

Study Project

Topic: Influence of bentonite type and content on the rheological and mechanical properties of controlled low strength materials (CLSM)

Description:

CLSM, also known as flowable fill, is a material usually composed of water, cement, aggregates and possibly other additives, such as bentonite, a swelling clay used to improve the quality of the fresh mix. The high water content of the mixture ensures the flowability of the fresh CLSM, a property that makes it suitable for void filling and utility bedding, reducing construction costs and time. The aggregate of a CLSM can consist of in situ excavated soil, but also a recycled material or an industrial by-product, thus preventing waste disposal and making CLSM a valuable material for the circular economy. Furthermore, through the choice of appropriate mix ratios, the mechanical properties of hardened CLSM can be adapted, in order to satisfy the use dependent requirements. Despite the wide use of these materials in different applications, there is still a lack of systematical investigations on the effect of the single constituents on the properties of the fresh and hardened CLSM. In particular, the influence of bentonite on the hardened CLSM has not been investigated so far.

Aim of the work:

Firstly, a literature review on the structure and the rheological properties of bentonite and cementitious materials has to be performed. Furthermore, the mechanical properties of hardened CLSM have to be summarized. Then, two series of sand based CLSM have to be mixed using two different bentonite types. For each bentonite type, nine mixtures with different bentonite and water contents have to be prepared and the evolution of their fresh properties (flowability, volume stability, bleeding) has to be observed over the first hours after mixing. Afterwards, the unconfined compression strength (UCS) of the CLSMs after different curing times (7, 14, 28 and 56 days) has to be determined to monitor the development of the compression strength over time. Finally, the influence of the bentonite type and content has to be assessed based on both fresh and hardened properties of the different CLSMs.

Candidate requirements:

Interest and enthusiasm in independent lab work

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