STUDY ON STRENGTH OF CONCRETE BY USING RECYCLED AGGREGATE FROM DEMOLISHED WASTE IN CONCRETE

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ABSTRACT

Today, the world's natural ecosystems are threatened by increased extraction of raw materials and greenhouse gas emissions to the atmosphere. One of the drivers of this problem is the impact from industries through their production. A possible strategy to reduce pressure on natural ecosystems is to increase the use of industrial ecosystems. The circular economy is an approach that supports the reuse of products by reusing, recycling and minimizing waste. Like a natural ecosystem, waste can be used as an input material for new production. Today, the construction industry contributes to a large amount of waste, requires a large amount of extracted materials and generates high levels of greenhouse gas emissions. One of the world's most widely used construction materials is concrete. By reusing and recycling concrete, the need for virgin material and waste sent to landfill can be reduced.
The aim of the study is to contribute to a better understanding of the current economic barriers and how different activities could be improved to create economic profitability and stimulate the reuse and recycling of concrete. Through a literature study of previous research regarding economic barriers of reuse and recycling of building materials, different circular strategies for the management of concrete, and EU and Swedish legislation, regulations, and certifications for circular economy in the construction industry, relevant interview questions could be developed. The interviews represent the result and answer questions regarding current economic barriers for reuse and recycling of concrete and opportunities for future profitability, as well as exploring the environmental suitability of different circular strategies in the concrete industry. A total of 10 interviews were conducted with different stakeholders in the concrete and construction industry

Keyword : - *Demolished Concrete, Aggregate, Recycling Of Demolished Concrete, Environment friendly*

1. INTRODUCTION

India having total population of over one billion and economic growth rate more than 8% is witnessing increasing trend of urbanization due to which there is a dire need of “construction of Roads, Railways, Airports and Power plants. India has a large and growing middle class population out of which a large section is in need on new houses” The migration of people from rural areas to cities result in consumption and generation of waste has put a considerable strain on natural resources to meet the rising demand for food, water, energy, and goods and services”. Buildings are an integral part for development in any sector of economic growth. Buildings consume resources consumed, waste generated can be judged from the fact that in any development project, the component of construction is about 50%- 95%. A.H Taylor (2000) reported that abrasion resistance of recycled aggregates are similar to that of normal aggregates, ratios of splitting tensile strength to that of compressive strength were found to be in good agreement with conventional values derived for concretes from natural aggregates.

1.1 Need For Study

The design, construction, operation, maintenance, and removal of buildings consume large amounts of energy, water, and materials, and generate The Swachh Bharat Mission under ministry of urban development imagines

handling of 100% waste produced in urban communities by second October, 2019 as a key target, which incorporates C&D waste MOEF&CC [21]. In India; C&D wastes is lost without reusing except recycling of 1% of waste generated. The abuses of C&D wastes are felt mainly in huge urban areas. As per C&D waste management rule 2016, specifies the management and treatment of C&D waste for productive utilization by reusing. There in it is mandated that the contractor or the Municipality has to procure and reuse 10 to 20% of C&D materials in corporation, municipality, and Government contracts. The risks involved in careless dumping that invite accidents, fatalities, trauma and environmental degradation. The land is scarce in urbans; landfill even cannot accommodate municipality waste. So recycling and reuse of this waste draw sources not only during its construction but also for operation throughout their life. The buildings which provide space for living, working, entertainment and numerous other activities have direct or indirect bearing on our large quantities of waste, and pollute the air and water.

2. METHODS

Demolished concrete can be recycled through crushing and sorting to create recycled concrete aggregates (RCAs) for various uses, including new concrete mixes, road bases, and other construction applications.
If at all possible, the most efficient technique of recycling is to undertake crushing operations at the construction site, which minimizes construction costs and pollution generated by transporting materials to a specific mine. About sixty percent of the crushed material can be used for various purposes.

