SARCOS – Self-Healing as Preventive Repair of Concrete Structures

Summary

The search for smart self-healing materials and preventive repair methods is justified by the increasing sustainability and safety requirements of structures. The appearance of small cracks in concrete is unavoidable, not necessarily causing a risk of collapse for the structure, but certainly accelerating its degradation and diminishing the service life and sustainability of constructions. That loss of performance and functionality promote an increasing investment on maintenance and/or intensive repair/strengthening works. The critical nature of such requirements is signified by their inclusion as priority challenges in the European Research Program.

The first focus of this proposal is to compare the use of self-healing capabilities of concrete with the use of external healing methods for repairing existing concrete elements (Figure 1). Despite the promising potential of the developed healing technologies, they will be real competitive alternatives only when sound and comparative characterization techniques for performance verification are developed, being this SARCOS´s second focus. The third focus deals with modelling the healing mechanisms taking place for the different designs and with predicting the service life increase achieved by these methods.

Working Group 1 – Self-healing concrete and external healing repair materials

Overview: Self-healing of cement-based construction materials represents a valuable and cutting edge asset because of their inborn capacity to repair damages once they occur. External repair methods based on incorporating "healing promoter additives", compatible with the existing cementitious substrate, are also innovative solutions beyond the know-how for the repair and rehabilitation of the existing building and infrastructures' stock. This working group will compare and analyse the current state of the different approaches for the preventive repair of concrete structures, producing a report of the current state of art for different technologies. Moreover, aim is to provide guidelines and recommendations for the different methods, including the identification of the optimal applying conditions of the evaluated approaches, even considering the implementation of hybrid solutions.

The leader of WG1 is Nele De Belie, Professor at Magnel Laboratory for Concrete Research, Ghent University.

Working Group 2 – Characterization and monitoring of crack healing

Overview: Verification of the healing ability and assessment of the repair durability through the implementation of robust and comparative characterization techniques is essential. This Working Group will analyse and compare different characterization techniques to quantify the self-healing capability for new structures and the healing efficiency of external repair methods for aged concrete structures. This will further provide guidelines for evaluating the healing effectiveness with reference to the recovery of different properties of concrete materials or structural elements, due to self-healing activity of concrete in new structures or to the repair ability of external methods, including the analysis of the Round Robin Test results.

The leader of WG2 is Liberato Ferrara, Professor at Politecnico di Milano.

Working Group 3 – Modelling of crack healing and service life prediction

Overview: The general objective of this Working Group is to model and computationally simulate healing mechanisms and their impact on the mechanical properties of concrete. Furthermore, this Working Group will also evaluate the durability of new and existing concrete structures and the increase of service life due to these preventive actions. Two main tasks are defined herein. Firstly, to focus on the development and calibration of self-healing and repair models and secondly, on the estimation of the enhanced mechanical properties by structural integrity studies and the evaluation of service life improvement due to the use of predictive transient approaches based on upscaling (also in time) and complementary experimental validation.

The leader of WG3 is Anthony Jefferson, Professor at Cardiff University.

SARCOS COST Action is leaded by research institutions searching on different self-healing technologies and repair solutions for extending service life of new and existing concrete structures, with high expertise in developing characterization techniques. Also specialists on modelling healing mechanisms and experts on numerical service life prediction models contribute for the Action´s success. This composition provides a solid framework to advance in implementing innovative and sustainable solutions for extending the service life of concrete structures (Figure 2).

CERIS : Civil Engineering Research and Innovation for Sustainability

COST CA15202 SARCOS
SELF-HEALING AS PREVENTIVE REPAIR OF CONCRETE STRUCTURES
SARCOS

Project Reference

COST Action CA15202

Leading Institution

CSIS – Center for Strategic and International Studies (Spain)

Partners

Ghent University (Belgium), KU Leuven – Katholieke Universiteit Leuven (Belgium), DTU – Technical University of Denmark (Denmark), CTU – Czech Technical University (Czech Republic), UT – University of Tartu (Estonia), INSA Rennes – Institut National des Sciences Appliquées de Rennes (France), University of Lille (France), UKIM – Ss. Cyril and Methodius University in Skopje (North Macedonia), TU Dresden – Technische Universität Dresden (Germany), TU Darmstadt – Technische Universität Darmstadt (Germany), Aristotle University of Thessaloniki (Greece), BGU – Ben-Gurion University of the Negev (Israel), Technion – Israel Institute of Technology (Israel), PoliMI – Politecnico di Milano (Italy), PoliTo - Politecnico di Torino (Italy), RTU – Riga Technical University (Latvia), KTU – Kaunas University of Technology (Latvia), VilniusTech – Vilnius Gediminas Technical University (Latvia), University of Malta (Malta), TUDelft – Delft University of Technology (Netherlands), Cracow University of Technology (Poland), NOVA University of Lisbon (Portugal), IST – Instituto Superior Técnico (Portugal), UTCN – Universitatea Tehnica Cluj-Napoca (Romania), University of Belgrade (Serbia), Slovenian National Building and Civil Engineering Institute (Slovenia), UCO – University of Cordoba (Spain), Universidad Politecnica de Valencia (Spain), IETcc – Instituto de Ciencias de la Construcción Eduardo Torroja (Spain), Cardiff University (United Kingdom), University of Cambridge (United Kingdom)

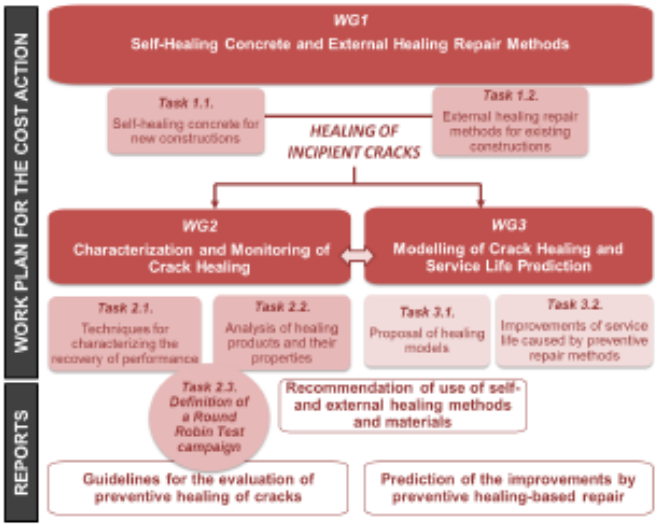

Figure 1. Work plan and dissemination strategy of SARCOS.

Figure 2. SARCOS members present in the Madrid 2017 meeting.

CERIS : Civil Engineering Research and Innovation for Sustainability

CERIS Principal Investigator

Paulina Faria
(paulina.faria@fct.unl.pt)

CERIS Research Team

-

Funding

COST – European Cooperation in Science and Technology

Period

2016-2021

Total

561 230.00€

CERIS

-

Project Website

www.sarcos.eng.cam.ac.uk

www.cost.eu/actions/CA15202