Completely Recycled Concrete as a Sustainable Strategy in the Development of Contemporary Architecture

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Abstract

In the context of a global awareness of the unsustainability of current production and exploitation models, the concept of circular economy is more and more promoted as a target to be reached by all industries with regards to their environmental footprint at every level, from the extraction of raw materials to global greenhouse gas emission and product recyclability. This is a major concern for the construction industry as well, where concrete production accounts for a significant part of the global CO_2 emissions and raw material extraction. At the crossing point between society and the construction industry, architects are more and more asked to play a part to promote sustainable architecture models, which are mostly limited by the sustainability of the materials they can choose from. In this context, the recycling of coarse aggregates for concrete production has attracted considerable attention and efforts to improve it, though so far with mixed results due to a relatively poor quality material after processing. Centered on the case of Japan, this study starts with two architectural case studies from completed construction projects using recycled concrete as their primary construction material. From the limitations observed with these projects and the feedback from the architecture studios themselves, we will compare the performances of different existing and new concrete recycling methods based on mortar removal, so as to identify the techniques with the best potential for large-scale industrial application. After this, we will quantitatively evaluate the performance of one of the most promising technique to date, based on acetic acid treatment, on several materials from different, non-selected origins. Finally, a complete cost-benefit analysis of the conversion to this method is performed in order to evaluate the economic potential of such technique, something often overlooked yet crucial to the deployment of new technologies and their usage by both companies and architects.

Keywords: circular economy, recycled concrete, sustainability, weak acid treatment

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