01 Plenary

Potter : TRANSPORT INTEGRATION - AN IMPOSSIBLE DREAM? [Open University]

ABSTRACT: Transport Integration and an Integrated Transport Policy have been widely espoused for many years, yet remain an ambiguous and ill-defined concept. After featuring strongly in the 1998 Transport Policy White Paper, recently transport integration has received less emphasis. However it appears it is set for a return under the new Transport Secretary, Lord Adonis. This paper explores the meaning of Integrated Transport. It concludes that there is no point in attempting to identify a single definition, but that there are overlapping layers of meaning, with higher levels incorporating lower, or narrower, understandings of the term Integrated Transport. This exploration of meanings of integration is a development of initial work (Potter and Skinner 2000) and is important as the alternative meanings lead to different transport policy responses. These meanings include: • Locational Integration: being able to easily change between transport modes (using Interchanges) - this is about services connecting in space • Timetabling Integration: Services at an interchange connect in time. • Ticketing Integration: Not needing to purchase a new ticket for each leg of a journey • Information Integration: Not needing to enquire at different places for each stage of a trip - or that different independent sources are easily connected • Service Design Integration: That the legal, administrative and governance structures permit/encouraging integration • Travel Generation Integration: Integrating the planning of transport with the generators of travel (particularly integration with land use planning) Furthermore, there are inherent tensions which make transport integration difficult to achieve. Only limited progress has been achieved in the UK since the 1998 White Paper, and even in Germany, with their strong transport policy structures, integration has failed (Schöller-Schwedes, 2009). This exploration of meanings will also explore the tensions involved as there is a danger of the UK chasing again a flawed concept.

02A Bus Travel (I)

Hodgson : CAN BUS BE THE NEW TRAM? [Open University]

ABSTRACT: The UK currently only has one new light rail (tram) scheme being implemented. By way of contrast, a number of high-quality bus systems have been developed; for example Cambridge and Luton Guided-busways, Thames Gateway Fastrack, Crawley Fastway and 'streetcar' bus operations in York and Swansea. What appears to be emerging is the idea that a high specification bus system can provide a near-light rail performance at a much lower cost. This paper reports systematic research intended to test this hypothesis. A model has been developed, using Reading as a case study, to compare the implementation and operational costs of a comparable light rail and a high-quality guided bus system. The Reading system design is based upon service performance where infrastructure and vehicle specifications for the bus-based system are sufficient to deliver equivalent performance to light rail. Performance equivalence considers the passenger experience and how this is achieved with a fast, reliable service using modern high-capacity vehicles. Equivalence tests address vehicle guidance, capacity and segregation to ensure availability, reliability and identity requirements are met. The results indicate that for an equivalent high quality guided bus system, the overall capital costs are approximately two-thirds of light rail, and operational costs are about the same. Interestingly, using hybrid-engine vehicles, even CO_2 emissions are similar. The flexibility of the bus system can reduce the operational costs and the equivalence can be fine-tuned to reduce the capital costs, but this will have a trade-off with the 'system attractiveness'– because the more the system feels like a tram the more likely people are to use it. The analysis provides support for

the continued development of high quality bus schemes in the U.K. in lieu of the more costly light rail schemes. This can also provide the flexibility to demonstrate ridership numbers and the business case for incremental upgrading.

Deng : THE PERCEPTION OF BUS RAPID TRANSIT: A PASSENGER SURVEY FROM BEIJING SOUTHERN AXIS BRT LINE 1 [University of Aberdeen]
ABSTRACT: Bus Rapid Transit (BRT), characterized by modern vehicles, dedicated busway, and application of Intelligent Transport Systems (ITS) technologies, has increasingly gained popularity throughout the world. Despite the obvious benefits and cost-effective advantage of a BRT system, its ability to provide a high quality transport service and potential to advance the economy have not yet been widely appreciated by decision-makers. The main objective of this study is to investigate the public attitude of the BRT services via data collected from a passenger questionnaire survey. This study focuses on Beijing Southern Axis Bus Rapid Transit Line 1 in China. A questionnaire was designed and administered to identify passenger satisfaction with the current performance of the BRT service, as well as their perception of living near BRT stations. A dataset of 525 questionnaires were assembled and analyzed using a combination of statistical techniques. The results show that BRT has gained great popularity among passengers, and brought a positive impact on property attractiveness. The data identifies that the majority of passengers were work-related commuters, and used BRT more than once a day. The captive users have a higher satisfaction than choice users on reliability, comfort & cleanliness, and overall satisfaction of BRT service. It is argued that the BRT has significantly improved the attractiveness of residential property along the BRT corridor.

Andrews : CONCESSIONARY FARES POLICY- A DISCUSSION OF THE KEY ISSUES [University of the West of England, Plymouth University]
ABSTRACT: The increased demand for bus travel in England since the provision of unlimited free bus travel to the over 60s has received considerable media attention; including reports of overcrowding in popular tourist destinations and of local authorities facing significant budget shortfalls. Looking beyond these more widely publicised controversies, this paper discusses the key debates around the issue of offering free fares emerging from an extensive literature review. First, some crucial inconsistencies were indentified in the conceptual relationship between the tool of a free bus pass and the stated goal of promoting social inclusion. This, in part was due to it being dependent on the user possessing the appropriate physical, cognitive and technical skills required to undertake a bus journey. The paper challenges the assumption that inability to afford bus travel was preventing participation in society, meaning those previously excluded remain so, despite the provision of a free bus pass. Second, evidence was found that when faced with a zero-fare, the standard cognitive transaction processes that conventionally are believed to guide purchasing behaviour can be circumvented. The implication of this is that a proportion of the generated trips could be attributed to a subconscious response to a zero-fare, promoting the case for the introduction of a nominal charge. Finally, the paper identifies a number of paradigmatic tensions that influence both how the policy is evaluated, but equally how behavioural responses are explained. The paper concludes by making the case for a greater emphasis on developing a psychological and sociological understanding of the mechanisms that underpin behavioural responses to major changes in the cost of bus travel, particularly within the context of the older traveller.

02B Commuter Journeys
McNamara : Identifying the socio-economic characteristics of CO2 emitters in the Greater Dublin Area [Trinity College Dublin]

ABSTRACT: Unprecedented economic growth in Ireland from the early 1990's until 2007 has led to increased employment and commuting in the Greater Dublin Area (GDA). Irish policymakers have struggled to keep pace with this increased economic activity in terms of providing the transport infrastructure necessary. This rapid economic growth has resulted in escalating car-ownership rates and increased commuting times and distances. This paper estimates green house gas (GHG) emission for all commuting trips terminating in Dublin City using activity based data from the Irish census of Population, 2006. The paper also estimates the total emissions from travelling to work on an annual basis in the Greater Dublin Area. A reliance on cars as the main mode of transport is identified. A stepwise logistic regression indentifies the important socio-economic factors that influence CO emissions. Factors such as gender, age, household location are found to be important factors in determining an individual's level of CO emissions.

Rackliff : THE JOURNEY TO WORK AS A BARRIER TO CONTINUED EMPLOYMENT IN LATER LIFE [Loughborough University]

ABSTRACT: Various economic, social and demographic factors have combined over recent years to make the promotion of longer productive working lives for older people a desirable policy objective. Although disability increases with age, many older workers lead healthy, active lives. With the UK Employment Equality (Age) Regulations (2006), employers now have to consider requests to continue working beyond retirement age, so the number and needs of older workers are likely to increase. Difficulty with the journey to work is one of the barriers to employment for older workers. Whilst owning a car increases independence and improves quality of life, the compensatory techniques that may be used by older drivers when driving becomes difficult (avoiding bad weather, darkness, rush hours and complex junctions) may not be easily applied to the journey to work. Public transport is not always an option, with journey time, cost and availability all being potential issues. Whilst there are new technologies in both public and private transport that could help, they may not be designed with the requirements and limitations of older workers in mind, restricting their usefulness. In addition, many older people experience conflicts with family commitments and activities. People can find themselves simultaneously caring for their parents, partners and grandchildren. These add to the complexity of journey planning and affect travel choices and decisions. This work describes the results of two focus groups in which older workers and employee representatives explored the key influence travelling to work has on employment. The information, support and technology that would enable older workers to adapt their travel to accommodate changing needs are highlighted, and the relationship between travel decisions and organisational factors is described. This work forms part of the "Working Late" project, a collaborative research project funded under the New Dynamics of Ageing Programme.

Smith (Smeed) : SCHOOL TRAVEL PLANS: HOW SUCCESSFUL ARE THEY? FACTORS AFFECTING THEIR SUCCESS [University of Southampton]

ABSTRACT: Understanding the impact school travel plans (STPs) can have on encouraging modal shift away from the car to sustainable modes on the school run is becoming increasingly important. This study contributes to an overall understanding of the factors affecting the success of STPs and the barriers to their wider implementation. To assess this a variety of surveys using a multi-methods approach were used, based at primary and secondary schools across London. The findings suggest STPs can be successful once they have been established for a few years and where effective measures, such as walking and cycling schemes and cycling workshops have been developed which take into account the characteristics of the local area. The extent of the success of a STP very much depends on the characteristics of the catchment households and their attitudes towards sustainable travel, the size of the school catchment area and distance between pupils' homes and the school, as well as the characteristics of the local area such as levels of crime, car ownership and the road accident rate.

