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Editorial

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Editorial

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Greetings to all our readers. We trust you are staying safe and healthy amidst the Covid-19 pandemic. It is in unusual circumstances we are jointly writing this editorial, and in a world where communication has moved from real to virtual mediums for the past few months. Universities, businesses and nations have taken a hit to their finances in the lockdown period and, while enduring it, reimagined their strategies and sharpened their vision for a different post-pandemic world. Since our peer-review system is fortunately online, nothing major has affected the activities of the journal – thanks to our fantastic editorial team. As always, *Construction Materials* seeks to publish original research and practice papers of the highest quality on procurement, specification, application, development, performance and evaluation of materials used in construction and civil engineering. The journal is as relevant as ever and is at the forefront of dissemination of cutting-edge knowledge, and is committed to publishing excellent articles.

This October 2020 issue of *Construction Materials* is themed on self-compacting concrete (SCC) and consists of six papers from India, Iran and UAE. Out of the six papers, two sets of authors have contributed two papers each on a different aspect of their research in SCC. But it must be noted that the constituents for making concrete vary widely across geographies and this brings unique challenges in the mix design of SCC. For example, the cement used in India is much coarser than in UAE. So are the aggregates, especially when you are using fine Dune sand available in UAE, which has a significant fraction of particles passing 300 μm and 150 μm sieves. Use of Dune sand naturally pushes the demand for high-range water-reducing admixture (HRWRA), especially if slump retention is required for a longer period. This is evident in the papers by Al-Martini and Al-Khatib (2020a, 2020b) where the dosage of HRWRA is 1.8% by mass of cement content. The composition of Dune sand as a fine aggregate is 35%. However, in the absence of Dune sand, researchers from India were able to achieve the desired flow at 1% HRWRA. SCC is a preferred material of choice for high-rise construction projects where concrete is required to have high flowability – for example, the Island City Center project in Mumbai, India (Figure 1). Not all the papers give information on the grading of aggregates and Blaine fineness of cement. Whilst most research in SCC is focussed on normal-density concrete, the paper by Fathi *et al.* (2020) is an interesting study on performance of lightweight SCC under cyclic loading.

Al-Martini and Al-Khatib (2020a) have considered practical difficulties and simulated the effects of hot weather during typical transit of SCC in a truck from the concrete batching plant to the construction site. Simulating the drum revolution in a transit truck, the authors have continuously mixed SCC in a laboratory mixer and heated it with a burner as well. Temperature was varied from 25°C to 40°C and the mixing time between 20 min and 110 min. The authors have investigated the optimum combination of silica fume and fly ash in binary and ternary blends. At 40°C, the slump flow dropped to less than 500 mm for a mixing time of 110 min. In practice, control of concrete temperature is important in hot weather conditions, and hence, use of ice flakes and chilled water is necessary for retaining slump flow and ensuring stability of SCC mixes. Another important aspect confirmed by this research and seen at construction sites is the effective 7% upper limit of densified silica fume which is necessary for ease of handling and placing, resulting in a well-compacted dense concrete resistant to permeability of chloride ions. However, retention of slump flow is better in binary blends with fly ash compared to ternary blends with fly ash and silica fume.

Figure 1. Island City Center project, Mumbai, India (courtesy: Larsen & Toubro)

In a companion paper, Al-Martini and Al-Khatib (2020b) have studied the rheology of SCC using a proprietary rheometer. Since the Dubai Municipality guidelines cap the use of fly ash at 35%, the authors have done studies on SCC mixes with 35% and 40% fly ash in a bid to stretch limits of usage and maintain the design slump flow at 750±50 mm. When silica fume is in the SCC mix, longer mixing time is always helpful to significantly lower the relative yield stress and viscosity compared to the control mixtures. Based on the visual stability index, the authors have classified the SCC mixes in four bands and, as they have rightly pointed out, its scope is within this experimental work.

The next paper, by Sankar *et al*. (2020), in contrast to the first two papers, advocates a high silica fume content of 10% to derive better fracture properties from SCC. There is always a tussle between theoretical findings and practical effectiveness that is to be necessarily considered during mixing and placing of concrete. In this research, SCC mixes contained silica fume at 5%, 10% and 15% levels. When comparing the fracture toughness and fracture energy values, there is only a marginal benefit obtained from 10% silica fume compared to 5%. Therefore, it is advisable not to exceed the 7% upper limit of densified silica fume, as it is important to strike a fine balance between research and practice, for achieving a densely packed durable concrete. For the cement content used, it is appropriate not to go for a coarse aggregate less than 12.5 mm.

Bawa and Singh (2020a) conducted a series of fatigue tests on fibre-reinforced SCC prisms and developed mathematical models for prediction of flexural fatigue strength. The authors have found 75% corrugated steel fibres and 25% polypropylene fibres in SCC as a viable combination to achieve a 50% increase in compressive strength and static flexural strength. Backed by an extensive experimental study, the authors have developed relationships between fatigue stress level, fatigue life and probability of failure. However, the authors are correct in warning against extrapolating findings from this research to field applications, considering the nominal size of prisms used and equally the development of cracks in pure flexure zone as the prism ends are simply supported.

Bawa and Singh (2020b), in a companion paper, detail the results of an investigation to analyse the flexural fatigue life of SCC with different proportions of steel and polypropylene fibres. As in the earlier paper, the SCC mix with 25% polypropylene and 75% steel fibres performed better, giving a maximum average static flexural strength relative to a SCC mix with 100% polypropylene fibres.

The final paper in this issue, by Fathi *et al*. (2020), reports on an investigation of lightweight SCC of compressive strength 40 MPa made with scoria aggregate under different compressive cyclic loadings. Cylinders made of lightweight SCC were subjected to eight types of cyclic loadings and the results show pre-peak loading affects the post-peak behaviour of the concrete.

We hope you enjoy reading this themed issue on SCC. Stay safe and healthy.

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