

# WASCON2015

Resource Efficiency in Construction

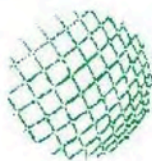
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9<sup>th</sup> International Conference on the Environmental and Technical Implications of Construction with Alternative Materials

## BOOK OF EXTENDED ABSTRACTS

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Organized by:



ISCOWA



GER Research Group  
Green Engineering & Resources



INGEPRO





**Book of extended abstracts of  
WASCON 2015**

Resource Efficiency in Construction

Book of extended abstracts of WASCON 2015 – Resource Efficiency in Construction

9th International Conference on the Environmental and Technical Implications of Construction with Alternative Materials

Organized by:

International Society for Construction with Alternative Materials, ISCOWA  
GER Research Group – Universidad de Cantabria  
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## FOREWORD

WASCON is the reference international conference on the use of alternative materials (secondary raw materials) in construction. The first WASCON conference was launched in 1991 by a group of scientists from Europe and North America. At that conference it was decided to found ISCOWA, the International Society for Construction with Waste materials. This initiative started an important movement around waste recycling in construction. The WASCON conferences became and remain the main activity of ISCOWA, and were from then on held every three years, i.e. in 1991, 1994, 1997, 2000, 2003, 2006, 2009 and 2012.

At WASCON 2012 in Gothenburg it was announced that WASCON 2015 would be organized in Santander, Spain, in collaboration with GER, the Green Engineering and Resources Research Group of the University of Cantabria, one of the top 10 Spanish Universities. GER consists of a group of active researchers whose research focuses on waste valorization, environmental information management and decision support tools, and process systems. The group actively interacts and collaborates with the community, the administration, industry and other research groups.

For WASCON 2015 the general theme **Resource efficiency in construction** was selected. On this memory stick you will find the proceedings of WASCON 2015, containing 60 extended papers, submitted by authors from 24 countries. The number, the variety and the quality of the papers indicate that WASCON still responds to a real need. I hope that these proceedings, a new extension of the large WASCON library (initially books, then CD-ROMs and now memory sticks), will provide ideas for commercial application and development, inspiration for future research and projects, and information useful for finding project partners.

Materials' recycling is enjoying more and more support e.g. from the EC that promotes Europe as a recycling society and the transition from the current linear economy towards a future Circular Economy. A sustainable society with a Circular Economy cannot be realised with an unsustainable construction sector. To date, the construction sector has much interest for Energy Efficiency (saving energy by insulation, construction of passive houses, innovative ways of efficient heating and cooling, production of renewable energy, etc.). We believe that recycling of materials, Resource Efficiency, in construction is of similar importance. Moreover, producing building materials from recycled materials, instead of from virgin raw materials may also save energy and emit less greenhouse gases. The future recycling society in a circular economy is however not possible without respect for environment and safety. New production techniques and new business models will be necessary to realize this recycling society and a circular economy. This and earlier WASCON conferences have shown several examples or niches that can contribute to this development. In order to reach a true recycling society and a circular economy, the niches must be transformed to norm via systemic eco-innovations, as described in the report "From Niche to Norm"<sup>1</sup>. This transformation will need a lot of effort by all stakeholders: science, industry, government as well as citizens. Therefore, the dual mission of ISCOWA "to promote and coordinate the exchange of information regarding the environmental and technical aspects of construction with industrial by-products" is today even more relevant than it was twenty-four years ago.

We hope that you will appreciate the scientific program and enjoy the social program with the wine reception, the boat trip and the Gala dinner.

Finally, the autonomous region of Cantabria is a privileged region due to its high quality of life. It combines with a mild climate other important elements such as art and nature, history and leisure, tradition and gastronomy. Situated between sea and mountain, it has the typical characteristics of an Atlantic climate with mild temperatures all year round. Santander, its capital, is a wonderful cultural and historical city with a friendly atmosphere. The city appeared to us the ideal location for WASCON 2015.

Prof. Carlo Vandecasteele  
University of Leuven  
Chairman of ISCOWA

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<sup>1</sup> From Niche to Norm: Suggestions by the Group of Experts on a 'Systemic Approach to Eco-Innovation to achieve a low-carbon, Circular Economy', EC, 2015, <http://bookshop.europa.eu/es/from-niche-to-norm-pbKI0115206/>



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## Performance of self-compacting mortars containing EAF slag as aggregate

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### Abstract

The use of oxidizing slag from steelmaking electric-arc furnaces (EAF) as an aggregate has been demonstrated to be a good practice in the manufacturing of mortar and concrete. It is a sustainable option, which does not decrease and even increase the mechanical properties of the mortar and concrete. It is recognized that the use of this slag involves obtaining a higher density and a worse workability than ordinary mixes made with natural aggregates; nevertheless, the resistance to shrinkage cracking is uncertain.

The self-compacting mortars and concretes have increased its importance in the field of construction in the last few years, and its use has been widespread all over the world. The final objective of this research is to get a mix design of self-compacting mortar with EAF slag as an aggregate that would have properties close to that of natural aggregate mixes, without being detrimental to its physical properties or to its durability.

Authors have characterized the EAF slag and designed different mortar mixes to find the admixtures, the cement and the fines proportions that fit well with this aggregate. The fresh properties of those mixes showed a suitable consistency without segregation, and the hardened properties - strength and shrinkage - demonstrated promising expectations.

*Keywords: EAF slag; oxidizing slag; self-compacting mortar; mix proportioning; admixtures.*



### Durability test

The results obtained after the test described in section 3.3 could be considered, in general, as satisfactory. The samples of mixes 3, 6 and 8, containing EAF slag have mostly conserved the volumetric integrity. However, samples of the mixes 4 and 5 (containing a notable amount of LF slag) have been destroyed; in Figure 3 it can be appreciated the result for the mixture 5. It is evident that the use of this kind of slag must be limited to lower values to avoid this default.



Figure 3. Mixture 5 after autoclave test

### Conclusions

- Self-compacting mortars have been performed using heavy aggregate as EAF slag.
- Even the use of LF slag in low proportions could be admissible.
- The results in terms of mechanical strength are promising.
- The drying shrinkage increases by the use of slag as aggregate.
- Durability tests show the weaknesses of some of these mixes containing LFS.

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