UNIVERSITY OF LEEDS

Institute for Transport Studies

January 2015

Research Report **2014**

INTRODUCTION

Dr Karen Lucas, Director of Research and Innovation

Research Excellence

The national Research Excellence Framework (REF2014) exercise confirmed that the Institute is a centre of research excellence. The overall result for the Institute's submission, made jointly with the University's School of Civil Engineering, was a research quality profile of 3.04, thus judged to be *'internationally excellent in terms of originality, significance and rigour'*. The Institute is the UK's largest transport research centre and this is also reflected in the REF result – 2nd for research power – a measure capturing quantity and quality.

Richard Batley led the successful submission to REF2014 and has been promoted to Professor in recognition of his contribution to research and academic excellence. Following the REF submission, Dr Karen Lucas has taken over as Director for Research and Innovation. Also newly promoted to Chair positions, Professors Greg Marsden, Simon Shepherd and Stephane Hess gave their respective inaugural lectures during 2014.

Influencing Government Policy

Members of the Institute gave evidence to a number of Parliamentary Committees:

- Professor Richard Batley to the House of Commons Transport Committee on 'Security on the Railway';
- Professor Oliver Carsten to the Transport Committee's 'Motoring of the Future' inquiry;
- Professor Greg Marsden to the Business, Innovation and Skills Committee on 'Business-University Collaboration';
- Professors Peter Mackie and Chris Nash to the House of Lords Economic Affairs Committee on the 'Economic Case for HS2'.

International Activity

Several staff members were invited to make overseas study visits:

- Professor Greg Marsden and Dr Karen Lucas visited the Institute of Logistics and Transport Studies, University of Sydney, Australia;
- Dr Susan Grant Muller visited Technion – Israel Institute of Technology Haifa;
- Details of further invited presentations are listed in our bi-monthly newsletter.

Academic Visitors

During 2014, the following visitors were hosted:

- Jeroen Baastienssen of Radboud University Nijgemen, hosted by Dr Karen Lucas;
- Dr Erwin Boer, an independent researcher, hosted by Dr Hamish Jamson at the Driving Simulator;
- Professor Nobuhiro Sanko of Kobe University, hosted by Professor Stephane Hess;
- Professor Ruth Steiner of the University of Florida, hosted by Professor Greg Marsden;
- Weitiao Wu of South China University of Technology, hosted by Dr Ronghui Liu;
- Professor Meng Xu of Beijing Jiaotong University, hosted by Dr Susan Grant-Muller, and continuing his visit via a Marie Curie Fellowship;
- Associate Professor Muneki Yokomi of Osaka University of Commerce, hosted by Dr Phill Wheat;
- A number of short-term visitors were also welcomed during the year, as listed in our newsletter. Presentations given by visitors and guest speakers are available via www.its.leeds.ac.uk/slideshare

Staff Changes

New research staff joining the Institute during 2014 were: Dr Thijs Dekker; Dr Giulio Mattioli; Dr Ian Philips; and Dr Andrew Tomlinson. New support staff were: Deborah Goddard; Louisa Nanovo; and Richard Smith. Staff leaving for pastures new were: Professor Malachy Carey; Dr Phani Chintakayala; Dr Antonio Ferreira; Keith Harrison; Andrew Koh; and Kirsten McCaskill.

Alumni News

During 2014 alumni gatherings were held in Korea, India and Hong Kong. Our alumni map showcases nearly 100 profiles, across 41 countries, and covering graduations from 1971 to date. We are always glad to hear from or meet up with our former students.

Student Success

The high quality of the Masters and PhD students we continue to attract was evident on the national and international stage, including:

Anne Clarke, MSc class of 2013, was awarded best paper from an author under 30 at the Scottish Transport Applications & Research conference;

Joanna Elvy, current research student, was runner-up in the University of Leeds Postgraduate Researcher of the Year competition;

Jeff Tjiong, another 2013 graduate, won the Neil Mansfield Award for his paper at the European Transport Conference.

PhDs awarded

Eight postgraduate research degrees were awarded to ITS students during 2014. **Mojtaba Moharrer** *"Investigating confidence through assessment and comparison of perceived and actual skills: A cross-cultural case study of British and Iranian drivers"*; **Helen Muir** *"The influence of area and person deprivation on adult pedestrian casualties"*; **Ian Philips** *'The potential role of walking and cycling to increase resilience of transport systems to future external shocks. Creating an indicator of who could get to work by walking and cycling if there was no fuel for motorised transport'*; **Evona Teh** *'Development of a workload estimator: The influence of surrounding traffic behaviour on driver workload and performance'*; **Muhammed Rahman** *'Integrating BRT with rickshaws in developing cities: A case study on Dhaka City, Bangladesh'*; **Andrew Tomlinson** *'Using the academic timetable to influence student trip-making behaviour'*; **Phillip Wheat** *'Econometric cost analysis in vertically separated railways'*; **Noor Yahaya** *'Temporal and spatial variations of ultra-fine particles in the urban environment'.* Further ITS PhD thesis are available via White Rose Etheses Online.

Research Students

A total of 72 students were registered during 2014. In addition to those graduating, the following undertook postgraduate research study: **Khaled Abdullah; Afzal Ahmed; Oladele Afuje; Mahmoud Al-Khazaleh; Segun Aluko; Izza Anwer; Peter Atkinson; Valerio Benedetto; Anzir Boodoo; John Buckell; Julian Burkinshaw; Chiara Calastri; Madga Cepeda-Zorrilla; Fiona Crawford; Louise de Tremerie; Joel Dodsworth; Umoh Edemeka; Rawia El Rashidy; Joanna Elvy; Anderson Etika; Fahmi Fahmi; James Fox; Qian Fu; Andrew Gillies-Smith; Alvaro Guzman; John Haith; Stephen Hanley; Probo Hardini; Nick Herbert; Jie Huang; Sheriff Idriss-Yahya; Christopher Kelsey; Haneen Khreis; Andrew Koh; Andyka Kusuma; Christopher Leahy; Tyron Louw; Chao Lu; Scott Meadows; James Musgrave; Tamas Nadudvari; Andrew Naimanye; Munajat Nugroho; Steven O'Hare; Sanna Pampel; Stephen Parkes; Rahman Pilvar; Romain Pujol; Lei Qian; Shafiq Rahman; Christopher Rushton; Ehsan Sadraei; Juan Carlos Sanchez Alonzo; Arwa Sayegh; Padma Seetharaman; Doh Shin; Aswin Siregar; Daosadeth Soysouvanh; Panagiotis Spyridakos; Yvonne Taylor; Jessica Taylor-Ashley; Nur Zaimah Ubaidillah; Ersilia Verlingheri; Yin Wang; Yao Yao; Jingyan Yu; Tatjana Zimasa.**

The co-supervision of research students registered in other University of Leeds Schools included: **Manuel Cabral** (Business School); **Clare Linton** and **Jennifer Norris** (School of Civil Engineering); **Pablo Guillen** (School of Computing); **Jing Ma** (School of Geography); **Maha Alsabbagh** (School of Earth & Environment); **Ashkay Dwarakanath** (School of Medicine & Health); **Laura Campbell, Andrew Dixon, Holly Edwards,** and **Richard Riley** (School of Chemical & Process Engineering).

Transport Systems Hub

The Transport Systems Hub works to strengthen relationships with industry partners. In a bid to respond to both current and future transport and mobility challenges in the UK, our workshops, training events, industry placements and communications initiatives have extended the reach of cutting-edge research beyond the academic community. We have established collaborations with ARUP and Jaguar Land Rover, as well as with York and Leeds City Councils, First Group and METRO among others. Activities particularly supported by the hub include:

- accelerating research impact by encouraging links with local, national and international non-academic organisations;
- identifying secondment opportunities for academics in industry and for industrial contacts at the University of Leeds, and to provide expert advice and secondment opportunities to the Transport Systems Catapult;
- increasing the number of industrially sponsored, iCASE, studentships;
- helping academics to disseminate their research to a wider audience using new technologies and social media (follow on Twitter via @TransportSH_UoL).

