Master thesis project in Building Materials
For the master program Structural Engineering and Building Technology

Effect of carbonation on futuristic calcined clay-blended concrete mixes

Background: Application of cement replacement materials have been a well-known solution to the environmental effects assigned to cement production. However, Shortage of most common cement replacement materials like slag and fly ash from one side and the recent cement crises in Sweden from another side, has brought huge attentions to availability of clay sources in Sweden as an alternative cement. Aside from environmental footprint and availability of concrete's raw materials, its durability also plays a major role in sustainability to avoid extra maintenance costs and re-constructions. This means that to assure sustainability of our infrastructure, not only new designs and optimization of more sustainable binders are needed but durability and maintenance requirements have also to be taken into consideration. One degradation scenario to take into consideration is carbon dioxide penetration into concrete and its effects on microstructural properties of the cementitious matrix.

Aim: The aim of this project is to account for the effect of calcined clays on hydrate phases assemblage and microstructure of cementitious matrixes and eventual effects of these changes on carbonation resistance of the mix as well as its capacity for storing (binding) carbon dioxide.

Method: An experimental approach utilizing an accelerated carbonation method on mortar specimens with different w/b and calcined clay type and content is aimed. The changes in microstructure, hydrate phase assemblage, resistivity, and permeability as well as capacity of the system for storing (biding) carbon dioxide will be accounted for with laboratory tests methods as well as instrumental characterization methods.

Required Qualification: Basic knowledge in concrete technology and chemistry as well as interest and openness towards exploring new laboratory analysis in favor of better understanding the building materials in focus.

Number of students: Up to two students can work on this project

Industrial collaborations: Thomas concrete group (Dr. Ingemar Löfgren) and NCC (Dr. Nilla Olsson).

Supervisor: Arezou Baba Ahmadi (Assistant Professor) and Amrita Hazarika (PhD candidate)

Examiner: Luping Tang (Professor)

Location: The project is planned to be performed at Chalmers, while small parts of the experiments will be performed at Thomas concrete group.