

Generative and Agentic AI for 3D Geological Modelling in Tunnelling

University of Strathclyde, DTU, COWI

Underground infrastructure plays a vital role in modern life, whether it is storing water, building transport tunnels or managing nuclear waste safely. However, constructing these systems is complex and risky. Unpredictable underground conditions can cause delays, raise costs, and even threaten safety. One major problem is the difficulty in fully understanding the ground before and during construction, especially in areas with fault zones that can weaken rock and affect water flow.

Engineers use 3D geological models to map what lies beneath the surface. These models help predict risks and guide safe design. But current methods for building these models are time-consuming, require expert knowledge, and often rely on manual interpretation of scattered data from surveys and boreholes. This can lead to human error and delays when fast decisions are needed.

This project aims to address this challenge by creating a new digital system that uses generative AI and intelligent AI agents. The system will automatically bring together different types of geological data to build accurate 3D models of the underground. It will also feature an AI assistant that understands plain language, allowing users to ask simple questions like “Are there any fault lines in the area?” and get clear, easy-to-understand answers. The innovation makes complex geology more accessible to everyone involved, from engineers to project managers and policymakers. It helps users spot potential underground hazards early, avoid surprises during construction, and make smarter, safer decisions.

The project is expected to deliver the following benefits:

- Faster, more accurate, and easier-to-access 3D geological models.
- A simple, user-friendly system that allows anyone to explore underground conditions and potential risks by asking questions in everyday language.
- Safer and more cost-effective infrastructure projects through earlier detection of underground hazards and better planning.

In short, this project uses cutting-edge AI to make underground construction safer, faster, and more efficient, by turning complex geological data into clear, actionable insights for all.