To get involved in any of the above activities, please contact our Business Development Manager Erik Thomasson.

The Transport Systems Hub has successfully negotiated the following secondments in 2014:

- Dr Chandra Balijepalli seconded to METRO (see 'Secondment to West Yorkshire METRO' page 8);
- Dr James Tate seconded to Transport for London on the project: Shaping London's Air Quality Strategy;
- Kasia Speakman seconded from Leeds City Council on the project: Retrofitting Accessible Highways;
- Anna Vickers seconded from ARUP to bring an understanding of industry priorities and how best to deliver impact.

University of Leeds Driving Simulator

The simulator welcomed three new staff and four students to support its ongoing research focus. Dr Erwin Boer joined as Visiting Professor, supplementing his previous consultancy role on the Programme for Simulation Innovation (PSI) project. Dr Boer continues to lead the group in the use of driver models to quantify simulator validity and is now acting as co-supervisor with Dr Hamish Jamson for the research students involved in the various sub-projects of PSI – Panos Spyridakos, Lei Qian, Ehsan Sadraei and Jessica Taylor-Ashley. Dr Andrew Tomlinson and Tony Horrobin are developing the next generation of simulator software with a significant focus on supporting the virtual vehicle prototyping work of PSI.

Research highlights of the year included:

- a Highways Agency funded project conducted by Dr Samantha Jamson and Dr Daryl Hibberd in collaboration with the transport consultant URS has investigated driver comprehension in the emerging Smart motorway infrastructure, especially in its novel ability to support temporary traffic management and lane closures more safely;
- on the ADAPTIVE project, Tyron Louw's work in vehicle automation aims to ease the hand-over of control between vehicle and driver;
- for the FORWARN project Michael Daly is creating scenarios for experiments to develop machine learning techniques that can characterise driver distraction in the adoption of forward collision warning systems. Dr Georgios Kountouriotis, and Dr Derek Magee in the School of Computing, are also involved in this work.

Dr Hamish Jamson revealed the hazards of distracted driving in his appearance on BBC1's Panorama. Other staff were interviewed by local and national media on topics ranging from the human factors of vehicle automation to the role of desktop driving simulators in medical fitness-to-drive dilemmas.

Further Research News

In September, ITS hosted the Symposium of the European Association for Research in Transportation (hEART 2014), organised by Professors Mark Wardman and Stephane Hess www.its.leeds.ac.uk/events/heart2014

Strategic partnership with the Transport Systems Catapult: the University of Leeds has been selected as one of seven Academic Centres of Excellence to join the Transport Systems Catapult (TSC) – the national research and innovation centre for Transport Systems. ITS will be developing programmes for innovation through the TSC's University Partner Programme.

Staff across the Institute are recognised for their contribution to research excellence which this year has resulted in the generation of 26 new research contracts and £2.8million income. Some notable grant awards included:

- Professor Richard Batley leading the ITS team on a new Value of Time study for the Department for Transport – one of the largest government funded research contracts in the sector in recent times and of international importance;
- Professor Stephane Hess and Dr Charisma Choudhury launched the Choice Modelling Centre, bringing together expertise in choice modelling from across different disciplines and Faculties of the University;
- Professor Hess was honoured as the 'Outstanding Young Member 2014' by Transport Research Board, and was also awarded a 5-year European Research Council Consolidator grant;
- Dr Ronghui Liu has been successful with Dr Tony Whiteing in a grant with the Rail Safety and Standards Board for the development of new approaches to railway signalling;
- Dr Natasha Merat is leading the ITS contribution to AdaptiVe – a major European project on safety enhancements in our increasingly automated vehicle fleet;
- Dr Dong Ngoduy won 3-year funding from Queensland University of Technology for appointment as a visiting Associate Professor;
- Jeremy Shires analysed travel aspects of the Grand Depart, in a Tour de France feedback survey (project is described on page 4).

The breadth and depth of our research expertise and impact is demonstrated in projects and publications. The quality of our research delivery is supported by ISO9001 accreditation. The projects listed below are grouped under themes, and include work that commenced or was completed during 2014.

RESEARCH PROJECTS

Theme: Active Travel

Co-Motion (Co-design of the built environment for mobility in later life)

Grant holder: **Bryan Matthews**
Investigator: **Frances Hodgson**
Funded by: **Research Councils UK (RCUK)**
Dates: **September 2013 – August 2016**
Collaborative partners: **University of York (Coordinator), University of Newcastle, University of Northumbria**

Abstract: The project is working with approximately 120 older people across three sites in Northern England. Focusing on life transitions which affect well-being and mobility – such as, losing a driving licence, losing a partner, sight deterioration or becoming a carer. We are conducting interviews with older people to explore their mobility and wellbeing over time. Smaller groups will participate actively in the research through a series of workshops, interviews and co-design sessions, helping to develop and test innovations such as crowd sourcing about mobility barriers, mobility apps, adaptations to mobility scooters, and means to overcome conflicts between the needs of different users of urban space. The project will co-create practical tools which can act as complements or alternatives to the redesign of the built environment.
Impact: *The project will produce a website and report at its conclusion.*

Feedback Survey: Tour de France Grand Depart

Grant holder: **Jeremy Shires**
Funded by: **West Yorkshire Combined Authority**
Dates: **August – September 2014**

Abstract: We were commissioned to develop and then analyse an online survey to understand the travel behaviour of residents within West Yorkshire during the Tour de France Grand Depart.
Impact: *Our survey results provided direct inputs into the official impact report: 'Three Inspirational Days of the Grand Depart in Yorkshire' http://letour.yorkshire.com/impact*

Lendal Bridge Closure

Grant holder: **Jeremy Shires**
Investigators: **Dr Ann Jopson, Dr James Tate, Professor Greg Marsden, Dr David Milne, Dr James Laird**
Funded by: **City of York Council**
Dates: **August 2013 – March 2014**
Collaborating Partner: **ARUP**

Abstract: In an effort to tackle the increasing traffic congestion and create a more attractive city centre for everyone, Lendal Bridge was closed to motorised traffic for a trial period. On behalf of York City Council we conducted an evaluation of the bridge closure and its impact upon tourists, residents, workers and visitors. We conducted street surveys both before the closure was put in place and during the closure. The 'before' and 'during' surveys replicated each other and were designed to capture respondents' experiences (via a series of rating questions) with regards to accessing the city, moving around in the city and their views on the bridge closure.
Impact: *http://www.talkaboutyork.com/2014/04/10/john-lewis-to-anti-chafe-pants-i-have-it-all-covered/*

Pedestrian Crossings

Grant holder: **Bryan Matthews**
Investigators: **Dr Daryl Hibberd, Professor Oliver Carsten**
Funded by: **Guide Dogs**
Dates: **May – August 2014**

Abstract: To determine the importance of road crossings for blind and partially sighted pedestrians a literature review was conducted and supplemented by stakeholder interviews, three of whom were blind or partially sighted themselves.

It was found that blind and partially sighted people rely on the provision of controlled pedestrian crossings, particularly in areas with high traffic flows. Their preference is for crossing with correctly installed tactile paving guidance, a rotating tactile cone and where appropriate an audible bleep. The absence of these cues was a frequent concern while uncontrolled zebra crossing were found to be more challenging and stress-inducing. In shared space areas such as Exhibition Road, London, the absence of controlled crossings and the removal of kerb delineation cause difficulties for blind and partially sighted individuals. The slow vehicle speeds in these areas was viewed as positive, but difficulties with making eye-contact as a means of inter-acting with drivers in such contexts is a particular problem, along with difficulties in judging safe gaps in traffic and difficulties with navigating in the absence of ordinarily relied upon cues such as kerbs and formal crossing points.

