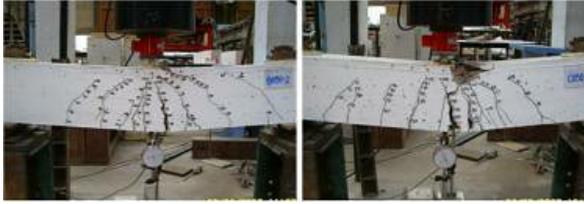


## Infrastructure engineering research group

Various aspects of the built environment have been researched at the University of Birmingham for some 80 years. In recent years much of the research has been related to the management of the infrastructure as an asset, and the various strands of the research have been brought together in the Infrastructure Engineering Research Group.



Currently research is carried out in four areas:

- Structural engineering
- Structural materials
- Sustainability management
- Risk management

For experimental work full use is made of the structural and material engineering facilities in the Civil Engineering laboratory which houses three strong floors, a range of testing machines, concrete mixing and curing facilities, environmental chambers, and specialist equipment for monitoring the condition of structures in the laboratory and on site.

In recent years work in structures has concentrated on the assessment of structures, including those with defects and deterioration, site quality and temporary works. Much of this work has informed UK and international codes of practice and other authoritative guidance on the design and assessment of structures.

This work is complemented by that in structural materials which has concentrated on the deterioration of concrete structures, materials used in the repair and strengthening of concrete structures, the development of durable cementitious composites, and the use of light steel sections.

Research in the field of sustainable engineering has focused on elements of the built environment, particularly the performance of buildings, such as sustainable building with structural insulation panels (SIPs), and their relationship with open spaces. Central to this work is the development and application of assessment methodologies and the use of environmental design strategies to evaluate and minimise whole life cycle impacts.

Research on safety risk and reliability management addresses the development more rational and sustainable safety risk, reliability and decision-making techniques for infrastructure systems, and the development of advanced procedures for minimising risks by improved design, construction and maintenance strategies based on risk and reliability assessment.

Research is also undertaken on asset deterioration and sustainable investment planning techniques as applied to asset-intensive industries, with particular focus on the water industry.

An **MSc is offered in Construction Management** (</postgraduate/courses/taught/civil-engineering/construction-management.aspx>) which covers many of the above topics.

Staff in the group co-operate widely with staff from other departments and schools through the University Collaborative Research Network in Sustainable Environment, Energy and Resources, one of the nine thematic networks that match the University Strategic themes.

### Structural Engineering

[Open all sections](#)

The Structures Group has been involved with research into the analysis, design, construction and assessment of both permanent and temporary structures for about 80 years. In recent years work has concentrated on the assessment of structures, including those with defects and deterioration, site quality and temporary works.

Much of this work has informed UK and international codes of practice and other authoritative guidance on the design and assessment of structures.

Recent and current projects include:

- [Impact performance of structural glass - pdf 109 KB. \(/Documents/college-eps/civil/research/low-velocity-impacts-on-safety-glass.pdf\)](#)
- [Effect of reinforcement ductility on beam ductility - pdf 82 KB. \(/Documents/college-eps/civil/research/steel-ductility-rc-beams.pdf\)](#)
- [Lateral torsional buckling of I-sections under fire conditions - pdf 55 KB. \(/Documents/college-eps/civil/research/lateral-torsional-buckling.pdf\)](#)
- [Shear transfer at ribbed slab-column connections - pdf 69 KB. \(/Documents/college-eps/civil/research/load-transfer-reinforced-concrete-ribbed-slabs.pdf\)](#)
- [Progressive collapses of precast concrete cross wall structures - pdf 85 KB. \(/Documents/college-eps/civil/research/precast-concrete-cross-wall-joints.pdf\)](#)
- [Strength and ductility of sections with inadequately anchored reinforcement - pdf 37 KB. \(/Documents/college-eps/civil/research/concrete-sections-anchored-reinforcement.pdf\)](#)
- [Structural performance and design of cold formed steel Sigma sections - pdf 221 KB. \(/Documents/college-eps/civil/research/coldformed-steel-sigma.pdf\)](#)
- [Sustainable building with structural insulation panels \(SIPs\) - pdf 27 KB. \(/Documents/college-eps/civil/research/structural-insulation-panels-SIPs.pdf\)](#)
- [Local, distortional and lateral-torsional buckling of cold-formed steel sigma sections - pdf 45 KB. \(/Documents/college-eps/civil/research/distortional-buckling-cold-formed-steel-sections.pdf\)](#)
- Robustness of concrete structures.
- Effect of corrosion on bond strength of reinforcement.

