

Earth Construction Materials

Influence of inorganic binders in earth construction materials and its recyclability

Background

Earth construction materials are made of unfired clayey soil and may be stabilized with low percentages of inorganic binders such as lime or cement to improve the strength and, especially, durability characteristics. When exposed to water, unstabilized soil will quickly erode and lose its strength. Thus, if earth construction should be used as façade material or for outdoor structures such as noise barriers, it is essential to consider the long-term durability.

The topic is highly relevant since earth construction is gaining interest from architects and engineers among others. The reasons for the increased interest are the low embodied energy, availability and low costs of the raw materials (e.g. excavation soil), and the sustainable aspects of earth construction. These factors are relevant as the requirements for the resources used in the built environment are increasingly getting stricter. Moreover, excavation soil is the largest waste fraction in Denmark with app. 15 mio. tonnes per year and could be used as raw material in earth construction.

Aim

The main objective of this experimentally based research project is to investigate the long-term influence of inorganic binders on compacted, clayey soil used for earth construction materials. This will be done based on mechanical tests and investigations of the reactivity between the soil and the added inorganic binders.

Moreover, when exposed to the atmosphere, CO₂ will gradually penetrate the material and cause carbonation of the soil-binder reaction products. The influence of carbonation on durability will be studied.

Unstabilized soil is completely recyclable, while there are other challenges to consider if inorganic binders are added to the soil. Therefore, it is relevant to consider the whole life cycle of the stabilized earth construction material. An interesting question is whether stabilized soil can be re-compacted to a decent quality for either new earth construction or for sub-soil purposes, e.g. as a replacement of virgin aggregates.

By filling these knowledge gaps, we will move from the present experience-based use of earth construction materials to an evidence-based understanding of its long-term behaviour and durability. This will make earth construction more applicable to the construction industry as a material with low embodied energy and could be one of the solutions for lowering the carbon footprint of the construction sector.