iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 13 **Issue:** IV **Month of publication:** April 2025

DOI: https://doi.org/10.22214/ijraset.2025.68085

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue IV Apr 2025- Available at www.ijraset.com

Replacement of Fine Aggregate with Crumb Rubber

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Abstract: ***The use of crumb rubber as a replacement for fine aggregates in concrete has gained attention due to the environmental and economic benefits it offers, particularly in reducing waste from used tires. This study investigates the effects of replacing fine aggregates with varying percentages of crumb rubber (5%, 7% and 9%) on the properties of concrete. Concrete mixes were prepared, and their workability, compressive strength, and durability characteristics were tested. The results indicated a decrease in compressive strength as the percentage of crumb rubber increased, due to the lower density and weaker bonding between crumb rubber particles and cement paste. However, the incorporation of crumb rubber improved the concrete's flexibility and impact resistance, making it a potential candidate for specific applications such as pavement construction and non-structural elements. The study also highlights the environmental benefits of reusing crumb rubber, contributing to waste management and promoting sustainability in the construction industry. Further research is recommended to optimize the mix designs and explore the long-term performance of crumb rubber concrete in various environmental conditions.***
Keywords: Compressive strength, workability, crumb rubber, rubberized concrete.

I. INTRODUCTION

Partially replacement with crumb rubber means that construction costs decrease, improves The quality of the concrete and the greenhouse gas from nature reduces gas. The result shows that 15 % of the penalty Combined with the same amount of crumb rubber can be replaced with a slight improvement Solid efficiency. The crumb rubber improves more than 5 %in the compressive power. Its effect The atmosphere to reduce harmful gas emissions. We are closely changing crumb rubber and gating with more strength, efficiency, flexibility And other qualities. Crumb rubber is a material that is removed from the regenerated tires and used as a component Concrete product. It is made into pieces of old tires in small granules, which can Then include the concrete mixture. Using crumb rubber in concrete gives many probability Benefits with improved mechanical properties, enhanced durability and low environmental The effect. Studies have shown that adding crumb rubber to concrete can improve compressive strength, Effect strength and elastic strength. This is due to unique properties of crumb rubber, such as Ability to absorb energy in concrete matrix and reduce the brittleness. In addition, using crumb rubber Can help reduce the permeability of concrete, which makes it more resistant to water access and chloride The transmission of ion. In case of durability, the crumb rubber is found to increase the resistance of concrete To a freezing cycle and chemical attacks. It can also contribute to reducing carbonation and Prevention of shrinkage cracks. These properties make crumb rubber an attractive option Application that is serious in road paving and durability in the bridge deck. From one An environmental perspective, using crumb rubber in concrete gives a sustainable solution to dispose of Of garbage tires. Recycling old tires and reducing the waste sent to them in concrete Landfill and natural natural demands have been reduced. It helps in natural conservation Reduce carbon footprint associated with resources and concrete production.

II. EXPERIMENTAL PROGRAM

A. MIX Design

Material for 0.15 x 0.15 x 0.15 M Cube

Material	Quantity (Kg/m^3)
Cement	1.478
Fine aggregate	2.171
Coarse aggregate	3.809
W/c ratio	0.45
Water content	0.665

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1) Mixed Design Proportions for Rubberized Concret

This work is 9 Standard cubic specimen of 15 cm size (3 sample for each percentage of crumb rubber) Which is casted for compressive strength of cubes for 7,14,28 days of curing. The crumb rubber is partially (5%,7%,9%) replace with fine aggregate.

B. Testing of Fresh Concrete

1) Slump cone: The test is employed on eighter site or laboratory it ik suitable for only fresh concrete, not more wet or not more dry concrete.