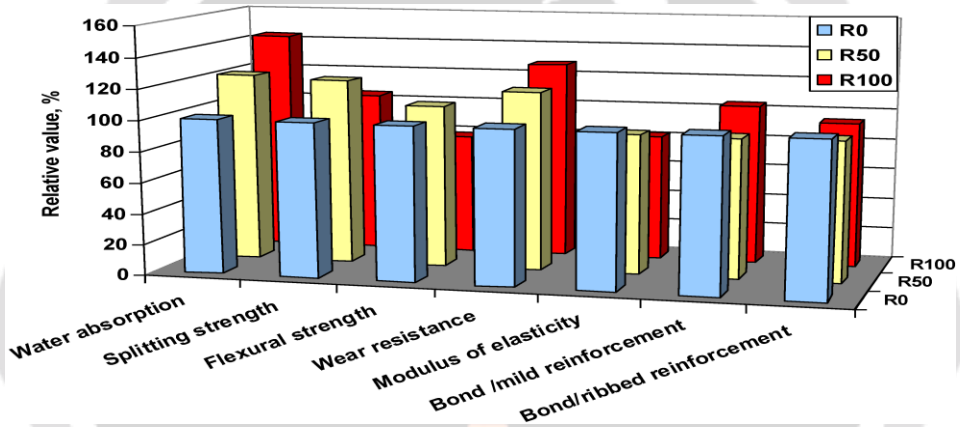

Fig.1 Relative value of demolished concrete

3. Experimental Work /Analysis

3.1 Slump Test

The slump value of the common mix was 84 mm. There was a gradual decrease in slump value with an increase in replacement content of recycled aggregates. The maximum slump change for mixes containing recycled coarse aggregate was −9.524% (for RCA40) and that for mixes containing recycled fine aggregate was −11.905% (RFA50) compared to the common mix.
The amount of aggregates and quantity of adhered mortar is not necessarily constant in a particular size range for all mixes as it is an assumption while calculating the additional water in this study. Another possible reason could be that the water was divided into two parts and added separately in the mixer using a two-stage mixing approach.

3.2 Rebound Hammer Test

Concrete strength estimation is a complex process that depends on Rebound Hammer Test Factors such as project requirements, accessibility, and precision. The UPV test measures the speed of ultrasonic pulses through concrete, which indirectly assesses its compressive strength. The Penetration Resistance Test measures the resistance encountered in concrete, with higher resistance indicating stronger concrete.

It involves the NDT Inspector and NDT technician preparing the concrete surface, calibrating the hammer, selecting test locations, holding the hammer, striking the surface, taking multiple readings, recording readings, correlating readings, and interpreting results.

Table 1: Rebound number and quality of concrete

Average Rebound	Quality of concrete
>40	Very good
30-40	Good
20-30	Fair
<20	Poor
0	Very poor

3.3 Economic Importance of Recycled C&D

Municipal wastes are distinct from C&D waste. International Market Analysis Research and Consulting (IMARC) Group have predicted the C&D wastes management market of the globe shall breed at @ 5.30% CAGR 2026. This C&D waste cannot be properly recycled and reused due to paucity of land fill areas, left unattended on roadside or drains hindering traffic flow and free discharge. The C&D wastes are included under the Sustainable Development Goals reported that by natural aggregate extraction involves huge energy consumption and CO2 emission. Recycled coarse aggregate from C&D from sites is economic.

4. Results and discussion

The estimated energy consumption and carbon emissions are detailed in Table 1, Table 2, Table 3 for the WM, AM and DM, respectively. As expected, the WM presents, by far, the highest values and the DM the lowest. However, between the AM and DM the results are relatively close since the specific energy consumption of air compressors is relatively low. The various results obtained from the compressive strength tests, tensile strength tests and flexural strength tests were discussed and tabulated. The charts representing the test results were also provided. The table 1,4 and 7 indicates the results of the compressive strength, tensile strength and flexural strength of the RCA concrete whereas the table 2, 3, 5 and 6 indicates the results of the compressive strength tensile strength, flexural strength of the RCA concrete with polypropylene fiber and natural fiber.