02C Rail Travel

Khadem Sameni : RAILWAY CAPACITY CHALLENGE: MEASURING AND MANAGING [University of Southampton]

ABSTRACT: In the European Union, the total length of railway lines has decreased since 1970, mainly by abandoning very old routes such as those to coal mines. However, there has been huge growth in the transport of goods and passengers due to economic growth and globalization. Accommodating more passengers and goods on less infrastructure has resulted in the railway capacity challenge. This paper reviews different definitions of railway capacity, examines underlying parameters that affect capacity utilisation, and studies current methods for analyzing capacity utilisation. It also suggests a hierarchy of soft and hard measures that can be deployed to increase capacity, and discusses five policies that can contribute to better utilising capacity.

Givoni : THE ACCESSIBILITY IMPACT OF A NEW HIGH-SPEED RAIL LINE IN THE UK – A PRELIMINARY ANALYSIS OF WINNERS AND LOSERS [Transport Studies Unit - University of Oxford]

ABSTRACT: This paper analyses the accessibility changes that might result from a new High-Speed Rail (HSR) line in the UK. A proposal for such a line put forward by Network Rail is used as the basis for the analysis. Using travel time to London as the main benchmark to measure accessibility of a station on the current (conventional) and future (high-speed) rail networks the paper examines the likely winners and losers from the construction of the new line. The results show that the accessibility benefits from the proposed line are relatively limited and that many cities close to it would not see any travel time reductions on journeys to London, thus will not see any accessibility benefits in this respect. In fact, for such places this will translates to relative reductions in accessibility to London compared to other locations and thus to potentially adverse socio-economic implications. Evidence from Spain is used to indicate the likely impact of HSR development on the conventional network, and this suggests a substantial reduction in services. In turn, it suggests that the accessibility benefits that were identified in the analysis are probably overestimated. The paper concludes by arguing that any examination of a HSR line must consider a wider geographic area than just the stations on the line, and that the case for a HSR line in the UK from a regional accessibility perspective, at least based on current proposals, is questionable.

Broadstock : The Economic impact of rail on the regional economies [Oxford - Transport Studies Unit, Surrey Energy Economics Centre, Halcrow Group Ltd.]

ABSTRACT: This paper provides an overview of the evidence base behind a study looking into the economic impact of rail on the 9 regional economies of England. The study implemented a holistic assessment of the role of the rail system in England, considering the implications of strategic connectivity as well as the provision of local services. Rail has a different role in each of the main regions of England, however as pressure mounts upon the economy during a time of recession and the dynamics of travel behaviour evolve, the historic and future role of rail needs to be better understood. Leading into the medium future (up to the end of control period 4) and looking into the longer term future (control period 5+) there is an imperative to better understand investment priorities, especially given the almost universally agreed long-term contraction of the UK economy. In delivering the assessment of the current and future impacts and needs of the rail system, we consider a range of scenarios for the future, analogous to the VIBAT methodology (VIsioning and BAck-casting in Transport), which are used to consider the appropriate policy roadmap to achieve future targets, while controlling for demand expectations. Integrating an assessment of the social and economic aspects, largely speaking the demand side expectations and requirements and contrasting these with the physical infrastructure, i.e. the supply side constraints. The findings,

among other things, demonstrate the value of both intra and inter-regional connectivity in the 9 regions of England, and also cross border connectivity with Scotland and Wales. Further, the work allows for an evaluation of the regional investment priorities ensuring that the are consistent with the targets of Delivering a Sustainable Transport System (DaSTS) for the UK.

02D Road Use and safety (I)
Wang (Smeed) : TRAFFIC CONGESTION AND ROAD ACCIDENTS: A SPATIAL ECONOMETRICS AND GIS ANALYSIS OF THE M25 AND SURROUND [Loughborough University]

ABSTRACT: Both traffic congestion and road accidents impose a burden on society, and it is therefore an important objective of transport policy makers to reduce both congestion and accidents. An ideal scenario would be that traffic congestion and accidents are reduced simultaneously, however, this may not be possible since it has been speculated that increased traffic congestion may be beneficial in terms of road safety. This is based on the premise that the number of fatal and serious injury accidents would be less due to low average speed when congestion is present. If this is confirmed then it poses a potential dilemma for transport policy makers: the benefit of reducing congestion might be off-set by more severe accidents. This paper aims to explore the relationship between traffic congestion and road accidents by using a spatial econometrics and GIS analysis based on the data from the M25 motorway and it surrounding major roads for the period 2003 – 2007. A series of econometric models that are suitable for panel count data are employed, including: classical count models (such as fixed- and random-effects Negative Binomial models) and spatial models using a full Bayesian hierarchical approach. Estimation results from the two types of models (i.e. classical count models and Bayesian spatial models) are generally found to be consistent with each other for most explanatory variables, and the spatial models appear to be more appropriate in terms of model inference and the fact that spatial models can take account of spatial correlated effects. The model estimation results suggest that increased traffic congestion is associated with more fatal and serious injury accidents and traffic congestion has little impact on the frequency of slight injury accidents. Other contributing factors have also been controlled for and produced results consistent with previous studies. The reason for the positive association between the level of traffic congestion and the frequency of road accidents on major roads may be higher speed variance among vehicles within and between lanes and worse driving behaviour in the presence of congestion. In addition, traffic speeds even within congested situations are likely to be relatively high on major roads compared to other parts of the road network. As such, any accidents occurring are likely to be more severe. The findings are significant for transport policy makers in developing safety policies aimed at reducing traffic accidents. Some strategies could be introduced to optimise traffic flow, which would be beneficial to both congestion and accident reduction.

Tolouei : ANALYSIS OF SECONDARY SAFETY PERFORMANCE AND AGGRESSIVITY PERFORMANCE OF MAKES AND MODELS IN BRITISH VEHICLE FLEET [University College London]

ABSTRACT: There are two distinct safety aspects for a vehicle involved in a two-car crash: secondary safety which is the injury risk to the occupants of that vehicle, and aggressivity which is the injury risk that the vehicle imposes to the occupants of the other vehicle. In a vehicle fleet, different makes and models have different levels of secondary safety and aggressivity performance depending on their design. Amongst various design elements, vehicle mass is a key variable contributing to both secondary safety performance and aggressivity performance of a vehicle. This study introduces a new methodology based on generalised linear modelling techniques to estimate secondary safety and aggressivity performance of popular makes and models in Great Britain based on driver injury risk using 2000-2004 twocar crash data. Two indices are defined for each make and model. Secondary Safety Index (SSI) that is the proportional difference in absolute driver injury risk of the make and model compared to the mean driver injury risk of all makes and models when involved in

similar accidents with the same vehicles, and Aggressivity Index (ASI) that is the proportional difference in the imposed absolute driver injury risk by the make and model to the other vehicles compared to the mean imposed driver injury risk by all makes and models to the other vehicles in collision. Unlike the previous methodologies, the estimated indices for a car model are independent of driver injury risk in the other car in collisions. For each make and model, SSI and ASI were estimated before and after controlling for the effect of mass of the colliding vehicles. Cross-comparison of estimates of SSI and ASI indices for each model before controlling for the effect mass shows a general trade-off between the two; however, controlling for the effect of mass confirms that this trade-off is imposed by vehicle mass. It is shown that even when the effect of mass is controlled, there are a few makes and models that are designed successfully in favour of both secondary safety performance and aggressivity performance or in favour of one aspect without a detrimental effect on the other.

Yang : Effects of In-Vehicle Secondary Tasks on Drivers' Visual Behaviour [Transportation Research Group, School of Civil Engineering and the Environment, University of Southampton]

ABSTRACT: In recent years, the increasing use of in-vehicle information systems (IVISs) has become a growing safety concern because such IVISs compete with driving tasks over limited visual and cognitive resources, therefore cause higher drivers' workload, which in turn may affect driving performance negatively. Eye movement measurements were found to be sensitive to the workload increased by in-vehicle secondary tasks. As an indicator for both drivers' vision impacted by external reasons (e.g. environmental changes) and drivers' demands influenced by internal factors (e.g. mental workload increasing), the drivers' eye movement while performing concurrent tasks have been investigated in this paper. The results show that auditory and visual tasks have different effects on drivers' eye movement. In visual tasks, driver deviation of gaze angle and percent of time looking at in-vehicle display increased, while the percent of time spent on windscreen, on mirrors, frequency of mirrors checking as well as saccade duration and saccade amplitude decreased, which suggest the higher visual workload and reflect the location effect of the display. Especially, the significant decrease in the frequency on mirrors checking is an indication of drivers compromising the information intake in extra visual workload. While when performing auditory tasks, on the contrary, there were significant increases in blink percentage, blink frequency and a minor increase in blink duration. It is also observed that drivers' horizontal and vertical gaze angles are sensitive measurements for task type and mental workload. According to these finding, a framework for detecting and predicting workload is established. This work suggested the potential developing a real-time tool of monitoring and predicting drivers' mental workload based on the eye-movement measurements. The future application can be used in in-vehicle alarm systems to enhance the human-related safety.

