Institute for Transport Studies, University of Leeds

By Professor Mark Wardman

INTRODUCTION

2005 was a year when again ITS staff numbers and research income grew and a very large and diverse range of high quality research was undertaken. ITS remains a key player in international research, securing around £1.4m of European Union funding in the period and maintaining research collaborations with numerous institutions around the world. In recognition of its excellence in research training, ITS continues to attract large numbers of research students, with significant programmes for overseas students funded by the European Union. In the important area of applied research and policy advice, ITS held significant 'call-off' contracts in 2005 with both the ITEA and ERLT divisions of the Department for Transport, the Office of the Rail Regulator, CfIT's academic and consultancy panels, and both the SRA's economics and its strategy and planning panels. Research is conducted in the broad areas of network modelling, safety, economics and behavioural modelling, policy and appraisal, and traffic and the environment, and the extent and diversity of this research is illustrated in the brief outlines below.

RESEARCH FACILITIES

ITS currently maintains two major research facilities, namely the Leeds Advanced Driving Simulator (LADS) and the Instrumented City (iC) Facility.

Since it became operational in 1994, the LADS has been an essential element in much of the driver behaviour and transport safety research work carried out at the University of Leeds. The simulator allows research into driver behaviour, road safety and intelligent transport systems to be performed in accurately controlled laboratory conditions. Prior to its decommissioning in October 2005, it was used in 25 major externally-funded projects with a combined total value of nearly £3m. Development work is currently underway to upgrade the LADS facility to one of the most advanced worldwide in a research environment. The re-development of the LADS has been made possible thanks to investment from HEFCE's Science Research Investment Fund and is due to be completed in the summer of 2006.

The new LADS will incorporate a state-of-the-art motion base. Long duration lateral accelerations will be simulated by sliding the whole vehicle cab and dome configuration along a railed gantry. Similarly, the whole gantry will slide along tracks to create prolonged longitudinal acceleration cues. The 7m long rails and tracks allow 5m of effective travel in each direction. In addition, sustained cues will be provided by a standard 2.5t payload, electrically-driven hexapod. The motion-base will enhance the fidelity of the simulator by proving highly realistic inertial forces to the driver during braking and cornering. It will also provide lifelike high frequency heave, allowing the simulation of road roughness and bumps, often felt by drivers encountering traffic calming measures such as speed bars and humps. The contact for LADS is Hamish Jamson, email: A.H.Jamson@its.leeds.ac.uk

Unlike many other simulators, especially in the U.K., LADS continues to develop using in-house expertise. In a research environment, where a wide range of studies are frequently undertaken, maintaining the ability to tailor virtual scenarios and experimental data collection to the exact requirements of a particular investigation is tremendously valuable.

The instrumented City, **iC**, Facility, is a multi-purpose, transport-related database and equipment facility. Since its inception in 1992, data from the iC facility has been (or is being) used in 20 different Universities in over 250 research projects funded by the EPSRC, EU, DTLR, Department of Health, Asthma Campaign, Local Authorities, private companies and student research. The most significant development for the **iC**, has been an investment of a £4m EPSRC: JIF award. This has enabled a novel integrated research programme by the LANTERN, Leeds health Air Pollution, Noise, Traffic and Emissions Research Network to be launched. A complete refurbishment and enhancement of the research laboratories in ITS, Energy Resources and Mineral and Mining, the School of Chemistry and the Molecular Epidemiology Unit in the School of Medicine, has taken place by considerable investment in new technologies. The equipment includes an instrumented vehicle, traffic monitoring systems (CCTV, ANPR, speed and count detectors etc), emissions engine test bed and monitoring systems, portable air quality, particulates, noise and exposure monitoring systems and computers and specialist software including, GIS, pollutant emissions, dispersion and attenuation models. The LANTERN is actively engaged with joint research activity in the projects funded by the EPSRC; DAPPLE (in collaboration with the Universities of Reading, Cambridge, Bristol and Imperial College London) and SUE: FUTURES (Universities of Southampton and West of England and TRL). The **iC** and LANTERN are engaged in research with Leeds, York and Leicester City Councils, Transport for London and SERCO. International research links include, Colorado State University and the University of Palermo. During 2005 the £1m HEFCE SRIF award has been invested in the instrumentation of a signalised junction in Leeds and a fleet of 8 instrumented probe vehicles, 5 with petrol and 3 with diesel engines, of different vintages have been purchased. These are now available to further extend the **iC** portfolio of research. For further information regarding the use of the iC Facilities contact the Instrumented City Manager, Dr James Tate (email: j.e.tate@its.leeds.ac.uk).

SOFTWARE

Following the retirement from the University of Dirck Van Vliet in August 2001, the continuing development of the SATURN simulation and assignment model is now a 3-way partnership between ITS, Dirck Van Vliet and Atkins Highways and Transportation (who are responsible for marketing). SATURN Version 10.6 was released in March 2006. The contact for SATURN is Dirck Van Vliet (email: dirck_van_vliet@yahoo.co.uk).

Also produced by the Institute and distributed by Atkins Highways and Transportation is the DRACULA microsimulation package. DRACULA shares a common network format with SATURN, allowing easy transfer of data between the two packages. DRACULA represents complete transport trip mechanisms, from a choice of where and when to travel, to the choice of mode and the simulation of the entire journey by motorised means at a microscopic (individual vehicle) level. The contact for DRACULA is Ronghui Liu (Tel: +44 (0)113 343 5338; email: r.liu@its.leeds.ac.uk).

STAFF CHANGES

Dr Gerard Whelan, formerly a Senior Research Fellow at the Institute, was appointed as Senior Lecturer in Transport Economics and Transport Policy and Dr Astrid Gühnemann joined us as Senior Lecturer in Transport Policy from the German Aerospace Centre, Berlin. Phillip Wheat and Andrew Koh joined ITS from transport consultancy companies as Research Officers in the Economics and Behavioural Modelling and Network Modelling research groups respectively whilst Phillip Skelton joined as Research Fellow in the Transport Environment and Informatics research group. Damien Stanchev and Narasimha Balijepalli joined as Research Officers in the Transport Policy and Appraisal and Network Modelling research groups. Nikolaos Thomopoulos, Nigel Tapley, Guido Paglione, Hedi Maurer, Na Chen and Kaushali Dave joined as Marie Curie Research Fellows as part of the Early Stage Training programmes in the field of

Transport Policy, Economics and Appraisal. Gordon Aickin joining ITS as our new Research Administrative Assistant.

Promoted during the year were James Laird, Dr Richard Connors and Bryan Matthews to Senior Research Fellow, Dr Andrew Smith to Lecturer B and Emma Holden to Research Administrator.
Of those departing ITS, Dr Abigail Bristow left ITS in March 2005 to take up a Chair as Professor of Transport Studies, University of Loughborough while Tri Tjahjono returned to an academic post in Indonesia. Computing Officer Peter Balmforth left to take up a post working for the university's ISS project team. Senior Research Secretary Lisa Burke left to take up a new administrative post within the Faculty in the School of Earth and Environment, and Cara Busfield and Poppy Salmon both left to take up posts elsewhere in the university.

STAFF NEWS

Professor Peter Mackie continued as Dean of the Faculty of Environment and was made a Fellow of the Transport Research Foundation.

Agachai Sumalee was awarded one of the distinguished RCUK (Roberts) Fellowships.

Professor Anthony May chaired a working group of Royal Academy of Engineering leading to Transport 2050: a review of national transport policy. He also continued as member of both the Scientific Committee of World Conference on Transport Research, responsible for Special Interest Groups and the European Conference of Ministers of Transport steering group on urban transport. He presented two papers at the Transportation Research Board Conference in Washington; gave a paper on barriers to sustainable urban transport at the European Conference of Ministers of Transport workshop in Tokyo; gave the keynote paper on sustainable urban transport at the Conference on Transport and the Environment in Nagoya and gave the keynote paper on decision making in urban transport at the East Asia Society of Transport Studies conference in Bangkok. In addition to the above, Professor May also spoke on urban transport policy at conference of Finnish local government in Helsinki and at British Council meeting in Rome and gave the inaugural Institution of Civil Engineers annual transport lecture in London on “can urban transport be sustainable?”

Prof. Chris Nash served as a member of the Scientific Committee, key note speaker and workshop chair at the 9th International Conference on Competition and Ownership in Land Passengers Transport - Lisbon, 5-9 September, 2005; he also gave papers at theThird Conference on Railroad Industry Structure, Competition and Investment, Stockholm School of Economics, October 20-22, 2005 and at the 2nd International Conference on Railway Transport Development, Athens, December 2005. Chris Nash and Dr Andrew Smith advised the Office of Rail Regulation on developing an approach to benchmarking the efficiency performance of Britain’s rail infrastructure provider, Network Rail, against international best practice. This is an important area of research given the scale of recent cost rises in the industry, the lack of comparator rail infrastructure companies in Britain, and the failure in previous regulatory price reviews to develop a robust international benchmarking framework.