- The compressive strength, Split tensile strength and flexural strength was also found to be considerably increased when compared with nominal and RCA concrete for RCA concrete added with natural (coir) fiber and 10% of silica fume as a replacement of cement.

- The increase in compressive strength , Split tensile strength and flexural strength of RCA with polypropylene fiber and natural (coir) fiber respectively along with 10% replacement of cement with silica fume was only up to 40% replacement of CA with RCA more than that the results were falling.

Table 2: Compressive strength of RCA concrete

% of RCA	Compressive strength of RCA concrete N/mm^2		
	7 Days	14 Days	28 Days
0	18.7	22.5	30.5

10	17.5	21.8	30.2
20	17.3	21.4	29.8
30	17.3	20.9	29.9
40	16.8	21	29.2
50	16.1	20.2	27.4
75	15.2	18.8	21.3
100	14.5	18	20.1

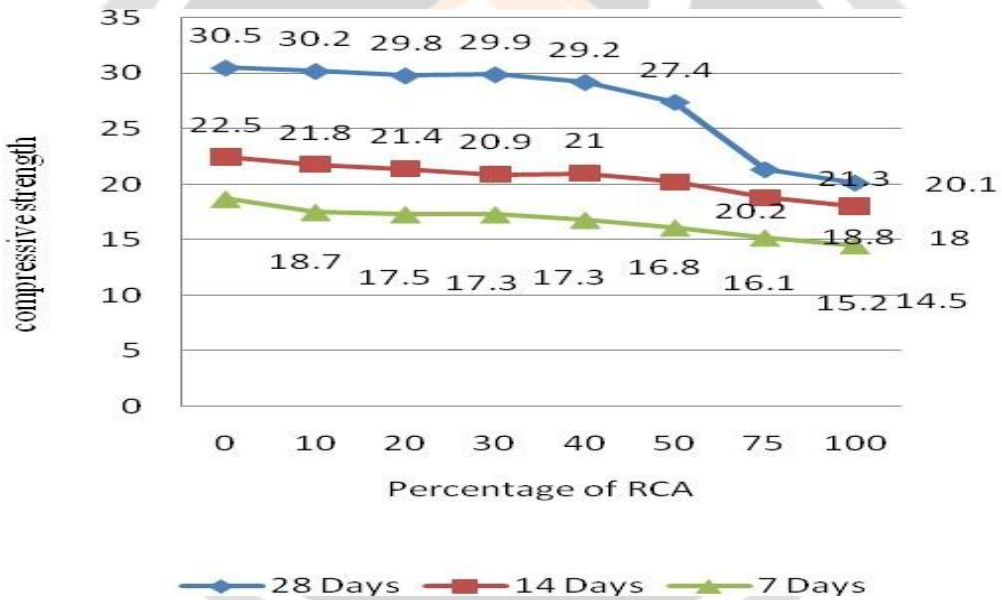

Chart -2: Compressive strength

4. CONCLUSIONS

It has been established that materials and components from demolished buildings are being reused for new construction work as well as renovation projects. In developing countries most of demolition rubble is dumped, the developed world has now started recycle it into aggregate for non structural concrete. It is hoped that recycling waste materials for use in the building will cut down cost of producing new raw materials thereby reducing consumption of natural resources like energy and reduces usage of landfills. By collecting the samples of concrete of construction and demolition waste from the various sites of the Pune region we can apply the various processes like crushing, screening, washing, oven drying we will get the sample for the further tastings. The processed sample is used for conducting the various tests like particle size distribution, sieve analysis and impact value tests. By conducting the tests over those sample we can concluded that the recycled aggregate is in workable condition or not

we can also conclude the feasibility and properties of the recycled aggregate. The future and scope of recycling demolished waste concrete are promising, driven by sustainability goals, environmental concerns, and the growing need for efficient use of resources. As urbanization continues and construction projects accelerate globally, recycling demolished concrete offers significant benefits and is becoming an integral part of the circular economy.

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