HEALCON

Self-healing concrete to create durable and sustainable concrete structures

Funding: European (7th RTD Framework Programme)
Duration: Jan 2013 - Dec 2016
Status: Complete with results
Total project cost: €5,610,519
EU contribution: €3,997,429

Call for proposal: FP7-NMP-2012-SMALL-6
CORDIS RCN: 106380

Objectives:

Within the call “Self-healing materials for prolonged lifetime”, self-healing concrete is an important topic. Adequate perpetuation of the road, tunnel and bridge network, is crucial to preserving European cohesion and business operations; and around 70% of this infrastructure is made of concrete. In order to guarantee liquid tightness of concrete structures, and enhance durability of elements prone to bending cracks, smart concrete with self-healing properties will be designed. Thanks to the existing expertise of the consortium in the field of self-healing concrete at a lab scale, a thoughtful selection of promising techniques is possible.

For early age cracks a non-elastic repair material can be proposed, such as calcium carbonate precipitated by bacteria, or new cement hydrates of which the formation is stimulated by the presence of hydrogels. For moving cracks under dynamic load, an elastic polymeric healing agent is suggested. Different healing agents and encapsulation techniques are tested and scaled up.

Self-healing efficiency is evaluated in lab-scale tests using purposefully adapted monitoring techniques and optimized with the help of suitable computer models. Finally, the efficiency is validated in a large scale lab test and implemented in an actual concrete structure. Life-cycle cost analysis will show the impact of the self-healing technologies on economy, society and environment compared to traditional construction methods.

Parent Programmes:
FP7-NMP - Specific Programme "Cooperation": Nanosciences, Nanotechnologies, Materials and new Production Technologies

Institute type: Public institution
Institute name: European Commission
Funding type: Public (EU)
Other programmes: NMP.2012.2.1-3 Self-healing materials for prolonged lifetime

Lead Organisation:

Universiteit Gent
Address: Sint Pietersnieuwstraat 25
9000 Gent
Belgium

Organisation Website: http://www.ugent.be
EU Contribution: €643,360
### Partner Organisations:

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<td>Innceinnmat SI</td>
<td>AVENIDA FERRANDIS SALVADOR 5 ENTLO 6</td>
<td><a href="http://www.ceinnmat.com">http://www.ceinnmat.com</a></td>
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<td>Technische Universitaet Muenchen</td>
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Technische Universiteit Delft

Address:
2600 GA Delft
Netherlands

EU Contribution: €504,174

Technologies:

Road structures
Smart concrete with self-healing properties

Development phase: Research/Invention

Key Results:

Bacteria and special polymers seal cracks

Around 70 % of Europe’s road, tunnel and bridge infrastructure is made of concrete whose structural stability can be compromised by liquids such as rainwater that enter through cracks. Novel self-healing concrete should solve the problem.

Inspection, maintenance and repair of reinforced concrete structures are time consuming and costly, and many structures are difficult to access. The EU-funded http://www.healcon.eu/ (HEALCON) (Self-healing concrete to create durable and sustainable concrete structures) project addressed these problems by developing novel self-healing concrete. It focused on early-age cracks and those due to mechanical loading or bending where self-healing concrete could have the greatest impact.

The team used inelastic limestone precipitation by bacteria and smart hydrogels to create water tightness and identified spores that discourage corrosion. The bacteria have been successfully incorporated into expanded clay particles or have been added to the concrete as self-encapsulated mixed cultures.

In addition, HEALCON developed encapsulated polymers to overcome bending cracks due to dynamic loading. It optimised the use of glass-encapsulated commercial polyurethane-based polymer precursors, investigated encapsulation in polymeric spherical capsules and worked on increasing durability during mechanical mixing.

Materials and processes were validated with computer models and non-destructive testing (NDT). Simulations of both the fracture and healing processes have provided insight regarding the most important parameters which affect self-healing. Three-point bending tests on concrete beams containing encapsulated polyurethane demonstrated the ability of several different NDT techniques to quantify self-healing.

Concrete remains one of the most important building materials and yet it has not changed substantially to reflect new technologies. HEALCON has made an important contribution to the fate of the future European infrastructure with the development of self-healing concrete.

The results were discussed in a final project conference held in November 2016 and in a video presentation available on the project website. The technology will undoubtedly enhance longevity while decreasing the complexity, time and cost associated with inspection, maintenance and repair.

STRIA Roadmaps: Infrastructure
Transport mode: Multimodal transport
Transport sectors: Passenger transport, Freight transport
Transport policies: Safety/Security
Geo-spatial type: Infrastructure Node