Impact: *Regarding the mobility and safety of blind and partially sighted people there was a clearly expressed opinion that further education of pedestrians, motorists and planners is required, and it would seem that technological advances may be positive though caution needs to be exercised to avoid possible over-reliance on such developments.*

Theme: Choice Modelling

Decisions

Grant holder and investigator: **Professor Stephane Hess**
Funded by: **European Research Council (ERC)**
Dates: **July 2014 – June 2019**

Abstract: Mathematical models of choice behaviour are used to understand consumer decisions and valuations and forecast choices across a range of topic areas, including transport and regional science. Their outputs form a key component in guidance underpinning government and industry decisions on changes to policy, infrastructure developments or the introduction of new services or products. Given the significant financial, environmental and societal implications of such decisions, model accuracy is crucial. Current models however, while powerful and flexible, still present a highly abstract representation of consumer decisions. This project aims to develop a new framework which realigns modelled behaviour with real world behaviour, jointly representing the choice of multiple options or products and the quantity of consumption for each of these. In contrast with existing work, these choices will be placed within a wider framework, incorporating links between long term decisions and day to day choices, accounting for the growing importance of virtual social networks and the role of joint decisions. The work will ensure consistency with economic theory and in particular deal with the formation and role of budgets and constraints. While many developments will take place within the random utility framework, the project will also operationalize alternative theories of behaviour, such as non-compensatory decision rules from mathematical psychology.
Impact: *The research promises a step-change in model flexibility and realism with impacts across a number of academic disciplines as well as real world benefits to society as a whole.*

TRANS-TOOLS 3 (Tools for transport forecasting and scenario testing) (TT3)

Grant holder: **Professor Stephane Hess**
Investigators: **Professor Andrew Daly, Dr Anthony Fowkes, Dan Johnson, Dr Anthony Whiteing, Professor Gerard de Jong**
Funded by: **European Commission**
Dates: **March 2011 – December 2015**
Coordinating partner: **Danmarks Tekniske Universitet**
Collaborating partners: **Kungliga Tekniska Hoegskolan, Stockholm; Rapidis APS, Denmark; Tetratplan AS, Denmark; University of Oxford, UK; National Technical Universtiy of Athens; John Bates; Statens Vag Och Transportforskningsinstitut, Sweden; Nestear Sarl, France; Eldgenossische Technische Hochschule, Zurich; Univerzitet u Beogradu, Serbia; Fomterv Mernoki Tervezo ZRT, Budapest; Austriatech GMBH, Vienna.**
Website: **www.transport-research.info/web/projects/project_details.cfm?id=41354w**

Abstract: The purpose of this project is to upgrade and further develop the current TRANSTOOLS model (TT2) to a new and improved European transport demand and network model.
Impact: *The TT3 will deliver a validated and user friendly model providing policy makers with a tool for assessing and developing better transport policies.*

Values of travel time savings and reliability

Grant holder: **Professor Richard Batley**
Investigators: **Professor Stephane Hess, Professor Mark Wardman, Dr Anthony Fowkes, Dan Johnson, Dr James Laird, Dr Phill Wheat, Dr Charisma Choudhury, Professor Andrew Daly, Dr Thijs Dekker, Manuel Cabral**
Funded by: **Department for Transport (DfT)**
Dates: **May 2014 – April 2015**
Collaborative partners: ARUP

Abstract: This study will update the valuations of travel time savings and reliability in order to better appraise transport infrastructure schemes. Collaborative partners ARUP will manage and deliver market research while Accent will undertake the data collection. We are responsible for the technical research and analysis. This study follows the publication of scoping reports in October 2013, which recommended that the DfT values should be updated. The previous study was conducted nearly 20 years ago, before the internet revolution and other changes in working and commuting practices. In addition to providing up-to-date national average values of travel time savings, our research will investigate the factors which cause variation in the values, and improve understanding of the uncertainties.
Impact: *Our research will provide values of reliability benefits and quality impacts, such as relief of overcrowding. The new information will feed into the UK's official transport analysis guidance, WebTAG, which mandates values of in-vehicle travel time savings for business, commuting and non-work travel for use in the assessment of publicly funded transport projects.*

Theme: Climate Change

Average Speed Variability (Microsimulation and IEM)

Grant holder: **Dr James Tate**
Investigator: **Dr Richard Connors**
Funded by: **DfT, Highways Agency (HA)**
Dates: **October 2013 – May 2014**
Collaborative partner: Atkins

Abstract: This project assessed the influence of road speed and the variation in speed on carbon emissions and vehicle operating costs. Tail-pipe emissions of carbon dioxide and air quality pollutants (nitrous oxides, carbon monoxide, hydrocarbons, particulate mass and particle number) were measured against the dynamics of vehicles i.e. when accelerating, decelerating, idling or cruising. An integrated traffic-vehicle emission model approach, namely traffic microsimulation and instantaneous emission modelling (IEM), were applied to contrasting types of network (urban, trunk road and motorway). All three networks were run in our model through a range of demand levels to establish the emission performance of different vehicle types through various traffic conditions and speeds. The influence of road gradient was also tested.
Impact: *Elements of this work were presented and written up by research student David Wyatt (supervised jointly at the University of Leeds Doctoral Training Centre by Dr Tate and Dr Hu Li, School of Chemical & Process Engineering):*

Wyatt DW. Li H, Tate JE (2014) The impact of road grade on carbon dioxide (CO2) emission of a passenger vehicle in real-world driving, *Transportation Research Part D: Transport and Environment,* ***32*** *160-170.*

Wyatt D, Li H, Tate J (2014) Modelling the Effect of Road Grade on the CO2 and NOx Emissions of a Passenger Car through a Real World-Urban Traffic Network. *International Transport and Air Pollution Conference, Graz, September.*

Developing the Business and Environmental Case for Hybrid Taxis

Grant holder: **Dr James Tate**
Investigators: **David Wyatt, Richard Riley**
Funded by: **Leeds City Council (LCC), Department for Environment, Food and Rural Affairs (DEFRA)**
Dates: **October 2014 – September 2015**

Abstract: Annual mean nitrogen dioxide concentrations in towns often fail to achieve the objectives set in the UK Air Quality Regulations and the limit values within the EU Directive PM2.5. Particles from diesel emissions have serious health consequences. The taxi fleet forms a significant proportion of the vehicles operating in the urban area throughout the day and night. By gaining a better understanding of the composition and operation of the taxi and private hire fleet in Leeds (over 4000 vehicles), we aim to assess the environmental benefits that may be achieved through the use of alternative vehicles (notably petrol-hybrids) and an analysis of the costs to operators.
Impact: *The project is developing a business case, looking into the feasibility and implications of the use of hybrid vehicles as the vehicle of choice for taxi operators in Leeds.*

Emission Factors from Road Vehicles by Remote Sensing Device

Grant holder: **Dr James Tate**
Investigator: **Christopher Rushton**
Funded by: **European Commission, Joint Research Centre (JRC)**
Dates: **January 2014 – April 2015**

Abstract: There is a pressing need to better understand the emissions from vehicles on the road. Remote sensing devices measure the tailpipe emissions of vehicles as they drive-through a monitoring site. The technology scans the exhaust plumes from thousands of vehicles per day. The measurements are combined with vehicle registration information. This allows the emissions to be characterized by vehicle type (car, van, light and heavy commercial vehicle, bus), age, fuel type and emission standard (e.g. Euro 0 – 6). This project is reviewing the capability of vehicle emission remote sensing instrumentation, to establish 'emission factors' for different classes and powertrain types.
Impact: *Elements of this work were presented by research student Christopher Rushton:*

Rushton C, Tate J (2014) Measuring and comparing taxi emissions with privately owned vehicles in an urban environment using a remote sensing device, *International Transport and Air Pollution Conference, Graz, September.*

Fuel Consumption at Junctions

Grant holder: **Dr James Tate**
Investigator: **Dr Richard Connors**
Funded by: **DfT, HA**
Dates: **May – October 2014**
Collaborative partner: Atkins

