Dear Readers,

We are pleased to share a special edition with some of the best publications presented in the 18th NCB International Conference and Exhibition on Cement, Concrete and Building Materials held at IICC Dwarka, Delhi in November 2024. These editions have been enhanced extensively and included in this edition that has been guest-edited by Er. P N Ojha and Er. Brijesh Singh.

Er. P N Ojha is the Joint Director and Head of the Centre for Construction Development and Research at the National Council for Cement and Building Materials (NCCBM), Ballabhgarh, Haryana, India. With over 34 years of experience in Cement and Concrete Technology, he has published more than 120 research papers and plays an active role as a member of various BIS committees and in the ISO panel of BIS for cement and concrete. He is a recipient of the Outstanding Concrete Technologist-2020 award by the Indian Concrete Institute, Gurugram Centre, and Ultratech Cement Limited.

Er. Brijesh Singh is the General Manager at the Centre for Construction Development and Research at the NCCBM Ballabhgarh, Haryana, India. His research interests include durability of concrete, high strength, and high performance concrete. He has published over 140 research papers and is a member of various BIS committees. He has received multiple awards, including the Outstanding Concrete Technologist-2021 and 2023, Prof. V. Ramakrishnan national Young Scientist award 2024, and the 15th CIDC Vishwakarma award 2024 for scientists.

We hope you enjoy this special edition and we look forward to your feedback.

Production Editor

Indian Concrete Journal

Dear Readers,

As guest editors of this edition, we are pleased to present a collection of thought-provoking papers focused on sustainable and durable construction materials. This issue showcases selected and extended version of best research papers originally presented at the 18th NCB International Conference and Exhibition on Cement, Concrete and Building Materials held at IICC-Dwarka, Delhi on 27-29 November 2024. The conference is known a biggest conference on cement and construction materials in India which saw more than 1500 participation this time by cement industry, construction industry, academia, researchers and experts from diverse fields to discuss and explore the latest advancements in the area of cement, concrete and allied building materials for construction industry. The research papers presented in this edition reflects a diverse topic in the area of lightweight concrete, alkali activated concrete, low-grade limestone for producing alternative low-CO_2 cement and red mud based portland cement.

In the first paper, B. Singh and co-authors [1] highlight the impact of measurement techniques in determining Modulus of elasticity (MOE) of lightweight concrete made using sintered flyash lightweight coarse aggregate for wide range of w/c from 0.3 to 0.7. The three measurement techniques *i.e.* (a) Compressometer and Extensometer (b) Linear Variable Displacement Transducer (LVDT) have been adopted for MOE determination. The paper discusses gauge length impact (ratio of length measured along height to specimen height) on the stress vs strain plot of structural lightweight concrete wherein comparison of stress vs strain plots attained from LVDT (gauge length =300 mm) and compressometer/extensometer (gauge length =150/200 mm) has been analyzed. The stress strain curve of unconfined lightweight concrete indicates linear behaviour upto 70-80 % of peak load as compared to normal weight concrete which gives linear behaviour upto 35-50 % of peak load. The MOE of sintered flyash lightweight coarse aggregate based concrete is around 30-35 % lower than that of normal weight concrete. Deformations measured from specimen surface using compressometer/ extensometer give more accurate strain values from stress-strain curve but once the peak load is reached, concrete begins to crumble and compressometer/extensometer gets disturbed.

In the second paper by Murali *et al.* [2], PZT sensor has been developed to monitor the changes in alkali activated fly ash-slag binders (AAFS). The durability of PZT sensors is verified for their suitability to monitor changes in high alkaline cementitious mediums. The changes in the elastic modulus of the AAFS binders with hydration are measured from the vibration response of the cylinder samples extracted using the embedded sensors. The isothermal calorimetry is performed to measure the kinetics of hydrations of these binders. The changes in Electrical impedance (EI) response parameters are correlated with the changes in kinetics of hydration to validate the sensitivity of the EI parameters to monitor the changes in workability and set behavior. The study reveals that workability, set behavior and elastic property development in AAFS binder system is highly influenced by the slag content in the mix. The uncontrolled setting, in AAFS binders needs careful study to transform these materials from lab to field.

The third paper by Singh *et al.* [3] explores an alternative approach to develop two categories of one-part alkali activated binders (AABs) namely binary and ternary-based binders. The binary binder utilises a solid activator (sodium metasilicate pentahydrate) and agro-industrial waste materials, fly ash (FA) and ground granulated blast furnace slag (GGBFS). Rice husk ash (RHA) was added as a precursor for the ternary binder. Experimental studies revealed that an AAB composed of a 30:70 weight ratio of FA to GGBFS and a 12 % solid alkali activator achieved a maximum compressive strength of 25.32 MPa under ambient curing conditions. In addition, the results of the ternary paste indicate that up to 10 % of the addition of RHA into the mix resulted in improved compressive strength. SEM analysis also demonstrated the formation of denser micro-structure under heat curing and at 10 % RHA-based ternary mix.

The fourth paper investigates the effect of pre-curing, moist curing, and CO_2 curing on compressive strength and microstructural characteristics of red mud-incorporated cementitious system. The study concludes that the 4-hour CO_2 cured samples prepared with 30, 40 and 50 % replacement of OPC with red mud performed better than 7-day moist cured samples [4]. Accelerated CO_2 curing significantly impacts early age strength, provided appropriate precuring duration is adopted. The CO_2 –curing significantly reduced the time to harden the specimens as the mechanism and reactant products differ from hydration. The precuring of 24 hours followed by 4 hours of accelerated CO_2 curing under higher pressure resulted in compressive strength of ~ 10 MPa, whereas 7 days of moist curing resulted in compressive strength of around 11MPa. A significant reduction in conventional curing duration could be achieved through mineralization. Both hydration and mineralization require an aqueous environment for its reaction. However, saturation limits the rate of reaction in the case of mineralization.

The fifth paper [5] investigates the feasibility of using low-grade limestone (less than 40 % CaO) with clayey and silicious impurities as an alternative raw material source to partially replace high-grade limestone. Calcium sulfoaluminate-belite (CSAB) cement is low-CO_2 alternative binder to Portland cement (PC) for various applications. Additionally, CSAB binders are rapid hardening, acid resistant, and help with shrinkage compensation. However, the commercial production of CSAB cement is limited due to the increased cost of raw materials and limited understanding of the composition-performance relationship of CSAB-based binders. The influence of raw mix composition on the clinker phase assemblage and hydration was investigated using different characterization techniques. The study concluded that Calcium sulphoaluminate-belite (CSAB) cement of phase assemblage similar to a high-ye[1]elimite commercial CSAB cement could be developed by incorporating 10–20 % of low-grade limestone in the raw mix. The hydrated phase evolution in all the lab-synthesized cements was comparable to that of the reference commercial cement, indicating that the incorporation of low-grade limestone did not affect the hydration reactions. The compressive strength of synthesized CSAB cement at both early and later ages was similar to that of commercial CSAB cement.

In presented edition, we the guest editors strived to build awareness and promote sustainable construction in India. The research presented in this issue offers promising insights into the future of sustainable construction materials. The use of alternative materials not only presents a novel solution but also contributes in reducing environmental impacts and promotes circular economy. We all together can continue to share and advance information and knowledge gathered in the realm of concrete industry. Please do continue to share the findings and application knowledge in your community groups to make a positive impact in the construction sector. It has been privilege to present this concise summary of the latest advancements in construction materials and showcasing their potential to redefine modern construction.

With Best Regards,

Er. P N Ojha and Er. Brijesh Singh
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