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Transport technology

The Transport Technology Group consists of **Professor Chris Baker (/staff/profiles/civil/baker-chris.aspx)** (CB), **Professor Martin Snaith (/staff/profiles/civil/snaith-martin.aspx)** (MSn), **Associate Professor Felix Schmid (/staff/profiles/civil/schmid-felix.aspx)** (FS), **Dr Min An (/staff/profiles/civil/an-min.aspx)** (MA), Dr Jennaro Odoki (JO), **Dr Harry Evdorides (/staff/profiles/civil/evdorides-harry.aspx)** (HE), **Dr Michael Burrow (/staff/profiles/civil/burrow-michael.aspx)** (MB) and **Dr Andrew Quinn (/staff/profiles/civil/quinn-andrew.aspx)** (AQ).

Transport based research at the University of Birmingham has a long history, dating back to the 1960s when a separate Department of Transportation existed in the University. Research in highway engineering continues to make strong advances in pavement structural performance and highway capacity, design, deterioration modelling and maintenance. Railway engineering is a more recent, thriving cross-University research thrust, notably underpinned by the new multi-disciplinary EPSRC-funded Railway Research Centre.

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

The research in the group covers a broad range of topics that have been grouped for convenience into four categories: railway engineering, highway management and engineering, vehicle dynamics, and safety and reliability management, though more truly span across the discipline.

Open all sections

Highway management and engineering

The work in Road Management and Engineering includes road asset management, road management and investment assessment systems, road economics and financing, road development and strategic planning, road maintenance and operations, road safety, road administration, energy use and vehicle emissions, social benefits from road investments, pavement design and analysis, the development of long-term prediction relationships, data collection and analysis methods, data integrity and information quality.

The research in highway management and engineering informs the **MSc programme in Road Management & Engineering (/postgraduate/courses/taught/civil-engineering/road-management-engineering.aspx)**, which is the direct descendent of an MSc that began in the 1970s and has attained an international reputation. The Group also delivers short courses:

- **Senior Roads Execuitve Programme (SREP) (http://civ-hrg.bham.ac.uk/)**
- **HDM-4 (/research/activity/civil-engineering/transport/highways/hdm4.aspx)**

Recent and current major research activities are as follows:

- **The resilience of the Jamaican road network to the possible effects of climate change (pdf) (/Documents/college-eps/civil/research/research-projects/resilience-road-network-climate-change.pdf)**
- **Road safety in Cyprus: the development of a new road safety model to assist in the choice of road safety measures (PDF 463 KB) (/research/activity/civil-engineering/transport/highways/pdfs/cyprus-road-safety.pdf)**
- The International Study of Highway Development and Management (ISOHDM), a collaborative research programme that has produced the **Highway Development and Management tool (HDM-4) (/research/activity/civil-engineering/transport/highways/hdm4.aspx)**, the de facto international system for road investment appraisal and road management. This is the successor to the World Bank's Highway Design and Maintenance Standards Model (HDM-III). The development of HDM-4 Version 2 at the University of Birmingham was led by Dr Odoki and Professor Snaith (with funding from the World Bank, DFID, Asian Development Bank, Swedish National Roads Administration and World Road Association, PIARC)
- Birmingham Automotive Safety Centre. The CCIS project (the Co-operative Crash Injury Study) which is an ongoing national study of real-world collisions, extending over 16 years to date, that is conducted in collaboration with local hospitals and police in the West Midlands and West Mercia regions. The CCIS work is conducted by a team of six people led by Dr Evdorides and Prof Chris Baker.
- **Energy efficiency for road transport (EERT) (PDF 83 KB) (/research/activity/civil-engineering/transport/highways/pdfs/energy-efficiency-road-transport.pdf)**
- **Development of effective and efficient ways of recovering road assets destroyed in areas affected by disasters and armed conflicts (PDF 15 KB) (/research/activity/civil-engineering/transport/highways/pdfs/recovering-road-assets.pdf)** (JO)
- **Structural integrity of laterite soils for asphaltic concrete surfacing (PDF 224 KB) (/research/activity/civil-engineering/transport/highways/pdfs/laterite-soils-asphaltic-concrete-surfacing.pdf)** (JO)
- **Optimal fund allocation for road maintenance (PDF 87 KB) (/research/activity/civil-engineering/transport/highways/pdfs/fund-allocation-road-maintenance.pdf)** (JO)
- Development of a cost-efficient system for the automatic collection of road roughness and rutting data from a moving vehicle directly to portable databases (MSn)State-of-the-art research on data collection and analysis that has developed automatic detection and analysis of cracking data collected from bituminous roads (MSn)
- An advanced system that uses artificial intelligence techniques to capture and analyse the characteristics of road markings (MSn and MB)
- Implementation of SHRP-IMS and LTPP Pavement Trials in the United Kingdom and the production of statistical analysis procedures for the long term pavement performance relationships
- Development of road managements systems, which are now used in a number of countries, and research in this area led by Dr Odoki is continuing in several countries including; Bangladesh, China, Czech Republic, Ethiopia, Ghana, Lebanon, Malaysia, Namibia, Poland, Ukraine, United Kingdom and others. Artificial intelligence techniques such as expert systems and evolutionary computational techniques are also being developed to aid planners and engineers to optimise maintenance programmes and designs.
  - **Impact of Climate Change on Road Maintenance (PDF 74 KB) (/research/activity/civil-engineering/transport/highways/pdfs/climate-change-road-maintenance.pdf)**
- Development of economic models and specifications for modelling road infrastructure condition to provide a common standard for EU road authorities based on best current knowledge. The models, based on sound economic principles, provided a rational methodology for evaluating the benefits of road infrastructure maintenance strategies. Dr Evdorides was one of the leading participants in the project – funded by the Commission of the European Union IV Framework Programme, Road Transport RTD, Task 7.4/26)
- Social benefits from road investments, a collaborative with IT Transport involving field studies in selected developing countries led by Dr Odoki - funded by the World Bank and TRISP
- Road accident modeling for highway development and management, a research conducted by the University of Birmingham in collaboration with Transport Research Laboratory (TRL) involving field studies in India and Tanzania - funded by the Department for International Development, UK. The work done by the University of Birmingham was led by Dr Odoki.
- The development of an analytical pavement design system for Bangladesh that will incorporate concepts of life–cycle analysis and both appropriate and efficient use of naturally occurring materials for Bangladesh. The methodology will be based full-scale pilot trials to be conducted in Bangladesh. This project led by Dr Evdorides is being funded by the Department for International Development (DFID) UK.

