Editorial

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In December 2015, the governments of more than 190 nations gathered in Paris to reach a new global agreement on climate change, aimed at reducing global greenhouse gas emissions and thus avoiding the threat of dangerous climate change. The construction industry can make a significant contribution towards this reduction and the articles published in this issue of *Construction Materials* are all aligned to reducing the environmental impact of construction materials by investigating the durability, re-use, recycling, renovation and optimisation of the materials used.

It is essential that the building industry finds suitable replacements for Portland cement, which has been identified as one of the most used materials on earth that is manufactured at an environmental cost of up to one tonne of CO₂ gas per tonne of cement manufactured. The use of industrial waste to manufacture alternative binders is highly topical and the article by Mobili *et al.* (2016) on the use of cement mortars and geopolymers with the same strength class indicates that it should be possible to replace Portland cement in mortars with alkali-activated, low-calcium fly ash. The formation of efflorescence, normally associated with geopolymers, can be limited by minimizing the free sodium ions. The relatively low moduli of elasticity, high vapour permeability and resistance to sulphate attack can be advantageous when using geopolymeric mortars in the restoration of historical buildings.

The environmental impact of the construction industry can also be reduced by increasing the use of recycled materials and large volumes of construction and demolition waste is already re-used in concrete as recycled aggregate concrete (RAC). The use of RAC for structural applications is limited by the lack of published information on the behaviour of reinforced concrete containing recycled aggregates. The structural behaviour of any composite material is dependent upon the bond between the materials used to form the composite. With their article on the pull-out behaviour of deformed steel bars in high-strength recycled aggregate concrete, Prince and Singh (2016) make a valuable contribution in expanding the database on structural performance of recycled concrete aggregate concrete.

Many masonry structures deteriorate with time or just do not have the structural capacity required under current conditions. Instead of demolishing existing masonry walls, these walls can

be strengthened and a widely used technique for strengthening unreinforced masonry walls is to epoxy fibre-reinforced polymer (FRP) strips to the surface of these walls. Epoxy is known to lose strength and stiffness at relatively low temperatures and in many parts of the world the surface temperature of buildings can be close to the temperature where the epoxy resin softens. As the warmer regions of the world are experiencing much higher temperatures than before, it is important to know when the FRP bond to the masonry wall will be affected by exposure to high temperatures. The extent of the loss in performance of near-surface-mounted carbon FRP strips was investigated by Masia *et al.*, (2016) in their article on the behaviour of masonry bond under elevated temperatures. Although they found that the reinforcement started moving at relatively low temperatures, loss of strength and total debonding was only observed at higher temperatures, thus indicating that near-surface-mounted carbon FRP reinforcement systems are not likely to become ineffective during hot weather. Although these results are not sufficient to provide a temperature limit beyond which irreversible damage would occur, it is important that journals such as *Construction Materials* publish the information required to build up a database of results for future use.

Nearly all structural concrete contains steel reinforcement and often the lives of structures are limited by corrosion of steel. The environmental impact of the construction industry can also be limited by ensuring that reinforcing bars are protected against corrosion, and studies on the corrosion resistance of steel are often conducted in an alkaline environment to simulate the passive protection provided by the concrete pore solution. Sodium, potassium and calcium hydroxide are used in the alkaline solutions and the effect of the sulphates in the pore solution is not taken into account. The effect of sulphates on passivation in alkaline environments was investigated by Moser *et al.* (2016) and their results indicate that passivation can be inhibited by the presence of concentrations of sulphates similar to what has been recorded in actual concrete samples. The work of these researchers is a reminder of the possible unintended consequences of the decisions made in creating simulated environments.

The articles contained in this issue of *Construction Materials* are all based on research relevant to reducing the environmental impact of the construction industry. Hopefully these articles will help the readers of *ICE Proceedings* journals to

think about innovative ways that we can refine the use of construction materials, thus making a contribution towards reducing greenhouse gas emissions.

REFERENCES

- Mobili A, Giosuè C, Bitetti M and Tittarelli F (2016) Cement mortars and geopolymers with the same strength class. *Proceedings of the Institution of Civil Engineers – Construction Materials* **169**(1): 3–12, <http://dx.doi.org/10.1680/coma.14.00063>.
- Prince JR and Singh B (2016) Pullout behaviour of deformed steel bars in high-strength recycled aggregate concrete. *Proceedings of the Institution of Civil Engineers – Construction Materials* **169**(1): 13–26, <http://dx.doi.org/10.1680/coma.14.00026>.
- Masia MJ, Shen J, Simundic G and Page AW (2016) Behaviour of NSM FRP masonry bond under elevated temperatures. *Proceedings of the Institution of Civil Engineers – Construction Materials* **169**(1): 27–38, <http://dx.doi.org/10.1680/coma.14.00029>.
- Moser RD, Kurtis K, Singh PM and Kahn LF (2016) Effect of sulfates on passivation in alkaline environments. *Proceedings of the Institution of Civil Engineers – Construction Materials* **169**(1): 39–43, <http://dx.doi.org/10.1680/coma.14.00016>.