Professor Bonsall has been invited to join the TRB committee on Telecommunications and Travel Behavior and to contribute to the development of the Leeds/WYPTE bid to the Transport Innovation Fund.

Professor Oliver Carsten continued as Director of ITS. In May, he was an invited speaker at the Volvo Safety Conference in Gothenburg and at the HUMANIST workshop on driver modelling held in Ispra, Italy. In August he spoke at the Transport Safety Lunch on Intelligent Speed Adaptation held by the European Transport Safety Council (ETSC). In December he presented the outcome of the HASTE project to a meeting of the High Level Group on Road Safety in Brussels. He continued as chair of the Road User Behaviour Working Party of the Parliamentary Advisory Council for Transport Safety (PACTS) and as an expert advisor to ETSC.

Professor Margaret Bell responded to invitations to give presentations to the Institute of Masters of Driving, the Skipton and Craven Advanced Motorist Group and the Institute of Highways and Transportation, and she delivered presentations during visits to research laboratories in the Universities of Salt Lake, University of Denver and Colorado State University. Professor Bell carried out an evaluation of the Hellenic Institute for Transport for the Ministry of Development in Greece, peer reviewed proposals for the Research Councils in Hong Kong, Belgium and Greece. Professor Bell is the Chairperson of the UK Universities Transport Studies Group, the ITS(UK), Smart Environment Group and the Noise Interest Group of the APRIL, Air Pollution Research in London. She is a member of the ITS(UK) Interest Group Chairs, and on the European Programme and International Programme Committees for organising the Annual Intelligent Transport Systems International Congress. Professor Bell was one of the Intelligent Infrastructure Systems Foresight project delivering a review of the role of intelligent transport systems in delivering environment solutions. ITS staff engaged in a comprehensive market research exercise to establish the potential exploitation of ITS research facilities and outputs funded by the HEFCE Capacity Build Fund.

Professor Tom van Vuren was re-elected to the Council of the Association for European Transport and continues as Chairman. He was also appointed as a member of the Academic Advisory Panel to the Commission for Integrated Transport (CfIT) as well as being appointed to the Editorial Advisory Board of Transportation.

Professor Mark Wardman was appointed as Visiting Professor at the University of Ulster and continued advising a number of organisations in the railway industry. He was responsible for the most recent update to the Passenger Demand Forecasting Handbook (PDFH4.1)

Professor Andrew Daly completed his term as Chair of the European Transport Conference Innovative Methods workshop. At the conference, he arranged and chaired the Keynote Address, given by Prof. Moshe Ben-Akiva, arranged and summarised a session comparing US and European modelling approaches, adjudicated the Neil Mansfield prize for papers submitted by young researchers and presented several papers.

Dr Miles Tight was appointed as a member of the EPSRC Peer Review College for 2006-2009. He was also appointed a member of the CfIT (Commission for Integrated Transport) Academic/Expert framework. He is a member of the Tyndall Centre Council and Deputy Research Programme leader for the Cities research stream in the Tyndall II programme. He is Joint editor for a Special Edition of Transport Policy on Innovation and Integration in Urban Transport Policy to be published in 2006 and was an invited delegate at the 10th biennial conference on Transportation Energy and Environmental Policy - ‘Towards a Policy Agenda for Climate Change held in Asilomar, Monterey, California in August 2005.

Dr Ronghui Liu was a keynote speaker at the 2005 International Workshop on Urban Road Network Reliability held in Beijing in December and was invited to serve on the Advisory Board for Beijing Transport Research Centre. In September, Dr Liu was also invited to present at the Workshop on Traffic Modelling sponsored by the US Federal Highway Administration in Sedona, USA. Dr Ronghui Liu has been invited to join the International Scientific Advisory Committee of the International Symposium of Transport Simulation to be held in Lausanne, Switzerland in September 2006.

Richard Connors, David Watling, and Agachai Sumalee were awarded an outstanding paper at the 5th Eastern Asia Society for Transportation Studies (EASTS), Bangkok, Thailand (September 2005) for: Connors, R., Sumalee A., and Watling D.P. (2005) Equitable Network Design.

Paul Timms and Agachai Sumalee organised an International Seminar on Sustainable Land-Use and Transport Policy in Bangkok in September 2005. More than 200 people from over 15 countries attended this seminar. Anthony May was one of the invited speakers.

Dr Anil Namdeo was awarded with the Chartered Environmentalist (CEnv) title.

Dr David Carslaw was appointed as a Specialist Scientific Adviser by Transport for London to provide advice on the technical aspects of the introduction of the London Low Emissions Zone, which is planned to be implemented in 2008. The advice relates to vehicle emissions and in particular the air quality effects of the scheme.

Dr Samantha Jamson has been appointed chair of the European Transport Safety Council's working group on motorcycle safety

Dr Paul Firmin became a Member of the Royal Institute of Navigation during the year (MRIN) following successful presentation at a London based conference. He has also recently become a Member of the World Road Association (MWRA).

VISITORS

Visitors in 2005 were Dr Shoichro Nakayama from Kanazawa University, Japan; Dr Takamasa Iryo from Kobe University, Japan; Mr Prapatpong Upala from Chulalongkorn University, Thailand; Maj-Britt Andersen from Technical University of Denmark; Fumitaka Kurauchi from Kyoto University, Japan; Jose Aparecido Sorratini from Universidade Federal de Uberlandia, Brazil; Professor Hasib Mohammed Ahsan from Bangladesh University of Engineering; Mr Lokanmi Oluwole Morenikeji from Federal University of Technology Minna, Nigeria; Dr Lorenzo Mussone; Dr Edward Sullivan from Cal Pol State University, California; Kwang Seok-Han from Railway Industry Restructuring Headquarters, Korea and Dr Satoru Kobayakawa from Nihon University, Japan; Professor Joe Beebe of Colorado State University; and Professor Oluwole Morenikeji from the Federal University of Technology in Nigeria.

PHD'S AWARDED

Five PhD's were awarded in 2005. They were: Frank Lai 'Driver attentional demand to dual-task performance'; Clifford Opurum 'Evaluation of the impact of automated fare collection systems on rail rapid transit: The case of New York'; James Tate 'A study of vehicular emissions and ambient air quality at the local-scale'; Jiao Wang 'A merging model for motorway traffic'; and Wenqun Wang 'Traffic incident duration analysis'.

RESEARCH STUDENTS

Other than those awarded degrees in 2005, the research students registered and their research topics were: Robert Bain, 'A quantitative credit scoring framework for highway concessions'; Narasimha Chandrasekha Balijepalli, 'A stochastic process model for dynamic traffic assignment'; Hazel Baslington, 'Education for behavioural change: School travel plans, pupils' health, attitudes and care dependency culture'; Ofelia Betancor, 'Pricing externalities in air transport markets: a case study of Madrid Barjas Airport'; Sarah Cain, 'Examining the Health Impact of Exposure to Traffic Related Pollutants'; Na Chen, 'Modelling demand for rail transport with dynamic econometric approaches'; Kaushali Dave, 'Applying multicriteria equations and fuzzy logic in choice modelling'; Pelle Envall, 'Managing car free households accessibility: A GIS tool for integrated transport and land use planning'; George Franklin, 'Developments in long distance commuting'; Adam Fularz, 'Assessment of economic and ecological performance of transport studies (DISTILLATE Project)'; Anthony Glass, 'Modelling competition in the British passenger rail industry'; Xu Hao, 'Using new technology to improve public transport service quality'; Yaron Hollander, 'The cost of bust travel time variability'; Shamsul Alam Mohammad Hoque, 'The role of improved quality bus services for developing countries: A case study for urban bus studies for Dhaka City'; Kaveh Jahanshahi, 'A comparative study of the influence of urban form on travel patterns in developing cities'; Hamish Jamson, 'Evaluation of driving simulator safety'; Sanjay Jamuar, 'Economic evaluation of metro rail investment in developing countries'; Sabariah Jemali, 'Urban passenger transport, sustainable policies and strategies'; Charlotte Kelly, 'An investigation into the effects of moving house on people's mobility levels'; Fumio Kurosaki, 'An analysis of the important factors behind railway reform'; James Laird, 'Modelling the economic impact of transport projects in sparse networks and peripheral regions'; Hui (Lucy) Lu, 'The effect of stated preference design on bias in responses'; Hedi Maurer, 'Efficient pricing for freight transport'; Daniel McGehee, 'The biodynamics of pre-impact bracing'; John Nellthorp, 'Transport investment, pricing and use of resources'; Quoc Hien Nguyen, 'Derivation and use of variable pcu values for traffic network models'; Guido Paglione, 'Supply chain theory and city logistics'; Nasir Rana, 'Modelling telework as an instrument of demand management strategy'; Pattarathep Sillaparcharn, 'National transport modelling: General approach and application to Thailand'; Manoj Singh, 'Restructuring and regulation in the Rail sector'; Anna Stapleton, 'Reducing rural car use'; Giovanni Tabacco, 'Modelling competition in the bus industry'; Nigel Tapley, 'Discrete choice modelling and the use of stated preference techniques to collect data'; Fitsum Teklu, 'Modelling an integrated urban public transport system including Informal Operators'; Sotirios Thanos, 'Aircraft externalities'; Nikolaos Thomopolous, 'Large transport infrastructure projects in Europe. New ways towards regional cohesion or divergent routes?'; Minh Tran Huu, 'Design of traffic management strategies for public transport priority in developing cities'; Helen Watters, 'Tradable carbon permits: their potential to reduce CO2 from the transport sector'.

