Dear Readers,

We are pleased to share a special edition with some of the finest publications presented in the International Conference on Recent Advances in Structural Engineering (RAISE-2024) held at Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat, Gujarat in December 2024. These editions have been enhanced extensively and included in this edition that has been guest-edited by Dr B. Kondraivendhan and Dr C D. Modhera.

Dr B. Kondraivendhan is an Associate Professor in the Department of Civil Engineering at the Sardar Vallabhbhai National Institute of Technology (SVNIT), Surat, Gujarat, India. With over 20 years of experience in teaching and research in the area of Cement and Concrete Technology, he has published more than 80 research papers and plays an active role as a review member of various reputed International Journals and conferences. He was a visiting student of University of Dundee, Scotland, UK. He also has a Post-Doctoral Experience from Nanyang Technological University (NTU), Singapore.

Dr C.D. Modhera is a Professor (HAG) in the Department of Civil Engineering at the Sardar Vallabhbhai National Institute of Technology (SVNIT), Surat, Gujarat, India. With over 35 years of experience in teaching and research. He has published more than 200 research papers and plays an active role as a review member of various reputed International Journals and conferences. His research interests include structural concretes, high performance concrete and earthquake resistance structure. He also held various Deans and In-charge Director positions at SVNIT Surat for number of times.

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 interesting papers focused on advanced sustainable and long-lasting construction materials. This issue showcases selected and extended version of best research papers originally presented at the International Conference on Recent Advances in Structural Engineering (RAISE-2024) held at SVNIT Surat, Gujarat on 16-18 December 2024. The conference is one of the cutting edge conference on cement and construction materials in India which witnessed more than 300 participations this time by cement industry, construction industry, academia, researchers and experts from diverse fields to discuss and disseminate the latest advancements in the area of cement, concrete and allied structural Engineering of construction industry. The research papers presented in this edition reflects a diverse topic in the area of recycled aggregate concrete, ternary blended concrete, CO_2 infused concrete, UHPC and its exposure to fire and the rebar corrosion as well.

In the first paper, Akshay Pawar and co-authors[1] highlight the scaled recycled coarse aggregate concrete beam specimen tests by simulated in FEA based analysis software, ATENA 3D. ATENA 3D offers freedom to the users to define the measured stress-strain relationship of the materials as input parameters through user define material definitions. Two numbers of scaled RC beam specimens were tested in the laboratory and subsequently simulated to analyze the response. Each beam specimen was (125 × 250) mm in cross-section and 2100 mm long. Experimentally evaluated values of compressive strength, split tensile strength and elastic modulus of concrete besides reported values of thermal coefficients and Poisson's ratio of concrete have been used as inputs against default inputs to explore the enhancement in the quality of simulation. Furthermore, in order to explore the potential for enhancing the simulation, the utilization of measured stress-strain relationship for the materials has been examined as an alternative to the default values. For subsequent analysis, a commonly reported constitutive relationship for recycled coarse aggregate concrete, as reported in the literature, has been considered. In addition to strength, the load deformation characteristics of simulated beams were compared to those of beam specimens examined in the laboratory. The outcomes show

that, tends of load carrying capacity reflect similar behavior, especially with due consideration of appropriate input parameters.

In the second paper by Dhaval Patel *et al*.[2], explores the durability performance of ternary blended concrete made using industrial by-products namely ground granulated blast furnace slag (GGBFS) and microfine (MF) as partial replacements for ordinary Portland cement (OPC), along with manufactured sand (MS) as a sustainable alternative to river sand. M30-grade concrete mixes were prepared, including a control mix and a ternary blend comprising 30 % GGBFS, 20 % MF, and 50 % OPC. Durability assessments were carried out by exposing the specimens to acidic (5 % HCl + 5 % H_2SO_4) and saline (10 % NaCl) environments. Compressive strength and weight loss were evaluated at 28, 56, 90, and 180 days. All the improvements in this investigation are credited to the denser matrix and increased chemical resistance from the combined use of GGBFS and MF.

The third paper Archana *et al*.[3] investigates the large CO_2 emissions of the construction sector have spurred research for environmentally friendly alternatives. CO_2-activated concrete strengthens itself, according to the literature reports, and it permanently stores carbon. This research evaluated mechanical properties of dry ice infused concrete at 10, 20, and 30 % shows incremental strength trend up to 20 % over the control mix, CO_2- infused concrete increases compressive, flexural, and split tensile strength, hence strengthening the resultant structure. It resists H_2SO_4 and HCl to some degree; $MgSO_4$ greatly increases strength. Including CO_2 into concrete could increase sustainability and performance, therefore lowering the environmental effect in construction.

