INTERNATIONAL JOURNAL OF ADVANCED INNOVATIVE TECHNOLOGY IN ENGINEERING

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Review on Experimental Investigation of Recycled Concrete using Demolished Waste

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Article History

Received on: 20 July 2026

Revised on: 15 Aug 2026

Accepted on: 20 Sept 2026

Keywords: Recycled Concrete Aggregate, demolished concrete, Waste Management, Sustainable Construction.

e-ISSN: 2455-6491

DOI: 0.65809/IJAITE/26/v03sp02/022

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ABSTRACT

Rapid growth in construction activities has significantly increased the demand for natural resources such as aggregates, while also generating a large amount of construction and demolition (C&D) waste. Managing this waste has become a major environmental concern. One effective solution is the use of recycled concrete aggregate (RCA), which is produced from demolished concrete structures. This review paper presents a summary of various experimental studies carried out on concrete made using RCA. Important properties such as workability, compressive strength, and durability have been discussed. Based on previous research, it is observed that partial replacement of natural aggregates with RCA (around 20–40%) gives satisfactory results with only a minor reduction in strength. The use of RCA not only helps in reducing environmental pollution but also supports sustainable construction practices.

1. INTRODUCTION

Concrete is widely used in construction due to its strength and durability. The materials required for its production, including cement, sand, and aggregates, are obtained from natural sources. With the increase in construction activities, the demand for these materials has grown rapidly, resulting in over-extraction and environmental concerns. At the same time, demolition and reconstruction activities generate large volumes of waste. Improper disposal of such waste creates environmental challenges. Recycling this waste into construction materials is an effective way to reduce landfill issues and conserve natural resources.

Recycled concrete aggregate (RCA), obtained from old concrete structures, can be used as a replacement for natural aggregates. This paper reviews studies where RCA is used in different proportions such as 20%, 30%, and 40%. The effects on fresh and hardened properties of concrete are discussed. Although RCA offers environmental advantages, it may influence strength and workability due to higher porosity

and water absorption. Therefore, proper mix design becomes important.

2. LITERATURE REVIEW

Joseph (2023**)** conducted an extensive study on the utilization of recycled aggregates (RA) in concrete production. The research revealed that replacing natural aggregates with up to 30% recycled aggregates results in acceptable performance levels in concrete, maintaining strength and durability comparable to conventional concrete. The study also highlighted that the incorporation of chemical admixtures can significantly enhance the quality and workability of concrete containing recycled materials. These admixtures help mitigate issues related to water absorption and bonding, thereby improving overall concrete properties.

Marvila et al. (2022) investigated the structural performance of concrete with recycled concrete aggregates (RCA). Their research concluded that when RCA is used in limited quantities, there is only a minor reduction in compressive strength, which is acceptable for many structural applications. The findings advocate for the sustainable reuse of RCA, promoting environmentally responsible construction practices without significantly compromising structural integrity.

Alkhtbeeb (2025**)** analyzed the workability of concrete incorporating recycled aggregates. The study found that workability tends to decrease as the proportion of RCA increases, primarily due to the higher water absorption capacity of recycled materials. However, this issue can be effectively controlled by adjusting the water-cement ratio and incorporating superplasticizers or other admixtures into the mix design. Proper adjustments ensure that workability remains within desirable limits for practical applications.

Antunes (2025**)** highlighted the environmental advantages of using recycled aggregates, including the reduction of carbon emissions associated with the extraction and processing of virgin aggregates. The study also emphasized resource conservation, waste reduction, and landfill diversion as key benefits contributing to more sustainable construction practices**.**

Alibeigibeni (2025**)** addressed the challenges related to the quality and performance of recycled aggregates. The research recommended various pre-treatment methods, such as cleaning, crushing, and surface coating, to improve the physical and chemical properties of RCA. These treatments enhance the bond strength and durability of concrete made with recycled materials, ensuring long-term performance and compliance with standards.

Dafedar et al. (2024) extended the application of recycled aggregates beyond concrete, demonstrating that they can also be successfully used in masonry units. Their experiments showed that masonry blocks produced with recycled aggregates exhibit comparable compressive strength and durability to traditional fired clay bricks, suggesting that recycled aggregates can be a viable alternative in various construction components, thereby supporting sustainability and resource efficiency.

CONCLUSIONS

- Recycled concrete aggregate can be used up to 30% replacement.
- Strength reduction is minimal up to this level.
- 20% replacement gives best performance.
- RCA helps in:
  1. Reducing construction waste.
  2. Saving natural resources.
  3. Promoting sustainable construction.

ACKNOWLEDGMENT

With profound feeling of immense gratitude and affection we would like to thank our guide Prof. PRIYANKA NAGDEVE, Civil Engineering Department for his continuous support, motivation, enthusiasm and guidance. His encouragement, supervision with constructive criticism and confidence enabled us to complete this project. We express our admirations for Dr. SANJAY MAHAJAN, Head of Civil Department, SCET for his valuable advice and support throughout this venture. We also put third our deepest sense of gratitude towards DR. V. G. ARAJPURE, Principal SCET for constant motivation and providing necessary infrastructure. Finally, a special thanks to project in-charge and all the faculty members of the department for their co-operation throughout the project work.

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