



International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.699

Volume 14, Issue 4, April 2025

Sustainable Utilization of Demolish Concrete and GGBS to Prepare Concrete Block

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ABSTRACT: In concrete production and investigates the application of Ground Granulated Blast Furnace Slag (GGBS) as a partial replacement for cement. The study assesses the strength properties of concrete blocks created from recycled C&D waste aggregates and GGBS, focusing on their compressive strength. Findings indicate that incorporating recycled aggregates and GGBS can mitigate the environmental effects The rising demand for concrete in contemporary construction has raised significant environmental issues, such as the exhaustion of natural resources, the buildup of construction and demolition (C&D) waste, and the greenhouse gas emissions linked to cement manufacturing. This research examines the potential for recycling C&D waste as aggregates of concrete production while preserving its mechanical properties. Additionally, the research explores the influence of GGBS on concrete characteristics, including compressive strength, revealing that GGBS enhances the mechanical properties of concrete and further lessens its environmental footprint. The utilization of recycled aggregates and GGBS presents numerous advantages, such as decreased reliance on virgin materials, diminished environmental impacts from the extraction and processing of natural resources, enhanced durability and mechanical performance of concrete, and lower greenhouse gas emissions. This study highlights the technical and environmental feasibility of employing recycled aggregates and GGBS for sustainable concrete production, advocating for the integration of this method within the construction sector. **Keywords:** Sustainable concrete production, construction and demolition waste, recycled aggregates, Ground Granulated Blast Furnace Slag (GGBS), cement substitute, environmental impact, mechanical properties

KEYWORDS: concrete, GGBS, demolition, waste, recycled aggregate, concrete blocks, , green building, material reuse, environmental impact, resource conservation, waste reduction

I. INTRODUCTION

The construction sector ranks among the largest users of natural resources and is a significant source of waste. The rising need for infrastructure development and urban expansion has resulted in a considerable amount of construction and demolition (C&D) waste. Demolished concrete constitutes a substantial portion of this waste, representing around 50% of the total generated. The disposal of this concrete in landfills poses a serious environmental issue, as it takes up precious landfill space and contributes to greenhouse gas emissions. Additionally, the extraction and processing of natural aggregates for concrete production have detrimental environmental effects, including resource depletion, high energy consumption, and water pollution. Recently, there has been an increasing focus on sustainable construction methods, particularly the reuse and recycling of C&D waste. Recycled concrete aggregate (RCA) derived from demolished concrete has emerged as a viable alternative to natural aggregates in concrete manufacturing. Nevertheless, the incorporation of RCA may present challenges, such as diminished mechanical properties and heightened water absorption. Ground Granulated Blast Furnace Slag (GGBS), an industrial by-product, has been extensively utilized as a supplementary cementitious material in concrete production. GGBS enhances the durability and mechanical characteristics of concrete while also mitigating the environmental impact associated with cement manufacturing. This study seeks to explore the sustainable use of demolished concrete and GGBS in the production of concrete blocks. It will assess the viability of employing RCA from demolished concrete and GGBS as replacements for natural

aggregates and cement, respectively. The mechanical properties and environmental advantages of the concrete blocks made with RCA and GGBS will be evaluated and compared to those made with natural aggregates and cement.

II. LITERATURE SURVEY

The concept of image inpainting was first introduced by Bertamio et al. [1]. The method was inspired by the real inpainting process of artists. The image smoothness information interpolated by the image Laplacian is propagated along the isophotes directions, which are estimated by the gradient of image rotated by 90 degrees. Exemplar Based method proposed by Criminisi et al. [2] used a best exemplar patch to propagate target patch including missing pixels. This technique uses an approach which combines structure propagation with texture synthesis and hence produced very good results. In [3], the authors decompose the image into sum of two functions and then reconstruct each function separately with structure and texture filling-in algorithms. Morphological technique is used to extract text from the images presented in [4]. In [5], the inpainting technique is combined with the techniques of finding text in images and a simple algorithm that links them. The technique is insensitive to noise, skew and text orientation. The authors in [6] have applied the CCL (connected component labelling) to detect the text and fast marching algorithm is used for Inpainting.

The work in this paper is divided in two stages. 1) Text- Detection 2) Inpainting. Text detection is done by applying morphological open-close and close-open filters and combines the images. Thereafter, gradient is applied to detect the edges followed by thresholding and morphological dilation, erosion operation. Then, connected component labelling is performed to label each object separately. Finally, the set of selection criteria is applied to filter out non text regions. After text detection, text inpainting is accomplished by using exemplar based Inpainting algorithm.

III. METHODOLOGY

[1] T. Vijayagowri, P. Sravana, P. Srinivasa Rao.: Studies on strength behavior of high volumes of slag in concrete 'Investigated the effects on compressive strength, split tensile strength and flexural strength of concrete at 28, 90, 180 and 360 days by partial replacement of cement with GGBFS. [2] Avinash More et al: The waste materials are used in an effective way for making blocks. The environmental pollution also reduces. Blocks manufactured using C&D waste are light in weight. As percentage of waste increases water absorption increases. Block made with ratio 2:3:3:2 gives high strength compared with others. [3] Sabai M.M et al: The aim of this paper was to investigate the extent to which the recycled aggregates from C&D waste can be used to replace natural aggregates from concrete block production in Tanzania. The aim is not only to reduce down cycling but also to solve the rising problem of material shortages. In this research, the recycled aggregates for both fine and coarse replace natural aggregates by 100% in the concrete blocks production. . [4] Eskinder Desta Sumiye and Zhao Jun: This paper presents a review of the use of Ground Granulated Blast Slag (GGBS) in concrete. The authors discuss the properties and benefits of GGBS, including its ability to improve the durability and sustainability of concrete. [5] Yonatan (Shanko) Ayele Abera, PhD: This study investigates the performance of concrete materials containing recycled aggregate from construction and demolition waste. The author examines the properties of recycled aggregate and its effect on the strength, durability, and sustainability of concrete.

IV. EXPERIMENTAL RESULTS

Sr.no	Particulars	Values	
		Natural aggregate	Recycled aggregate
1	Specific Gravity	2.5-3.0	2.2-2.45
2	Water Absorption	0.28%-0.29%	0.3%-0.34%
3	Crushing Value	18.7%	36.53%
4	Impact Value	17.8%	35.4%

TABLE NO:-1 COMPARISON PROPERTIES OF NATURAL AND RECYCLED AGGREGATE

Grade of concrete	Slump value (mm)
M15	48.5
M20	54
M25	62

TABLE NO :- 2 SLUMP CONE TEST

Grade of Concrete	Replacement of natural Aggregate with RA (20%) (N/mm ²)	Replacement of cement with GBBS (40%) (N/mm ²)	Replacement of both (N/mm ²)
M15	30.82	18.03	15.75
M20	18.15	22.97	21.12
M25	23.92	28.73	26.45

TABLE NO :- 3 COMPARISON OF COMPRESSIVE STRENGTH

V. CONCLUSION

This project has demonstrated that replacing aggregate with recycled aggregate and cement with GGBS is a viable and sustainable solution for the construction industry. The environmental, economic, and social benefits achieved through this project make it an exemplary model for future construction projects.

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