03A Bus Travel (II)

Wong : USING VIRTUAL DETECTION POINTS FOR LONDON BUSES [University of Southampton]

ABSTRACT: "iBus" is Transport for London's new GPS-based Automated Vehicle Location System. The System is being rolled out to the entire contracted fleet of vehicles across London, with the aim of improving bus regularity and punctuality through improved fleet management operations, and giving buses priority at traffic signals. The System uses "Virtual Detection" Points (VDP) to detect vehicles using a set of GPS longitude and latitude coordinates. These virtual detectors/VDPs are replacing existing infrastructure-based systems for triggering bus priority, which are ageing and relatively expensive to maintain, and their versatility and lower unit installation cost provides an opportunity for many more sites to benefit from bus priority. The VDPs are also being used to trigger the capture of statistical and other operational information, including journey times and typical dwell times between bus stops, as well as helping to improve on-board "Next Stop" signage and

"Countdown" vehicle arrivals information for passengers. Testing and research to date suggest however, that the siting of VDPs is not necessarily straightforward, and the effectiveness of these detectors is governed by their ability to capture all the requisite vehicles for their intended purpose. A methodology therefore needs to be developed to account for the different VDP uses, to provide consistency, and to ensure that all vehicles are suitably and uniquely detected. The proposed methodology provides guidance on how VDPs may be sited to provide journey time measurements between junctions, to replace existing physical detectors, to provide points for measuring key performance Indicators and to capture typical dwell time information at bus stops.

Yahya (Smeed) : ASSESSMENT OF SERVICE QUALITY AND SATISFACTION FROM PASSENGERS' PERSPECTIVE TO INFORM [Newcastle University]
ABSTRACT: This research considers important aspects of bus service improvement through a detailed investigation of current bus operations and service quality initiatives in the context of an informal Quality Bus Partnership. This research uses a qualitative approach to assess passengers" views of the quality of bus service improvement by comparing routes which have experienced significant improvements in quality using Tyne and Wear, UK as a case study. How service quality factors, such as reliability, frequencies, punctuality, cleanliness, etc., influence passenger satisfaction, in the context of their perceived importance, is investigated to better understand which specific quality attributes influences on overall perception of service quality. Results show that quality factors that are important and lead to passenger satisfaction can be different for different passenger groups with different characteristics such as gender, age and trip purpose. For all service types, provision of information was identified as a quality attribute, whilst reliability was both important, and will lead to satisfaction, for male commuters of age group 25 – 49 years. On the other hand older female shoppers identified cleanliness at bus stops as important and friendliness of driver and service frequencies in the evenings are contributory factors to the delivery of satisfaction.

Meek (Smeed) : CURRENT VMT EFFECTS OF BUS-BASED PARK AND RIDE AND POTENTIAL IMPROVEMENTS [Loughborough University]
ABSTRACT: Since the 1960s, bus-based Park and Ride (P&R) has been used in the UK. Over the past 20 years particularly, it has been promoted by the UK government as a tool to deal with traffic congestion and air pollution. The limited evidence on its effect however suggests that it may be counter-productive in these terms. This paper aims to add to the body of evidence on the traffic effects of P&R. It also goes on to look at alternative concepts of car-bus interchange and their relative benefits. The evidence on both current and future concepts is derived from a large survey of P&R in Cambridge, UK. It is suggested that while current P&R significantly increases the vehicle miles travelled by its users, some of the alternative model presented may offer considerable improvements.

03B Modelling (I)
Ellingham : TACTICAL HIGHWAY TRAFFIC FORECASTS USING PATTERN RECOGNITION TECHNIQUES [University of Bristol]
ABSTRACT: Data-driven methods are developed for the automatic recognition of pattern in spatiotemporal highway traffic data. A kernel-based smoothing method is used to pre-process inductance loop data so that the methods are independent of the precise infrastructural set-up. Then the k-means clustering method is used 1. to find patterns in daily AM/PM flows and 2. to develop a probabilistic journey time forecasting method. Finally cross-correlation methods are developed which identify wave structure and wave velocities. Together these methods form a basic

set of tools which can be used in future for the evaluation, monitoring, forecasting and control of highway traffic flow.

Han : A NEW METHOD FOR PROBABILISTIC TRAFFIC STATE IDENTIFICATION USING LOOP DETECTOR DATA: THEORY AND EMPIRICAL RESULTS [Imperial College London]

ABSTRACT: Identifying relevant traffic states is an important problem in a number of areas of traffic operations and control, especially those involving real time ITS systems. A simple but particularly important version of the state estimation problem is to determine whether or not traffic is congested, based on data from inductive loop detectors (ILDs). This problem arises in various forms in both urban and interurban contexts. A number of methods to automatically determine the traffic state are available in the academic literature including simple classifiers based on thresholds and more sophisticated approaches based on fuzzy logic. Most of the methods however, either require auxiliary data inputs that are not always readily available in real time or depend on loop-specific parameters that are not readily transferrable across sites. Moreover, most methods encounter difficulties in dealing with traffic states that fall into the transition zone between uncongested and congested conditions. In this paper we present a novel new approach to state estimation based on analysis of loop occupancy and flow data alone. The method in based on the assumption at the relationship between flow and occupancy displays distinct regimes according to whether the system is congested or uncongested. A probabilistic classifier is developed, based on the Expectation-Maximisation (EM) algorithm. This new algorithm is evaluated using data from the ILDs on highways and urban links. The results demonstrate that the proposed algorithm, which does not need site specific calibration, is able to identify the traffic state on both urban and highway satisfactorily.

Lee : DATA BLURRING: MODELLING THE IMPERFECTIONS OF TRAFFIC SENSOR DATA IN A MICROSCOPIC TRAFFIC SIMULATOR [Centre for Transport Studies, Imperial College London]

ABSTRACT: The increasing availability of diverse traffic sensor data is opening up enormous opportunities for improving traffic management. However, all real traffic sensors are subject to a range of imperfections that degrade the quality of their outputs. By contrast, traffic microsimulation models typically assume that the outputs of sensors are perfect. Hence, the simulated sensor may not represent the real traffic sensor well. This study emphasises the necessity of representing the imperfections of traffic sensors in traffic microsimulation models and proposes methods to adjust the quality of data from simulated inductive loop detectors to match the real loop data. A microsimulation model is employed to describe the physical interaction between loop detectors and vehicles to investigate the factors that cause the systematic errors of the loop outputs. Several algorithms are proposed to address the mismatch between simulated data and real loop data. The results show that the installation of cross-lane loop detectors or a high density mixed traffic flow containing single-track twowheelers can cause significant errors. In addition, the proposed algorithms are able to adjust the level of data quality for the simulation outputs to match the real data. The outcomes of this study can enhance the accuracy of model calibration to simulators and improve the flexibility of the simulation outputs to be used in other areas.

03C Mobility and Inclusion

Wilde : MOBILITY AND SOCIAL INTERACTION IN RURAL AREAS: PERSPECTIVES OF ACTIVITY-BASED APPROACHES [Centre for Sustainable Transport, University of Plymouth]

ABSTRACT: The provisional thoughts contained in this paper represent the methods and an early interpretation of the first part of a PhD research about the relationship between mobility, social interaction and space. The research is mainly based on the activity-based approach in transport geography. Activity-based approaches are interesting concepts to analyse, illustrate and interpret

mobility patterns in space and time: they unite theories about structures and agents, which highlights the wider relationship between mobility, individual activities and society. One of the most significant contributions to the conceptual foundations of these approaches relates to Hagerstrand's (1970, 1989) studies of time, space and activities. However, a critical examination with reference to theoretical developments shows that interpretations of mobility, which are based on those approaches, are not going far enough. In this paper, I will give an outline of the theoretical framework for the investigation of individual mobility in rural areas. I further intend to give an overview of the qualitative methods that I used for the mobility research as well as early interpretations of the data.

Kamruzzaman : IDENTIFYING RURAL TRANSPORT DISADVANTAGE USING A MULTI-DAY TRAVEL DIARY [University of Ulster]

ABSTRACT: This paper identifies transport disadvantage using a 7 day activity-travel diary data from two rural case study areas. A composite participation index (PI) measure was developed for this study based on six indices measuring elements of travel and activity participation. Using the index the paper then goes on to compare these results, with the results obtained from other more traditional indicators used to identify transport disadvantage. These indicators are related to the size of activity space such as unique network distance travelled, number of unique locations visited, activity space area, activity duration, and fullness (shape) of activity spaces. The weaknesses of these indicator based measures are that: firstly, they do not take into account the relativity of the measure between different areas i.e. travel distance in terms of the wider context of available activities within an area; and secondly, these indicators are multi-dimensional and each represents a different qualitative aspect of travel and activity participation. As a result, six individual indices were developed to overcome these problems. These include: participation count index, participation length index, participation area index, participation duration index, participation type index, and participation frequency index. These are then aggregated to assess the relative performance in terms of these different indices and identify the nature of transport disadvantage. GIS was used to visualise individual travel patterns and to derive scores for both the indicator based measures and the index based measures. Factor analysis was conducted to derive weights of the individual indices to form the composite index measure. From this analysis, two intermediate indices were also derived using the underlying factors of the data related to these indices. Using the scores of all these measures, multiple regression analyses were conducted to identify patterns of transport disadvantage.