SAFETY

ISA for London

Transport for London from January to July 2005

Dr Samantha Jamson, Kathryn Chorlton, Grant holder: Prof. Oliver Carsten

Collaborating partners: MIRA Ltd.

A scoping study was carried out to determine the possible mechanisms for and the likely efficacy of the introduction of Intelligent Speed Adaptation (ISA) in London. A calculation of likely safety benefits was made, if a London implementation were to proceed. Implementing Mandatory Fixed ISA (equivalent to getting all vehicles to obey the current posted speed limits) produces a 20% reduction in injury accidents and a 37% reduction in fatal accidents. For an individual vehicle with an overridable intervening ISA (i.e. one linked to the vehicle drivetrain), the predicted reduction in involvement in injury accidents per unit of time is 19.3%.

Human Machine Interface and the Safety of Traffic in Europe (HASTE)

EU Fifth Framework programme from January 2002 to March 2005

Hamish Jamson, Dr Samantha Jamson, Dr Natasha Merat, Frank Lai, Grant holder: Prof. Oliver Carsten

Collaborators: Delft, MIRA, TNO, Transport Canada, Volvo, VTI, VTT, University of Minho

The aim of HASTE was to develop methodologies and guidelines for the assessment of In-Vehicle Information Systems (IVIS). The first goal was to decide, from a vast range of behavioural parameters, which were the best indicators of risk. This was achieved by carrying out a large number of simulator and field trials, using real and surrogate information systems. HASTE was pioneering as it attempted to differentiate between the effects of visual and cognitive distraction on driving performance. The HASTE project achieved a significant amount in its three year lifetime. We are part-way to test regime, but there are still some areas that require further attention.

Intelligent Speed Adaptation

DfT from January 2001 to December 2006

Dr Samantha Jamson, Hamish Jamson, Kathryn Chorlton, Sarah Gawthorpe, Dr Tri Tjahjono, Frank Lai, Grant holder: Prof. Oliver Carsten

Collaborating partners: MIRA Ltd, Peter Jesty Consulting

This project is the follow-on to External Vehicle Speed Control, funded by DETR between 1997 and 2001. The main tasks of the project are to investigate user behaviour with ISA by means of set of field trials, to study overtaking behaviour with ISA in a driving simulator, to prepare an ISA design for motorcycles and large trucks and to build a demonstrator of each, to prepare a system architecture for a mass production configuration of ISA, to have an input into relevant standards activities at an international level, to carry out a process of technology watch throughout the project duration, and to further investigate the costs and benefits of ISA. Each of the four field trials lasts for six months, of which two months are without ISA and four months are with ISA. Three of the four field trials with twenty equipped cars have been completed.

Project for Research On Speed adaptation Policies on European Roads (PROSPER)
EU Fifth Framework programme from December 2002 to March 2006
Dr Ronghui Liu, Kate Woodham, Dr Tri Tjahjono, Kathryn Chorlton, Grant holder: Prof. Oliver Carsten
Collaborators: Swedish National Road Administration (coordinator), Langzaam Verkeer, AVV Transport Research Centre, CERTU, Lund University, MIRA

The global project objective is to answer the following questions: (1) how efficient are the use of road speed management methods based on information technology (ISA) in comparison with traditional physical means; (2) how will road users across Europe react to such developments; and (3) what are suitable strategies for implementation and what obstacles have to be overcome. This is being be achieved through: the collection of homogenous data on user aspects and policy issues in a variety of European environments; the performance of road speed management experiments and demonstrations with the use of high technology equipment in complex environments; the development of models to translate results from experiments and surveys to driver behaviour in different road networks; the technical analysis of the prospects for and obstacles to implementation of new speed management methods; the investigation of the legal and policy situation and development of implementation strategies for Europe; and the dissemination of information and knowledge to a broad range of stakeholders in road speed management development across Europe. ITS work in the last year has mainly involved predicting the network effects, safety impacts and costs and benefits of ISA

NETWORK MODELLING

Marie Curie Training Site TMS
European Commission from January 2002 to July 2006
Grant holder: Dr Susan Grant-Muller

The Traffic, Modelling and Safety Marie Curie Training Site is one of two sites for which ITS gained international recognition under the EU FP5 programme. Students registered for PhD study in Europe are able to benefit from the opportunity for supervision and training by leading researchers in this field. To date 10 students have visited the site from countries including Italy, Spain and Poland. Example topics of study include (i) understanding the influence of real time information systems in travel choice and (ii) investigating spatial and temporal variations in air pollution within a realistic urban street 'Canyon' environment

Towards a Sustainable Travel Modal Choice for Beijing
VOLVO Research Foundation from January 2005 to December 2005.
Grant Holder: Dr Ronghui Liu
Collaborating Partners: Prof. Haiyan Wu (Beijing Institute of Civil Engineering and Architecture, Beijing, China)

The project is part of a long-term program of research into the development of sustainable travel modal choice model of Beijing. The specific task of the project is to predict a sustainable modal ratio of travel as the future target, which minimize the fuel consumption, air pollution and maximize the utilities in traffic infrastructure etc. The project also has the function of forging a formal collaboration adhere the research groups with the government and planners in Beijing.

A Model to Assess Public Transport Reliability
EPSRC/DfT from September 2003 to August 2005.
Dr Kate Woodham, Peter Balmforth, Grant Holders: Dr Dirck Van Vliet, Dr Ronghui Liu

The overall aim of this project is to enhance modelling of bus operations and to develop methods for direct assessment and analysis of public transport reliability. More specifically this project will develop explicit representation of buses in terms of their timetables and scheduling and of bus passengers into an existing micro-simulation model of vehicle traffic, DRACULA, in order to model how, on a day-to-day basis, unreliability occurs and to quantify its scale and causes. The model will produce numerical measures of reliability and assess how measures such as bus lanes or signal priority schemes can improve reliability. Specific studies of Warrington will be carried out in conjunction with Warrington Borough Council and with the cooperation of several bus operators and transport consultants.

A Theoretical Approach to Deriving Practical Road Pricing Cordons with Investment in Capacity
EPSRC from September 2005 to August 2008
PhD Studentship: Anna Clark, Researchers: Dr Agachai Sumalee, Andrew Koh, Project Manager: Dr Simon Shepherd, Grant Holders: Prof. Anthony May, Prof. David Watling.

The project follows on from our previous EPSRC project into cordon design. The principal aim of the project is to advance methodologies for identifying optimal cordon designs and charge structures with optimal changes in capacity taking into account the needs of practitioners. This aim will be addressed through a number of objectives, which are to:-

i. develop algorithms for determining joint optimal toll levels and changes in capacity for given locations,
ii. develop algorithms for determining jointly optimal locations for imposing tolls and capacity changes while taking into account judgmental constraints;
iii. combine approaches from (i) and (ii) to solve the simultaneous problem of toll/capacity levels and locations under practical constraints;
iv. incorporate the political and operator objectives and constraints in the design process;
v. extend the algorithms above in terms of the user response dimension, to account for the effects of time-of-day and user heterogeneity;
vi. implement and test all the above methods, demonstrating their practicality for realistically large networks.

The project is in its first stage and has so far concentrated on implementing a constraint cutting algorithm approach as described by Lawphongpanich and Hearn (2004) to solve the optimal toll level for a given set of links and we have extended it to incorporate investment in capacity. This has been implemented in Matlab and is being tested on realistic networks. The next stage of the project will look at location of tolls and capacity changes in parallel extending our previous work with genetic algorithms.

STEPS
EU from Jan 2004 to July 2006
Prof. Anthony May, Dr Simon Shepherd, Dr Ann Jopson, Dr Graham Clarke (Geography), Grant holder: Dr Simon Shepherd
Collaborating Partners: Buck Consultants International (BCI), The Netherlands (Project Coordinators), AUEB, Greece, JRC IPTS, Spain / EU, KUL - SADL, Belgium, LT, Finland, Novem, Netherlands, Spiekermann und Wegener (S&W), Germany, Stratec, Belgium, TIS, Portugal, TRL, United Kingdom, TRT, Italy, TTR, United Kingdom, UPM, Spain.