Abstract: This work follows on from the Average Speed Variability project described above. The same techniques were used to assess the influence of junction type on fuel consumption and pollutant emissions. The environmental performance of vehicles at crossroads, roundabouts and signalised intersections was compared by coupling microscopic traffic simulations with an instantaneous emission model.
Impact: *This work was presented at a conference:Tate J, Connors R (2014) Mapping vehicle emissions through urban streets and intersections. /International Transport and Air Pollution Conference, Graz, September.*

Modelling Wakefield Air Quality Action Plan Measures

Grant holder: **Dr James Tate**
Investigator: **Arwa Sayegh**
Funded by: **Wakefield Council, DEFRA**
Dates: **Oct 2014 – Mar 2015**
Collaborative partner: **Fore Consulting Limited**

Abstract: We are evaluating the environmental benefits of a range of potential junction improvements in several Air Quality Management Areas (AQMAs) in Wakefield. Traffic microsimulation and instantaneous emission modelling is proven to provide accurate estimates of vehicle emissions, critically including robust predictions of oxides of nitrogen from modern diesel engines, which are likely to be the principle cause of air quality exceedances in the AQMAs under consideration. The modelling compares vehicle and fuel types and is able to consider the contribution from Euro 6 vehicles, some of which are now in operation.

Shaping London's Air Quality Strategy: Phase 1

Grant holder: **Dr James Tate**
Funded by: **Transport for London (TfL)**
Dates: **October 2013 – May 2016**

Impact: As a result of extensive vehicle emissions measurements on behalf of Local Authorities across the UK, and in particular his report that diesel vehicles are more polluting within cities than manufacturer's specifications would have us believe, Dr James Tate has been seconded to London in an advisory capacity. Dr Tate is working with the TfL environmental policy and strategy team, to support the on-going development of London's transport and emissions action plan; low emission vehicle strategy; and design of an the Ultra-Low Emission Zone. The secondment brings the latest research developments and international evidence to the TfL air quality team. Work includes enhancing the robustness of the road transport carbon (CO_2) and air quality pollutant emission evidence base. The secondment is facilitating the application of emerging research methodologies to the Greater London road transport network that can take better account of congested driving conditions.

Speed Emission/Energy Curves for Ultra Low Emission Vehicles

Grant holder: **Dr James Tate**
Investigator: **Dr Richard Connors, Richard Riley**
Funded by: **DfT**
Dates: **September 2014 – March 2015**
Collaborative partner: **Ricardo-AEA**

Abstract: We are developing fuel/energy consumption and emission speed curves for a range of low emission vehicles (petrol hybrid, diesel hybrid, petrol or diesel plug-in hybrid and battery electric vehicles). The performance of low emission powertrains on cars, light-goods vehicles, rigid- and articulated heavy-goods vehicles are being evaluated. Where experimental data is available this is used. Extrapolation methods and mathematical models of powertrains are used where little empirical data is available. These curves should be consistent with the existing curves used for conventional vehicles by the National Transport Model (NTM) and WebTAG.
Impact: *ITS is contributing its vehicle emission expertise and hybrid powertrain modelling capability.*

University of Leeds Travel Survey

Grant holder: **Jeremy Shires**
Funded by: **University of Leeds**
Dates: **April – June 2014**

Abstract: This annual travel survey collects data on travel behaviour from University of Leeds staff and students to assist with the University's travel planning and to enable the calculation of Scope 3 travel emissions in accordance with new local authority environmental planning controls. This involves looking at both commuting and business travel for staff and travel between term-time residences and the University sites for students.
Impact: *The survey provides a unique database that is used by university researchers and students.*

Theme: Dynamic Modelling

NETIMIS (Network Tools for Intervention Modelling In Sepsis)

Grant holder: **Dr Ronghui Liu**
Investigators: **Dr Charlotte Kelly**
Funded by: **Technology Strategy Board (TSB)**
Dates: **March 2013 – September 2014**
Collaborative partners: **XLab Ltd, University of Oxford, Philips Healthcare, Leeds Teaching Hospital Trust and, at the University of Leeds; Leeds Institute of Health Science, Yorkshire Centre for Health Informatics, School of Computing,**
Website: **www.netimis.co.uk**

Abstract: This project is one example of an increasing number of our collaborations with 'Health'. To support the analysis of cost impact and patient benefit, we adopted the advanced network modelling techniques of DRACULA software to explore new clinical devices. We delivered a set of modelling tools for the economic and clinical performance assessment of novel point of care test technologies applied in the detection and management of sepsis (infection).
Impact: *Linking diagnostic outcomes to the downstream impact of clinical interventions enables earlier detection of neutropenia, faster intervention, more appropriate antibiotic prescriptions, reduced septic episodes and fewer emergency admissions. A case study demonstrates the impact: netimis.co.uk/downloads*

Secondment to West Yorkshire METRO – long-term issues in land use and transport planning

Grant holder: **Professor Simon Shepherd**
Investigators: **Dr Narasimha Balijepalli**
Funded by: **EPSRC, University of Leeds Impact Acceleration Account**
Dates: **November 2013 – October 2014**

Abstract: Dr Balijepalli was seconded to the West Yorkshire Combined Authority (WYCA) with the aim of developing a new link between ITS and the Development Directorate of WYCA. The three main objectives to this secondment were to: (i) extend the MARS land-use transport simulation model beyond Leeds city to include the West Yorkshire area ensuring compatibility with other modelling tools, and (ii) analyse the transport links and identify the critical ones to unlock the economic growth potential using the Urban Dynamic Model (UDM) of land-use transport interactions and (iii) analyse the marginal cost critical links including highways, bus route networks and rail links. The first objective required large amounts of data and the aim was to use the same data sets as used by the UDM. Using MARS, the long term aim is to develop an optimal set of policies for transport schemes which can best unlock growth in jobs within the region.
Impact: *The benefits from this secondment were mutual. WYCA benefitted from the methodology to identify the critical links and Leeds University from access to the UDM and permission to export the datasets. Both institutions enjoyed extended professional networks. Building further on his new WYMARS model, Dr Balijepalli won an EPSRC sandpit grant for work with Water@Leeds to identify the interdependencies between transport, water supply and environment systems in the West Yorkshire area.*

Train Control

Grant holder: **Dr Ronghui Liu**
Investigators: **Andrew Koh, Dr Tony Whiteing, Professor Malachy Carey**
Funded by: **EPSRC; Rail Safety and Standards Board (RSSB)**
Dates: **March 2011 – February 2014**
Collaborative partner: University of Salford
Website: **http://p.sparkrail.org**

Abstract: The operation of a rail network is safe-guarded through the use of train control and protection systems, in particular in the forms of block signalling and interlocking. Under the current rules, the signal at the entry to any track block is set to red unless the block is completely ready to accept the next train. This means that a train approaching such a red signal must start to decelerate and prepare to stop from two blocks in advance, even though there may be minutes (or at least many seconds) before it arrives at the 'red' signal, by which time the block ahead will be cleared (as planned) in most normal operating conditions. The use of clearly conservative speed profiles on approaching such blocks has a knock-on effect on other trains and can cause a network to operate at considerably less than its full achievable capacity. This research project studies a fault tolerant approach to the design and operation of the rail network. The term fault tolerance is used here in a broad sense, to represent any abnormalities or unexpected events in operations or equipment. Enhanced fault tolerant capability would provide safety assurance so that, in normal operating conditions, trains can adopt much faster speed profiles when approaching a 'to-be-cleared' signal block at stations and junctions than those currently permitted, effectively turning the status of 'be ready to stop' to that of 'proceed with caution'. In the rare event of a 'fault' in the system, e.g. a train in front fails to move out a signalling block as expected or a switch fails to operate as required, the train would be re-routed to take an alternative path. Relevant scenarios include the management of right-turn junction conflicts, train routing through complex junctions at station approaches or the re-allocation of trains to alternative station platforms. Increased capacity will be achieved through improved capability to handle disturbances and/or reduced operating constraints, without compromising the overall integrity of the system.
Impact: *The project produced the following publication: Liu R, Whiteing A, Koh A (2013) Challenging established rules for train control through a fault tolerance approach: Applications at a classic railway junction, Journal of Rail and Rapid Transit, 227 685-692.*

