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Using recycled materials in producing a high quality, inexpensive and green concrete mix

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Summary

This project has been funded by EXPO 2020 under the "**University Innovation Programme**" in 2018. Under the supervision of Dr Mustafa Batikha, three of our UG Civil Engineering students, that time, worked on this project: **Syed Talha Muhammad Ali, Ali Rostami and Meirzhan Kurtayev**. This project aims to validate the utilizing of the recycled materials available in UAE on producing a concrete mix of high quality, low cost and low CO_2 emissions. Ceramic Waste Powder (CWP), Ceramic Fine Aggregate (CFA) and Recycled Coarse Aggregate (RCA) were used as a replacement of the cement, Natural Fine Aggregate (NFA) and Natural Coarse Aggregate (NCA) respectively. The experimental work was divided into three levels. Firstly, finding the optimal percentage of cement replacement by CWP. Then, the optimal percentage of NFA substitution by CFA. Finally, the effect of using 100% of RCA and ceramic waste together in the same mix to achieve the highest usage of the waste into the concrete mix for reducing the landfills.

Conclusions highlight

- ✓ The partial replacement of the cement and NFA by the ceramic waste should not exceed 20%.
- ✓ The RCA produced in the UAE and used in this research is of high-quality production properties.
- ✓ At the end of this project, a new concrete mix was produced of 100% NCA replacement by RCA, 20% cement substitution by CWP and 20% NFA replacement by CFA. This new product offers 22% lower cost and 23% less CO2 emissions than conventional concrete with a drop of 2% only in the mechanical properties (Cylindrical compressive strength of 46MPa). Moreover, the shrinkage of the new concrete dropped about 230% less than the normal concrete. On the other hand, the substitution of the usual concrete components by recycled materials reaches 47% which significantly helps in saving our natural resources and reducing the landfills.

Publications

Ali STM and Batikha M (2020) Producing green concrete by using recycled materials in UAE, in: Mateev M and Nightingale J (Eds.), Sustainable Development and Social Responsibility—Volume 1, Advances in Science, Technology & Innovation, Switzerland :Springer, pp.149-155. https://doi.org/10.1007/978-3-030-32922-8_14

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