The recycling of crushed waste bricks in the self-compacting mortar

Auteur : Tabarelli, Enrico
Promoteur(s) : Courard, Luc
Faculté : Faculté des Sciences appliquées
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Summary

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Student: Enrico Tabarelli

Supervisor: Luc Courard

Master: Ingénieur Civil des Mines et Géologue

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Abstract

One of the most challenging tasks that humankind has in the future is to develop new cities for a growing population in spaces and with materials that are not as abundant as in the past. In order to face this difficulty, buildings should be designed and constructed with cutting-edge technologies that aim to reduce their impact on the environment. The use of virgin raw materials in the building phase is still the most convenient solution in terms of organization and economic budget, but it worsens the exploitation of quarries in the territories.

Moreover, the disposition of old and abandoned buildings all over the world, is another unsolved issue to be addressed by the building industry. Their demolition is often preferred due to simpler procedures and a quicker creation of a possible available spaces for other purposes, but leads to another tricky problems, that of managing the wastes generated. To avoid the frequent disposal of inert material in landfilling, the European Community enacted the Directive 2008/98/CE that sets the objective for each state member to achieve by 2020 a minimum of 70% by weight of re-use, recycling and recovery of non-hazardous construction and demolition wastes.

The aim of this study is to analyze the possible recycling of waste bricks coming from demolition for the production of self-compacting mortar (SCM). The investigation is performed on mortars made with different replacement's percentage of the limestone filler, in one case, and of the limestone sand, in the other. First, the bricks are prepared and treated to achieve the similar physical properties of the filler and the sand of limestone. Then the materials are characterized in order to make a comparison with the limestone fractions and to design the mix for the mortar. Several tests are performed to highlight the influence of the recycled material in the traditional mix of the mortar. The analysis is done on mortars' samples through the concrete equivalent mortar (CEM). Moreover, for this specific case study, it is avoided the traditional use of the superplasticizers, in order to enhance the behavior of the bricks fraction and its influence on the mortar. Finally, the study of the compressive strength and flexural strength demonstrates how the substitution can affect or improve the mechanical properties of the hard mortar samples.

The study demonstrated that the use waste bricks' fractions to substitute sand and filler fractions inside self-compacting mortar is possible. The water absorption of the recycled material plays

a fundamental role in designing the proper mortar's mix. Several parameters must be considered during the choice of the composition, especially the amount of water to add and granulometry. In the case of the limestone filler replacement by the bricks' filler, the workability is only partially affected. Moreover, the mechanical properties of the mortars present negligible changes compared to the reference mortar. Sand replacement with bricks sand, does not reduce significantly the workability of the mortars, even with further increases of the bricks sand content. The small differences in compressive and flexural strength between the reference mix and the new samples, demonstrate that the brick's sand does not change significantly the final mechanical properties.

Keywords: *Construction and Demolition wastes; Self-Compacting Mortar (SCM); Recycling in SCM; Recycling wasted bricks; Recycling C&DW*