

Sustainable Civil Infrastructures

Suman Saha
Sabyasachi Biswas *Editors*

Innovations for Sustainable and Resilient Infrastructure

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Enhancing Concrete Properties Using Waste Marble Dust and Rice Husk Ash as Sustainable Binder Replacements

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Abstract. This study investigates the utilization of waste marble dust (MD) and rice husk ash (RHA) as partial substitutes for conventional binders in concrete. The primary objective is to evaluate the impacts of these materials on the concrete properties, which has seen significant advancements over the past decade. The research shows that MD acts as filler, improving workability, compressive strength of concrete. MD has ability to fill the voids in the concrete mix, acting as ultra-fine aggregates. Conversely, RHA exhibits pozzolanic activity, which not only contributes to the strength enhancement but also improves its impermeability characteristics, making concrete more durable. In this study, various groups of concrete mix were casted into cubes. First group having conventional materials and subsequent groups explored different replacement ratios such as 5%, 10%, 15% MD as cement replacement and 5%, 10%, 15% RHA as cement replacement. Various tests were conducted to assess concrete's workability, compressive strength with different mix ratios incorporating MD and RHA. The findings suggest that the inclusion of these waste materials can effectively improve the mechanical property of concrete without adversely affecting its structural integrity. This experimental approach aligns with the broader goals of sustainable construction practices by reducing the utilisation of natural resources and energy, while also reducing environmental pollution from cement production. The study also contributes to the development of more eco-friendly concrete technologies, promoting the use of industrial by-products and agricultural waste in construction. This not only helps in managing waste but also in producing cost-effective and durable concrete structures.

Keywords: Sustainable concrete · Marble dust · Rice husk ash · Compressive strength · Concrete durability