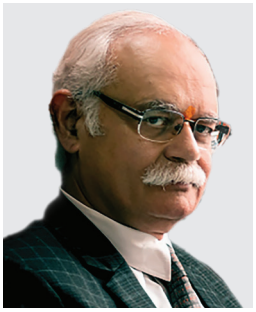
Dear Readers,

We hope you are doing well and are safe. We are pleased to bring to you an edition that focuses on research in concrete engineering with a focus on applications. We thank Dr. Sudhir Misra who is the Guest Editor of this edition.

Dr. Sudhir Misra has rich professional and academic experience spanning over 35 years. He is a graduate from Indian Institute of Technology (IIT) Kanpur and holds a Ph.D. degree from the University of Tokyo. Over a decade of experience with reputed construction and consulting companies across India and abroad, enabled him build key insights into challenges faced, research and practical applications of concrete in diverse areas. He has been teaching at the Department of Civil Engineering at IIT Kanpur for over 25 years, and has spearheaded creation of a graduate program in Infrastructure Engineering and Management in the department. He has published papers extensively in journals of repute, and served as an invited speaker at several national and international conferences . He has keen interest in different aspects of concrete construction and management, concrete materials and engineering, development and utilization of special concretes such as high strength, self-compacting concrete; deterioration, non-destructive testing and evaluation; and repair and rehabilitation of concrete structures.

We sincerely hope you enjoy reading this edition. Please do share your comments with us.

Production Editor
Indian Concrete Journal



Dear Colleagues,

It is a privilege to be the guest editor of the Indian Concrete Journal, which has served as a platform for sharing knowledge in the area of cement and concrete for several decades in India and abroad. In the last few decades, we witnessed the development of tailor-made high performance concretes with the rapid progress in the areas of chemical and mineral admixtures. Now, with the constructions becoming increasingly complex, we need to leverage developments in data handling, including sensors, storage and interpretation, to be able to keep pace with the demands of higher performance in terms of economy, safety, quality, durability and sustainability.

I firmly believe that in the area of cement and concrete research, litmus test of the impact of work is the performance of a structure finally built. With this as a central theme each one of the papers in the present edition is dealing with a unique aspect of concrete construction – in-situ and precast construction, productivity in construction, sustainability and management. I would like to express my gratitude to all the authors and reviewers whose efforts have made it possible to shape this edition and meet different timelines! I sincerely thank Prof. Surendra P. Shah for accepting our invitation and sparing time to write a foreward for this edition.

As you would have noticed the cover page of the edition is a picture of a ground breaking project, record-tall wind turbine tower created with 3D-printed concrete bases co-developed by GE Renewable Energy, COBOD and LafargeHolcim. With appropriate modifications and development in technology, digital fabrication could completely alter the way we think of concrete construction. A review of the development of digital fabrication methods with an emphasis on extrusion-based 3D printing has been included to provide readers an insight into a Portland cement-based 3D printable formulation and areas in digital fabrication that require further research and attention. Another paper addressing the future of concrete construction reviews some of the recent advancements in sensors made of cementitious matrix using Carbon Nanotubes (CNT's) and includes experimental results from studies of the electro-mechanical behaviour of the sensor when subjected to loads, this is also an attempt to provide a glimpse into the future of cement and concrete research.

In this day and age, it is equally important for professionals engaged in concrete construction to be aware of issues related to increasing productivity at sites. Aligned to this paper, discussing challenges related to labour productivity, which strongly influences both time and cost of construction of precast concrete buildings has been included in this edition.

In order to remain competitive, construction engineers often leverage developments in other areas, and one of the papers in the edition discusses the adoption of innovation process model from the well-known Software Development Life Cycle (SDLC) process to fast-track technology development in the field of construction materials with several real-life case studies, e.g., semi-flexible extruded ECC pipe, geopolymer, and ultra-high volume flyash concrete.

For quality construction, it is important that provisions in the codes are periodically revised and aligned with related developments in research and technology. The issue of using concretes of different strengths in the same structure is significant from that point of view, and a paper that discusses the provisions relating to use of high and normal strength concrete in columns of multi-storied buildings has been included in this edition.

Detection of defects in concrete structures has attracted the attention of researchers and engineers for several decades, and now rapid developments both in the hardware and our ability to handle large volumes of data generated can have applications in this area and structural health monitoring. A paper demonstrating the use of machine learning of spectrogram images and other tools to improve our understanding of defects using impact echo tests has been included in this edition.