STEPS (Scenarios for the Transport System and Energy Supply and their Potential Effects) is funded under the EU Thematic Priority 1.6.2 'Sustainable Surface Transport'. The Overall objectives are (i) to develop scenarios for the transport system and energy supply of the future which will be compared and assessed, (ii) to translate these scenarios into policy recommendations and to identify needs for future research, (iii) to communicate and discuss the results and findings of the project by holding Sounding Board Forums and Clustering Meetings. The project is near completion and has developed a scenario based approach which investigates the effects of scarcity of oil supply combined with broad policies on demand regulation versus investment in new technologies and infrastructure, on the sustainability of the transport and land use system. Three levels of models are used, first a model of the world energy market which gives the development of fuel prices, this interacts with a European level transport model and in combination these models define the development of the fleet and fuel prices which are then applied in the regional level land use transport models. An assessment of the impact and robustness of each policy against assumptions about the future supply of and demand for oil has been made.

The results highlight several key issues relevant to policy makers and other stakeholders. Scarcity

of oil can accelerate the development and take up of alternative fuel technologies, in response to increasing fuel prices. Investment in alternative technologies could alleviate the impact of local emissions and reduce energy consumption per km travelled, but will only reduce yearly CO2-emissions after a time lag of about 15 years. As a consequence, regulation on the demand side will be necessary to reduce total emissions and externalities caused by congestion. The final results are being presented along-side the first Transport Research Arena (TRA) conference in Gothenburg, Sweden in June 2006.

PERIURBAN

EC from September 2002 to November 2005

Frances Hodgson, Grant holder: Dr Paul Timms

Collaborating partners: The Energy Research Institute (TERI), New Delhi; Anna University, Chennai; IRMA, Gujarat; Stockholm Environment Institute (SEI); Technical University of Vienna (TUW)

The specific scientific and technological objectives of PERIURBAN were to:

i. identify interlinkages between environmental and socio-economic processes in the peri-urban interface (PUI), particularly in India.
ii. understand the existing institutional mechanisms within PUI in the Indian region.
iii. identify and understand energy and transport sector pressures on natural resources in peri-urban areas.
iv. formulate a set of policy options to promote economically and environmentally sustainable settlements in the rural fringe areas around urban settlements in Indian region.

ITS was responsible for a work package concerning transport issues in peri-urban areas, involving: a workshop In Bangalore in July 2004; a workshop in Leeds in April 2005; and production of a deliverable "Transport and Peri-urban Communities in India" in November 2005.

Sustainability Planning for Asian Cities making use of Research, Know-how, and Lessons from Europe (SPARKLE)

European Commission (Europe-Aid) from November 2004 to August 2006

Prof. Anthony May; Dr Agachai Sumalee, Grant holder: Dr Paul Timms

Collaborating Partners: Institute for Transport Planning and Traffic Engineering, Vienna University of Technology (Austria), Faculty of Engineering, Ubon Ratchathani University (Thailand), Faculty of Engineering, Chiang Mai University (Thailand).Faculty of Engineering, Khon Kaen University (Thailand),Transport Development and Strategy Institute (Vietnam), National Transport Committee, Ministry of Communication, Transport, Post and Construction (Laos PDR), Ministry of Public Works & Transport, Department of Planning (Cambodia).

The project objectives are: (1) to promote and transfer knowledge, from relevant EU research projects, to the countries of South East Asia on the process of developing sustainable urban land use and transport policies; and (2) to provide technical training to local planners and decision-makers on how to use scientific and logical approaches to formulate a sustainable land use and transport policy. The project organised a three day seminar in Bangkok, "Sustainable Urban Transport and Land Use Planning", in September 2005, with more than 200 participants from 11 countries in South East Asia (further information can be found on the seminar website: http://www.en.kku.ac.th/sirdc/SPARKLE. It has also organised eight training workshops in Thailand, Vietnam, Laos and Cambodia. There will be a final seminar in Hanoi in June 2006 (more information can be found on the seminar website: http://www.mt.gov.vn/seminar/sparkle).

Platform Grant: Towards a Unified Theoretical Framework for Transport Network and Choice Modelling

EPSRC from January 2004 to December 2007

Dr Paul Timms, Dr Richard Batley, Dr Agachai Sumalee, Dr Richard Connors, Dr Simon Shepherd, John Nellthorp, Dr Gerard Whelan, Grant holders: Prof. David Watling, Prof. Andrew Daly, Prof. Anthony May

The objectives of such Platform Grants (PGs) are strategic, assisting in the coordination of existing research projects?in our case, across ITS's research in networks, choice modelling and appraisal?as well as enabling international collaboration and supporting small scoping studies of speculative ideas. The theme of this particular PG has been the development of modelling capabilities for the future; it departs, however, from other modelling initiatives that have focused only on the development of computational methods. Rather, the thesis in the PG is that a sounder theoretical grounding is required for the methods we presently have, unifying alternative modelling paradigms, as well as addressing the inconsistencies in the approaches commonly adopted in practice between the stages of behavioural modelling, network modelling, and appraisal. During 2005, particular exploratory activities have included: linking alternative paradigms for decision-making under uncertainty, such as prospect theory, to network modelling; deriving the cost of risk-bearing inherent in travellers' choice of departure time, leading to a theoretical link between risk-based choice modelling and an appraisal measure termed the 'reliability premium'; a continuing study of the philosophical bases upon which transport modelling has been founded, and exploration of links to the sociology of science and models; incorporation of targets for network reliability in the appraisal/design process, linking bi-level network optimisation with network assignment models under stochastic demand; development of a trip-chain traffic assignment model, specifically exploring the impact of such a model on the economic benefits of an area pricing scheme; and devising experimental designs for the use of probe vehicles in the collection of network congestion data. Several of these studies have involved collaboration with colleagues across several universities in Japan (Kobe, Tokyo and Kanazawa), with visits of researchers from a few days to twelve months in both directions. This Japanese collaboration also led to joint research on the problem of Dynamic Traffic Assignment (DTA), as well as a series of DTA workshops involving several UK groups, and culminating in our hosting the first international symposium on DTA in 2006 (see www.its.leeds.ac.uk\dta2006).

Towards the Development of Efficient, Equitable and Acceptable Urban Transport Systems

Volvo Research Foundation, Future Urban Transport programme, from January 2004 to December 2005

Dr Agachai Sumalee, Dr Richard Connors, Grant holder: Prof. David Watling

Collaborating Partners: Prof. Michael Patriksson (Chalmers University, Gothenburg), Dr Clas Rydergren (University of Linköping)

The objective of the project was the development of a multi-modal decision support tool for designing packages of policy measures (e.g. road capacity changes, tolls, public transport subsidies, bus frequencies) that address both the conventional economic efficiency objective as well as the 'softer' objectives of equity and public acceptability. The technical approach involves the adoption of a multi-modal, multi-class equilibrium model, for which sensitivity analysis is used to compute directional derivatives of changes to network flows caused by the policy variables, and which in turn is used to compute directional derivatives (analogous to 'directional' elasticities) of the multiple objectives with respect to the policy variables. This in turn requires the concepts of equity and acceptability to be quantified. Of the three basic classes of equity measure in the literature?statistical, welfare-related and axiomatic?we selected a statistical one known as Theil's entropy measure, especially due to its advantage (over the more commonly used Gini measure) of additive decomposition between user groups. Our measure of acceptability was based on one proposed in the literature on voting theory combined with discrete choice analysis, where individuals are assumed to trade off their personal gain with the gain to their 'group' (e.g. those in same geographical area or same social class). This whole framework has been implemented for the network of Norrköping, and a process proposed for how these techniques may be exploited in practice within the planning process.

Advancing Transport Network Design through Improved Behavioural Response

EPSRC, April 2003 to December 2005

Dr Richard Connors, Dr Agachai Sumalee, John Nellthorp, Grant holder: Prof. David Watling

The objective of this project was to advance the techniques available for problems of the network-level, bi-level optimisation kind, e.g., determining

optimal toll levels/locations while anticipating the equilibrium response of drivers to the tolls. Using a novel, probit-based model of elastic demand traffic assignment with multiple user classes, a number of optimisation algorithms were developed and tested on realistic networks based on an implicit programming formulation. By adopting such a model, a key computational hurdle of traditional user equilibrium assignment was overcome (non-differentiability with respect to design parameters), with sufficient conditions established to ensure this differentiability. An efficient computational method, avoiding the uncertainties of Monte Carlo simulation, was developed to derive the derivatives (sensitivity analysis) of the equilibrium flows. The method devised for continuous design variables was extended to mixed discrete/continuous problems through the use of an outer-approximation method. Successful applications of this method included determining optimal toll levels and locations, that maximise social welfare for the probit model described, yet enforce a constraint on the 'fair' distribution of user benefits across groups of the population.

