

## 2. Development of fibre-matrix bond on single fibre pull-out

### Description

Investigation on the evolution of the performance of SFRC during the hardening process of concrete. The study focuses on characterizing the “maturity-dependent” performance of steel fibres subject to pull-out and correlate it to the development of the mechanical properties of the matrix (i.e. compressive strength, tensile strength, Young’s modulus).

### Aim and objectives

The aim of this project is to characterize the evolution of the fibre-matrix bond performance during the hydration of the matrix. The following objectives are defined:

- 1- Summarize and categorize the existing literature on the evolution of residual-tensile performance of SFRC and “maturity-dependence” of the pull-out behaviour of a single steel fibre.
- 2- Optimize the operation of the existing standard test-setup for the execution of fibre pull-out testing.
- 3- Characterize the pull-out performance of commercial fibres at different concrete maturities (i.e. 2-5-7-14-28-56 days). Correlate these values with measured concrete properties at same ages.

### Methodology

In order to fulfil the abovementioned aim and objectives, the study will comprise the following tasks:

- 1- Literature review: Identification, classification and summary of scientific literature
- 2- Experimental study: Pull-out testing on standard test-rig at 119
- 3- Analysis of results: Descriptive statistics of the experimental data, regression model of exp. datasets.

### Minimum requirements

The project is oriented to BSc education level, preferably a group of 2 students. The students are expected to be able to work independently on theoretical, organizational and practical level (introduction to tasks will be provided). The specific requirements for accessing this project are:

- 1- Intermediate English level on a technical basis, and understanding of scientific and technical literature
- 2- Basic-level programming skills (e.g. Matlab, R) and intermediate-advanced informatics skills (text processing, excel etc.)
- 3- Intermediate-level on statistics (exploratory statistics at BSc level)
- 4- Understanding of concrete technology and mechanics of materials

Remarks on experimental project: Students will need to have a reasonably free schedule, and will have to prioritize project activities over other obligations. Extra ECTS may be added to the project upon agreement.

### Recommended literature (background)

- Bentur, A., Mindess, S., 2006. Fibre Reinforced Cementitious Composites, Second Edition, Second. ed. CRC Press.
- Neville, A.M., 2012. Properties of Concrete, IV. ed. Prentice Hall, Harlow, UK.
- Mehta, P.K., Mehta, P.K., Monteiro, P.J.M., 2006. Concrete: microstructure, properties, and materials, III. ed. McGraw-Hill, Berkeley, California.
- Bozik, Simon. 2016. “Single Fiber Pullout of Steel Fibers from Concrete, Enkelt Fiber Tilbagetrækningen Af Stålfibre Fra Beton.”