAC is a viable structural material for non-load-bearing and certain load-bearing applications, contributing to sustainable construction practices.

Keywords: Recycled aggregate concrete, sustainability, structural stability, mechanical properties, durability, finite element modeling

1. Introduction

After water, concrete is by far the most utilized material in the world (Chinnu et al. 2021). It is frequently used in construction projects because of its strength, economical cost, durability, and versatility. All these attributes make it suitable for infrastructure development around the globe. Unfortunately, concrete requires large quantities of raw aggregate materials which has caused many countries to face environmental issues. Therefore, the construction sector is looking for effective ways to ensure more sustainable concrete usage in the future. 1996; Shatkin 2016). The urbanization of the continent has in turn fast tracked construction activities which has further escalated the need for aggregates. Makul et al. (2021) and Tam, Soomro, and Evangelista (202) have shown in their studies, the consumption of aggregates all over the world over the last years.

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2. Methodology.

1. Collection of Material
2. Collected cement (PPC)
3. Collected Natural Aggregate (20mm), Collected Waste Aggregate
4. Collected Fine Aggregate (retained from 1.18mm sieve)
5. Material Testing
6. Cement Testing (Standard Consistancy Test)
7. Aggregate Testing (Los Angeles Abrasion Testing), (Impact Value)
8. Sand Testing (Sieve Analysis)
9. Mix Design
10. Preparation of Concrete

Used **1:1.65:2.91** ratio for making M40 grade concrete

3.1 Figures and Tables

Figure 1: Compression Testing Machine (CTM)

Compression testing machine is use to determine the strength of the specimen or whichever is induced under the loading of the machine

Figure 2 : Using Non-porous sand for the concrete mix size between 0.15mm – 4.75mm

Figure 3 : Using mould of size150x150x150mm for casting of cube

Figure 4 : Using Non-porous Aggregate with specific gravity 2.7 and size of 20mm check with flakiness index

Figure 5 : Used curing tank for cube for 7 , 14 and 28 days simultaneously

We have conducted test for Concrete blocks in 3 durations, such as 7 days, 14 days and 28 days

3.2 Tables.

SPECIMEN	Compressive strength in 7 days (MPa)	Compressive strength in 14 days (MPa)	Compressive strength in 28 days (MPa)
Cube 1	16.67	19.11	26.67
Cube 2	14.44	16.88	24.44
Cube 3	14.78	18.88	24.78
Avg.	15.29	18.29	25.30

Table 1: Normal Aggregate Concrete

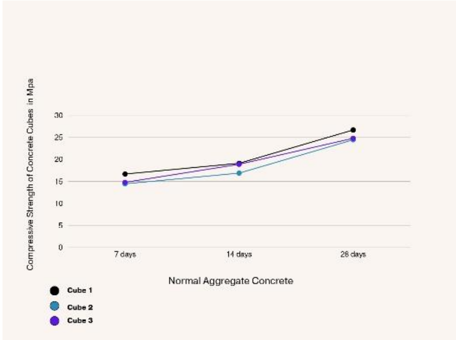
SPECIMEN	Compressive strength in 7 days (MPa)	Compressive strength in 14 days (MPa)	Compressive strength in 28 days (MPa)
Cube 1	12	17.88	20.88
Cube 2	11.11	16.33	21.66
Cube 3	16.67	17.88	19.11
Avg.	13.26	17.36	20.55

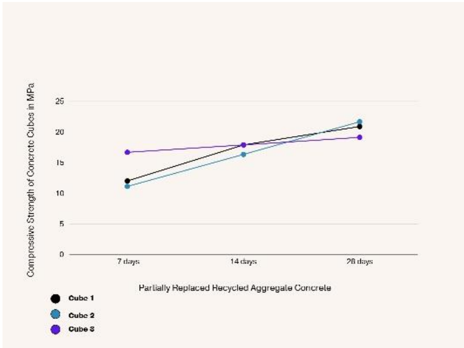
Table 2: Partially Replaced Recycled Aggregate Concrete

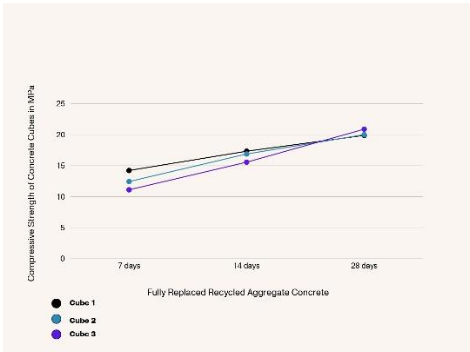
SPECIMEN	Compressive strength in 7 days (MPa)	Compressive strength in 14 days (MPa)	Compressive strength in 28 days (MPa)
Cube 1	14.22	17.33	19.88
Cube 2	12.44	16.88	20
Cube 3	11.11	15.56	20.88
Avg.	12.59	16.60	20.25

Table 3: Fully Replaced Recycled Aggregate Concrete

3.3 Graph.







Conclusion.

This article gives a detailed look at using recycled aggregate or concrete material in building project , focusing on their use in structures & the challenges & chances for these materials in Southeast Asia .For the first time it checks the basic features of recycled concrete ,like how much water it can absorb, it weights,
& how strong it is . It also summarize what other studies says about recycled concrete, especially how strong it can be when pushed, pulled or bent .The article suggest different ways to make recycled concrete work better.it discusses what was found earlier studies & notes what still needs to be researched. The main points & conclusions from the earlier article are presented at the end.

Recycled Aggregate Concrete [RAC] is an environmentally friendly alternative to traditional concrete, incorporating recycled concrete aggregates [RCA] sourced from the construction & demolition waste. The development RAC aims to reduces the environmental impact to promote sustainability in the construction industry.

The production of [RAC] involve substituting natural aggregate [NA] with RCA. However, RCA often contains residual adhered mortar,
leading to increase of porosity & water absorption compared to NA. these characteristics can affect the mechanical, properties & durability of the resulting concrete. To address these issues, various treatment methods have been explored to enhance the quality of RCA. For instance, studies have shown that adding natural aggregate does not significantly improve the performance of RCA at low cement content
[< 2 %] treatment .

While the challenges remain, the continued research & technological innovations in recycled aggregate concrete make it a promising & practical solution for the sustainable construction our future efforts are to focused on optimizing mic proportion, improving RCA treatment method, & increasing the acceptance of RAC in large-scale Structural projects **.**

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