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Editorial

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Editorial

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Dear Readers,

Civil engineering built infrastructure majorly comprises of some of the building materials such as concrete and steel, performance of which is required to be improved not only at material level but also at structural system level against anticipated loading cases. Therefore, a structural designer strives achieving desired safety and economy by employing proper combination of these materials, while striving to attain sustainability. Performance of materials and structural systems has evolved in modern structures with the introduction of high-strength materials and analysis of intricate structural systems made with such materials on possibilistic and probabilistic scales. Baddoo (2022) has reported development of a guide for design and execution of high-strength steels (HSS) dealing with specification, design, and fabrication, stipulating more economic design rules. Such HSS help in saving material consumption and in-turn addresses issues related to climate change. For concrete materials, alternatives for cement are being investigated to address the myriad of environmental issues. To this effect, concrete mixes with nanosilica (NS) particles were tested by Mustafa *et al*. (2022) to characterise their mechanical properties and then investigating flexural behaviour of reinforced concrete (RC) beams made with such nano-modified concrete. Dosage of adding NS by weight of concrete has been evaluated experimentally and it was found that increased NS in the RC beams has improved their ultimate load-carrying capacity with reduction in the corresponding deflection.

The RC members have steel reinforcing bars with finite length available in the market (e.g. typically 12 m long steel rebars). Hence, splicing of the steel rebars becomes inevitable, where lap length and transverse reinforcement over the lap length govern the effective force transfer. A new model was developed by Rezaiee-Pajand *et al*. (2022) for predicting the length of lapping, spacing of the transverse reinforcement, and distribution of the bond stress in RC beams. The equations proposed by them are applicable for both, normal strength and high strength concretes. For covering large areas space structures are used with combination of concrete and steel in the structural systems while improving load-carrying capacity. Composite spatial grid structures without and with RC topping have been studied by Shahbazi-Reveshti *et al*. (2022) to investigate their buckling behaviours. The composite behaviour of the double-layer grids and the RC topping with improved strength and stiffness has offered significant advantages in terms of ultimate load-carrying capacity, improved ductility, post-buckling behaviour, preventing progressive failure and sudden collapse.

Sustainable seismic design of structures, which refers to structural operability upon post-earthquake realignment and repairs, is the next generation earthquake engineering practice, wherein structures experience accepted level of damages that can be repaired. The new philosophy of designing earthquake-resistant structures has been elaborated by Grigorian and Kamizi (2022) by giving some numerical examples. The philosophy is based on the weakest link concept where controlled damage is permitted, and recentring of the displaced structure is then done to reinstate it based on energy equivalency concept. Moment frames of uniform shears were developed and weak links were incorporated to develop an earthquake-resistant hybrid structural system of rocking core - moment frame, which is a new structural system becoming increasing popular for new structures.

For existing structures built conventionally using RC frames, seismic strengthening is carried out to improve their performance under earthquakes. How effective the scheme of strengthening is quantified by assessing their seismic vulnerability before and after the strengthening operations when subjected to varied levels of earthquake hazard. Fragility curves were obtained analytically for the existing and strengthened RC frame buildings by Kehila *et al*. (2022) for four damage levels, such as immediate occupancy, damage control, life safety, and collapse prevention – by using the maximum inter-storey drift ratio as the damage measure. Their investigation has evidently shown that providing RC shear wall has improved seismic performance level considerably by reducing inter-storey drifts to the order of about 25%.

In pursuit of making hazard-resilient communities, new research directions in earthquake engineering were highlighted in an earlier editorial by Matsagar (2016). Various researchers have continuously been developing high-tech solutions at material and structural system levels, as deliberated above, in order to minimise seismic vulnerability and maximise structural performance. Similar technological interventions have been dealt with in this edition of the *Structures and Buildings*.

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