Curl : DO CURRENT APPROACHES TO ACCESSIBILITY PLANNING ADDRESS WHAT MATTERS? AN INITIAL ASSESSMENT OF TOOLS AND TECHNIQUES [University of Aberdeen, Centre for Transport Research]

ABSTRACT: This paper presents the outcomes of the first year of PhD research into how currently used measures of accessibility relate to individual perceptions, or the "lived experience" of accessibility. Accessibility has been framed in the context of social exclusion within UK Transport Planning, focussing on the ability of people to participate fully in society, which is seen as being limited by poor accessibility. Despite the policy recognition of multiple barriers to accessibility such as information, cost, safety and security, travel horizons, provision of services and journey times, measures used in accessibility planning are dominated by "easily" quantifiable time/distance measures, and therefore do not necessarily reflect the complex interactions, perceptions and behaviours of individuals which influence travel and ultimately the ability of people to access destinations. If measures used do not accurately reflect individuals" perceptions of their accessibility then the cross sector, social inclusion objectives of Accessibility Planning, such as reduction of unemployment, missed appointments or those not in education or training, may not be realised. For the first stage of this research, a categorisation of tools used and techniques applied to accessibility

problems has been developed. This characterises international approaches, both theoretical and applied, to measurement in terms of their practicality, geographical coverage, data requirements and relation to desired outcomes, in order to understand the current application of accessibility in transport planning and where there are gaps in understanding and measuring the aspects of accessibility that are important to individuals in their everyday mobility. This paper presents this categorisation of tools, techniques and data available to accessibility planning and areas for future research are outlined in terms of understanding the difference between current, often time based objective measures and individual perceptions or the "lived experience" of accessibility.

03D Road Use and Safety (II)
Alkaabi : Modelling Response Time of Highway Traffic Accidents in Abu Dhabi [School of Civil Engineering & Geosciences, Newcastle University]
ABSTRACT: Due to the fact that traffic incidents have a lot of adverse impacts in many areas such as traffic flow, air pollution, fuel consumption, and secondary crashes, it will be useful for traffic incident responders and operators to understand how they can improve the efficiency of traffic incident management process. This paper presents the results of investigating the effects of traffic accident characteristics on the accident response time using hazard-based duration models. Accident characteristic and response times of 297 accidents were obtained from Abu Dhabi Highway Collision Investigation Branch (AHCIB) for the period from January to May 2009 to develop this model. Allowing for unobserved heterogeneity test, Weibull model without heterogeneity has found to be the best fit distribution for the dataset. Model estimation results indicate that various accident characteristics such as day of week, month of year, location, severity level, and light condition have a significant effect in the accident response time.

Kaparias : MODELLING THE WILLINGNESS OF PEDESTRIANS TO SHARE SPACE WITH VEHICLES [Imperial College London]
ABSTRACT: This paper investigates the importance of certain factors affecting the willingness of pedestrians to share space with vehicles. Using an innovative web-based stated preference survey, a set of responses is collected from pedestrians, who are presented with different combinations of seven binary factors forming the scenarios. The seven factors are: vehicular traffic (high-low), pedestrian traffic (high-low), provision of „safe zones" (yes-no), street surface condition (wet-dry), level of lighting (good-low), provision of trees and plants (yes-no) and provision of seating facilities (yes-no). A logit regression analysis is carried out by fitting a series of logit models, which include not only the scenario-specific factors but also a number of respondent-related attributes, such as age, gender and driving frequency. The results suggest that pedestrians feel most comfortable sharing space in conditions which ensure their presence is clear to other road users, i.e. conditions involving low vehicular traffic, high pedestrian traffic, good lighting and provision of pedestrian-only facilities. A further conclusion is that female pedestrians and pedestrians over 50 years old seem to show a lower level of willingness to share when compared to their counterparts. The paper describes the survey method and results in full.

Darby : EVALUATION OF FLEET ROAD SAFETY INTERVENTIONS [Loughborough, Edinburgh Napier]
ABSTRACT: Work related road traffic fatalities are the largest cause of work fatalities in the UK. It is estimated that 25% of UK road accidents involve someone driving for work. This risk profile makes fleet safety an important topic for study as it can have a significant impact on the overall road toll, and on worker safety. Although many regulations relate to the operation of large trucks and buses there are fewer special regulations for those driving for work in other contexts. Fleet risk management has traditionally focused on cost control rather than employee and public safety

although this has been changing. Studies have shown that changing behaviours in both drivers and the rest of the organisation can make a large improvement in outcomes. This study has unique access to the detailed insurance claims data from a large UK telecoms fleet of approximately 40,000 vehicles since 2001 and information on interventions applied to manage this risk. The interventions have been developed from published work in the field of risk and behaviour management. The data represents a wide range of vehicle types from large trucks and white vans through to personal cars all or some of which could be used for work related journeys, commuting or pleasure. There have been ongoing and significant performance improvements. Interventions have included behind the wheel training, building safety into management performance metrics and risk assessments yet it is unclear as to which intervention shows most or any impact on safety outcomes. Data consistency issues have further obscured the investigation. The merging of this historic quantitative and qualitative information has shown that management strategies and the safety culture are worthy investments.

04 Plenary

Wilson : Car-Following Models - Fifty Years of Linear Stability Analysis: A Mathematical Perspective [University of Bristol and University of Limerick]

ABSTRACT: It is widely accepted that the formation of stop-and-go waves in highway traffic is caused by some kind of instability. In fact, ideas from nonlinear stability are necessary to explain all empirical features, but the tuning of linear stability properties is still very popular in the microsimulation community --- and in fact, the linear stability analysis of car-following models dates back to classic papers in the late 1950s. My purpose is to provide an easy-to-understand survey of the different types of linear instability in car-following models, illustrated by simple pictures, and defined rigorously by mathematical criteria. I recently identified generic mechanisms and new formulae for linear instability (Phil. Trans. R. Soc. 2008) and I want to ensure that these are understood by the mainstream Engineering community (without cluttering the argument with proofs that are probably not of general interest). In particular, for a wide class of models, my key test requires the calculation of only 3 simple partial derivatives. Finally, I will show that there is still some fresh groundin this much-studied topic. Broadly speaking, the only reasonable form of linear instability is `string instability' in which the envelope of perturbations grows as it travels up a column of traffic, but each individual vehicle returns to equilibrium after the envelope has passed. However, because of the underlying (forward) vehicle motion, it is not possible to say a priori whether this envelope is confined to upstream propagation relative to the road, or whether it can also convect downstream (contrary to what empirical data suggests). This distinction seems not to have been considered previously, but it is important in model parametrisation. I will outline methods, using group velocity and the asymptotic analysis of the inverse Laplace transform, to develop criteria which distinguish between these convective and absolute instability types.

05A Aviation

Budd : SAFEGUARDING PUBLIC HEALTH AT UK AIRPORTS: AN EXAMINATION OF CURRENT HEALTH SECURITY PRACTICES [Loughborough University]

ABSTRACT: In response to the H1N1 influenza outbreak and the role of air travel in facilitating the virus‟s rapid spread around the world, this paper contributes to debates concerning the governance of infectious disease by examining the role of the Port Health Regulations and associated health security practices that are enacted at UK airports. While airports have been at the forefront of measures to prevent the importation of „foreign‟ infectious diseases since the early 1930s, the present scale of international aeromobility combined with heightened awareness of the role air travel plays in the global spread of human pathogens, the epidemiological obsolescence of many

early aeronautical sanitary regulations, and a dearth of academic studies on health security at airports, provide compelling reasons to examine the development, content, and implications of the existing Port Health Regulations and associated health security practices that are performed at UK airports. Drawing on extensive archival research and fieldwork interviews with key stakeholders in the aviation and health care sectors (including airport managers, „front line" customer-facing airline personnel, and medical practitioners), we chart the development of sanitary regulations at UK airports and explore the current practices of health security that are performed at individual sites. We then identify the main challenges involved in safeguarding global public health against the dissemination of „foreign" infectious diseases by air through UK airports and conclude by offering recommendations for improved practice.