TRAFFIC, ENVIRONMENT AND INFORMATICS

LANTERN Platform Grant Renewal
EPSRC from January 2005 to January 2009
Dr Paul Goodman, Dr James Tate, Dr. Anil Namdeo, Grant holder: Prof. Margaret Bell
Collaborators: Leeds, York and Leicester City Councils

The LANTERN Platform Grant (PG) was renewed in January 2005 for a further four years. This will provide the time needed for key researchers from the internationally leading departments of ITS and the Energy and Resources Research Institute (ERRI) to carry out fundamental research identified by LANTERN thereby making the best use of the equipment and facilities enhanced by the EPSRC:JIF and HEFCE:SRIF infrastructure investment.
The PG Renewal aims to carry out a truly interdisciplinary and fundamental programme of research including determining the interactions between chemical processes and the formation of secondary pollutants, urban meteorology and its influence on dispersion and noise attenuation, exposure monitoring and modelling, the composition and health impacts of ultra-fine particulates and the influence of driver behaviour and transport policies on pollutant emissions of both air and noise. Consistent with the philosophy of EPSRC: Platform Grants, the renewal will facilitate the retention and further development of the unique expertise of key staff and employ this expertise to carry out a profile of high quality and novel research in the area of transport, urban air pollution and health impacts, whilst allowing researchers to successfully progress their individual careers. The research will result in proposals and deliver research at the boundaries of current activity and thus extend into the other LANTERN areas, broadening and strengthening existing and developing new international research activity ensuring both national and international research impacts. In achieving its objectives ways to more effectively influence National Government policy and achieve a wider dissemination of the results to key stakeholder beneficiaries, the academic research community and national and international groups responsible for traffic management, planning and policy will be explored. More information on the Platform Grant is available on the ITS **iC** website.

DAPPLE (Dispersion of Air Pollutants and their Penetration into the Local Environment).
EPSRC from April 2002 to March 2006
Dr. James Tate, Dr Anil Namdeo, Dr Haibo Chen, Grant holder: Prof. Margaret Bell
Collaborators: Universities of Cambridge, Surrey, Bristol and Westminster, Imperial College London, Met Office

This is a collaborative project with LANTERN partners ITS and ERRI of the University of Leeds, and the Universities of Cambridge, Surrey, Bristol and Westminster, Imperial College London and the Met Office.

The global aim of DAPPLE is to increase our understanding of vehicle emissions, pollutant dispersion and exposure to pollution in realistic urban environments, to such an extent that makes possible the improvements necessary to enable the better planning and management of urban air quality needed to make our cities healthier and more pleasant places in which to live and work. The research includes wind tunnel modelling, computer simulations, field work and analysis. The research teams have worked closely with the users of the project output (e.g. local authorities and government agencies) to ensure the deliverables were of real and practical value. The field work is based in the area around the intersection between Marylebone Road and Gloucester Place in central London. It involved vehicle movement monitoring, wind and pollution measurements, tracer dispersion studies, and personal exposure assessment. The DAPPLE project is a mostly field based campaign aiming to understand the influence of urban traffic and urban junction topographies on the dispersion of pollutants. The LANTERN consortium members have played an important role in the delivery of two major four-week survey campaigns during which intensive simultaneous monitoring of air flow, traffic and pollutant concentrations at several positions in the vicinity of the junction were made. The flow measurements supported the evaluation of a tracer release experiment that took place in the middle of the campaign in order to provide an understanding of how an accidental release may disperse through London streets. ITS set up a database for the data collected during the campaigns, developed an algorithm that compensated for masking of traffic flows due to the one detector loop configuration over two lanes in the Marylebone SCOOT, Split Cycle Offset, Optimisation Technique, Region. The WebCOMIS and Enhanced Traffic Emissions Module that was developed by ITS in other research projects were implemented and using the meteorological conditions data a richer understanding of the Canyon dispersion was achieved. More information on DAPPLE is available on the ITS iC website.

Future Urban Technologies Undertaking Research to Enhance Sustainability (FUTURES)
EPSRC from April 2004 to March 2009
Dr Paul Goodman, Dr Phil Skelton, Grant holder: Prof. Margaret Bell
Collaborating partners: Energy and Resources Research Institute (ERRI), University of Leeds, Transport Research Group, University of Southampton, Institute of Sound and Vibration Research, University of Southampton, Unit for Transport & Society, University of the West of England, Bristol, Centre for Human Service Technology, University of Southampton, Intelligence, Agents, Multimedia Group, University of Southampton, Transport Research Laboratory (TRL)

ITS in collaboration with ERRI of the LANTERN are engaged with the core project of FUTURES namely: Environment Assessment of New Vehicle Technology with Improved Confidence. FUTURES is one of four transport research consortia within the EPSRC's Towards a Sustainable Urban Environment Programme. The project, following on from an initial scoping study, is a five-year research programme to investigate and promote the role of new technologies in achieving sustainable urban mobility. FUTURES will address the ways in which new transport-related technologies will be able to contribute to a sustainable urban environment. There is no single scenario or vision which describes the extent to which various communications, location, detection, materials; power train, vehicle and computing technologies can contribute to a sustainable urban environment. Travellers can have their urban mobility needs met in effective and efficient ways through a mixture of conventional and novel services, utilising advanced vehicle and related technologies and tele-services. Understanding and quantifying the opportunities involves social, environmental, traffic, mobility, location/communication, vehicle, goods and operational issues, from a range of disciplines. The FUTURES consortium is comprised of six main research groupings in four institutions. The consortium possesses a collective and complementary expertise and track record in the understanding, development, application and opportunities of transport and transport-related technologies. It also harnesses an understanding of people, systems and vehicles which FUTURES believes are the three key 'actors' in the use of new technologies to pursue sustainable urban mobility. The overriding priority of the consortium is to conduct high quality research. More information on SUE FUTURES is available on the ITS iC website.

RETEMM (Real World Traffic Emissions Monitoring and Modelling)
EPSRC from October 2003 to September 2007

Dr Haibo Chen, Dr Anil Namdeo, Dr James Tate, Grant holder: Prof. Margaret Bell
Collaborators: Energy & Resources Research Institute (University of Leeds), City Councils of York, Leeds, and Leicester, Ford.

The RETEMM project, an EPSRC award of £624k to LANTERN, namely ITS and ERRI, will research real-world, regulated and unregulated emissions with low time resolution (to be achieved through in-vehicle and dynamometer measurements) to enable the effect of driver behaviour on exhaust emissions to be investigated. A fleet of five vehicles will be employed and they will be driven in a range of urban traffic conditions; busy, quiet, congested, in cities, along different road types and across various junction geometries, to produce data suitable for the development of microscopic traffic emissions models. Building on earlier work, the emissions measurements will include cold starts for winter and summer and will seek to investigate the speciation of the cocktail of exhaust gases and explore how the levels vary across the spectrum of vehicles in the UK fleet. The results will improve the emissions prediction algorithm based on the traffic characteristics data from SCOOT, (Split Cycle offset Optimisation Technique) and demonstrate the transferability of the results in London. This RETEMM project will use state of art equipment made available from the EPSRC: JIF award, and collect data of a volume and nature that will be unique in the world. More information on RETEMM is available on the ITS iC website.

IMAGINE (Improved Methods for the Assessment of the Generic Impact of Noise in the Environment)
EU Sixth Framework from December 2003 to December 2006
Dr Paul Goodman, Dr Phillip Skelton, Grant holder: Prof. Margaret Bell

In response to the need for strategic noise maps as required under the EU Directive 2002/49/EC, improved assessment methods for environmental noise will be required. Noise from any major noise source, be it major roads, railways, airports or industrial activities in agglomerations, needs to be included in the noise mapping. For road and rail, improved methods will be developed in the 5th Framework Harmonoise project and these will be adopted to develop methods for aircraft and industrial noise in the IMAGINE. Noise source databases, to be developed in IMAGINE for road and rail, will allow a quick and easy implementation of the methods in all member states. Measured noise levels can add to the quality of noise maps because they tend to have better credibility than computed levels. Guidelines for monitoring and measuring noise levels will be developed to produce a combined product (measurement and computation) that has high quality and high credibility. Noise action plans will be based on strategic noise maps. The IMAGINE project will develop guidelines for noise mapping that will make it easy and straightforward to assess the efficiency of such action plans. Traffic flow management will be a key element of such action plans, both on a national and a regional level. Noise mapping will be developed into a dynamic process rather than a static presentation of the situation. IMAGINE will provide the link between Harmonoise and the practical process of producing noise maps and action plans. It will establish a platform where experts and end users can exchange their experience and views. This platform should continue after the project and provide a basis for exploitation of the IMAGINE results. More information on IMAGINE is available on the ITS iC, website.

