

Dear Readers,

It is with great pleasure we bring to you this edition with research papers covering various aspects of geopolymer and alkali-activated binders (AABs). These binders, presently in the initial stages of research in India, offer a wide variety of applications. This edition has been guest edited by Prof. Shashank Bishnoi and Ms. Meenkashi Sharma.

Prof. Shashank Bishnoi is an Associate Professor and a Chair Professor at the Department of Civil Engineering, Indian Institute of Technology (IIT) Delhi. He is an active researcher in the area of cement hydration, supplementary cementitious materials, microstructural development, durability and repair. He has authored over 100 journal and conference articles and has worked on 250 industry and government sponsored research and consulting projects. He has served as an expert in various capacities to several Government bodies, Courts including the Supreme Court of India. He is an active member of several committees of the Bureau of Indian Standards and of several technical committees of RILEM. He is a member of the Editorial Advisory Board of Cement and Concrete Research and an Associate Editor of RILEM Technical Letters. Ms. Meenakshi Sharma is a Ph. D. scholar at the Department of Civil Engineering, Indian Institute of Technology (IIT) Delhi. She holds a B.Tech. degree in Civil Engineering from National Institute of Technology (NIT) Kurukshetra and has a M.Tech. degree in Construction Engineering and Management from IIT Delhi. Her research interests are analytical modelling, multi-scale modelling of mechanical and transport properties of concrete, continuum micromechanics, supplementary cementitious materials, durability and sustainability of concrete structures.

We hope you enjoy reading these papers and we look forward to your valuable feedback on this edition.

Production Editor
Indian Concrete Journal



Dear Colleagues,

Despite the development of many alternatives, Portland cement remains the main binder used in construction. This is because Portland cement has been shown to be efficient, versatile, cost-effective and has a relatively small environmental footprint. There have still been many developments that attempt to address the concerns regarding the environmental effects due to the large volumes of cement produced. While it is understood that Portland cement and its derivatives are likely to remain as the primary binders for construction, the alternatives offer many advantages, especially in specialized applications and construction conditions.

Geopolymers and alkali-activated binders (AABs) are the most promising amongst the proposed solutions that have the potential to reduce the environmental impact of construction. That these binders can help in reducing CO₂ emissions has been widely reported; they can also help in the consumption of raw materials that are otherwise not efficiently utilized. Although geopolymers and AABs are produced using materials that can be used in combination with Portland cements, their production methods,

properties and performance are significantly different. Although this makes the use of these binders more difficult in traditional construction applications, they open new opportunities that may not be possible using traditional binders.

This issue of the Indian Concrete Journal brings together articles that explain various aspects of the production and use of geopolymers and AABs. The articles have been selected by the editors and the reviewers to bring together research from renowned experts, covering a wide range of characteristics. The opening article by Prof. Cyr from University of Toulouse, describes the subject of mixture design of geopolymers and AABs, comparing it to an equivalent process for Portland cements. While the article shows that the process is more complicated, it describes the steps that have to be mastered in order to be able to carry out the mixture design.

The next article, by Yadav et al. from National Council for Cement and Building Materials, presents the engineering properties of geopolymers and AABs that have been cured at various temperatures, including ambient conditions. Both, workability and mechanical properties are covered in the article and practical applications of the materials are demonstrated. The article stresses on the importance of standards that would help in the design and use of geopolymer and AAB concrete mixtures.

The third article, from Singh and Subramaniam from SRM University and IIT Hyderabad, presents a scientific basis for the choice of activators and their influence on the performance of AABs produced using a low calcium fly ash. The influence of alkali content and elemental ratios on strength development of

high-strength concretes is also presented. The next article from Rahman, et al. from CBRI Roorkee, presents various specialized applications of geopolymers and AABs, including insulating materials and fire-resistant materials. The article shows the wide range of possibilities in precast products produced using these binders.

The fifth article from Mishra et al. from VSSUT, Burla and GCE, Keonjhar, presents the role that geopolymers can play in circular economy and sustainable development. The article goes on to describe the preparation and properties of geopolymer concrete produced using ferrochrome ash as an example. The next article by Manjunath et al. from NIT Karnataka presents the mechanical properties of self-compacting AAB concrete, including the bond with the reinforcement. The article shows how workability can be achieved in AABs, and also how it will be important to understand several minute aspects of the mechanical performance of these concretes before they can be used practically, since many of these properties are likely to be different from those of Portland cement.

The point-of-view article in this issue, by Radhakrishna and Venugopal from RV College of Engineering and SEA College of Engineering, demonstrates how the use of geopolymers should not be limited to concretes, but should also extend to the production of structural masonry units that can be used for load-bearing walls. The article presents initial results and points towards the further research required for replacing existing types of masonry units, many of which have high environmental costs.

Research on geopolymers and AABs in India is still in its initial stages. However, as the readers will appreciate, geopolymers and AABs offer a great potential for research and there are a

wide variety of applications where these materials can be more suitable. So as to point those, whose curiosity this issue succeeds in awakening, in the right direction, the last part of this issue presents a recent book published on the subject that provides a comprehensive review of the technology. The review describes how the book can be useful for researchers and practitioners alike. It is hoped that the readers of this issue will feel encouraged to gain a deeper understanding of the subject from this book.

The main photograph in the cover of the image, for which The University of Queensland has kindly given permission, shows the Global Change Institute building which uses precast geopolymer and AAB concrete units with slag and fly ash. The left inset on the cover shows a pavement and the middle inset shows precast panels that are described in more detail in the article by Rahman et al. The right inset shows a scanning electron micrograph of a fly ash based geopolymer that has been taken by Idawati Ismail, University of Malaysia Sarawak, and Susan Bernal, University of Leeds, UK and has been sent to the journal by Prof. John Provis of the University of Sheffield, UK.

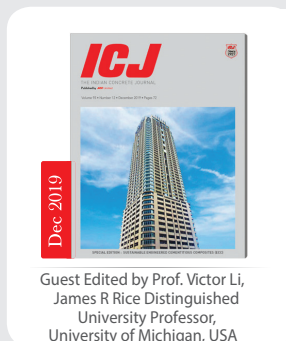
The guest editors of this issue would like to thank all the authors for submitting their work. The editors especially thank Prof. Martin Cyr for agreeing to make his article available in open access. The guest editors also profusely thank the reviewers who have put in a lot of effort in helping to improve the quality of the articles published here. We hope that the team of people that makes this Journal possible will continue to strive to raise its level to new heights.

**Shashank Bishnoi and
Meenakshi Sharma**

Guest Editors, ICJ

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