Controlling crack formation since early ages: Contributions of COST Action TU1404 and research project IntegraCrete

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ABSTRACT
The present contribution summarizes main activities and conclusions brought about by two funded projects: EU-funded COST Action TU1404 'Towards the next generation of standards for service life of cement-based materials and structures' and Portugal-EU funded project IntegraCrete 'A comprehensive multiphysics and multiscale approach to the combined effects of applied loads and thermal/shrinkage deformations in reinforced concrete structures'.

Key words: Concrete, crack control, early ages, collaborative research.

1. INTRODUCTION

Cracking in concrete structures as perceived by society is influenced by many aspects, most of which endure developments since the early ages of concrete. This happens for example through: residual stresses caused by restraint to heat of hydration induced volumetric changes; non-uniform stress fields caused by drying shrinkage, which affect at crack development since the earliest ages of exposure. Two recently finished funded initiatives on this concern are described hererin: COST Action TU1404 and the Portuguese Research Project IntegraCrete.

2 COST ACTION TU1404

The COST Action TU1404, entitled 'Towards the next generation of standards for service life of cement-based materials and structures' operated in 2014-2018, with participation of 33 countries, and several integrative research meetings and activities in the scope of the service life of reinforced concrete structures, particularly in concern to cracking behaviour. For more details on the general operation and meetings of COST TU1404, the reader is referred to www.tu1404.eu. One important tool for scientific networking were the Round Robin Testing program, which involved more than 100 ton transport of raw materials and 43 participating labs [1]. Another important tool for this Action was the numerical simulation benchmark, which was composed of several stages [2,3,4]. Both RRT+ and numerical simulation benchmarks interacting with each other, with important exchange of information, namely in regard to parameters for modelling, but also with results of experiments (e.g. TSTM, ring test) made available for validation of simulation approaches [2,3,4].

3 RESEARCH PROJECT INTEGRACRETE

The research project IntegraCrete was taking place 2017 and 2019, funded by a Portuguese Grant (partially supported by EU), and its aims were mostly centred in better understanding the interplay between imposed deformations and applied loads in the crack width formations observed in real structures (see more details on the project in http://civil.uminho.pt/integracrete/). Several initiatives were taken, with some of them interacting directly with COST TU1404. The following initiatives of relevance can be highlighted: the IntegraCrete design challenge for design of

reinforcement for a real case with bending and restraint to deformation [5]; the real-scale laboratory experiment for restraint/bending in reinforced concrete [6]; results obtained through thermo-hygro-mechanical modelling of crack widths in a real sized example [7].

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