The fourth paper[4] investigates the mechanical performance, workability, microstructural behavior, and environmental impact of Ultra High-Performance Concrete (UHPC) incorporating supplementary cementitious materials (SCMs) such as fly ash, ground granulated blast furnace slag (GGBFS), and microfine particles. Six UHPC trial mixes (TM01–TM06) were developed with a fixed water-to-binder ratio of 0.2 and evaluated through compressive, split tensile, and flexural strength tests at 7, 28, and 56 days. mixture, which included steel fibers, achieved the highest mechanical performance, showing a 25 % increase in compressive strength and 20–30 % improvement in tensile and flexural strength compared to fiber-free mixes. Workability was assessed using slump flow tests, drop in slump due to the presence of steel fibers was also observed. SEM analysis confirmed that TM04 exhibited a denser microstructure with uniformly distributed N-A-S-H and C-A-S-H gels and reduced porosity, while TM01 showed scattered gel formations and micro-voids. While TM04 and TM05, which used higher SCM content and cut cement by 40 %, achieved up to 35 % lower carbon emissions compared to TM01, Life Cycle Assessment (LCA) results showed TM03 achieved up to 18 % lower embodied carbon emissions (E-CO_2).

The fifth paper[5] investigates the thermo-hygro coupled mechanical behavior of high-performance concrete (HPC) under severe transient heating conditions, specifically from ambient temperatures up to 1000°C for four hours. The experimental study reveals that HPC mix designs containing supplementary cementitious materials (SCMs) are highly susceptible to thermally induced spalling. It was found that the chemically bonded saturated moisture within the highly durable concrete matrix significantly contributes to explosive spalling, more so than free saturated moisture during transient heating conditions. Under unrestrained conditions, HPC blocks that experience severe heating on one side are especially prone to developing pore pressure at a depth of 20 mm from exposure. Nominal spalling was observed in the 126 to 266°C temperature range, while explosive spalling occurred between 325 and 449°C. Furthermore, it is observed that within the 325 to 449°C range, the phase change of saturated moisture to vapor increased the heat transmission rate within the concrete matrix. Addressing these issues is crucial for enhancing the safety and integrity of reinforced concrete (RC) structures, particularly in severe fire loads, thereby reducing the risk of failure or collapse may possible.

The sixth paper by Chirag Thummar and Co-authors[6] investigates rebar corrosion in geopolymer concrete with three water-to-binder ratios (0.45, 0.5, and 0.55) and two binder contents: ground granulated blast furnace slag (GGBS) alone or equal fractions of fly ash and GGBS. The corrosion performance of embedded rebar in Geopolymer concrete was tested in wet (7 days) and dry (14 days) cycles with 3.5, 5, and 7.5 % NaCl. The cast cylindrical specimens were tested for half-cell potential and corrosion current density using linear polarization resistance (LPR) after 28 days ambient curing at 1, 7, and 150 days as per ASTM G109 for each exposure condition. The cube specimen was tested for compressive strength at 7 and 28 days of curing. Binders, water-to-binder ratio, testing age, and NaCl exposure percentages affect Geopolymer concrete rebar corrosion. A blend of fly ash and GGBS-based Geopolymer concrete with a water-to-binder ratio of 0.55 had a higher risk of corrosion based on this investigation.

The seventh Paper by Akshay Bura and Co-author[7] explores The need to reduce carbon emissions from cement production necessitates the development of more environmentally friendly construction methods. The long-

term corrosion behaviour of steel rebar embedded in concrete with natural zeolite fine aggregate and powder (ZP) as a partial substitution to reduce CO_2 emissions from the concrete manufacturing sector and improve stable CO_2 sequestration in the matrix of concrete under macrocell corrosion conditions for 365 days was studied. It investigates the performance of rebar placed in concrete composed of 100 % ordinary Portland cement (OPC), 85 % OPC+15 % ZP, 85 % Portland pozzolana cement (PPC)+15 % ZP and 85 % Portland slag cement (PSC)+15 % ZP under accelerated carbonation. The carbonation depth measurement test was conducted to ascertain the degree of carbonation after 365 days of exposure. The corrosion performance of steel rebar was assessed by measuring the macrocell total corrosion after each wet-dry cycle. Fourier transform infrared spectroscopy (FTIR) measurements were done to evaluate the extent of carbonation in each mix. Results showed 100 % OPC had lower carbonation depth and macrocell total corrosion than binder incorporated with ZP, indicating greater carbonation in zeolite containing concrete. Additionally, specimens cured with 0.5 M and 0.75M carbonated solution had higher carbonation depth and macrocell total corrosion compared to those cured with the normal water.

In presented edition, we the guest editors attempted to create awareness and encourage sustainable and durable construction practice 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 collectively can continue to disseminate the advance information and knowledge gathered in the realm of concrete industry. The topics covered in this issue will definitely disseminate the in-depth knowledge of advances happening in the field of Civil Engineering materials. Please do continue to share such new findings and applications to make a constructive impact in the construction sector. It has been great privilege to present this concise summary of recent advances in construction materials and showcasing their interesting research outcomes.

With Best Regards,

Dr B. Kondraivendhan and Dr C. D. Modhera

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