Dear Readers,

We are pleased to share with you papers covering varied topics. This edition is guest edited by Prof. Bijily Balakrishnan.

Prof. Bijily Balakrishnan is an Assistant Professor in the Department of Civil and Environmental Engineering, Indian Institute of Technology (IIT) Tirupati. She was awarded a PhD degree from the Indian Institute of Technology (IIT) Madras. Her research interests are primarily in the area of the behavior of reinforced and prestressed concrete structures and bridges and has contributed to this cause consistently.

While we thank her for curating this edition, we also hope you enjoy reading this edition and look forward to your feedback!

Best Regards,
The Production Editor
Indian Concrete Journal

Dear Readers,

I am delighted to introduce the new edition on the topic "Sustainable Construction Materials." The seventeen sustainability objectives are interrelated.

The owner must prioritise objectives such as 'sustainable cities and communities,' 'industry, innovation, and infrastructure,' 'responsible consumption and production,' and 'climate action' for the architect, designer, contractor and other stakeholders in the value chain of any infrastructure project. The present version addresses sustainable materials as a little advancement towards the seventeen sustainable development goals. It is essential to acknowledge that merely having sustainable resources is insufficient for achieving sustainability goals.

The initial paper [1] addressed the utilisation of agro-industrial waste, specifically sugarcane bagasse ash (SCBA), in self-compacting concrete (SCC) to minimise cement consumption. The study examined the utilisation of SCBA levels in SCC combinations, which ranged from 7.5 to 25%. The study demonstrates improved mechanical characteristics. The structural integrity and quality have been assessed utilising ultrasonic pulse velocity testing, yielding promising results for a maximum replacement ratio of 25 %. The durability of the produced concrete has been evaluated using the chloride ion penetration test, which demonstrated enhanced resistance. The research recommends utilising agricultural waste, specifically raw SCBA, as a substitute for cement in the production of SCC within the construction sector. This study aims to create sustainable concrete by substituting cement with the reutilization of agro-industrial waste materials.

The second paper [2] examines geopolymer binders such as GGBS and FA as alternatives to OPC in concrete formulation. The production of geopolymer concrete (GPC) generates 30-50 % less CO2 compared to ordinary portland cement (OPC) concrete. GPC not only reduces CO2 emissions but also employs industrial waste. Maximising mechanical strength necessitates the consideration of three critical parameters: sodium hydroxide (NH) concentration, solution-to-binder ratio (S/B), and NS/NH proportion. This study investigates the mechanical and microstructural characteristics of GPC cured under ambient conditions, utilising mixtures with different NaOH concentrations (10 M - 16 M), solution-to-binder ratios (0.45 - 0.55), and sodium silicate to sodium hydroxide ratios (1.5 - 2.5). A life-cycle assessment (LCA) was performed to evaluate the environmental impact of GPC. This research establishes that the enhanced strength and improved environmental performance of the generated product classify it as a sustainable material.

This study in the third paper [3] assesses the substitution of cement with Ultrafine Slag and the incorporation of 0.1 % wt./volume water-dispersed graphene oxide (GO) into a 1:3 cement-sand mortar with a water-to-cement ratio of 0.30. The research initially established the ideal percentage of Ultrafine Slag replacement, subsequently including varying quantities of water-dispersed graphene oxide. Compressive and flexural strength increased, whereas pore refinement resulted in greater water absorption and resistance to sorptivity. Nonetheless, fluidity decreased with heightened GO consumption. Enhanced hydration rates and nanoscale fibres derived from graphene oxide occupy micro-pores and voids, resulting in improved outcomes. Increased levels of GO aggregation may result in inadequate vacancy filling. FE-SEM and X-Ray Diffraction analyses demonstrated increased strength attributed to pore refinement and significant C-S-H formation inside the microstructure. Optimal outcomes were attained using 15 % Ultrafine Slag substitution and 0.05 % water-dispersed graphene oxide. The resultant product from substituting ultrafine slag and GO yields enhanced strength and durability, so directly decreasing cement consumption and indirectly reducing concrete usage by producing a stronger and more durable concrete.

Geopolymer concrete (GPC)[4] presents a viable eco-friendly substitute for conventional concrete. Creating a reliable model for predicting compressive strength is challenging due to the intricate physical and chemical interactions inherent in geopolymerization. This study evaluates the performance of artificial neural networks (ANN) and decision tree (DT) models in predicting the compressive strength parameters of ground granulated blast furnace slag (GGBS)-based geopolymer concrete (GPC). The research utilised 558 datasets on GGBS-based GPC from various literature sources, incorporating 11 input variables. The ANN model surpassed the DT model in forecasting the compressive strength characteristics of GPC manufactured using GGBS, achieving an R2 value of 0.943. The sensitivity analysis of input parameters on the ANN model demonstrated a substantial influence of specimen age, sodium hydroxide molarity, and curing temperature on compressive strength. A dependable model prediction can reduce the utilisation quality of concrete in laboratory settings, with the environmentally sustainable option of GPC.

With Best Regards,
Prof. Bijily Balakrishnan
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