International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 5 May 2022, pp: 424-427 www.ijaem.net ISSN: 2395-5252

Use of Recycled Aggregates in Green Concrete

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Submitted: 01-05-2022 Revised: 04-05-2022 Accepted: 08-05-2022

ABSTRACT: Recycling aggregate is a significant step toward sustainable development in the concrete industry and building waste management. Concrete, with its basic elements of cement, aggregates (course and fine), and water, plays an important role in infrastructure development. Of these materials, aggregates account for around 60–75 percent of total concrete volume. Recycled aggregate concrete is a feasible alternative to natural aggregate that contributes to environmental protection .This researchpaper focuses on the possibilityof using recycled concrete aggregateswith structural concrete. The purpose of this study is to investigate the compressive strength of concrete. Casting of Concrete was done using recycled concrete aggregates having replacement percentage of 30%, 40% and 50% and then tested after curing of 7 and 28 days respectively.

Keywords:-Recycled aggregate concrete, Compressive strength, Green concrete

I. INTRODUCTION

Green concrete is defined as concrete that contains at least one component made from waste, or whose manufacturing method does not harm the environment, or which has excellent performance and life cycle sustainability. After water, concrete is the world's second most consumed material, and its extensive use is the foundation for urban development. Each year, it is estimated that 25 billion tonnes of concrete are produced. Concrete is the world's top construction material and most commonly employed in all forms of civil engineering projects,Infrastructure, modest and highrise buildings, defence installations and so on.Concrete is a manmade substance made up mostly of cement, aggregates, and water.Aggregates have traditionally been inexpensive and widely available. On the other side, every year, over billion of tonnes of construction and demolition trash are generated around the world.Crushed concrete is now widely available in enormous quantities, owing to demolition of existing structures and leftover concrete from new construction. Every year, it is projected that 2 percent to 10% (on average, 5%) of the estimated ready mixed concrete is returned to the concrete plant, which is also a major concern in terms of disposal. Over the last two decades, it has become increasingly significant. Minimizing waste and lowering the pressure on landfills is a global issue.The use of recycled aggregate in concrete has been the subject of extensive research around the world.Hardened concrete can be crushed and utilised as a partial replacement for natural aggregate in new concrete construction, which is a proven method. Recycling building trash is critical for both environmental and economic reasons.It will reduce the amount of open land required for land infill and also resource depletion. Recycling of concrete materials has two major advantages: it conserves natural aggregate and reduces waste.It reduces the environmental costs of exploitation and transportation, and it keeps away landfills from being used.In the last few decades, aggregate has been produced for the production of fresh concrete.All concretes in which natural coarse aggregate was replaced with recycled aggregate prepared by crushing old concrete showed a decrease in compressive strength in general.Use of Recycled aggregates in green concrete is being studied.

1.1.Recycledaggregate Concrete (Rac)

RAC is an alternative to natural aggregate. It is made up by recycling clean concrete aggregate waste where the other building wastes are very low. RAC is produced in three major steps:

- Assess the quality of source concrete
- Crushing of destroyed concrete
- Removal of contaminantsfrom the RAC.

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1.1.Benefits Of Recycled Aggregate Concrete (Rac)

Using recycled aggregates has numerous economic, environmental, and social advantages.

Cost Saving

- Recycling aggregates rather than new materials can save money because they are less expensive to manufacture.
- The cost of transporting aggregates can be decreased if recycled aggregates are available locally.
- Recycling aggregate for resale is less expensive than sending unwanted materials to the landfill.

Eco Friendly

- Recycled Aggregate is considered a "green" building material.
- Using recycled aggregate minimises the amount of fresh aggregate produced, resulting in decreased natural resource consumption.
- To fulfil the environmental standards, there is increasing pressure on landfill capacity and on building sites to divert trash away from disposal.

Versatile

- Recycled aggregates can be utilised for a wide range of purposes, including construction projects, landscaping, and home improvement projects.

Durable

- Recycled Aggregate has been shown in studies to be as structurally sound as natural aggregate and to be as safe to use.

II. OBJECTIVES OF THE STUDY:

- To make concrete from locally available materials (e.g., recycled aggregate concrete).
- To investigate the strength qualities of green concrete with natural aggregates partially replaced.
- The purpose of this study was to see how recycled coarse aggregate affect the strength of concrete.
- To figure out what the best percentage of recycled coarse aggregate to use in concrete.