Edwards : Exploring the decision making of low-cost airline passengers – A UK-wide survey [University of Westminster]
ABSTRACT: The decision-making process of individuals travelling by air is a complex area of study that has received relatively little academic attention. This research investigates the decisionmaking processes of a self-selected sample of 83 individuals who have travelled with a low cost airline within the last twelve months. Undertaken with the cooperation of members from the UK's largest independent consumer body, the study employs a largely quantitative questionnaire that builds upon stated preference and revealed preference techniques (at a basic level) to provide insight to consumer decision-making and airline choice. Respondents were asked to report on their travel choices and experiences from their last journey with a low cost operator, whilst in light of their experience infer decisions that they may make in future. Given the growing number of travel choices individuals are faced with and increased consumer heterogeneity, an abundance of factors appear to be influential in LCC choice. Emphasis is placed upon the psychological and sociological implications of decision-making and the influence of demographic factors on decisions made by the UK-wide panel. The study thus takes an alternative approach to much of the technical literature available in transport choice and decision-making.

05B Modelling (II)
Watling : PARETO OPTIMALITY OF THE TRAFFIC ASSIGNMENT PROBLEM WITH HETEROGENEOUS TASTES [Institute for Transport Studies]
ABSTRACT: There are many factors other than travel time, such as congestion charging, road service level and road safety, that may affect a driver's route choice behaviour. In this paper, we first aim at classifying these different causes, and discuss how they give rise to problems that are beyond conventional traffic assignment models, such as those with non-additive route travel costs and heterogeneous route choice sets among different classes of users. We show how some such kinds of traffic assignment problem with non-additive route travel cost can be solved by column generation algorithms, enabling analysts to exploit some kinds of data from travel behaviour surveys to analyse network traffic flow, so as to judge whether some specific taste of travel route choice behaviour among some part of the population would affect the aggregate network traffic flow equilibrium on the transportation system or not. On the other hand, some kinds of traffic assignment problem with non-additive route travel cost are more difficult to solve, since even finding a shortest path (based on the generalised route travel cost) by Dijkstra's or a label-setting method is difficult. In these cases, we propose to translate the generalised route travel cost function into a route travel cost vector, all the elements of which are relevant to users' heterogeneous tastes. Then, depending on the elements of the route travel cost vector other than travel time, we define users' dominant set which are relevant to users' individual tastes and which can be recognized by a branch and bound technique, k-shortest path method, etc. In this way we are able to find a Pareto optimal solution of the traffic assignment problem with heterogeneous tastes on a dominant set of user classes. At the

end of the paper we conclude in what situations planners need to analyse network problems on a dominant set and how to use the new framework to cope with some realistic problems.

Wang : STUDY OF PEDESTRIAN-VEHICLE INTERACTION BEHAVIOUR ON UNSIGNALISED URBAN ROAD SECTIONS [University of Southampton]

ABSTRACT: For environmental and health reasons, travellers increasingly are being encouraged to walk more, either as a main mode of travel or as part of a multimodal trip. Roads can be barriers to pedestrian movement and a greater understanding of the ways in which pedestrians and vehicles interact can inform future design and control systems to improve safe crossing experiences for pedestrians. Microsimulation is increasingly being applied to supplement empirical methods to address problems related to Pedestrian-Vehicle Interaction (PVI). A sound credible model is the key for simulation study. However, current microsimulation tools are of limit use for evaluating the operations of pedestrian-involved systems, especially in unsignalised conditions. Common microsimulation models typically oversimplify the more complex PVI process, due to insufficient knowledge to build behaviour models and lack of convincing validation. Thus, while most of existing microsimulation tools may be capable for studying signalised scenarios, they do not offer a way to study PVI in unsignalised conditions or comparing the operations of signalised scenarios to unsignalised ones. This research aims to develop a fundamental understanding of the PVI behaviour on unsignalised road sections. The PVI behaviour from real traffic scenarios is carefully and non-intrusively recorded with an array of video cameras. Static and dynamic data of both two modes are extracted to establish a substantial data base from which understandings are gained through data analysis and modelling approaches. The results of this research can be used to supplement existing guidelines for pedestrian-involved problems, or to form a knowledge base for incorporating pedestrians into existing vehicle-dominated microsimulation models in a more realistic way. This paper presents the detailed methods and some initial results.

05C Transport and ICT

White : Potential Role of Time Savings through Teleworking [University of Westminster]

ABSTRACT: The promotion of more flexible working patterns has become more widespread in recent years, including substitution of home-based working for that in the office, otherwise known as teleworking. Numerous benefits have been identified in removing or altering the normal commute to work, including travel time savings and reducing peak time congestion and associated pollution. The scope for teleworking has been identified by a number of authors. A study jointly conducted by the University of Westminster, University College London, and Imperial College London indicated that the growth was in part-week rather than full-time teleworking, mainly by staff at senior levels. Potential benefits were identified through more productive working, notably substitution of some of the travel time savings by additional productive work, for which higher values of time savings than for 'non working' rates would be applicable. A survey conducted in summer 2009 enables such concepts to be examined further. With the co-operation of the Department for Transport and Government Offices for the Regions, a sample of over 800 respondents was obtained from their staff, indicating the extent of, and attitudes toward, teleworking. In addition to indications of how time savings were used, both benefits and disbenefits of such working were examined. The sample size attained enables meaningful breakdowns to be produced by type of person concerned, and how this influences the frequency, impacts and perceptions of teleworking. An economic evaluation of such changes may then be produced.

Hook : What Transport and Weather Information Sources are used by the Public, and How Useful and Effective are they? : - A Case Study of the Use of Transport and Weather Information during a Period of Snowy Weather in Bristol during February 2009 [University of the West of England, Bristol]

ABSTRACT: This study looks at the link between weather and use of transport information. With little previous research having been done on the relationship, this study builds on recent work by Drobot (2008), Kajita et al (2008) and Ivanov et al (2008) in linking the need to search for Transport Information with severe weather situations. A UK case study takes the form of an in-depth look at the impacts of snowy weather which built up to cause disruption to the transport network in and around Bristol. To discover how the snowy weather affected peoples' travel and whether they consulted weather and transport information a survey was constructed which was posted online and conducted at busy shopping locations and a major transport hub. Major findings of the survey were that transport information is not used to the extent of weather forecasts and that the internet is the main source of information. Much of the internet sources were found using search engines or reliant on familiar media organisations such as the BBC. Findings for the government supported sources Traveline and Transport Direct show little use, reflecting previous indications of a lack of public awareness. Suggestions are made to improve the spread of information for public transport as survey results showed that demand is not being met. In addition to the use of transport information via the internet there is a small but significant use of information obtained using mobile phone technology and Variable Messaging Services. Use of Cross-tabulations showed that younger respondents and those in part-time employment were more likely to use transport information reflecting ONS and Ofcom studies on use of the internet and mobile phones. A case is built for further study on a larger scale with recommendations for improvements to information provision on a local and national scale.

05D Road Use and Safety (III)

Zheng : FROM OPEN TO DEDICATED E-LANE OPERATIONS [University of Southampton]

ABSTRACT: This paper describes the investigation of traffic operations on both dedicated and open e-Lanes. The scenario is regarded as a migratory stage towards eventually full automation of urban principle traffic operation. The traffic operations were investigated using a be-spoke microscopic simulation model. It was found that under certain DMV demand level and at certain headway policy, the open e-Lane operation can be further improved by migrating to a dedicated e-Lane operation.

06A Attitudes and Beliefs

Dudley : LOST IN TRANSLATION: PROBLEMS IN INTERPRETING BUSINESS ATTITUDES TO TRANSPORT [Centre for Transport & Society, University of the West of England, Bristol]

ABSTRACT: Following a 2008 review for the Department for Transport (DfT) of public attitudes to transport, the authors have subsequently reviewed for DfT available UK evidence on (private sector) business attitudes to transport, comprising over 160 reports and other articles, of which 97 were examined in detail and a synthesis of findings produced. There are some prima facie similarities between public and business attitudes in relation to congestion, the order of importance of transport attributes (especially reliability), stated conditions for support of road pricing, public transport, travel plans, telecommunications, and some issues of reducing travel. There are, however, some differences also: transport concerns are less ubiquitous; less attention is given to the environmental concerns associated with road building; and there is less attention to wider government goals such as equity, health, social welfare, and the environment. However, both similarities and differences may be misleading, as research on business attitudes is less disciplined, and they are expressed in a way that obscures any simple clarity of the contribution of transport to business objectives. There are no well-established theoretical frameworks (such as exist for

individual attitudes) for understanding attitudes, when applied to the corporate views of a commercial body. As a result, it is very difficult, from the existing evidence, to interpret a clear and coherent view or set of views of business on transport issues, and the connections between the evidence collected, and the conclusions expressed as reported headlines, are not always transparent or unambiguous. There can be significant difficulties in distinguishing between the considered expression of a corporate view, and the personal attitudes of individuals within a firm who have the job of 'answering questionnaires'. This lack of transparency highlights problems in the quality and robustness of the evidence. The authors suggest some protocols, with the aim of improving research methods that, if implemented, could help improve the credibility and clarity of claims to represent the 'voice (or, more realistically, voices) of business.'