Theme: Economic Appraisal

Assessing new approaches to estimate the economic impact of transport using Gross Value Added (GVA)

Grant holder and investigator: **Dr James Laird**
Funded by: **New Zealand Transport Agency**
Dates: **November 2013 – February 2015**
Collaborative partners: **MWH Global, Infometrics**

Abstract: Current appraisal methods focus on the welfare impacts of transport investment focus and are based on an estimate of users' willingness to pay. Alternative methods of measuring economic impacts have been developed and have begun to be used. Broadly these methods are based on calculating a relationship between some measure of economic output in the area (wages or GVA), and set of explanatory variables. Unlike the conventional Cost Benefit Analysis (CBA) approach, the GVA method

seeks to quantify the total effect on economic output and measure the potential economic impact on an area, rather than impact on existing firms only.
Impact: *This study will develop a GVA methodology applicable to New Zealand using local data, will determine how GVA benefits relate to conventional transport welfare benefits and will use a case study to show how the GVA methodology can be applied.*

Buses and the Economy

Grant holder: **Daniel Johnson**
Investigators: **Jeremy Shires, Professor Peter Mackie**
Funded by: **Greener Journeys, DfT**
Dates: **December 2011 – June 2014**
Collaborative partner: **Marco Ercolani, University of Birmingham**
Website: **www.greenerjourneys.com**

Abstract: This project has met the following objectives: 1) quantify the relationship between public transport accessibility, employment and gross value added; 2) show how this relationship might be implemented in line with Department for Transport guidance; 3) understand the role buses play in helping the unemployed and in re-vitalising town centres and 4) quantify the value of bus services in rural areas.
Impact: *Our findings were highlighted in the Daily Mirror and the Financial Times and formed the basis of a press launch event in July 2014 in London. Two papers were presented at the 2014 hEART conference and a report to Greener Journeys was published: Johnson DH, Mackie P, Shires J (2014) Buses and the Economy II*

Economic Productivity and Transportation Investment Priorities (EPATIS)

Grant holder: **Dr James Laird**
Investigators: **Daniel Johnson, Professor Peter Mackie**
Funded by: **National Cooperative Highway Research Program (NCHRP), Transportation Research Board (TRB)**
Dates: **January 2012 – March 2014**
Collaborative partners: **EDR Group (lead), System Metrics Group, David Simmonds Consultancy, Prime Focus LLC, David Gillen, Roger Vickerman**

Abstract: The objective of this research was to develop a methodology and guide for incorporating productivity gains in the analysis and prioritization of transportation investments.
Impact: *A report has been published that encourages Departments of Transport and other agencies to apply consistent analysis methods and produce results that facilitate public decision making about transportation improvement priorities within a state or other large region: Weisbrod G, Stein N, Williges C,* ***Mackie P, Laird J, Johnson D,*** *Simmonds D, Ogard E, Gillen D and R Vickerman (2014) NCHRP report 786. Transportation Research Board: Assessing Productivity Impacts of Transportation Investments.*

HF Insight

Grant holder: **Dr Astrid Gühnemann**
Investigators: **Dr John Nellthorp, Charlotte Kelly, Andrew Gillies-Smith**
Funded by: **Health Foundation (HF)**
Dates: **October 2013 – December 2014**
Collaborative partners: **University of Warwick (lead), Adelard, Deep Blue, Human Reliability, Karolinska Institute Stockholm, University of Glasgow, University of York**
Website: **health.org.uk**

Abstract: Is it suitable to place a monetary value on human quality of life, or is there a moral obligation to reduce risk to as low as possible? At present, healthcare organisations have few clear guiding principles for how cost-benefit should inform risk management decisions. The aim of this project was to describe how cost-benefit decisions in safety are made in other industries, and to identify lessons for healthcare. The project reviewed published guidance and conducted interviews with stakeholders in five safety-critical industries: aviation, defence, nuclear, petrochemical and transportation.
Impact: *The findings were shared with healthcare stakeholders in a workshop and will help shape future practice in healthcare provision. The findings will be available on the Health Foundation website in early 2015.*

Highways Benchmarking Club

Grant holder and investigator: **Dr Phill Wheat**
Funded by: **EPSRC**
Dates: **October 2013 – September 2014**
Collaborative partner: **Measures to Improve – M2I**

Abstract: With original funding from the Highways Maintenance Efficiency Programme (HMEP/DfT), a 'benchmarking club' for highways departments across Local Authorities in England was initiated to help identify the minimum possible cost of producing a given set of services. We developed and demonstrated the analytical tool and opened a web-portal. Further funding arranged via the Transport Systems Hub enables us to take the benchmarking club forward and potentially into Scotland and Wales. This involves substantial 'outreach' and marketing work to engage the 150 potential customer authorities (i.e. those with transport responsibilities). The more LAs can be brought into the benchmarking club, the better will be the usefulness of the tool. Our analysis will identify the gap between a Local Authority's actual cost and the minimum possible cost of producing a given set of services, this is known as the 'efficiency gap'. There are bottom up approaches which look at detailed functions in an organisation and try to suggest ways to improve their undertaking and also top-down methods which take a more holistic approach and aim to quantify the

extent to which organisations can save expenditure by adopting best practice. 'Frontier benchmarking' is a top-down technique that is being used successfully in the rail industry. The key advantage of frontier benchmarking is the way that the model recognises that all Authorities are different and thus their minimum possible costs are different. This analysis estimates the relationship between cost and the factors which drive cost, these factors include measures of quality, customer and other attribute data. The model will identify an efficiency gap for each Authority.

Impact: *Whilst maintaining confidentiality of the results our experience in the rail sector suggests that the potential for savings (efficiency gaps) are in the order of 20% on average.*

Improving the Evidence Base on Journey Time Reliability on the Trunk Road Network in Scotland

Grant holder: **Dr Anthony Fowkes**
Investigators: **Professor Gerard de Jong, Jeremy Shires, Dr Haibo Chen, Dr James Laird**
Funded by: **Transport Scotland**
Dates: **November 2013 – November 2014**

Impact: *The project reported on (i) a survey of users on their perception of the reliability of Scottish trunk roads with a calculation of Reliability Ratios; (ii) reviews worldwide of how journey time reliability is planned and appraised; (iii) data analysis relating to the trunk road network in Scotland; (iv) future possibilities for modelling journey time reliability; and (v) implications of the foregoing for appraisal guidance.*

Transport Investment and Economic Performance

Grant holder and investigator: **Dr James Laird**
Funded by: **DfT**
Dates: January 2014 – May 2015
Collaborative partners: **Oxford University, London School of Economics**

Abstract: The aim of this project is to boost the quality of public debate around transport infrastructure, by providing an up-to-date, comprehensive, authoritative summary of: (a) the impact of transport investment on economic performance; (b) to what extent are these impacts captured by the current appraisal framework and modelling methods; and (c) broad quantification of the relative scale of any impacts not captured.

West Yorkshire Bus User Survey

Grant holder: **Daniel Johnson**
Investigators: **Jeremy Shires, Professor Peter Mackie**
Funded by: **First Bus**
Dates: **August – November 2014**

Abstract: We were commissioned to analyse the number of bus-dependent commuters, the value of retail spend and the jobs supported by bus services in West Yorkshire. Additionally we looked at the option value of buses for users and non-users.

