**Infrastructure and urban systems**

Quantitative engineering research relating to the development of resilient infrastructure and urban systems.

This area encompasses quantitative engineering research relating to the development of resilient infrastructure and urban systems.

The infrastructure and urban systems research area was formed from the merger of the transportation operations and management and the sustainable land management areas. It also includes relevant infrastructure and urban systems aspects of the built environment area.

The merger recognises that future sustainability and resilience concepts underpin the majority of research in those areas, and the clear drive across government and research councils towards the cities and urban living agenda. We will continue to work with other research councils, innovation partners (for example Innovate UK) and the government to support multidisciplinary research related to infrastructure and urban systems.

Research in this area plays a key role in addressing engineering challenges associated with systems-wide infrastructure and smart cities. The community should seek to address concepts highlighted in the engineering grand challenge across future cities. This research area will be characterised by:

* long-term transformative research, led by the community and addressing core engineering and whole systems integrated approaches to future infrastructure
* research into physical and digital interventions that allow cities to become more effective
* improving the performance, capacity and connectivity of transport networks
* solutions to systemic failure due, for instance, to ageing or stretched capacity
* research taking a holistic view of cities and their systems, including dependencies between them and critical infrastructure
* a portfolio addressing research challenges in a whole system context, in conjunction with those set out in the [built environment](https://www.ukri.org/our-work/browse-our-areas-of-investment-and-support/built-environment/), [structural engineering](https://www.ukri.org/our-work/browse-our-areas-of-investment-and-support/structural-engineering/), [ground engineering](https://www.ukri.org/our-work/browse-our-areas-of-investment-and-support/ground-engineering/) and other relevant (especially IT-based) research areas.

### Addressing leadership and skills

We will work with the community to understand and address leadership or related skills challenges (for example concerning early career researchers), alongside similar needs in the built environment, structural engineering and ground engineering areas.

The community should position itself to maximise the impact of the investment in the [UK Collaboratorium for Research in Infrastructure and Cities](https://www.ukcric.com/) (UKCRIC) and capitalise on the UK leadership created through such an investment, ensuring that multidisciplinary opportunities are harnessed.

We will work with other government bodies, with [Catapults](https://catapult.org.uk/) and across research councils to:

* align investment
* encourage a more joined-up approach to grand challenges
* de-risk
* provide evidence for future government infrastructure investment.

Research in this area needs to remain led by technology with appropriate consideration of social challenges.

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.

In this area, an extensive research community has strong international standing. Research is inherently multidisciplinary and supported across a number of themes, particularly with the civil engineering-related research areas, built environment, ground engineering and structural engineering. Key strengths are in systems-based approaches. Coupled with centres for doctoral training (CDTs), this has resulted in a large cross-disciplinary community and generated a wealth of knowledge and expertise.

There has been a steady number of students supported through doctoral training partnerships (DTP) and industrial Collaborative Awards in Science and Engineering, and a large overlap with student training in the built environment, ground engineering and structural engineering research areas.

This research area has a low number of early-career researchers funded by ESPRC, in terms of first grants and early-career fellows. The number of funded early-career researchers is falling – a trend reflected in other areas related to civil engineering.

### More than 80% of population live in urban areas

Over 80% of the UK population live in urban areas. Urban infrastructure is the foundation of economic productivity and human wellbeing. According to the [UK Collaboratorium for Research in Infrastructure and Cities](https://www.ukcric.com/) (UKCRIC), inadequate infrastructure costs the nation £2 million a day. UKCRIC has major facilities and city observatories across the country, with core areas aligned to the challenges of the infrastructure and urban systems research area.

The economic returns of well targeted infrastructure investment can be up to £10 per £1 spent. The [National Infrastructure and Construction Pipeline](https://www.gov.uk/government/publications/national-infrastructure-and-construction-pipeline-2021) totals £468 billion, yet research among UK universities to inform this agenda equates to only a small fraction of this. Future sustainability and resilience is a clear driver across government and the research councils. This is reflected in the publishing of the National Infrastructure Plan, the Government Office for Science’s [Future of Cities project](https://www.gov.uk/government/collections/future-of-cities), and the formation of the [Infrastructure and Projects Authority](https://www.gov.uk/government/organisations/infrastructure-and-projects-authority) and [National Infrastructure Commission](https://nic.org.uk/).

Innovate UK’s [Connected Places Catapult](https://cp.catapult.org.uk/) provides world-class facilities and expertise and brings together businesses and universities.