Health Effects and Risks of Transport Systems (HEARTS)
European Union 5th Framework Programme, "Quality of Life" Thematic Programme from September 2002 to September 2005.
Dr Paul Goodman, Dr Anil Namdeo, Grant holder: Prof. Margaret Bell
Collaborative Partners: WHO Europe (coordinators), Imperial College London (UK), KTL - Kansanterveyslaitos Folkhälsoinstitutet (Finland), ENEA - Ente per le Nuove Tecnologie, l'Energia el'Ambiente (Italy), ISIS - Institute of Studies for the Integration of Systems (Italy), INRETS - Institut National de Recherche sur les Transports et leur Securite (France), PRISM Laboratory, Université de Versailles Saint-Quentin (France), NTUA - National Technical University of Athens (Greece), RIVM - Rijksinstituut voor Volksgezondheid en Milieu (Netherlands), Berry Environmental Ltd. (UK), Institute for Transport Studies, University of Leeds (UK)

The HEARTS project promotes healthier transport policies through the development of tools that support the integration of health impact assessments in the decision-making process. The project focuses on health risks associated with air pollution and noise, and with injuries, especially within vulnerable groups such as children and elderly people. HEARTS tools are based on models of exposure and health effects generated by different transport policies. Scenarios will be developed and linked to provide integrated estimates of health effects. These models have been embedded into a geographical information system (GIS) and tested by three European pilot cities. HEARTS models specifically address traffic and emissions, air pollution, noise, traffic accidents, time activity and exposures, and health effects. As part of the HEARTS project ITS delivered and validated a 2.5-D noise model for the HEARTS area of Leicester (a region to the south east of the city, in the vicinity of a main radial from the motorway with an area of 42km2 and 42,000 buildings). This was used for the validation of the GIS:HEARTS model for noise. More information can be obtained from the websites: ITS iC and the main HEARTS page on the World Health Organisation (WHO) site.

MoSeS: Modelling and Simulation for e-Social Science
ESRC from 2005 to 2008
Dr Haibo Chen, Prof. Jie Xu, Prof. Justin Keen, Prof. Martin Clarke, Prof. Phil Rees, PI: Dr Mark Birkin (School of Geography, University of Leeds)

The overall vision which underpins this project is the creation of a Research Centre with a focus on Modelling and Simulation as a Node on the UK e-social science programme. The Node will provide a suite of modelling and simulation tools which will be thoroughly grounded in a series of well-defined policy scenarios. The scenarios will be validated by both social scientists and non-academic users.

The objectives of the project are directed towards a research programme which is centred on the representation of the entire UK population as individuals and households, together with a package of modelling tools which allows specific research and policy questions to be addressed. Thus the project aims to create a synthetic model of the whole UK population; to demonstrate a forecasting capability for the population model; to develop case study applications with specific reference to transport, business and health, including evaluation of wider-ranging policy scenarios; and to create a generic framework for the application of policy and simulation tools to social science problem domains.

M42 ATM
Highways Agency through Mott Macdonald from September 2002 to August 2007
Prof. Margaret Bell, Prof. Peter Bonsall, Prof. Oliver Carsten, Dr Haibo Chen, Sarah Gawthorpe, Hamish Jamson, Dr Ronghui Liu, Dr James Tate, Dr Tri Tjahjono, Grant holder: Dr Susan Grant-Muller

The Active Traffic Management project for Junctions 3A-7 of the M42 is one of the Highways Agency's largest and most significant implementation of ATM to date. ITS is advising on the assessment approach for establishing whether operational regimes have had a significant impact. Primary indicators have been specified, including impacts on safety and the environment as well as the performance of the traffic system overall. Work to date has involved the specification of a comprehensive assessment methodology and preliminary analysis of the 'before' data.

ECONOMICS AND BEHAVIOURIALMODELLING

Consumer Response to Complex Prices
DfT from May 2005 to October 2006
Prof. Peter Bonsall
Partners: BMRB and MVA

This project is conducted in the context the possible implementation of road pricing schemes in the UK – either as part of a national scheme or via local schemes such as those being considered under the Transport Innovation Fund. The research was commissioned following a review, conducted for DfT by ITS, of existing evidence on consumers' response to complex or highly

differentiated prices. The current project has two main phases; the first qualitative and the second quantitative. The qualitative phase, now complete, involved focus groups and depth interviews exploring people's general attitudes to prices and methods of payment and their specific response to uncertainty or complexity in prices. Its findings (detailed in a report published on the DfT website) included evidence of a widespread tendency to disengage from the process of evaluating prices. Interestingly this attitude seemed to be more closely related to factors such as age and gender than to income. We also found widespread lack of knowledge about the cost of individual car journeys and a tendency to consider the cost as an "irrelevant" consideration. The project continues with the specification and trial of a quantitative survey designed to establish the prevalence and incidence of these kinds of opinions and, more specifically, to allow estimates to be made of the implications that this has for the performance of road pricing schemes.

Prediction of the Effects of the E-economy on Transport (POET)
EC Fifth Framework from November 2002 to March 2005
Prof. Peter Bonsall and Jeremy Shires
Collaborating partners: Rand Europe, Transek, ARPA, HUJI, PROODOS, Kessel, and Partners, TRAIL and Solving International

This project sought to develop a basis for predicting the effects of developments in the e-economy on passenger travel and freight traffic. It involved literature reviews, formulation of an analytical framework, development of scenarios, collection of case study data, calibration of models and prediction of effects for a number of European city regions. The early stages of the project have been summarised elsewhere (see for example www.poet-eu.org). ITS developed and implemented a questionnaire seeking employers' expectations of trends in their employees' telecommuting and business-related road travel under different future scenarios. The questionnaire was made available in 5 different languages and administered via the Web and in hardcopy version. Analysis of the results suggested that telecommuting was expected to grow and that business-related road travel was expected to decrease but that the extent of the changes would depend more on the level of service offered by ICT (notably the speed and security of communications) and on the road network (notably the extent of congestion) rather than on price. Some interesting differences were found by comparing the data obtained via the web with that obtained via hardcopy questionnaires and the implications of this have been explored. Our results, together with those from other sectors produced by our consortium partners, were used to adjust the traffic forecasts from urban and regional models to show the broader impacts of ICT on travel and freight movements in selected European city regions.

GRACE (Generalisation of Research on Accounts and Cost Estimation)
European Commission Sixth Framework from July 2005 to 2007
Bryan Matthews, Prof. Peter Bonsall, Daniel Johnson, Jeremy Shires, Dr Andrew Smith, Dr Agachai Sumalee, Phillip Wheat, Dr Kate Woodham, Grant Holder: Prof. Chris Nash

The project involves a consortium of 15 partners in 11 countries. The aim is to provide new evidence on the costs of transport infrastructure use for all modes of transport, and on the consequences of charging these costs to users. This involves studies to measure the marginal cost of wear and tear, congestion, accidents and environmental impacts. For road and rail this will emphasise filling gaps in existing knowledge on costs; for air and water, there is much less work on which to build. Understanding of how these costs vary with circumstances will be improved, and the role of transport accounts in helping to measure and monitor them further explored. Modelling of the consequences of charging users these costs will concentrate on regional and equity issues as well as economic efficiency.

Rail Research UK
EPSRC from April 2003 to July 2006
Dr Gerard Whelan, Dr Anthony Fowkes, Daniel Johnson, Batool Menaz, Dr Andrew Smith, Phillip Wheat, Grant Holders: Prof. Chris Nash and Prof. Mark Wardman

Work is proceeding on three projects within the overall Rail Research UK programme. On project C2 on user needs, we are concentrating on the role of new technology in meeting user needs for information. For project C3 on alternative rail strategies, we have developed new strategic rail passenger and freight demand models. For project B4 on cost modelling we have both constructed a simple spreadsheet model and undertaken econometric work to identify the variability of different elements of infrastructure and train operating costs. We have also reviewed trends in costs to try to understand the reasons for the large increases in recent years, and whether these are likely to be sustained or reversed.

Evaluating Research Performance
ESRC from June 2005 to November 2005
Prof. Peter Mackie, Prof. Chris Nash, Grant Holder: Prof. Mark Wardman.