Theme: Energy

DEMAND Centre

Grant holder: **Professor Greg Marsden**
Investigators: **Dr Caroline Mullen, Dr Anthony Whiteing**
Funded by: **RCUK Energy Programme**
Dates: **May 2013 – May 2018**
Collaborative partners: **University of Lancaster, University of Reading, University of Aberdeen, University of Birmingham, University College London, University of Southampton, EDF Research, Transport for London**
Website: **www.demand.ac.uk**

Abstract: ITS' work on the Demand centre includes a project on 'Need, mobility poverty and the ethics of the future cost of mobility'. The project investigates prospects for social and environmental justice of policies intended to reduce pollution from transport. Whilst recognising that policies respond to the major justice problems created by existing travel practices (such as deaths and ill health from local pollution, and the threats associated with climate change), unless they take account of other forms of transport justice, these polices can ignore or even exacerbate other injustices such as costs of travel, inaccessibility and other types of exclusion. We use conceptual analysis and empirical work with citizens and policy makers to investigate ways of informing policy; for tackling pollution and enabling mobility that does not lead to financial or physical exclusion. This project forms part of Demand Theme 4: Normality, need and entitlement, sub theme: Energy, need and justice, and is closely invlolved with Dr Giulio Mattioli's project on 'Energy related economic stress in the UK, at the interface between transport, housing and fuel poverty.'

Impact: *Early outputs include two sessions on Social Justice, Energy and Mobility held at the 2014 Royal Geographical Society Conference – presentations are available at www.its.leeds.ac.uk/research/themes/socialequity/rgs*

Energy-related economic stress in the UK

Grant holder: **Professor Greg Marsden**
Investigators: **Dr Karen Lucas, Dr Giulio Mattioli**
Funded by: **EPSRC**
Dates: **November 2014 – April 2016**
Collaborative partners: Professor Jillian Anable, University of Aberdeen
Website: **http://gow.epsrc.ac.uk**

Abstract: This project is attached to the DEMAND Research Centre as part of the End Use Energy Demand programme, and is related to other on-going work at ITS on qualitative understandings of transport needs and affordability. At present, home energy issues are framed in terms of reducing energy consumption and emissions while at the same time taking into account fuel poverty – an established area of interest for British policy and research. The same is not true for transport poverty and economic stress, which are currently under-researched, despite increasing concerns for transport costs. The project will develop the concept of transport poverty, exploring its relationships with housing and fuel poverty, its systematic patterns and implications for energy demand reduction and social justice. It will develop connections between the British academic and policy debate and similar debates abroad. The project consists of 5 interdependent work packages, mostly consisting of secondary quantitative analysis: (1) Conceptualising the relationships between transport, housing and fuel poverty in an interdisciplinary and international perspective; (2) Exploring patterns of transport spending and its relationship with spending on housing and domestic energy in the UK, by analysing family expenditure data; (3) Explore material deprivation and economic stress in low-income car owning households in the UK and the EU; (4) Exploring more geographically detailed patterns of transport poverty with the Merseyside Travel Poverty Survey; (5) Exploiting MOT Tests and Results Data to produce UK-wide maps of the fuel-related economic stress and oil vulnerability of car users.

Theme: Optimal design

MOPED

Grant holder: **Dr Susan Grant-Muller**
Investigator: **Professor Meng Xu**
Funded by: **FP7 Marie Curie Actions (International Incoming Fellowship)**
Dates: **April 2013 – March 2015**

Abstract: Congestion results in unpredictable travel time and increases fuel consumption and driver stress. Tradable Permits cover a variety of instruments that range from the introduction of flexibility into traditional regulation to the organization of competitive markets for permits. This project investigates the use of permits for emissions from driving. The main approach was to establish road traffic network models to investigate alternative Tradable Permit schemes, their impacts, the advantages of different types of schemes, their socio-economic implications and to develop efficient algorithms for the proposed models.
Impact: *Two papers have been published from this research: Grant-Muller S, Xu M (2014) The Role of Tradable Credit Schemes in Road Traffic Congestion Management, Transport Reviews, 34(2) 128-149.*

Xu M, Grant-Muller SM, Huang H, Gao Z (2014) Transport Management Measures in the Post-Olympic Games Period: Supporting Sustainable Urban Mobility for Beijing?, *International Journal of Sustainable Development & World Ecology.*

Theme: Railway Costs

European Rail Access Charging (Guest Researcher Programme)

Grant holder: **Dr Andrew Smith**
Investigators: **Dr Phill Wheat, Professor Chris Nash**
Funded by: **Centre for Transport Studies at the Royal Institute of Technology (KTH, Sweden), Swedish National Road and Transport Research Institute (VTI, Stockholm).**
Dates: **August 2011 – March 2016**

Abstract: This project is an extension of a previous visiting researcher arrangement with Sweden. European rail legislation on enhancing competition and ensuring economically efficient and fair access to the common infrastructure focuses on three main areas. First, developing our research on estimating marginal (wear and tear) rail infrastructure costs, which is important information needed to set track access charges. In particular the research is seeking to better understand renewal costs, through corner solution panel models and exploring dynamic approaches. Second, the research aims to quantify the impact of contracting out of rail maintenance activity in Sweden on costs and efficiency using stochastic frontier analysis techniques. Third, the research will explore how to better model heterogeneity between decision making units, including modelling the impact of climate variables and quality measures.
Impact: *A paper has been produced*

showing that tendering of rail maintenance has reduced costs by around 12%:

Odolinski K[a] and ASJ Smith[b] (forthcoming) 'Assessing the cost impact of competitive tendering in rail infrastructure maintenance services: evidence from the Swedish Reforms 1999 to 2011'.

Half Cost Train

Grant holder: **Dr Andrew Smith**
Investigator: **Professor Chris Nash**
Funded by: **RSSB**
Dates: **April 2013 – January 2014**
Collaborative partners: **Loughborough University, Imperial College**

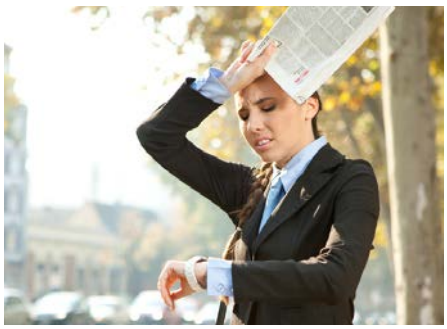
Abstract: The 'half cost train' is an initiative to develop radically lower-cost railway rolling stock. The basic premise is the assertion that the aerospace industry has proved much more dynamic and successful in delivering better, cheaper aircraft than the rail industry has been in respect of rolling stock. Our research compared the rail and civil aircraft industries to see how their incentives to deliver innovative stock solutions differ, and what changes are needed to enable innovation in the rail industry. We also study trends in costs (and innovation) for both industries to challenge or verify the assertion that the civil aircraft has performed better than rail.
Impact: *The initial research showed that air costs had come down much faster than in rail, but that there were limited lessons to be learnt from air, given the much less regulated environment in which airlines operate. Instead, we focussed on how the British rail model could work better, either by reforming existing arrangements (e.g. public rolling stock procurement body at arms-length from DfT), or giving the private sector a greater role in rolling stock procurement. The latter would however require further more fundamental reforms, such as increasing the role of open-access operators, which may have wider consequences.*

Cost and efficiency modelling

Grant holder: **Dr Andrew Smith**
Funded by: **The Water Services Regulation Authority (Ofwat)**
Dates: **August 2012 – October 2014**
Collaborative partner: **Cambridge Economic Policy Associates (CEPA)**

Abstract: Our work under the theme Railway Costs has been adopted by Ofwat. This project developed new econometric models and advised on how they could be used to set a 'corridor' for allowed cost levels, whilst aiming for a 'light touch' approach to regulation. The preliminary report sets out the approach developed by ITS (with CEPA) which has fed directly into Ofwat's 2014 regulatory review. Half way through the project Dr Smith was appointed as the regulator's academic advisor on cost assessment and his role changed to one of peer review.
Impact: *Ofwat has adopted the ITS approach to econometric modelling. The final price controls for water and sewerage bills were set by Ofwat in December 2014, based on this work.*

Theme: Reliability



Cross Modal Metrics

Grant holder: **Professor Greg Marsden**
Investigators: **Professor Mark Wardman, Jeremy Shires, Dan Johnson**
Funded by: **Temple Group Ltd.**
Dates: **July – September 2014**

