

Synopsis – Substitution of natural aggregates in concrete applications

Aggregates, such as sand, gravel, and crushed stone, are the most mined materials on Earth. They constitute the foundation for modern civilization and are essential for building homes and infrastructure but are also an increasingly scarce resource. Concrete is, second to water, the most used material in the world, and aggregates is a major constituent in concrete.

The overall objective of this project is to combat sand scarcity by developing the necessary knowledge that enables substitution of sand in concrete with bottom ashes from waste-to-energy plants and biomass combustion. This would also present a solution to bottom ash waste products that are currently not utilized.

The research aims to explore the influence from such sand substitution - from fundamental theory to practical aspects for use in concrete. The knowledge built will be compiled in a guidance, specifically for bottom ash in different concrete products.

How much sand can be replaced with ash and which effects does it have on parameters like strength and durability? Will the potential pollutants in the ash be contained in the concrete, or is there a risk of seepage of these materials? What are the requirements to the ash characteristics to enable them for use in concrete? To answer these questions, and to lead the way for an introduction of ash as sand replacement in the global concrete industry, COWI, represented by Carola Edvardsen and Anders Haumann as supervisor and co-supervisor, and DTU, represented by Professor Lisbeth M. Ottosen as supervisor, have joined forces for this project. The project is led by COWI engineer Anders Hedegaard Jensen, and the project is financially supported by COWIfonden and Innovationsfonden. Collaboration with relevant actors in the industry is planned, such as Eminent, Biofos and Afatek, and the comprehensive testing required in the project will be carried out in the state-of-the-art concrete lab at DTU.

To make the research applicable in practice, barriers in relation to lack of standards will be identified, and methods will be proposed to overcome these challenges. In addition, the aim is to make the replacement material is cost competitive.