- The TRACE project, directed by Dr Evdorides, is a pan-European analysis of road accident causation, and investigation of road traffic management and violations in developing countries.
- **The resilience of the UK's transport network to climate change (http://www.arcc-futurenet.org.uk/)** - this major four year, £1.5million, research project starting in June 2009 will investigate how the UK's transport systems can be made resilient to the predicted effects of climate change.

Vehicle aerodynamics

Research in vehicle aerodynamics concentrates on the behaviour of road and rail vehicles in cross winds, the development of early warning systems for high winds, investigations of the slipstreams and wakes of vehicles, and the effect of transient pressure loading on train structures due to other trains passing and the passage through tunnels.

In general, the significance of aerodynamic effects on vehicles increases with the square of the relative speed between the vehicle and the surrounding air. Thus as train or road vehicle speeds increase, or as the wind speed increases, these effects become more significant.

Recent work in this area at the University of Birmingham has concentrated on the effects of cross winds on road and rail vehicles, the effects of vehicle slipstreams and the dispersion of pollutants in the wake of vehicles.

Recent and current projects include:

- **The slipstreams and wakes of high speed trains (PDF 14 KB) (/research/activity/civil-engineering/short-term/wind/research/slipstreams-wakes-high-speed-trains.pdf)**
- **WEATHER – the development of an early warning system for road vehicles in high cross winds (PDF 15 KB) (/research/activity/civil-engineering/transport/highways/pdfs/weather.pdf)**
- **Climate Change and Heat Risk in Urban Areas: A Birmingham Case Study (PDF 57 KB) (/research/activity/civil-engineering/transport/highways/pdfs/climate-change-heat-risk-urban-areas.pdf)**
- The quantification of the resuspension of road vehicle pollutants by wind and vehicles
- The West Coast Route Modernisation Project – provision of aerodynamic expertise
- The analysis of unsteady wind forces on trains and the development of a new conceptual model of the risk of train overturning
- The integration of aerodynamic effects into dynamic models of trains

Safety and reliability management

Dr An (/staff/profiles/civil/an-min.aspx) transfers novel research into risk and reliability in the construction industry to the railway industry. This research theme focuses on target risk and reliability, safety-cost analysis based decision making, life cycle analysis, uncertainty analysis, safety-critical software assessment, dynamic and static finite element analysis, and overall safety case preparation for industry. Further information on the **safety, risk and reliability management research pages.**

(/research/activity/civil-engineering/risk/index.aspx) Recent and current projects include:

- Application of fuzzy reasoning approach to the railway safety risk assessment process
- An intelligent safety prediction system for rail design and maintenance
  A safety based railway maintenance decision-making system using FRA and MCDM decision processes
- Development of risk assessment models and tools for rail construction and maintenance
- Prediction of traffic noise risk using GIS
- Cost-reliability improvement of automotive products and components
- Risk assessment in road/rail interfaces
- Reliability prediction models for reliability assessment of ageing bridges

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