III. DESIGN MIX METHODOLOGY

A mix of M25 grade was designed as per IS 10262:2009 and the same was used to prepare the test samples. The design mix proportion is shown in Table

Table 1:Concrete Design Mix Proportions

W/C Ratio	Proportion	Cement (Kg/m 3)	Fine Aggregate (Kg/m 3	Coarse Aggregate (Kg/m 3)	Water
0.55	1:1.56:3.48	338.18	528.98	1176.99	186

Table 2:Details of M25 Grade Concrete Mix

Mix	Recycled Coarse Aggregate
Mx1	0%
Mx2	30%
Mx3	40%
Mx4	50%

IV. EXPERIMENTAL METHODOLOGY

Cement, water, fine aggregate, and coarse aggregate are all used in concrete (Recycled and Natural). With the command ,the natural aggregate is replaced with recycled aggregates in concrete to the extent that 30%,40% and 50% of the natural aggregate is replaced. Three cubes For each 1:1.56:3.48 concrete mix with partial replacement of coarse aggregate with a w/c ratio of 0.55, samples were cast on a mould with dimensions of 150x150x150 mm. The specimens were de-moulded after around 24 hours and water curing proceeded until they were assessed for compressive strength after 7 and 28 days.

V. COMPRESSIVE STRENGTH

Using cube samples, compression strength tests were done on a compression testing machine. The average strength values provided in this research were determined by testing three samples each batch. The cube is loaded at a rate of 35 N/mm2 each minute. Comparative tests were

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conducted on their characteristics for a concrete mix ratio of 1:1.56:3.48 with partial substitution of natural aggregate with recycled aggregates of 30%, 40%, and 50%, respectively.

VI. EXPERIMENTAL RESULTS

Table 3:Compressive Strength of cubes at 7 and 28 Days

Sr. No.	Mix	Average compressive strength in N/mm^2	
		7 Days	28 Days
1.	Mx1	22.23	32.4
2.	Mx2	19.4	28.14
3.	Mx3	16.9	27.4
4.	Mx4	14.59	25.36

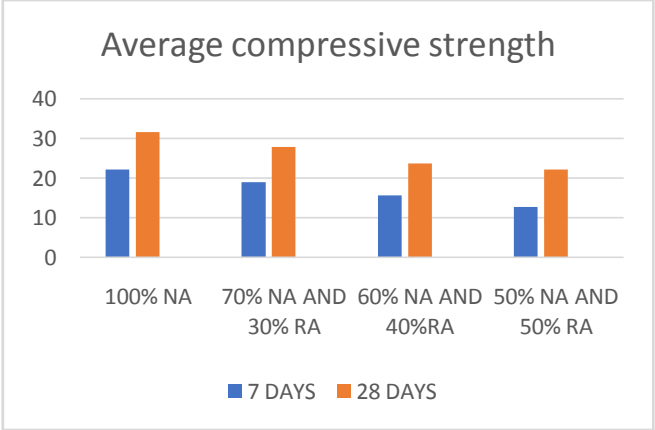

Figure 1:Graphical Representation of different mix at 7 and 28 days respectively

VII. COST ANALYSIS

The change in cost due to replacement of aggregates is worked out in table 5 The basic market rates of materials are given in table 4.

Table 4

Sr. No.	Materials	Rate (Rs/Kg)
1	Cement	7
2	Fine aggregate	0.60
3	Coarse aggregate	0.65

Table 5

Concrete grade		% Replacement in aggregate	Materials				Total cost	% Change in cost
			Cement [Kg/m^3]	Fine aggregate [Kg/m^3]	Coarse aggregate [Kg/m^3]	Recycled coarse aggregate [Kg/m^3]		
M25	Mx1	0	338.18	528.98	1176.99	0	3449.691	0
	Mx 2	30	338.18	528.98	823.893	353.097	3220.178	(-)6.65
	Mx3	40	338.18	528.98	706.194	470.796	3143.668	(-)8.87
	Mx4	50	338.18	528.98	588.495	588.495	3067.169	(-)11.09

30% Replacement of Recycled Aggregates Gives desired results in compression strength and hence it can be used for construction purpose. and making use of recycled aggregates over virgin Aggregates can save money and here also 30% replacment of RA can save 6.65% of total budget of materials

VIII. CONCLUSION

Following are the conclusions have been made based on the results of the experimental study.

- In terms of technical, environmental, and economic considerations, recycled aggregates in concrete have shown to be a valuable building resource.
- The compressive strength has been observed to have increased for 30% RA replacement, however more replacement of RA reduces the compressive strength.
- The recycled aggregate has proven to be extremely durable and beneficial in a variety of situations. Their characteristics are nearly identical to those of virgin aggregate.
- The use of recycled aggregate in combination with natural aggregate can help to reduce waste and pollution. The goal of this project is to promote the use of waste products as building materials in low-income homes
- Use of RA promotes Green Concrete this protects the environment and sustainability can be achieved.

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