Dear Readers,

It is with great pleasure we bring to you this special edition with research papers covering various aspects of corrosion and its control in concrete structures (C3S). This edition has been guest edited by Dr. Radhakrishna G. Pillai and Dr. Deepak K. Kamde.

Dr. Pillai is an associate professor in the Department of Civil Engineering at Indian Institute of Technology (IIT) Madras. He earned B.E. degree in Civil Engineering from the M. N. Regional Engineering College (now MNNIT), Allahabad. Then, he earned M.S. and Ph.D. degrees in Civil Engineering at Texas A & M University, U.S.A. and has been passionate to combat corrosion of steel in reinforced and prestressed concrete structures. Beyond teaching in the areas of construction materials, concrete technology, and maintenance/repair of concrete structures, recently, he has been extending his research towards the extension of the residual service life of concrete structures through durable repair techniques such as cathodic protection. Most of his projects contribute to address the practical challenges and enhancing standards and specifications. He is also an active volunteer contributing to various association bodies like the Indian Concrete Institute (ICI), the NACE International Gateway India Section (NIGIS), and the International Union of Laboratories and Experts in Construction Materials, Systems and Structures (RILEM).

Dr. Deepak K. Kamde is an Institute Postdoctoral Fellow at the Department of Civil Engineering, IIT Madras, India. He earned his B.Tech. degree in Civil Engineering from Shri Ramdeobaba College of Engineering and Management, Nagpur and M. Tech. degree in Structural Engineering from S. V. National Institute of Technology Surat, Gujarat. In 2020, he earned a Ph.D. degree in Civil Engineering from IIT Madras. His Ph.D. work at IIT Madras focused on understanding the corrosion mechanisms and estimating the service life of concrete structures with coated steel reinforcement. He has co-authored multiple papers and is a recipient of four national and international awards in this area. He continues to pursue his research interests in the areas of corrosion, durability, service life estimation, repair, and cathodic protection of concrete structures. He is actively involved in the activities of ICI, RILEM, and NIGIS; and served as a president of NIGIS - South Zone Student section (2018-2020).

On behalf of the ICJ team we wish you, your family and friends a very happy Diwali, and a prosperous new year.

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associated risk. The civil engineering fraternity must start perceiving the high risk associated with corrosion-induced failures and start allocating larger budgets for frequent condition assessment and preventive maintenance measures. Such approach will help to ensure adequate safety of the users and minimize the life cycle cost and life-cycle material usage – better sustainability. Also, the efforts to ensure durability for the structures is of utmost importance because the money saved by avoiding repairs can be diverted to the development of new infrastructure. The design-for-durability strategy involves the use of high-performance materials, a change in the approach from prescriptive to performance-based specifications, and the adoption of regular condition assessment and preventive maintenance strategies. This special edition will address these issues through various articles.

The nine papers in edition has been ordered in the following subthemes: Corrosion condition assessment, performance of advanced materials, advances in service life estimation, and the advances in cathodic protection. The first paper of this edition is authored by Dr. Carmen Andrade, a world-renowned authority on corrosion and its control in concrete structures – from Centre Internacional de Mètodes Numèrics a l’Enginyeria (CIMNE), Barcelona, Spain. This paper provides guidelines for measuring corrosion parameters such as corrosion potential, resistivity, polarisation resistance of RC systems, the corresponding measurement techniques and data interpretation. Some possible ‘on-site’ assessment strategies for various site conditions are also discussed in this paper.

Then, five papers on the advantages of the use of advanced materials are provided. The second paper by Dr. Raghu Babu and Dr. Kondaivendhan from the Sardar Vallabhbhai National Institute of Technology (SVNIT), Surat presents the possible corrosion resistance of the concrete containing metakaolin and red mud as supplementary cementitious materials. The third paper by Dr. Kaur and others provides insights on the electrochemical properties and performance of migratory type corrosion inhibitors that can be applied on the surface of concrete on existing structures in order to resist carbonation and carbonation-induced corrosion and is based on an original work at Thapar Institute of Engineering and Technology in Patiala, Punjab. The fourth paper by Mr. Ojha and others from the National Council for Cement and Building Materials (NCCBM). They have conducted short-term and long-term (1-year) tests on organic bipolar corrosion inhibiting admixture and highlighted the correlations between the various test methods and expected field performance in the long run. The fifth paper by Ms. Joseline and Dr. Pillai from the IIT Madras presents the hidden nature of corrosion in prestressed concrete structures and the associated challenges of detecting corrosion. It also suggests to use fly ash and bipolar corrosion inhibitors and specify “Mx-Dy” concretes to enhance the service life of prestressed concrete systems.

The sixth paper is authored by Ms. Arya and others and is based on original experimental research conducted at the RIT (Government Engineering College) in Kottayam, Kerala. This paper focusses on the corrosion resistance of the cement-polymer-composite (CPC) coated steel rebars and clearly concludes that the currently adopted site practices can lead to early corrosion initiation and adversely affect the service life of RC systems. The seventh paper is by Dr. Haji and Ms. Roopa from the B.S.A.R. Crescent Institute of Science & Technology in Chennai. Their paper discusses the mechanical and corrosion characteristics of the galvanized steel rebars and observed about 2 to 3 times better corrosion resistance than the uncoated rebars, without compromising the bond strength. The editors believe that the high abrasion/crack resistances are very critical for realizing the claimed corrosion resistance; hence, unless the construction sites are able to start handling rebars like babies and ensure no damage to the nonmetallic coating, it is not advisable to use rebars with nonmetallic coating.

The eighth paper of this edition is authored by Dr. Zakka and Dr. Otieno from the University of Witwatersrand, South Africa. This paper considered the fact that corrosion initiation and service life are governed by the corner rebars and recommends to use 2D chloride transport models (instead of 1D models) to estimate service life. The final paper of this edition is by Mr. Naveen and others from IIT Madras and Vector Corrosion Technologies India and Canada. This paper presents a field case study on a recent cathodic protection technology - with the use of hybrid anodes - to enable fast re-passivation of steel and further protection from corrosion.

In short, this special edition calls for a major change in the mindset among the various stakeholders in the following lines: (i) introduce specifications to achieve corrosion resistance and durability for new structures (say, Mx-Dy concretes instead of just Mx concretes); (ii) introduce cost-effective, relevant and frequent condition assessment and estimation and updation of residual service life of structures; and (iii) introduce the concept of specifying target service life for repairs on existing structures.

We thank the opportunity given in guest-editing this ICJ special edition on corrosion and its control in concrete structures. The ICJ is well-read by the practicing engineers and decision makers in the concrete industry, especially in India. Such knowledgeable and wide readership (outside the academia and research community) has a huge role in implementing the latest technologies in the field of construction. Hence, we request the readers (the concrete technologists and researchers) to consider publishing in ICJ to take the results from the purpose-driven research in laboratories to the construction sites and thereby make a positive impact on the concrete construction sector.

Regards,

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Guest Editors

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REFERENCES

