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Mechanical Properties Analysis of Masonry Residue Mortar as Cement Replacement

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Abstract : The cement industry is responsible for around a 5% of the CO2 emissions worldwide and considering that concrete is one of the most used materials in construction its total effect is important. An alternative to reduce the environmental impact of concrete production is to incorporate certain amount of residues in the dosing, limiting the replacement percentages to avoid significant losses in the mechanical properties of the final material. Previous researches demonstrate the feasibility of using brick and rust residues, separately, as a cement replacement. This study analyses the variation in the mechanical properties of mortars by incorporating masonry residue composed of clay bricks and cement mortar. In order to improve the mechanical properties of masonry residue, this was subjected to a heat treatment of 650 ° C for four hours and its effect is analyzed in this study. Masonry residue was obtained from a demolition of masonry perimetral walls. The residues were crushed and sieved and the maximum size of particles used was 75 microns. The percentages of cement replaced by masonry residue were 0%, 10%, 20% and 30%. The effect of masonry residue addition and its heat treatment in the mechanical properties of mortars is evaluated through compressive and flexural strength tests after 7, 14 and 28 curing days. Results show that increasing the amount of masonry residue used increases the losses in compressive strength and flexural strength. However, the use of up to a 20% of masonry residue, when a heat treatment is applied, allows obtaining mortars with similar compressive strength to the control mortar. Masonry residues mortars without a heat treatment show losses in compressive strengths between 15% and 27% with respect to masonry residues with heat treatment, which demonstrates the effectiveness of the heat treatment. From this analysis it can be conclude that it is possible to use up to 20% of masonry residue with heat treatment as cement replacement without significant losses in mortars mechanical properties, reducing considerably the environmental impact of the final material.

Keywords : cement replacement, environmental impact, masonry residue, mechanical properties of recycled mortars
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