

Smarter Use of Soil in Sustainable Construction

Developing next-generation design methods for stronger, greener infrastructure

Who

This Industrial PhD project is a collaboration between COWI A/S, Aarhus University, Aalborg University, and industry partner Huesker GmbH, a major manufacturer of soil reinforcement materials.

What

The project will develop new, advanced design methods for reinforced soil structures — for example, embankments, retaining walls, and flood defences. These structures use layers of reinforcement (like very strong “textiles”) to stabilise ordinary soil, making it possible to build safely and efficiently even in difficult ground conditions.

Why

The building sector is responsible for around 40% of material use and 35% of CO₂ emissions in the EU. Current design methods are based on conservative “worst-case” assumptions. That means we often use far more material than necessary — costing more money, producing more CO₂, and missing opportunities for smarter construction.

By introducing probabilistic design — a method that uses data and risk analysis to account for natural variation in materials, loads, and weather over time — we can deliver safe structures while reducing waste and emissions.

How

Over three years, the PhD will:

- Analyse large datasets from laboratory tests, real projects, and monitoring systems.
- Develop advanced computer models that simulate how reinforced soil behaves under real-life conditions — including changing loads, long-term material performance, and climate impacts such as flooding.
- Compare traditional and new methods through case studies.
- Identify the best ways to reduce CO₂ emissions and costs while keeping the same level of safety.

Partners will share knowledge continuously, ensuring results are tested in practice at COWI and ready for use in real projects.

Where and When

The work will be carried out mainly in Denmark at COWI and Aarhus University, with an international research stay at the GeoEngineering Centre in Canada. The project runs for 36 months.

What then

The results will help COWI — and the wider construction industry — design more resource-efficient, reliable, and climate-friendly infrastructure. The methods are expected to influence future Danish and European building standards (Eurocode), supporting Denmark's green transition.