Abstract: This project explored the potential benefits of integrated measures of performance across multi-modal journeys. It explored the aspects of travelers journeys which are most important to mode choice beyond price and journey time which are already available across modes at least in part. Reliability, crowding, access (walk and wait time), interchange and information were identified. However, whilst we have some data for some of these metrics for particular modes there is little joining up for multi-leg journeys within modes and even less for integrated journeys.
Impact: *The project was conducted for the Transport Systems Catapult and made practical recommendations on how to advance the current state of art.*

Theme: Resilience

Disruption

Grant holder: **Professor Greg Marsden**
Investigators: **Dr Antonio Ferreira, Jeremy Shires, Dr Caroline Mullen**
Funded by: **Research Councils UK Energy Programme**
Dates: **October 2011 – May 2015**
Collaborative partners: **University of Aberdeen, University of Brighton, Glasgow University, University of Lancaster, Open University, University of the West of England**
Website: **www.disruptionproject.net**

Abstract: When, for whatever reason, an otherwise stable context is disrupted, habits associated with that context are also broken. This suggests that analysis of unplanned disruptions presents a window of opportunity to capture the maintenance, substitution, abandonment and protection of travel practices during disruption, something which can provide insights into the main factors shaping an individual's travel practices. In turn these insights can help reveal the kinds of changes,

to transport systems, social systems, individual lifestyles etc. that are needed to inspire conversions to lower carbon travel. The project thus seeks to move beyond the purely individualistic view of behaviour change. Leeds is responsible for leading the project, the work package on data collection from planned and unplanned disruptions and the deliberative policy design workshops. The project has already generated some unique insights into travel behaviour under disruption.
Impact: *The project has developed a Green Paper (www.fleximobility.solutions) which pulls together all of the findings and suggests new ways in which we should approach travel behavior and transport policy. It is forming part of a series of workshops with local government and stakeholders to test its application.*

Theme: Road Safety

All Lanes Running (ALR) Alternative Temporary Traffic Management Techniques Simulation Studies

Grant holder: **Dr Samantha Jamson**
Investigator: **Dr Daryl Hibberd**
Funded by: **HA**
Dates: **August 2013 – June 2014**
Collaborative partners: **ARUP, URS**

Abstract: A series of temporary traffic management scenarios were designed, each currently in use or under consideration for future deployment on an All Lanes Running motorway; a motorway on which the hard shoulder can be used as an active driving lane when required. These scenarios were tested in the University of Leeds Driving Simulator, each involving a single or multiple lane closure, communicated to drivers through on-road signage. The objective of the project was to assess driver comprehension and behaviour in response to different signage methods. The study demonstrated that the aspirational sign designs were at least as effective at getting drivers to change lane in a timely manner. Furthermore, these signs were shown to be as effective in both day and night-time driving conditions, and for high and low experience drivers.
Impact: *These results are positive due to the reduced manual handling and safety risks associated with the aspirational sign designs. The study also provided an investigation of how drivers respond to emergency incidents in an All Lanes Running motorway environment. It was observed that potential safety benefits could be achieved by educating drivers about the importance of speed compliance and the meaning of lane closure symbols in this situation. This work has led to a set of recommendations which have been provided to the Highways Agency, which could be used to inform the selection of future traffic management techniques on All Lanes Running motorways. This project also included substantial development of the simulation of night-time driving in the University of Leeds Driving Simulator.*

Pedestrian Safety

Grant holder: **Professor Oliver Carsten**
Investigator: **Dr Frank Lai**
Funded by: **First Group Plc**
Dates: **June – July 2014**

Abstract: We studied the interaction between bus drivers, pedestrians and passengers. First we identified potential pedestrian-bus conflicts and causations from the official UK road accidents records. Then we conducted field observations in Manchester, Oldham and Leeds. We found that the behaviour of pedestrians, passengers and bus drivers largely support the findings from the accident database. Pedestrians were frequently observed as failing to adequately check for the presence of vehicles before crossing the road, whether at controlled or uncontrolled road crossings. Pedestrians often put themselves at risk by being distracted, for example by mobile phones. Site audits highlighted a number of possible safety concerns around bus stop and bus shelter configuration, guard rail positioning and pedestrian signal location. Roadside interviews found that pedestrians were largely in favour of the use a proposed auditory warning system. The project concluded with recommendations for remedial measures.
Impact: *This project led to the introduction of a new pedestrian warning bell to improve safety around buses in Manchester: firstgroup.com/ukbus/greater_manchester/travel_news/.*

Sleep apnoea in urban areas

Grant holder: **Dr Samantha Jamson**
Investigator: **Michael Daly**
Funded by: **National Institute for Health Research (NIHR)**
Dates: **December 2014 – April 2015**
Collaborative partner: **Leeds Teaching Hospital NHS Trust**

Abstract: We have shown in previous studies that it is possible, using continuously measured variables, to identify with a high degree of accuracy, a subset of patients with sleep apnoea who fail a simulated driving test during an hour of motorway 'driving' using a driving simulator. There is also a relationship between what the individual reports about their driving, their recent accident history and performance on the simulator. We now wish to establish if the same holds true for urban driving, which is inherently more engaging and requires a higher level of attention.
Impact: *This is important information for clinicians who may be providing guidance to sleep apnoea patients as to when and where they should be limiting their driving.*

UDRIVE

Grant holder: **Professor Oliver Carsten**
Investigators: **Dr Frank Lai, Dr Natasha Merat**
Funded by: **European Commission**
Dates: **October 2012 – September 2016**
Collaborative partners: **19 partners across 11 countries, see website for details**
Website: **www.udrive.eu**

Abstract: UDRIVE is the first large-scale European Naturalistic Driving Study, with a plan to instrument 210 vehicles across cars, trucks and powered-two wheelers, with a sample of 290 participants. It aims at enhancing in-depth understanding of actual road user behaviour by means of field observations. The objectives of the project are to identify measures to improve road safety and to identify approaches for reducing vehicle emissions and fuel consumption in order to make road transport more sustainable. ITS is involved in all stages of the project, including study design, field trials, data analysis and dissemination. ITS has particular responsibility for the analysis of everyday driving, i.e. examining how the choices that drivers make second-by second on aspects of driving such as speed choice and car following are linked to risk. The study design has been completed. The field trials are scheduled to start in Spring 2015 for a period of 21 months.

Theme: Social Equality

Retrofitting Accessible Highways

Grant holder: **Bryan Matthews**
Investigator: **Kasia Speakman**
Funded by: **EPSRC, LCC**
Dates: **June 2014 – June 2015**
Collaborative partner: **Leeds City Council**

Abstract: Through a series of interviews with disabled people across the Leeds district we aim to understand the problems encountered by people with mobility impairment. The three main strands are; Economic (explore how local spending by older and disabled people may be influenced by the accessibility of shopping parades); Personal (scope how a more accessible street environment may contribute to independence, wellbeing and a reduced reliance on care delivery) and Social (greater participation of disabled people in Town Planning and Highways decision making processes).
Impact: *Findings from the early stages of the work have been published: Speakman K, Matthews B (2014) Retrofitting an accessible highway: a user-led approach, Proceedings of the ICE – Municipal Engineer, 167(4) 207-213.*

Theme: Social Media and Mobility

SUNSET (Sustainable Social Networking Services for Transport)

Grant holder: **Dr Susan Grant-Muller**
Investigators: **Frances Hodgson, Dr Nikolaos Thomopoulos**
Funded by: **European Commission**
Dates: **February 2011 – January 2014**
Coordinating partner: **Stichting Novay (NL)**
Collaborative partners: **Novay (NL), DOCOMO (DE), Queen Mary College University of London, Eco2Win (SE), LocatieNet (NL), Universiteit Twente (NL), Gemeente Enschede (NL), Viktoria Institute (SE)**
Website: **SUNSET http://cordis.europa.eu/project/rcn/97445_en.html**