One of the major recipients of the ESRC's research funding in the transport area had been the Transport Studies Unit at UCL. Funding came to an end in 2004 and this evaluation of its performance covered the second period of funding between 1999 and 2004. The aim of the review was to provide accountability for ESRC's investment during the review period and an assessment of the scientific quality and both the academic and non academic impact of the Centre. The evaluation made use of: ESRC's earlier evaluation covering the 1994-1998 funding period; the Centre's final report for the funding period 1999-2004; the Centre's mid term report and subsequent annual reports; the Centre's publications and other outputs; the comments of eleven invited referees; interviews with the Centre Director, Deputy Director, research staff and Chair of the Advisory Committee, and discussions with academics consultants and local government officers who had not acted as referees.

Fares Evidence Scotland
Transport Scotland from December 2005 to May 2006
Dr Joyce Dargay, Dr Jeremy Toner, Daniel Johnson, Dr William Lythgoe, Dr Gerard Whelan, Grant Holder: Prof. Mark Wardman

Scottish Ministers now have responsibility for the strategic development of rail in Scotland. Transport Scotland recognises that in order to optimise the range, level and complexity of fares with respect to Scottish circumstances, any policy decisions need to have a firm basis in sound evidence. The aim of this study is to provide a review of fares elasticity evidence relevant to Scotland, to review existing and possible means of modelling competition between tickets as a means of informing regulatory decisions and to provide recommendations for further research needs and data requirements. As part of the study, fresh econometric analysis of tickets sales data is being conducted.

WebTAG units on Choice Modelling
DfT from September to December 2005
Dr Gerard Whelan, Dr Richard Batley

ITS drafted two webTAG units on choice modelling for the Department for Transport. The first provides guidance on the development of mode choice models (Unit 3.11.3) and the second provides comprehensive guidance on the development of advanced mixed logit models (Unit 3.11.5).

POLICY AND APPRAISAL

Aircraft Noise Perception, Representation, Measurement, Modelling and Valuation: Further work
EUROCONTROL from December 2003 to June 2005
Prof. Mark Wardman, Dr Richard Batley, Grant holder: Dr Abigail Bristow

This project aims to fully exploit the social survey and stated preference data set obtained in the original study in order to obtain further insights into the perception and valuation of noise and annoyance from airports. The first phase of this study added modelled aircraft noise data to the existing data sets which has enabled the use of the level of noise experienced by respondents as a variable in the stated preference models. We have explored the influence of a range of socio-economic and other variables on noise values. We have also obtained a value per unit change in Leq

from the substitution of aircraft movements in a stated preference model with modelled changes in Leq. The final phase of the work has involved the modelling of the relationship between noise and annoyance, further development of the stated preference analysis, with special emphasis on values by time period, threshold and non-linear effects and the appropriate noise index; and comparisons with values obtained elsewhere.

Marie Curie Training Site EPA
European Commission from January 2002 to December July 2006
Grant holder: Dr Susan Grant-Muller

The Economic, Policy and Appraisal Marie Curie Training Site is one of two sites for which ITS gained international recognition under the EU FP5 programme. The site provides an opportunity for PhD students in Europe to benefit from supervision and training by leading researchers in this field. To date 11 students have visited the site from countries including Belgium, Italy, Spain, Poland, Czechoslovakia and Germany. Example topics of study have included (i) CGE models for evaluating climate change due to Transport and (ii) Tradeable mobility rights: feasibility and socio-economic issues, (iii) Rail ownership models in Europe.

Study of Policies regarding Economic instruments Complementing Transport Regulation and the Undertaking of physical Measures (SPECTRUM)
European Commission from September 2002 to August 2005
Dr Paul Timms, Prof. Anthony May, Prof. Chris Nash, Dr David Milne, Charlotte Kelly, Daniel Johnson, Sarah Gawthorpe, Grant holder: Dr Susan Grant-Muller
Collaborators: University of Antwerp (BE), University of Oxford (UK), VTT (Fi), Technical University of Vienna (AT), University of Las Palmas (ES), Budapest University of Technology and Economics (Hu), Catholic University of Leuven (BE), ISIS (It), TOI (No), University of Gdansk (Pl).

The overall project aim was to develop a theoretically sound framework for defining combinations of economic instruments, regulatory and physical measures in reaching the broad aims set by transport and other relevant policies. Research has concentrated on the extent to which economic transport measures can be substituted for (or work in synergy with) physical and regulatory measures. Case studies were carried out at both urban and interurban levels to provide quantified evidence on the performance of a range of economic and other instruments alone and in packages. Both passenger and freight transport were considered and all modes were studied. A large number of specific results were obtained at detailed case study level, which were subsequently reviewed together in terms of both efficiency and feasibility. Transferability of the results was considered in both ex-post and ex-ante terms. In general it has been found that there remains considerable potential for the greater use of economic instruments at both urban and interurban levels, particularly when implementation in packages with other instruments. The project has now been completed and the final report can be obtained from www.its.leeds.ac.uk/projects/spectrum.

Policy, Economics and Appraisal in Transport (PEAT)
European Commission from September 2004 to August 2008
Grant holder: Dr Susan Grant-Muller

The PEAT training site is one of a small number of highly prestigious training sites funded under the EU FP6 Marie Curie training and mobility programme. It provides a comprehensive research training environment covering the theoretical, methodological and contextual research issues within the field of Policy, Economics and Appraisal for the transport network of today and tomorrow. A total of 8 full time scholarships have been funded, each for a 3 year period of study towards PhD at ITS. Following a competitive recruitment process, the scholarships were awarded and Fellows have now taken up post.

HEATCO
EC from February 2004 to July 2006-05-04
James Laird, John Nellthorp, Charlotte Kelly, Grant Holder: Prof. Peter Mackie
Collaborating Partners: IER, COWI, TNO, E-CO, NTUA, Sudop, VTI, ISIS, BUTE, Herry, EIT, Ecoplan, UBath

High quality facilities for transportation are of vital importance to the economy and the environment. However, there are still no clear guidelines for evaluating the costs and benefits of transport investments and policies agreed among EU Member States. While national evaluation frameworks exist, these methods are inadequate to address specific EU challenges such as cross-border effects or competitiveness. There is a clear need for an unambiguous and harmonised framework for socio-economic evaluation of transport policies. Although first steps were taken in the EUNET and IASON projects, further integration between existing methods and practices is necessary and will be addressed in HEATCO.

HEATCO's primary objective is the development of harmonised guidelines for project assessment on EU level. This includes the provision of a consistent framework for monetary valuation based on the principles of welfare economics, contributing in the long run to consistency with transport costing. Based on work undertaken e.g. in the EUNET project, current project assessment practice in the EU15 member states and the new member states will be reviewed and analysed. Existing practice in the assessment of the value of time and congestion, accident risk reduction, health impacts and nuisances from pollutant and noise emissions, and infrastructure costs will be compared to the theoretical and empirical evidence from the literature. As a key feature of HEATCO, harmonisation of guidelines will be organised in a cycle process, involving representatives from member countries from the beginning of guideline development, with discussions and revision of different guideline versions. A number of stated-preference surveys will be carried out to help fill the most significant gaps in monetary values and add knowledge on the issue of transferability and comparability of values between countries. The harmonised guidelines will be applied to 3 TEN transport infrastructure projects to illustrate differences to existing CBA evaluations.

Freight Scheme Benefits
DfT from October 2004 to 2005
Dr Anthony Fowkes, John Nellthorp, Dr Anthony Whiteing, Prof. Gerard de Jong, Dr Jeremy Toner, Grant Holder: Prof. Peter Mackie

As an input into the study by Rod Eddington for the DfT and the Treasury into the appropriate level of future transport investment in the UK, a confidential (at this time) note was produced at ITS. This reviewed the benefits of transport schemes currently included in appraisal studies in the UK, and considered whether any benefits had been missed. In particular, we were asked to consider whether there should be a mark-up on measured benefits to account for consequential system efficiency improvements (or 'second round' effects).

Appraisal of Sustainability
Rees Jeffreys Road Fund from August 2004 to March 2006
Mary Kimble, Charlotte Kelly, John Nellthorp, Grant Holder: Dr Greg Marsden

In the July 2004 Transport White Paper (DfT, 2004), the Department for Transport put in place a commitment to ensure that its appraisal techniques somehow capture the complexities of sustainable development in its broadest sense. However, despite sustainability appraisals of Regional Spatial Strategies and Strategic Environmental Assessment of Local Transport Plans there remains a gap between the appraisal processes currently in use for selecting transport strategies and schemes and those that cover the full range of sustainability concerns. This project has already developed an operational framework for assessing the sustainability of transport interventions. The current stage of the project is to apply the framework and compare it to the outcomes of a traditional appraisal. The findings will be discussed in an expert seminar in the autumn.

DISTILLATE
EPSRC from April 2004 to March 2008
Matthew Page, Dr Simon Shepherd, Dr Greg Marsden, Dr Ann Jopson, Charlotte Kelly, Jeremy Shires, Grant holder: Prof. Anthony May
Collaborating Partners: TRL; Universities of Westminster, West of England, York.