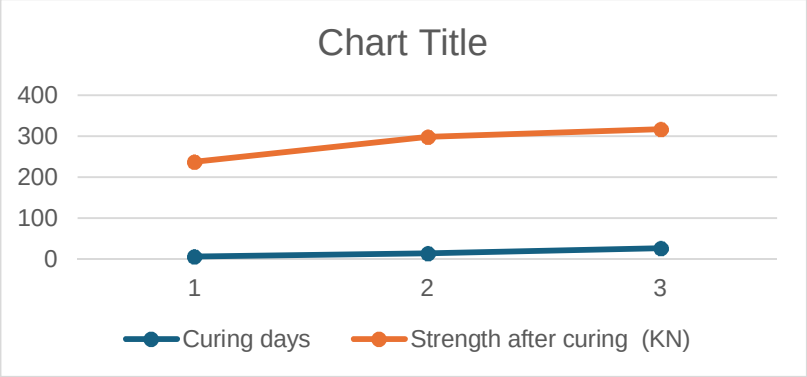
2) Compaction factor : The test is suitable for only fresh concrete for checking its workability & compacting factor. Compaction factor= Weight of freely fall concrete/ Weight of compacted sample.

3) Compressive strength of concrete cube: The test is conducted in the universally testing machine. It is helpful to determining the compressive strength of concrete. The specimen after 7 days, 14 days and 28 days of curing is tested in universally testing machine.

III. RESULTS

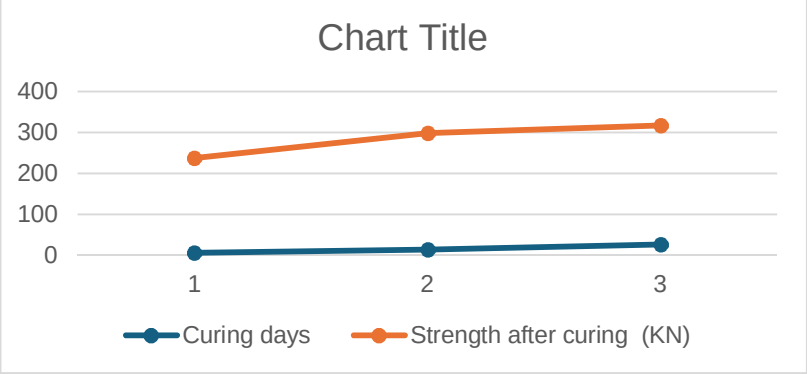
A. 5% of Replacement of fine Aggregate with Crumb Rubber

Curing days	Strength after curing (KN)
7	220
14	260
28	280



B. 7% of Replacement of fine Aggregate with Crumb Rubber

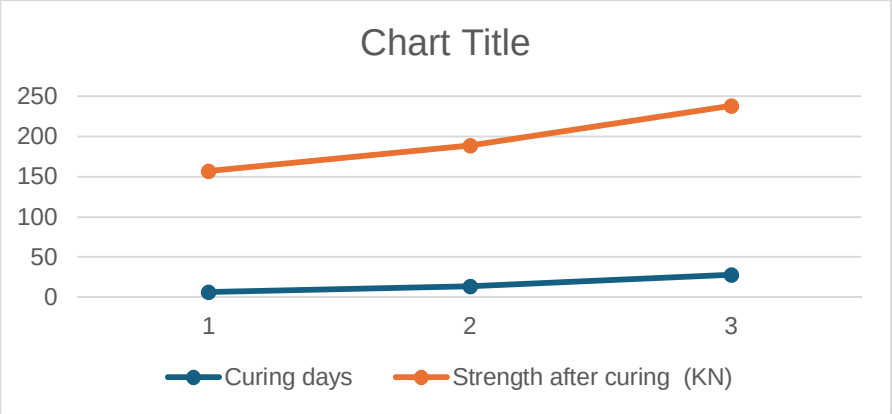
Curing days	Strength after curing (KN)
7	230
14	285
28	290



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C. 9% of Replacement of fine Aggregate with Crumb Rubber

