**Ground engineering**

Understanding and tackling challenges relating to ground and underground structures, geotechnics and environmental and hazardous aspects of structures.

This area encompasses understanding and addressing the challenges relating to:

* ground and underground structures, including tunnelling, piling, ground reinforcements, trenchless technology and pavement engineering
* geotechnics, rock mechanics and the interaction of structures with soil (using a range of numerical modelling approaches)
* environmental and hazardous aspects of structures on, off and in the ground (for example, the effect of climate change).

We want the community to focus on delivering against resilience-related goals, such as ensuring a reliable infrastructure and mitigating the risks of climate change. We encourage the community to find sustainable solutions to national needs, seek to apply intelligent technologies and systems and maximise the impact of the investment in the [UK Collaboratorium for Research on Infrastructure and Cities (UKCRIC)](https://www.ukcric.com/). We will also explore the requirements of early career researchers.

The themes outlined below will characterise the area.

### Resilient infrastructure

The UK has a strong heritage in this discipline and is at the forefront of research, with substantial links into industry. Investments will deliver against EPSRC’s resilient nation ambitions, in particular by addressing (with industry) long-term challenges associated with structure-soil interaction, to prevent failure of critical infrastructure.

### Intelligent technologies

The community needs to continue adopting disruptive technology, for example novel applications of sensor technology, or ground-penetrating systems.

### Sustainability

Sustainable solutions for national needs are another challenge which the community should seek to address alongside industry. For example:

* decarbonisation by developing green construction materials with fewer emissions
* developing and designing solutions which minimise impact on the surrounding environment
* improved resource-efficient design of structures – these can be addressed alongside the structural engineering area.

### Working to address leadership and skills

This area has clear links with other research areas, for example [structural engineering](https://www.ukri.org/our-work/browse-our-areas-of-investment-and-support/structural-engineering/), [built environment](https://www.ukri.org/our-work/browse-our-areas-of-investment-and-support/built-environment/),  [infrastructure and urban systems](https://www.ukcric.com/). It will be critical for the community to take a whole-systems view regarding the smart cities agenda. Researchers are encouraged to go on addressing cross-research council issues, including engaging with social and environmental sciences.

We will work with the community to understand and address leadership or related skills challenges, particularly in relation to early career researchers. This will be addressed alongside similar needs affecting built environment, infrastructure and urban systems, and structural engineering.

Researchers are expected to continue to take a leading role in large infrastructure projects, maximising the outcomes of investments and harnessing the multidisciplinary opportunities.

This research area is also of potential relevance to the [Foreign, Commonwealth and Development Office’s Official Development Assistance](https://www.gov.uk/government/collections/official-development-assistance-oda--2) funding streams.

The UK’s research community is a world leader in this area, characterised by key strength in geotechnical engineering. More recently, there has been a shift towards geophysics, offshore and climate change analysis, nuclear waste management and infrastructure resilience.

Ensuring sustainable, resilient infrastructure in the light of climate change presents a major challenge, and this has been identified as a key focus for ground engineering. Rapid change towards a digital economy means the UK could be left behind if there is no increased uptake of intelligent technologies.

Large infrastructure projects rely on increased understanding of how the ground behaves and interacts during construction and whole-life performance. Four-fifths of all construction-related projects supported by EPSRC are delivered alongside industry partners. The [Construction 2025](https://www.gov.uk/government/publications/construction-2025-strategy) strategy, though, identified limited uptake of research by industry, so research knowledge should be made more visible in the wider construction industry.

### Collaboratorium establishes new laboratories

Use of high performance computing will advance the modelling of soil mechanics. The [UK Collaboratorium for Research on Infrastructure and Cities](https://www.ukcric.com/) will establish major ground engineering labs at Southampton, Cambridge and Birmingham universities.

Two centres for doctoral training overlap with ground engineering research and will contribute to developing leadership and knowledge. There has been a small increase in overall student numbers associated with this research area that are supported through the Doctoral Training Partnerships and industrial Collaborative Awards in Science and Engineering. There is strong overlap with student training in associated civil engineering research areas, for example built environment, infrastructure and urban systems, and structural engineering. Skills provision is key to the wider construction sector.

This area has a low number of early career researchers funded by EPSRC, in terms of first grants and early career fellows, with overall funded early career researchers falling. This trend is reflected in other areas related to civil engineering.