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Production of upgraded recycled aggregates from construction and demolition waste for replacement of primary sand in cement mortars

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Waste concrete is the most predominant constituent material among construction and demolition waste. Recycling of this material could minimize landfilled waste and mineral resources depletion. This study investigates, in laboratory scale, the production of upgraded recycled concrete aggregates, suitable for the replacement of primary (crushed limestone sand) used in cement mortars, by means of selective crushing and autogenous grinding. These particle size reduction techniques, compared to traditional crushing/grinding, have the potential to remove the brittle cement paste from the aggregates, thus significantly improving their quality. The granulometry, the density, the water absorption (EN 13755) and the flow coefficient (EN 933-6) of the produced upgraded sand was determined and compared to crushed limestone sand. Subsequently, cement mortar specimens were manufactured using upgraded aggregates for total replacement of crushed limestone sand. Specimens were tested for their compressive and flexural strength (EN 196-1), density and water absorption. Results indicated that the upgraded recycled sand produced through the selective crushing and autogenous grinding processes had improved properties compared to the one produced by conventional crushing processes (flexural and compressive strength of cement mortar specimens were increased by 29% and 7%, respectively). However, the quality of the upgraded sand is lower than that of the primary crushed limestone. To further explore the issue, it is planned to investigate in more detail the process of autogenous grinding and to investigate the use of other selective aggregate-cement paste liberation technologies.