Sustainable Civil Infrastructures

Suman Saha
Sabyasachi Biswas *Editors*

Innovations for Sustainable and Resilient Infrastructure

Proceedings of International Conference on Sustainable and Resilient Infrastructure 2024 (ICSRI2024)

Springer

Sustainable Civil Infrastructures (SUCI) is a series of peer-reviewed books and proceedings based on the best studies on emerging research from all fields related to sustainable infrastructures and aiming at improving our well-being and day-to-day lives. The infrastructures we are building today will shape our lives tomorrow. The complex and diverse nature of the impacts due to weather extremes on transportation and civil infrastructures can be seen in our roadways, bridges, and buildings. Extreme summer temperatures, droughts, flash floods, and rising numbers of freeze-thaw cycles pose challenges for civil infrastructure and can endanger public safety. We constantly hear how civil infrastructures need constant attention, preservation, and upgrading. Such improvements and developments would obviously benefit from our desired book series that provide sustainable engineering materials and designs. The economic impact is huge and much research has been conducted worldwide. The future holds many opportunities, not only for researchers in a given country, but also for the worldwide field engineers who apply and implement these technologies. We believe that no approach can succeed if it does not unite the efforts of various engineering disciplines from all over the world under one umbrella to offer a beacon of modern solutions to the global infrastructure. Experts from the various engineering disciplines around the globe will participate in this series, including: Geotechnical, Geological, Geoscience, Petroleum, Structural, Transportation, Bridge, Infrastructure, Energy, Architectural, Chemical and Materials, and other related Engineering disciplines.

SUCI series is now indexed in SCOPUS

and EI Compendex.

Editors
Suman Saha
Department of Civil Engineering
National Institute Technology Durgapur
Durgapur, West Bengal, India

Sabyasachi Biswas
Department of Civil Engineering
National Institute of Technology Durgapur
Durgapur, West Bengal, India

ISSN 2366-3405 ISSN 2366-3413 (electronic)
Sustainable Civil Infrastructures
ISBN 978-3-031-91975-6 ISBN 978-3-031-91976-3 (eBook)
https://doi.org/10.1007/978-3-031-91976-3

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

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

Chanchal Das[1(✉)], Satabdi Saha[2], Md. H. Alam[1], Koyndrik Bhattacharjee[1], Arijit K. Banerji[1], and Niraj Kumar[1]

[1] Department of Civil Engineering, Dr. B. C. Roy Engineering College, Durgapur, West Bengal 713206, India
chanchal.das@bcrec.ac.in

[2] Department of Civil Engineering, Elitte College of Engineering, Sodepur, Kolkata, West Bengal 700113, India

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

S. Saha and S. Biswas (Eds.): ICSRI 2024, SUCI, pp. 94–103, 2025.
https://doi.org/10.1007/978-3-031-91976-3_10