## Structural Materials

Research on structural materials has concentrated on several aspects of the deterioration of concrete structures and on materials used in the repair and strengthening of concrete structures. Current interests are concerned mainly with corrosion and its prevention in reinforced concrete as this is the most widespread and costly form of infrastructure deterioration encountered worldwide.

Current projects include:

- [Effects of electric arc furnace bag house dust as a concrete additive - pdf 193 KB. \(/Documents/college-eps/civil/research/electric-arc-furnace-dust-concrete-durability.pdf\)](#)
- [Modelling durability for reinforced concrete structures - pdf 83 KB. \(/Documents/college-eps/civil/research/modelling-deterioration-reinforced-concrete.pdf\)](#)
- [New techniques for assessing the visual condition of civil engineering structures - pdf 73 KB. \(/Documents/college-eps/civil/research/structure-inspection.pdf\)](#)
- Combined influence of chloride and carbonation on the corrosion of reinforcing steel in concrete structures.

## Sustainability Management

Research in the field of [sustainable engineering \(/research/activity/civil-engineering/long-term/sustainability/index.aspx\)](#) has focused on elements of the built environment, particularly the performance of infrastructure, including both new build and refurbishment projects, and their relationship with open spaces. Central to this work is the development and application of assessment methodologies and the use of environmental design strategies to evaluate and minimise whole life cycle impacts.

Recent projects include:

- [Sustainable building with structural insulation panels \(SIPs\) - pdf 27 KB. \(/Documents/college-eps/civil/research/structural-insulation-panels-SIPs.pdf\)](#)
- [Implications of adopting sustainable construction practices in social housing - pdf 14 KB. \(/Documents/college-eps/civil/research/sustainable-construction-social-housing.pdf\)](#)
- Evaluation of passive building design strategies using software based thermo-dynamic simulation tools;
- Investigation of the impacts of climate change uncertainty on the performance of the built environment;
- Evaluation of the impacts of including environmental externalities in investment decision-making;
- Feasibility assessments for the integration of low carbon and renewable energy technologies in the built environment;
- Sustainable development of post-war listed educational buildings.
- Water distribution network modelling and sustainable investment planning.
- Improvements to design in water treatment unit processes to deliver required quality improvements with reduced energy and material usage.

## Risk Management

The objectives of research on safety risk and reliability management are to:

develop more rational and sustainable safety risk, reliability and decision-making techniques and methods to facilitate risk and reliability analysis of infrastructure systems for railways, roads, underground transport facilities, bridges, offshore oil & gas, nuclear and water industries so that safety and reliability aspects can be taken into account in design, construction and maintenance processes

develop advanced procedures for minimising risks by improved design, construction and maintenance strategies based on risk and reliability assessment

Recent and current projects include:

- Construction project risk assessment at appraisal – the FRAP approach (MA)
- Development of a new service-performance model to improve understanding of businesses and environmental change with time, taking account of maintenance, product quality and other strategic requirements (MA)
- Managing risks in construction projects (MA)
- Risk Assessment based on Decision Making at the Construction Planning Stage (MA)
- Reliability prediction models for reliability assessment of ageing bridges (MA, LC)
- Further information on the research, projects, people and publications related to [Safety Risk and Reliability Research can be found here. \(/research/activity/civil-engineering/risk/index.aspx\)](#)

A major new research initiative in [Sustainability Engineering \(/research/activity/civil-engineering/long-term/sustainability/index.aspx\)](#) has been created that spans across the School and the University.