

Editorial

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The April 2020 issue of *Engineering Sustainability* comprises four papers that consider a residential dwelling in the United Kingdom, electric vehicles in Beijing, preplaced recycled-aggregate concrete, and cementitious mortar using treated wastewater. Each of these papers was published ‘ahead of print’ on the Virtual Library homepage of *Engineering Sustainability*, thereby allowing quicker access to fresh content.

The first paper is entitled ‘Life-cycle cost analysis of retrofit scenarios for a UK residential dwelling’ (Salem *et al.*, 2020). This paper is an excellent example of engineering sustainability in its use of life-cycle cost analysis to evaluate energy-efficient and near-zero-energy-building retrofit scenarios for a typical pre-1990 free-standing residence in the UK. This evaluation was performed because of a 2003 European directive to reduce total energy consumption from the building sector and increase usage of renewable energy sources through ‘nearly-zero-energy buildings’. The directive was recast in 2010 (EC, 2010) after it was realised that the building sector continued to contribute substantially to total energy consumption in Europe. The recast directive set out a requirement for all new buildings and buildings that would undergo refurbishment by 2020 to meet the near-zero-energy definition; however, it provided only a generic definition and no specifications as to how this should be implemented. Importantly, the directive stated that the near-zero-energy standard need not be applied in cases where a cost–benefit analysis of the economic life cycle of a building is conducted and shows negative rather than positive benefit. A majority of near-zero-energy-building definitions consider only incorporation of renewable energy sources, neglecting the inclusion of energy efficiency measures to reduce the energy demand of the building first. Salem *et al.* (2020) conclude that the building to be retrofitted must be analysed and its base performance determined to establish areas of focus for the retrofit measures. With appropriate retrofit scenarios with energy-efficient measures applicable to the dwelling, and considering its primary energy consumption, the energy performance of the dwelling for each scenario may then be compared with the directive standard. The results of engineering economic calculations for each retrofit scenario for the selected life-cycle period allow the cost-optimal retrofit solution to be selected.

The second paper is entitled ‘An investigation into electric vehicle timeshare rental schemes in Beijing, China’ (Luo *et al.*, 2020). The objective of this study is to investigate adaptation to electric vehicles available through timeshare rental in Beijing by analysing electric vehicle timeshare rental (EVTR) system data and user responses to a questionnaire survey. The study results are summarised in terms of mobility patterns, pricing structure, willingness to use and satisfaction of using EVTR. System data reveal users’ mobility

patterns and usage habits, whereas the questionnaire responses capture users’ preferences contributing to their adaptation to using EVTR and opinions about their satisfaction. The survey was conducted at each rental station over a 2-week period in July 2016; 600 questionnaires were given out at random, 581 questionnaires were recovered, of which 559 were considered valid. The results revealed an uneven use on a daily and a weekly basis, which was characterised as related to travel reasons. The most rentals occurred at 09:00 on Saturday mornings. The EVTR stations with highest usage are in residential, commercial and university locations. The authors conclude that high-tech parks, university-concentrated regions, large-scale residential areas and commercial areas should be taken as priority areas for further EVTR stations in Beijing.

The third and fourth papers pertain to sustainable construction materials and are dominated by material properties and test results; the sustainability content is largely implied in terms of saving resources (aggregate and water) and reducing landfill disposal of materials that are suitable for reuse (aggregate from preplaced concrete, rubber and steel fibres from scrap tyres). The test results are intended to demonstrate suitability of the construction materials to enable them to be specified or at least considered for use in suitable applications and regions. The third paper is entitled ‘Eco-efficient preplaced recycled aggregate concrete incorporating recycled tyre waste’ (Alfayez *et al.*, 2020). This study builds on a 2017 study by other researchers that used tyre rubber granules and recycled stone aggregate as partial replacement for virgin coarse aggregate, by eliminating all virgin coarse aggregate and adding steel fibres from scrap tyres. The coarse aggregate is hand-placed in forms and then injected with flowable, self-leveling cementitious grout to produce what is known as preplaced aggregate concrete. Preplaced aggregates are not involved in material mixing, resulting in increased volume of aggregates, which reduces cement content, thereby limiting greenhouse gas emissions from cement production. The preplacement technique eliminates the negative effects of recycled concrete aggregate and tyre rubber on the rheology and flow of concrete, including segregation and workability loss. Self-leveling grout eliminates the need for mechanical vibration or compaction effort, which saves energy and reduces labour costs.

The fourth paper is entitled ‘Biotechnological approach for enhancing the properties of mortar using treated wastewater’ (Saxena and Tembhurkar, 2020). The research described in this paper uses treated wastewater and bacteria from soil to produce mortar in which calcium carbonate precipitated by bacteria fills pores and cracks. Results and discussion in the paper pertain to (a) compressive strength, (b) durability and (c) microstructure and morphology. The conclusions section begins with a list of material properties and

qualities and then states that the biotechnological approach using treated wastewater will not only help in improving the properties of cement mortar, but also save fresh water, by replacing it with treated wastewater. The developed biomortar using treated wastewater possesses higher strength compared with conventional mortar.

REFERENCES

- Alfayez SA, Omar T and Nehdi ML (2020) Eco-efficient preplaced recycled aggregate concrete incorporating recycled tyre waste. *Proceedings of the Institution of Civil Engineers – Engineering Sustainability* **173(2)**: 84–96, <https://doi.org/10.1680/jensu.18.00027>.
- EC (European Community) (2010) Directive 2010/31/EU of the European parliament and of the council of 19 May 2010 on the energy performance of buildings (recast). *Official Journal of the European Union* **L153/13**.
- Luo W, Sun L, Shi M, Yao L and Rong J (2020) An investigation into electric vehicle timeshare rental schemes in Beijing, China. *Proceedings of the Institution of Civil Engineers – Engineering Sustainability* **173(2)**: 73–83, <https://doi.org/10.1680/jensu.18.00025>.
- Salem R, Bahadori-Jahromi A, Mylona A, Godfrey P and Cook D (2020) Life-cycle cost analysis of retrofit scenarios for a UK residential dwelling. *Proceedings of the Institution of Civil Engineers – Engineering Sustainability* **173(2)**: 57–72, <https://doi.org/10.1680/jensu.18.00055>.
- Saxena S and Tembhurkar AR (2020) Biotechnological approach for enhancing the properties of mortar using treated wastewater. *Proceedings of the Institution of Civil Engineers – Engineering Sustainability* **173(2)**: 97–106, <https://doi.org/10.1680/jensu.18.00050>.