Susilo : SUSTAINABLE URBAN DESIGN AND RESIDENTS ENVIRONMENTAL BELIEFS: GREEN TRAVEL PATTERN? [University of the West of England/Oxford Brookes University]
ABSTRACT: Using data that has been collected from the residents of thirteen purportedly sustainable neighbourhoods in the UK, this paper explores the influence of individual environmental beliefs and various built environment factors on the individual daily travel mode choices. The study found that, although the development was aimed to promote sustainable behaviours, the motivation of residents to move to these neighbourhoods varied between groups. Thus, although almost all respondents were aware of environmental issues, their travel behaviour differed significantly. The analysis also shows that the individual environmental concerns only have a strong influence in encouraging walking within and nearby the neighbourhoods. The impacts are rather limited on cycling behaviour and there is no evidence of such influence on public transport travel or walking and cycling to locations outside the neighbourhood. The results overall show some positive evidence that certain elements of urban design can support more sustainable travel behaviours. However, it also shows that people's attitudes are significant, and only a combination of a supportive environment and the desire to make more sustainable travel choices is likely to lead to a real shift to sustainable travel in the UK.

Nikitas (Smeed) : EXAMINING OLDER PEOPLE'S ATTITUDES TO ROAD CHARGING: HOW SPECIAL ARE THESE AND WHAT IS THE LESSON TO BE LEARNT? [Centre for Transport and Society UWE]
ABSTRACT: Public acceptability is possibly the 'key factor' for the introduction of road charging. Understanding any special attitudes of older people to the policy may inform attempts to enhance acceptability by identifying some of the potential social dilemmas of road charging. In an ageing society, where older people have a growing influence in politics in general, and potentially on the acceptability of road charging in particular, their attitudes to road charging are of interest because they face specific types of risk of transport-related social exclusion. Moreover, there is evidence to suggest that older people favour, more than any other age group, what is positively valued for society – a process known as 'pro-social value orientation'. Hence in a transport context, older people may be more likely to express positive or negative attitudes to the acceptability of road charging depending on whether they believe it would be good or bad for others, or society in general. Family and friends may also affect older people's considerations about their intentions and choices - thus the importance of studying the influence of 'social norms' on older people's attitudes to road charging. The paper develops a theoretical and empirical understanding of these issues, based on a twophase research scheme consisting of a quantitative survey and a series of focus groups that was conducted in Bristol a city that has been seriously discussing for a number of years the introduction of a road charging scheme. Robust evidence is provided for the view that the attitudes of older people towards road charging are different from those of younger people and that older people's particular pro-social value orientations and social norms do affect these attitudes. People aged 60 to 74 are the people most likely to be negatively oriented to road charging while

people aged 75 and over are the people more likely to be positively oriented to road charging than any other age group.

06B Modelling (III)

Maher : A COMPARISON OF THE USE OF THE CELL TRANSMISSION AND PLATOON DISPERSION MODELS IN TRANSYT 13 [University of Leeds]

ABSTRACT: TRL's TRANSYT software has been used for optimising signal timings in signalised networks for over 30 years. It consists of a deterministic, macroscopic traffic model that evaluates the performance index (PI) for any given set of timings x (cycle time, greens and offsets) and an optimiser that employs a "hill climbing" method that seeks to minimise the PI and hence find the optimal timings x*. The conventional traffic model in TRANSYT employs a platoon dispersion model (PDM) to transmit the flow profile from the upstream end of any link to the downstream stop-line. It has long been well-known that one major weakness of this model is that it treats queues as if they stacked vertically at the stop-line, so that it does not model "blocking back". However, recognising this weakness, TRL has incorporated into the latest version of the software, TRANSYT-13, an alternative form of traffic model, the cell transmission model (CTM), in which each link is split into a sequence of cells, thus allowing the spatial extent of queues to be modelled. In principle, the CTM should provide a more appropriate and accurate means of modelling queues and delays than does the PDM, especially in networks with closely-spaced intersections, where blocking back may readily occur. The research described in the paper carried out an investigation into the sensitivity of the resulting optimal signal timings to the choice of traffic model, through application of TRANSYT-13 to a number of test networks, the one reported here being a 6-arm signalised motorway roundabout. The main objective is to see whether it makes much difference which traffic model is used, and to measure how much additional benefit is likely to result from this development in the TRANSYT traffic model. A number of ways in which this benefit may be expressed on an easily-interpreted scale are proposed and applied to the results from the test network.

Al-Obaedi : TESTING VISUAL ANGLE CAR FOLLOWING MODELS USING DIFFERENT SETS OF DATA [University of Salford]

ABSTRACT: The basic assumption in visual angle car following models is that the following distance between successive vehicles is a function of the object (i.e. leading vehicle) width. This paper examines the validity of this assumption using two types of data. Published real traffic data from instrumented vehicles in the USA and Germany have been used to check the ability of these models to replicate real traffic movements when both leading and following vehicles are "small cars". Also, another type of data was used based on over 4 million cases of individual vehicles which have been abstracted from inductive loop detectors installed on the M25 and the M42 motorways in the UK. The data was then filtered and analysed to examine the following distance according to the type of the leader (i.e. Car or Heavy Goods Vehicle - HGV). The results show that while the visual angle car following models can successfully replicate real traffic movements based on the instrumented vehicles data, the assumption of leaving larger following distance if the leader is an HGV is found to be not the case for the majority of UK drivers. This will have a negative impact on the use of visual angle car following models to represent real traffic behaviour.

SHIBIKOM : Characterizing Conditions for Stability and Chaos in Doubly Dynamic Departure Time Choice Modelling [Institute for Transport Studies]

ABSTRACT: Traditional analysis of supply-demand problems in transportation systems and practical equilibrium models assume a steady state of Economic Equilibria to prevail. However, we know that transport systems are typically dynamic with highly variable characteristics that change over time.

These factors that change over time include behavioural variation, demand/supply dynamics and system interaction with internal and external factors. Static equilibrium models, though can be elegantly applied to general networks, are indifferent to transient states and sometimes misleadingly guarantee stable system equilibrium a priori. Hence, several dynamic modelling techniques have proposed dynamic and adaptive models to represent transport features such as route and departure time choice. These approaches study the system evolution of the inherent transition function over a period of time and predict end state of the system by studying how transient states give rise to a long-term behaviour. In this paper, a doubly (discrete time day-to-day and continuous time within-day) dynamic departure time choice model is studied. The study brings together different aspects of network modelling such as departure time choice modelling using schedule disutility theory, theory on travel time functions based on continuous-time whole link models, fixed point formulation of day-to-day dynamic traffic assignment using learning and adaptation, discrete choice models to replicate choice behaviour and finally stability analysis using nonlinear dynamical systems theory. Concept from dynamical systems theory is then used to establish factors that give rise to stable and unstable (including periodic, quasi-periodic and chaotic) behaviour in the underlying transport system by studying the Jacobian Matrix of the transition function and the associated eigenvalues. The theory is used to analyze a test network and resulting numerical results are reported.

06C Environment (I)
Borthwick : THE POTENTIAL FOR 'GREEN' FISCAL MEASURES TO LESSEN THE ENVIRONMENTAL IMPACT OF CAR USAGE IN SCOTLAND [Transport Research Institute, Edinburgh Napier University]

ABSTRACT: Given that private car use accounted for 10% of all Scotland‟s 2006 greenhouse gas emissions, the paper centres on the ability of „green‟ fiscal policy in altering driver behaviour in a pro-environmental manner. It starts by highlighting the current upwards trend in private vehicle use and ownership, and its relationship with climate change. The „green‟ fiscal measures currently in place are then considered, including vehicle excise duty, hydrocarbon oil duty, value added tax on both the vehicle purchase and on fuel; with some reflection of future Scottish policy. From a review of past literature, it is shown how these fiscal instruments appear to influence the initial vehicle purchase and extent of fuel consumption. More general perceptions, such as public acceptance and the level of incentive required to instigate behaviour changes are also examined. An initial questionnaire designed for a pilot study was implemented, providing a set of empirical results and helping to revise the anticipated focus and methodologies of the full PhD research. The influence of vehicle excise duty and carbon dioxide emissions in the purchasing decision are firstly quantified; plus the level of acceptance towards measures aimed at reducing usage. Details of the full research are then presented: its aim, subsequent objectives and their corresponding methodologies – highlighting areas where the influence of the pilot study is most felt. The paper concludes by reviewing the most pressing tasks in the research process and the planned timescale for the remainder of the study.

Howarth : PERCEIVED BEHAVIOURAL CONTROL AND THE ROLE OF INFORMATION ON CLIMATE CHANGE IN INCREASING SUSTAINABLE TRAVEL [University of Southampton]

ABSTRACT: This paper investigates the extent to which information on climate change can influence travel behaviour. Travel behaviour on the aggregate level is unsustainable; in light of increasing awareness on climate change, the need to substantially reduce emissions from the transport sector is growing. The status of travel behaviour has grown both in terms of its potential to fill the gaps left by technological and political progress as well as the potential longevity and transferability of its impacts to coerce the sustainability of other aspects of human behaviour. The role of information on climate change is analysed and its impact on influencing travel behaviour is investigated particularly

when considering perceived behavioural controls. Analysis of results from questionnaires and focus groups shows climate change is viewed as too impersonal, immeasurable and un-mitigable, whilst individuals consider their potential to change too insignificant and futile in terms of impacts and adequacy. While motivation for sustainable travel behaviour is high, perceived ability to do so is consequently low. This paper concludes by considering how information on climate change can be used to increase perceived ability to change. Information on (i) the availability of alternative travel options, (ii) seemingly effortless behavioural changes and (iii) environmental benefits of change as a by-product, not a driver, have significant potential in bridging the gaps left by technology and policy, towards achieving more widespread sustainable travel.

