CERIS : Civil Engineering Research and Innovation for Sustainability

Shear strength of the interface between concrete layers cast at different ages

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Summary

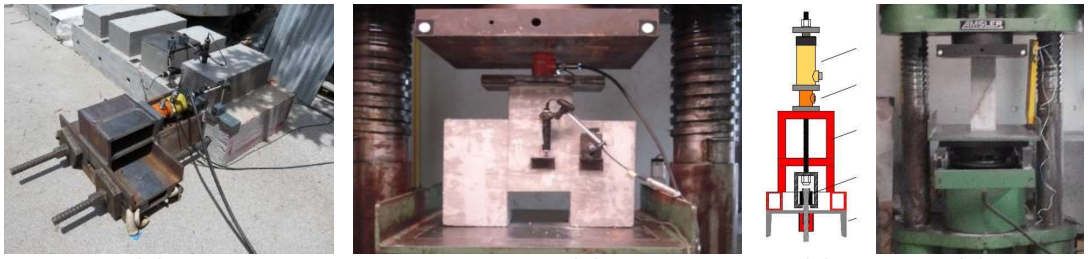
This thesis aims at contributing to the state of the art on the behaviour of concrete-to-concrete interfaces. Two research projects have been carried out in this scope, so far, namely: (i) Intelligent Super Skin, funded by the National Science Foundation (FCT), and (ii) Hiper Connector, funded by the National Innovation Agency (ANI). In the first project, an innovative concept – the super skin – consisting of an ultra high-performance concrete (UHPC) cover and a current concrete bulk has been developed to significantly enhance the durability of concrete structures. Several laboratory tests were carried out aiming at identifying the influence of each mechanism involved, namely: adhesion, friction, and dowel action.

In the second project, a new connector for concrete-to-concrete interfaces has been developed. Several laboratory tests were conducted with isolated connectors (shear, pull-out, and shear-bend tests), as well as with connectors embedded in concrete (adhesion, pull out, and shear tests). Based on the discussion of the results obtained with both abovementioned projects (in the Figure some tests setups are shown), additional slant shear tests were carried out, considering different interface angles and different roughness levels for the interface surface, the latter measured with the 2D laser roughness analyser developed by the research group. Currently, data gathered from the projects referred to, as well as from numerical studies available in the literature, are being processed aiming at delivering design guidelines.

The main goal is to provide structural designers with a document on how to accurately calculate the shear strength of interfaces between concrete layers cast at different ages and on how to correctly detail this intervention.

Keywords

Concrete-to-concrete interfaces, shear-friction theory, adhesion, friction, dowel-action.



(a) (b) (c) (d)

Examples of experimental tests performed:
(a) shear test (b) direct shear test, (c) pull out test, and (d) slant shear.