DISTILLATE (Design and Implementation

Support Tools for Integrated Local Land use, Transport and the Environment) is one of 14 research programmes funded under EPSRC's Sustainable Urban Environment programme. Its principal objective is to develop ways of overcoming the barriers to effective development and delivery of sustainable urban transport and land use strategies. It is based on the Scoping Study, which highlighted nine priority research needs, of which seven were funded in the main programme. The seven are understanding the barriers to delivery; generating strategy and scheme options; establishing a set of core indicators and targets; supporting effective collaboration; overcoming financial and other implementation barriers; enhancing predictive models; and improving appraisal methods. These are being pursued, in conjunction with 16 local authority partners, through a combination of research and case study trials. An initial detailed survey of the barriers experienced by local authorities has been followed by literature reviews on option generation, indicators and financing, and recommendations for a set of key performance indicators. All results are available on the website: www.distillate.ac.uk.

KonSULT (Knowledgebase on Sustainable Urban Land use and Transport)

DfT since 2002; Rees Jeffreys Road Fund and EPSRC

Dr Ann Jopson, Charlotte Kelly, Bryan Matthews, Jeremy Shires; Grant holder: Prof. Anthony May

KonSULT has been developed as a web-based knowledgebase on the impact of a wide range of urban transport policy instruments. The prototype was developed with EPSRC funding in 2001, and DfT and Rees Jeffreys support was used to populate it with information on some 25 policy instruments. The opportunity has been taken since to include information generated in other research projects. To date, 37 policy instruments are included out of a potential list of 60. KonSULT is now being used as an input to the research on option generation in the DISTILLATE research programme. The website can be found at www.konsult.leeds.ac.uk.

EXTRAWEB

EC from 2003 to July 2006

Dr Paul Firmin, Dr Ann Jopson, Mary Kimble, Bryan Matthews, Batool Menaz, Damian Stantchev, Nusrat Walid; Grant holder: Prof. Anthony May

Collaborating partners: GOPA-Cartermill (coordinating); DITS Roma, IABG, ISIS France, Neptune, Systema

EXTRAWEB has produced a web-based Transport Research knowledge Centre to summarise research conducted on all aspects of transport by the European Commission and the countries of the European Research Area over the period covered by the EC Fifth Framework. Research results for up to 600 projects are summarised in a standard format; these are collated into 28 Thematic Summaries dealing with different transport sectors, policy objectives and policy instruments. In the final year a set of 15 Policy Brochures is being prepared. Details can be found at:
http://europa.eu.int/comm/transport/extra.

Contribution of Parking and Traffic Management to Congestion Targets

DfT from March 2004 to April 2005

Dr Ann Jopson, Dr Ronghui Liu, Dr Nick Marler, Bryan Matthews, Dr David Milne, Jeremy Shires, Grant holder: Prof. Anthony May

Collaborating Partners: MVA Ltd (principal contractor Jacqui Dunning)

The aim of this project is to assess the contribution of a range of traffic management measures to the relief of congestion, and to assess the effectiveness of different modelling techniques in carrying out such assessments. In discussion with the clients, a total of 20 traffic management measures were selected, and assessed using the formal structure offered by the KonSULT knowledgebase. A range of modelling approaches have been reviewed, and discussed with model users. This has complemented by a series of case studies of cities which have been innovative in their use of models. The final report provided guidance on appropriate techniques for modelling and assessing traffic management measures.

PLanning and Urban Mobility in Europe (PLUME)

EU Fifth Framework programme from November 2002 to July 2005

Dr Simon Shepherd, Dr Paul Timms, Bryan Matthews, Dr Ann Jopson, Grant holder: Prof. Anthony May

Collaborating partners: TTR, ISIS and POLIS.

PLUME (Planning and Urban Mobility in Europe) is a Thematic Network within the Land-Use and Transportation Research cluster of the City of Tomorrow key action funded by the European Commission DG Research. The objective of PLUME is to facilitate the transfer of innovation in the field of planning and urban mobility from the research community to end-users in the cities of Europe in order to improve urban quality of life. 23 Synthesis Reports summarise research on key subject areas. Annual State-of-the-Art Reviews (SoARs) provide a synthesis of research findings and case studies, with recommendations as to which policies, measures and tools are best able to meet the need for sustainable development, taking account of user needs and barriers to implementation. Beside the SoARs PLUME facilitates meetings between researchers and end users at a series of workshops, where the usefulness and relevance of the themes addressed is verified through discussions with stakeholders, politicians and city authorities. Sources for the SoARs are the existing 12 LUTR cluster projects (ARTISTS, ASI, CITYFREIGHT, ECOCITY, ISHTAR, PROMPT, PROPOLIS, PROSPECTS, SCATTER, SUTRA, TRANSPLUS, VELO-INFO) and ongoing national and international research activities. Detailed information (deliverables, SoARS, Synthesis reports, contacts, etc.) can be found under the project website www.lutr.net. As part of the project, the 2003 PROSPECTS Decision Makers' Guidebook has been updated to reflect the results from the LUTR cluster and republished in six languages. Copies are available from the Institute, and the English version will be incorporated into the KonSULT website.

Sustainability Of Land Use and Transport In Outer NeighbourhoodS (SOLUTIONS)

EPSRC from April 2003 to 2008

Dr Anil Namdeo, Sarah Gawthorpe, Grant Holder: Dr Gordon Mitchell

Collaborating Partners: Dr Tony Hargreaves, Prof. Marcial Echenique, The Martin Centre, University of Cambridge: Prof. Hugh Barton (UWE), Dr Stephen Marshall (ICS), TORG, University of Newcastle

The overarching research questions that SOLUTIONS intends to answer are how far, and by what means, can towns and cities be planned so they are socially inclusive, economically efficient and environmentally sustainable. The method for answering these questions consists in a series of in-depth, integrated case studies in cities that represent different urban scales and characteristics, undertaken in partnership with the local planning authorities. The research examines the interaction between strategic (whole city) and local (neighbourhood) levels with close attention to transport and urban design issues. The method will apply and test theoretical options to ascertain if there are findings that are transferable between different localities in each case study and between case studies, and how size and characteristics of the city influence the results.

The alternative designs of land use dispositions and transport configurations will be combined to form distinct archetypes of development at strategic and local scales. Each of the alternatives will be analysed in case studies through a combination of quantitative and qualitative procedures to estimate, through time, the likely outcome in terms of people's opportunities and behaviour. The resulting forecast will be assessed in terms of sustainability criteria that encompass the impacts in the economic efficiency of the area studied, its social equity implications, and environmental sustainability. The outcomes of the assessment would be discussed with local and national stakeholders to ascertain the feasibility of implementation of the alternatives as well as their acceptability. The final products of the research will be individual case study reports and the production of a generic, innovative, practical guide for the development of outer cities to achieve sustainable urban environments. To develop a practical framework for the analysis and evaluation of sustainable urban design that encompasses the strategic and local scales and various forms of transport (walk, cycle, car, public transport, etc), and recognises the different dimensions of sustainable development

(economic, social and environmental).

To establish and explain the degree to which outer city areas are (or are not) environmentally, socially and economically sustainable, and to explore in what ways and to what degree social/economic/environmental goals are likely to be compromised should current trends continue.

To devise alternative transport and land use design and implementation strategies, (e.g. regulation, fiscal, investment, etc.), at neighbourhood and city levels which could satisfy aspirations better, and to evaluate the short-term feasibility and long-term effectiveness and robustness of the alternative strategies using a combination of quantitative and qualitative approaches.

To identify both the key barriers to, and the potential drivers of positive change, and reach conclusions in relation to both local and national policy.

To produce generic, normative guidelines for the development of outer city areas for land use and transport planners/designers, public/private/voluntary sector investors and community groups.

TRANSLINK (Transportation Research Links for Sustainable Development)
European Commission Asia-Link programme from August 2005 to July 2008.
Dr Nick Marler, Dr Paul Timms, Dr Samantha Jamson, Dr Tri Tjahjono, Grant Holder: Dr Miles Tight
Collaborators: Department of Infrastructure, Royal Institute of Technology (KTH), Sweden, University of Indonesia, Indonesia, University of MARA, Malaysia.

The quality of the transport system is a major factor in economic development. Transportation research provides the knowledge, skills and tools to implement efficient transport policies, systems and services. This three year project is a partnership between two European and two South-East Asian universities with the overall aim to promote sustainable urban development in the latter region through development of their human resources. The main target groups are the transport research staff at the Malaysian and Indonesian universities who will be trained in research methodology and supervision. Institutional assistance will also be provided aiming at the creation of a transport PhD programme in their departments. The expected outcome is that the Asian universities will have staff with the skills and experience to develop their research programmes further, to the future benefit of their students, the transport planning profession and sustainable development in their countries

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