Yahaya : THE SPATIAL AND TEMPORAL VARIATION OF ULTRA-FINE PARTICLE (UFP) CONCENTRATIONS IN A BUSY URBAN STREET, HEADINGLEY, LEEDS, UK. [Institute for Transport, University of Leeds, UK]

ABSTRACT: The road transport sector is the dominant source of smaller particles in urban areas. Road transport is estimated to emit 54% of particles smaller than PM 0.1 in the UK (DEFRA, 2005). Research studies have investigated the effects of traffic flow, meteorological factors on roadside concentrations of coarser particles (PM10 and PM 2.5), but few studies have considered UFP. This paper presents preliminary results from a traffic, dispersing air-flow and UFP measurement study at a research site in Headingley, City of Leeds (UK). The experimental work is based at the semi-permanent „Instrumented Junction" research site, a component of the Instrumented City research Facility. Co-ordinated measurements across the 1km2 study area include: traffic flows, route journey times, prevailing and in-street dispersing air-flows, UFP concentrations at three kerbside and one local background site. UFP concentrations are measured by TSI 3775 Buthanol-based ultrafine Condensation Particle Counters with a 4.0nm - 3 µm size range. Analysis demonstrates significant variations in UFP concentrations between the stations, largely influenced by the prevailing winds, building geometries, background concentrations, but also tidal traffic flows.

06D Road Use and Safety (IV)

Heslop (Smeed) : CATEGORISATION OF DRIVERS IN RELATION TO EXPERIENCE OF AND COPING WITH DRIVER BOREDOM [Newcastle University]

ABSTRACT: This study aims to categorise drivers based on a combination of attitudes towards driving, experience of and coping with driver boredom. Data were gathered using a self-report questionnaire. The questionnaire included a driver boredom scale measuring driver responses to under-stimulation, flow, lapse and error proneness, and anxiety. It also included measures of age, gender, experience, offence and crash histories, and speed on various stretches of road. Drivers were split into four groups using two-step cluster analysis. Tests of difference between the groups indicate that those with the highest enthusiasm for driving suffer the lowest levels of driver boredom. Tests also indicate, in contrast, that those with the lowest enthusiasm for driving are likely to either suffer very high or low levels of driver boredom. Findings suggest that unenthusiastic drivers who only suffer low levels of boredom only have low stimulation needs. Findings also suggest that most drivers are relatively ambivalent about driving and suffer moderate levels of driver boredom. Findings indicate that high and moderate boredom drivers are more likely than low boredom drivers to have been penalised for speeding and to have caused a crash. Results thus suggest that driver boredom is a problem. This paper reports analyses which are part of a larger study of driver boredom. Heslop et al. (2010) addressed reduction of a driver boredom scale and relations between speeds, demographic variables and factor scores. This paper builds on that of Heslop et al. (2010) by considering how relationships between these variables differ between different driver groups.

Musselwhite : PUBLIC ATTITUDES TO ROAD USER SAFETY: A REVIEW OF THE LITERATURE 2000-2009 [Centre for Transport & Society, University of the West of England, Bristol]

ABSTRACT: This paper forms the first stage of a research project for the Department for Transport (DfT) that will inform the DfT's new post-2010 road safety strategy. The paper presents the findings from a critical review of 72 recent research papers, reports and journal articles examining public attitudes to road user safety, concentrating mainly on evidence from the UK dating from the year 2000 onwards. The critical review exercise found that at the aggregate level there is high support from the public that behaving in a safe manner on the roads is important and that increasing safety through various interventions, including enforcement, engineering and education, is seen as generally acceptable. For example, there is generally a high level of understanding that faster speeds are linked to collisions and high support for drink-driving laws, 20mph zones in residential areas, traffic calming and speed cameras. However, closer inspection of the literature suggests some subtle differences both between and within individuals. Overwhelmingly, there seems to be a consensus that drivers and pedestrians see themselves as safe road users and other users of the road environment as more risky and dangerous. Hence, support for interventions is largely accepted as necessary for "other" road users rather than for themselves. In addition, the public's conceptualisation of road user safety shows the social nature of appraising risk and the road user environment and consequently the impact of normative pressure, especially the influence of others, is evident in much of the research. Hence, distorted views on the behaviour of others towards safety and risk influence the public's own behaviour. There are differences in road user safety attitudes amongst different segments of the population. Older and female road users have more safety orientated attitudes almost across all road user domains than younger and male road users. In addition, attitudes vary depending upon the context of the research and of the researched. Hence, findings are different when investigating attitudes towards road user safety between a pedestrian and a driver. Implications for interventions are also discussed.

Fairchild (Smeed) : SIMULATED TRIALS OF AN AUTONOMOUS COLLISION AVOIDANCE SYSTEM [Newcastle University]

ABSTRACT: The shipping industry employs many thousands of people and is responsible for handling 90% of the world's trade. However, this industry still suffers from avoidable accidents, which are in part due to the over-reliance on fewer crew members performing more tasks. Whilst safety is taken seriously, the industry is slow to change and adopt new practices. This paper presents a solution to the problem of ship to ship collisions; namely, an autonomous collision avoidance system utilising autonomous agents, target vessel detection and collision avoidance mechanisms. A series of tests are presented and conclusions are drawn which show whilst collision avoidance can be successfully demonstrated, a closer inspection of the mechanisms of target detection and classification are required.

Saeed : Investigation of Pedestrian Accidents at pedestrian crossings [Edinburgh Napier University]

ABSTRACT: Despite all government efforts to protect pedestrians from the risk of accidents, such incidents are still quite pervasive the severity of which is considered very high because pedestrians are generally unprotected from road accidents. Also, despite an overall positive outlook on road safety in the UK, compared to other European countries such as Austria, Finland, Ireland, Norway, Switzerland, Belgium, Denmark ,Germany Netherlands, Sweden, France, Italy and Spain; "pedestrians form a higher proportion of fatalities in the UK than other countries. For example, the rate of pedestrian fatalities per head of population in the UK is almost three times the level experienced in the Netherlands", (Commission for Integrated Transport, 2007). On the other hand other statistics show a reduction in total number of pedestrian accidents in the UK. Statistical analysis of the UK police accident records (STATS 19) provides a rich data of pedestrian accident records which includes different variables that characterise pedestrian accidents. In this data set, it

appears that number of pedestrian accidents a counted for 13.6 % of the total number of accidents. This percentage ranked third place after driver or rider and passenger. Some previous research and analysis have been conducted in terms of locations of pedestrian accidents. However, they have not further investigated nor modelled this further. In this research therefore, a detailed investigation of the factors affect pedestrian accidents at signalised pedestrian crossing is undertaken. One more objective of this research is to investigate measures of exposure in modelling pedestrian accidents using pedestrian volumes at pedestrian crossing. Lastly, previous work on modelling pedestrian accidents included factors such as traffic flows, width of road, type of crossing facility, time of crossing and socio-economic data. Not much work was done to investigate impacts of the distance of the pedestrian accidents from the crossing lines. Further investigation of this factor is presented in this paper. The paper is divided into three sections. First, an introduction and background of pedestrian accidents statistics is given. Secondly, an investigation of measure of exposure for pedestrian accidents and severities at traffic signalised junctions. Thirdly modelling of accidents severities at signalised junctions are presented.

08A Disadvantaged Users
Lamont : UNDERSTANDING THE DYSLEXIC TRAVELLER THROUGH TRAVEL ETHNOGRAPHY [Centre for Transport and Society, University of the West of England]

ABSTRACT: This paper examines in-situ the co-existence of dyslexia and travel information provision for travel by both car and public transport. Through a travel ethnography study, the researcher examined the movement and behaviour of dyslexic people and observed the informational and emotional setting within which these travellers find themselves during an unfamiliar journey lifecycle. The findings complement and provide ecological validity to previous research, and as such, a change to the fundamental attitude of the transport industry towards dyslexia becomes even more important. Introduction Previous focus group research highlights a clear lack of recognition of dyslexia within travel information provision, which leads to dyslexic people facing poor accessibility to the transport network. Inappropriate information places considerable demands upon dyslexics across an entire journey lifecycle ('the series of stages of information need and use that an individual encounters from deciding to plan a journey to arriving at its destination'), which makes travel difficulties particularly pronounced and persistent. The research also exposes appropriate travel information as a key support mechanism for dyslexic people, vital to managing the physical symptoms of dyslexia and psychological well-being (Lamont and Lyons, 2007; Lamont, 2009). This paper deepens the understandings which emerged from the above mentioned research by examining in-situ the co-existence of dyslexia and travel information provision through a travel ethnography study. By taking this approach, a deeper understanding of the movement and behaviour of dyslexic people and the informational and emotional setting within which these travellers find themselves has emerged.