Concrete is being used in pavement construction and given the conditions there, it is sometimes compacted using rollers, and efforts to use recycled material (including reclaimed asphalt pavement) is a step towards reuse of waste and sustainable construction. This brings to fore the need to understand the morphological characteristics of such concretes. An examination of such concrete using a scanning electron microscope (SEM) has been included to draw the attention of readers towards the changes in ITZ under different conditions.

While I earnestly hope the readers will find the collection interesting and informative, I would also like to point out that the papers are only the proverbial 'tip of the iceberg' in each case, and one would need to delve a lot deeper for a comprehensive understanding. I also express my thanks to authors whose papers could not be included in this edition for different reasons – I truly appreciate their efforts and recognise the fact that it takes a lot of work to put a document together, and I am hopeful their results will be soon published.

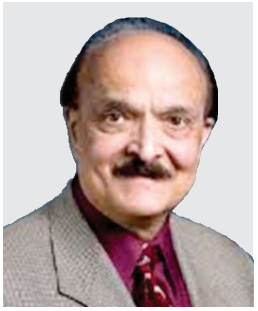
I sign off this note with sincere hope and prayer that each one of you continue to stay safe in these challenging times. I would also encourage you and your colleagues to lend your great support to the ICJ and continue contributing your papers and subscribing to the same.

Please do share your comments and feedback with us.

Best Regards,

Dr. Sudhir Misra
Guest Editor, ICJ

FOREWORD



I am happy to write a foreword for this edition of the Indian Concrete Journal and take this opportunity to wish you all the very best of health.

Concrete has gone through great changes and that too at an extremely fast pace, and I consider it a privilege to have had an opportunity to be part of some of them, in the last few decades. Journals such as the ICJ, which have a long history have also witnessed and reported on some of them!

With technology seeping into every facet of our lives today, there is much that will continue to evolve, and the area of construction materials and their use is no exception. Use of different admixtures in concrete and a better understanding of the hydration process has given us a tremendous opportunity in developing new cementitious materials with emphasis on durability, economy and sustainability.

Across the world, professional bodies and different stakeholders have joined hands and worked together to achieve excellence in development of appropriate tools for research and dissemination of results through a rigorous peer review. India is no exception and journals such as the ICJ have a very important responsibility in this regard. Though cement science recognizes no barriers, its application in different parts of the world needs to be done keeping in mind the local conditions. In fact this recognition should guide further research and create interesting breakthroughs.

I would also like to emphasize the multi-disciplinary nature of research in the area of cementitious construction materials and ask the Indian concrete fraternity to keep this in mind while they work to better understand cement and concrete. Development of appropriate test methods to measure precisely and reliably is yet another area that requires careful attention. I must also emphasise the importance of team-work in creating and using good quality construction material – it simply cannot be an individual effort. All stakeholders – academicians, cement manufacturers, construction agencies, and professional bodies need to understand each other's strengths and weaknesses, and work together. I have tried to follow these simple rules in my work and have never been disappointed by the results. They held me in very good stead as I worked through different projects across the world.

I hope you will enjoy this present special edition with papers highlighting both the rigorous research and the need for understanding of principles such as productivity and construction engineering, giving a glimpse of the diversity in the field of development and applications of cementitious construction materials.

Best Regards,
Surendra P. Shah

About :

Dr. Surendra Shah is a Presidential Distinguished Professor at University of Texas at Arlington, and Walter P. Murphy Professor of Civil Engineering at Northwestern University (emeritus). He was the founding director of the pioneering National Science Foundation Science and Technology Center for Advanced Cement-Based Materials. He is also a Distinguished Professor of IIT Madras. His current research interests include fracture, fiber reinforced composites, non-destructive evaluation, transport properties, processing, rheology, nanotechnology and use of solid waste materials. He has co-authored books and published more than 500 journal articles and these have exemplary statistics to share a few (from Google Scholar) - 72000 citations, with an h-index of 127 and I10 index of 120; and has more than 20 books edited. He is past editor-in-chief of RILEM's Materials and Structures journal.

Dr. Shah is a member of the National Academy of Engineering and a foreign member of the Chinese Academy of Engineering and the Indian Academy of Engineering. He is the only civil engineer who is a member of these three academies. Further, he is member of the (US) National Academy of Inventors and Foreign Member of the Russian Academy of Engineering. His work has been recognised extensively and he has received several awards.