Curing days	Strength after curing (KN)
7	150
14	175
28	210

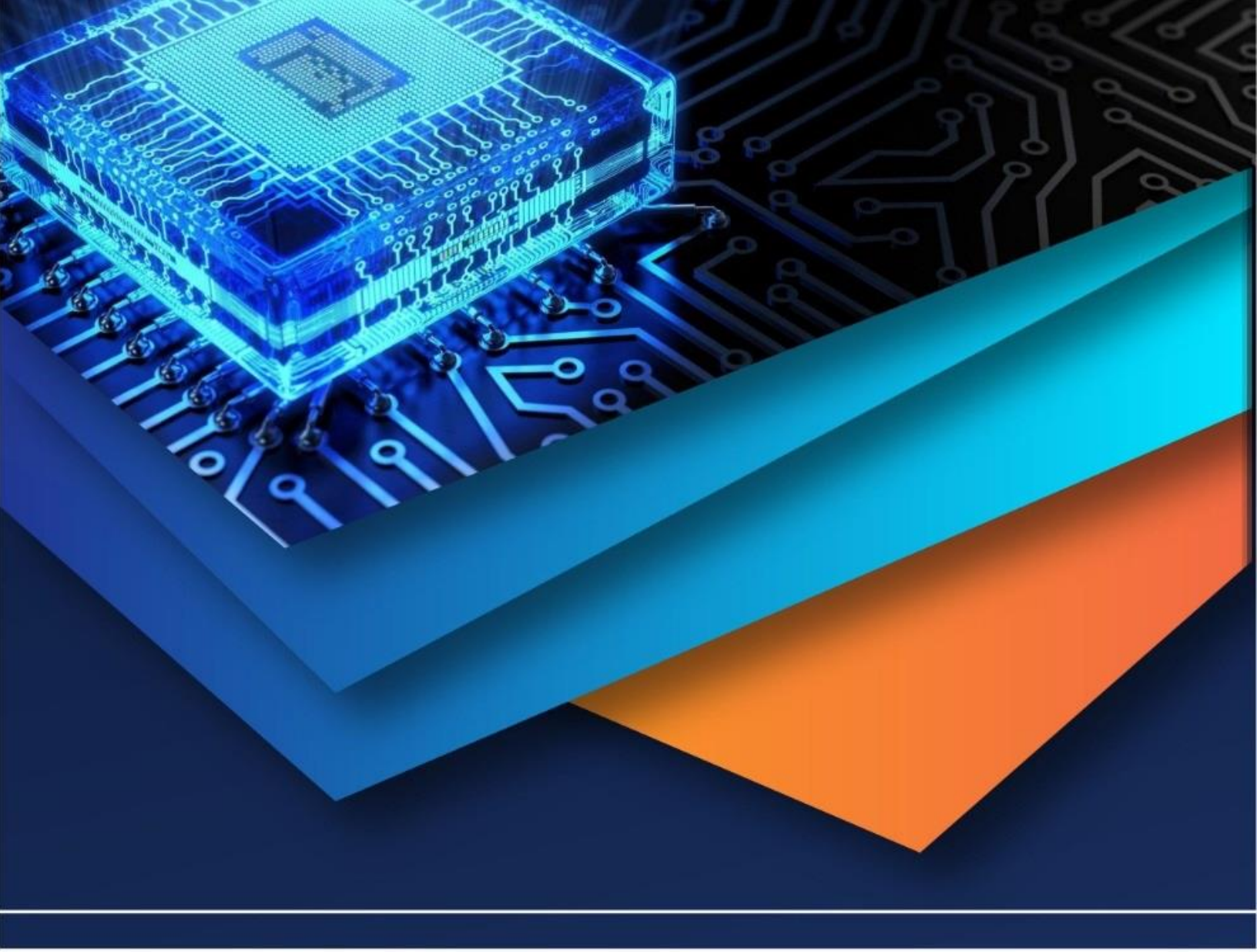


IV. CONCLUSION

As expected, the addition of crumb rubber reduces the workability of concrete, especially at higher replacement levels. The incorporation of crumb rubber decreases the compressive strength of concrete. While the reduction is not severe at lower replacement levels (5–10%), it becomes significant at higher levels (15–20%).The durability tests revealed a decrease in water absorption and chloride resistance with the increase in crumb rubber content. This suggests that crumb rubber could compromise the concrete's long-term durability.

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