Abstract: The rise in personal mobility has consequences in terms of safety, economic efficiency and the environment. The project took a new approach to urban mobility management using the latest ICT technologies. This is based on a user-centred mobility paradigm involving cooperation by information sharing and provision of positive incentives between travellers, road authorities and other parties. The information is targeted on individual travel behaviour, and thus allows road authorities to fine-tune their transport policies and allows individuals to meet their personal objectives. The personalized approach can also help to alleviate other societal problems such as safety, social exclusion and health.
Impact: *The project is now completed. Public deliverables are available from the SUNSET website. ITS contributed to the Living Lab plan and to Business Aspects.*

UNIETD (Understanding New and Improving Existing Traffic Data)

Grant holder: **Dr Susan Grant-Muller**
Investigator: **Frances Hodgson**
Funded by: **Transnational Road Research Programme (CEDR)**
Dates: **April 2014 – July 2015**
Collaborative partners: **Mott McDonald (lead), NAST consulting ZT GmbH (AT), TRANSVER (DE)**

Abstract: The primary objective is to guide the national road administrations' use of third party data such as crowd sourced / social media and floating vehicle data in place of traditional infrastructure-based techniques.
The more detailed objectives of the project are (1) to develop, implement and test methods for quality assessment of traffic data and services based on mobile devices, (2) to understand the potential of social media analysis for traffic management and (3) to understand the implications of these new data sources to support traffic management decision-making.

Theme: Technology and Human Factors

AdaptIVe (Automated Driving)

Grant holder: **Dr Natasha Merat**
Investigators: **Professor Oliver Carsten, Dr Hamish Jamson, Dr George Kountouriotis**
Funded by: **European Commission**
Dates: **April 2014 – June 2017**
Collaborative partners: **the project includes 45 partners, see website for details**
Website: **www.adaptive-ip.eu**

Abstract: AdaptIVe develops various automated driving functions for daily traffic by dynamically adapting the level of automation to situation and driver status. We investigate how drivers' intentions and actions should be taken into account in the design of automated systems.

FOT-Net Data (Field Operational Test Networking and Data Sharing Support)

Grant holders: **Dr Haibo Chen**
Investigators: **Professor Oliver Carsten, Victoria Arica Morales, Erik Thomasson**
Funded by: **European Commission FP7**
Dates: **January 2014 – December 2016**
Collaborative partners: **VTT (coordinator), ERTICO, SAFER, IKA, PTV, CTAG, University of Leeds, CEESAR and DAI**
Website: **www.fot-net.eu**

Abstract: Objectives of this project are to (1) support the efficient sharing and re-use of available Field Operational Tests (FOTs) datasets, (2) develop and promote a framework for data sharing and data re-use, (3) build a detailed catalogue of available data and tools and (4) operate an international networking platform for FOT activities. The project keeps the momentum of the FOT network and delivers new perspectives with regard to the sharing and re-usage of globally available FOT/Naturalistic Driving Studies datasets. The sharing of these datasets will yield further research results, create new collaborative options, generate financial and time savings in transport research, support education at high levels and contribute to the market introduction of improved vehicle ICT. The project will also update and promote the FESTA methodology, maintain the FOT Wiki and reach an agreement on the adoption of data sharing principles.

Theme: Vehicle Design

Programme for Simulation Innovation (PSI)

Grant holder: **Dr Hamish Jamson**
Investigators: **Dr Erwin Boer, Tony Horrobin, Dr Andrew Tomlinson**
Funded by: **EPSRC, Jaguar Land Rover (JLR)**
Dates: **April 2013 – December 2017**
Collaborative partners: **Universities of Loughborough, Warwick, Cambridge, Sheffield, Manchester.**

Abstract: PSI aims to develop capabilities in advanced simulation to support a virtual vehicle design process and to reduce the reliance on physical prototypes. If a vision of zero physical prototypes is ever to be realised, then the process of digital design and verification needs to encompass not just the physical dimensions of component and system

functionality, but also the driver's perceptual experience. Hence, an emerging lynch-pin in PSI is an increasingly complex driver model. This is being developed in a number of sub-projects in PSI which characterise how visual, vestibular, auditory, tactile and haptic cues are perceived, integrated and used to produce resulting vehicle control actions. This driver model will ultimately allow us to develop an objective Simulator Functionality Matrix which aims to quantify, at a task-based level, the capability of a specific simulator to undertake a specific vehicle evaluation task. Within the scope of the project this ranges from high-quality Human-Machine Interface (HMI) design to the development of a human-like co-driver to underpin well-accepted and reliable vehicle automation.

Vehicle and Road Automation (VRA)

Grant holder: **Dr Natasha Merat**
Funded by: **European Commission**
Dates: **November 2013 – December 2016**
Collaborative partners: **the project includes over thirty partners, see project website for details**
Website: **http://vra-net.eu**

Abstract: VRA is a support action to create a collaboration network of experts and stakeholders working on deployment of automated vehicles and its related infrastructure.

Theme: Visioning

STEP-CHANGE (Sustainable Transport Evidence and modelling Paradigms: Cohort Household Analysis to support New Goals in Engineering Design)

Grant holder: **Professor David Watling**
Investigators: **Dr Paul Timms, Dr Richard Connors, Dr David Milne**
Funded by: **EPSRC**
Dates: **April 2012 – January 2016**
Collaborative partners: **University of Manchester, University of Birmingham, London School of Economics**
Website: **www.changing-mobilities.org.uk**

Abstract: STEP-CHANGE is a multi-centered multi-stranded project. Although ITS collaborates across all the project strands, its main contributions continue to be in (a) Planning for urban resilience in 2050 and (b) New modelling paradigms. Research on both (a) and (b) in 2014 has built upon a theoretical base developed earlier in the project[1] With respect to (a), progress has been made in 2014 in improving methods for participatory visioning; exercises were carried out with local government staff, NGOs and other stakeholders in: San Salvador, El Salvador (April); Telford, UK (September); and L'Aquila, Italy (September). With respect to (b), research in 2014 has concentrated upon constructing a multi-disciplined rhizome of narratological elements, involving the investigation of already-existing (published) narratives of transport in four historical classes: (1) pre 20th century narratives; (2) 20th century narratives, up to 1980; (3) narratives of recent times; and (4) narratives of the future. Insights over narratological approaches employed in (1), (2) and (3) will be used to help design methods for constructing narratives of the future, thus providing the underpinnings for the creation of new transport models.
Impact: *Initial results were presented to a seminar at the Transport Systems Catapult (Milton Keynes) in September. Also, in (b), we have explored the extent to which new metaphors from other disciplines[2,3] may be useful in representing phenomena involving substantive (step) change. More generally, this line of research has provided an initial grounding as to how mathematical thinking might contribute to post-positivist narrative construction.*

[1]Timms P, Tight M, Watling D (2014) Imagineering mobility: Constructing utopias for future urban transport, *Environment and Planning A,* **46** 78-93.
[2] Schmöcker J-D, Hatori T, Watling D (2014) Dynamic process model of mass effects on travel demand, *Transportation*, **41** 279-304.
[3] Watling DP, Cantarella GE (2014) Model representation and decision-making in an ever-changing world: The role of stochastic process models of transportation systems, *Networks and Spatial Economics*, in press.

The following project will impact across many themes

Consumer Data Research Centre (CDRC)

Grant holder: **Professor Mark Birkin (University of Leeds)**
Investigator: **Dr Susan Grant-Muller**
Funded by: **(ESRC)**
Dates: **February 2014 – January 2019**
Collaborative partners: **Universities of Oxford and Liverpool, University College London.**
Website: **www.lida.leeds.ac.uk/cdrc.html**

Abstract: This Big Data initiative, brings together world-class researchers at four universities. The Centre seeks to open up consumer data resources and focus on ways in which value can be extracted from new sources of data to benefit researchers in business, government and society at large.

JOURNAL ARTICLES

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