Parkin : ACCOUNTING FOR THE NEEDS OF BLIND AND VISUALLY IMPAIRED PEOPLE IN PUBLIC REALM DESIGN [University of Bolton]

ABSTRACT: Public realm schemes are being introduced in urban areas without the usual delineation between the footway and carriageway provided by kerb edges. The emphasis is usually on aesthetic enhancement, but the needs of vulnerable road users must also be taken into account. Concern has been expressed about the resulting spaces on behalf of the approximately two million people in the UK who or blind or visually impaired. The research presented in the paper summarises and evaluates current design guidance and its approaches to accommodating blind and visually impaired people. It also presents the results from a questionnaire and in-depth interviews, and observational studies of blind and visually impaired people navigating in urban streets and spaces with and without shared surfaces. These surveys provide a rich set of data to interpret the methods and problems of

navigation. Suggestions from blind and visually impaired people are presented which would help to improve their ability to navigate safely. The results show that blind and visually impaired people can identify many different surface types and delineators, and they use these, along with other features of the urban environment, in creative ways to identify their location and guide themselves. There is evidence of differences in understanding between highway designers and blind and visually impaired people regarding the use and value of features assumed to assist, including tactile paving. Shared Space schemes need to preserve a safe area for pedestrians, they need to provide a rich physical environment of contrasts in terms of surface tactility, colour contrast, and the enhancement of sound and other sensory clues. Further work is required on demarcation aids based on laboratory and real life investigations.

08B Modelling (IV)
Zhang : A comparison study on environmental impacts caused by bus signal priority strategies [Transportation research group]

ABSTRACT: To improve bus efficiency and reliability, implementation of bus signal priority strategies are increasingly promoted due to their dynamic, flexible, and cost-effective features. The most common signal priority strategies involve providing extended green time or early green recall to buses approaching the signalised junction. Previous studies on bus priority have focused mostly on the evaluation of efficiency improvement from such strategies, e.g. delay savings. However the environmental impacts, i.e. changes of emissions and fuel consumption related to bus signal priority, both on buses and general traffic have not been explored. This paper presents early findings from PhD research on this topic. It includes a typical comparison and discussion of the impacts on regulated vehicle emissions and CO_2 caused by 2 main bus signal priority strategies at a junction. In this study, microscopic simulation is considered as the best approach to evaluate bus priority, and then the output obtained from microsimulation is applied into emission models to estimate vehicle emissions.

Ho (Smeed) : IMPACT OF TRANSPORT MODELS ON CONNECTIVITY OF INTER-BUS COMMUNICATION NETWORKS [Imperial College London]

ABSTRACT: Vehicular Ad-Hoc Networks (VANETs) are attracting considerable research and commercial interest with promising applications in a number of areas including cooperative vehiclehighways systems, sensor networks and safety systems. However, due to high speed and variable driver behaviour, automotive ad-hoc networks will behave in fundamentally different ways to the most prevalent models in Mobile Ad-Hoc Network (MANET) research. Previous work in MANETs usually assumes that the mobile nodes move randomly with an unconstrained mobility model and it is clear that a random mobility model is not adequate to represent the major characteristics of real-world vehicle motions, and may therefore lead to unreliable results. Recent studies of VANETs have attempted to introduce macro- and micromobility constraints to model vehicle motions, but they usually focus on modelling the mobility of generic private vehicles. Given the potential for the co-ordinated deployment of network nodes on centrally-managed fleet vehicles, it has become important to model the characteristics of a VANET featuring vehicles of different types, with systematically different behaviour patterns. In this paper, we study the connectivity of mobile ad-hoc networks that consist of buses moving in urban area, and examine the implications for transport-related services. Buses have a unique set of behaviour characteristics, such as fixed routes, schedules, bus stops, specific priorities, etc., which gives rise to distinct impact on node connectivity in the communication network. Through extensive simulations based on real bus routes in central London, we demonstrate the impact of the locations of stops and the prevailing traffic patterns on node connectivity (including the distributions of contact duration and inter-contact time between buses), and explore its implication on the design of a dissemination system to

capture and disseminate data. Our results give a key message that the mobility of buses has to be modelled explicitly, and such kind of knowledge of connectivity among buses will be significant for the studies of routing algorithms and other networking functions in inter-bus communication networks.

08C Environment (II)
Dinwoodie : A SYSTEMS APPROACH TO ASSESSING THE ENVIRONMENTAL IMPACT OF MARITIME OPERATIONS IN FALMOUTH HARBOUR [Plymouth Univsersity]

ABSTRACT: International supply chains embrace numerous ship movements which routinely involve maritime operations in port but currently, few formal tools exist for assessing their environmental impact in smaller ports. This case study based on Falmouth Harbour Commissioners (FHC) explores the contribution of a framework which is accessible to smaller port authorities, to assess the potential environmental impact of maritime operations. The procedures are framed within a systems approach which begins by identifying relevant inputs and outputs. An input-output process modelling technique is used to identify functional units and flows that define processes involved in the environmental assessment. The model first identifies processes at a strategic level, affecting present and future operations and their potential impacts. Next, it defines service processes which are tactical and in which service level and quality are guaranteed through the integrity of processes. At the final output level, operational processes are defined. The systems approach offers a framework within which to plan more sustainable maritime operations and findings present a comparative case study of applications to bunkering and anchoring operations by FHC. Analysis of operations identifies potential environmental impacts, facilitates mitigation of potential risks and equips FHC to assess development proposals pro-actively. A generic systems tool may be emerging.

North : Using heterogeneous sensor networks to characterise the micro-structure of urban air pollution [Imperial College London]

ABSTRACT: Across the European Union, authorities are struggling to meet their air quality obligations for 2010. These problems are particularly acute in urban areas, where transport-related sources dominate and it is imperative that effective method are implemented to monitor, model and manage pollutant emissions from road traffic. Traditional air pollution monitoring is conducted at a relatively small number of fixed locations to investigate trends over long periods. This provides suitable information to judge compliance with existing air quality objectives, but does not provide sufficiently detailed information to inform the design and implementation of effective mitigation strategies. Indeed, the pollution levels observed on street are no longer in line with projections based on activity, emission and dispersion models. In this paper we describe how the pervasive sensing technologies developed in the EPSRC and DfT-funded MESSAGE project can be deployed to provide high-resolution information about the spatial and temporal characteristics of urban air quality. This use case is illustrated with reference to data collected during a combined deployment of three different sensing technologies at a test site in central London that show the formation of pollution hotspots in the vicinity of traffic features such as signalised intersections and pedestrian crossings. These technologies now open the possibility to better understand the mechanisms involved in the formation and dispersion of pollution hot spots and ultimately to proactively manage our traffic to reduce their incidence.

08D Methods
Letherby : [Univeristy of Plymouth]
ABSTRACT:

Roby : APPLYING BUSINESS STUDIES METHODS TO TRANSPORT RESEARCH [Open University]

ABSTRACT: As transport planning and policy diversify from infrastructure development to demand management and Smarter Choices, there is also a need to diversify the research methods for transport studies. With the development of behaviour change as a fundamental part of the Smarter Choices programme, the use of psychology and behaviour change models has been accepted. It should therefore follow that where transport planning involves businesses, such as workplace travel planning, an approach that involves business studies is also needed. A project using aspects of Roger"s Diffusion of Innovations, including the attributes of an innovation and the process of an innovation in an organisation will be used as an example to illustrate this. It shows how a business studies theoretical framework can be used as a structure to analyse qualitative data from case studies. The aim of the project was to understand how workplace travel plans had developed and embedded into an organisation"s processes and culture. To understand this requires an appreciation of the culture and structure of an organisation and how the travel plan fits within them. To help explain this relationship another aspect of business studies, Mintzberg"s Structure in Fives was used. The Mintzberg model describes different types of organisations, such as a professional or machine bureaucracy or a divisionalised form. These forms are then divided into five different parts, which group together the different functions of an organisation and show their interrelationship. This framework was used to help understand the impact of the position of the travel planner on the embedding of a travel plan. This paper will discuss how appropriate the use of business studies methods was for the analysis of the qualitative data for this project. It will then move on to discuss the relevance of business studies techniques as a method in transport studies in general.

09A Policy Issues (I)

Pangbourne (Smeed) : SOME IMPLICATIONS OF THE CHANGING GEOGRAPHY OF SCOTTISH TRANSPORT GOVERNANCE FOR EFFECTIVE TRANSPORT STRATEGY AND GOVERNANCE THEORY [University of Aberdeen]

ABSTRACT: This paper reports on some of the results of a qualitative PhD study of state restructuring of transport governance in Scotland. Seven Regional Transport Partnerships (RTPs) were created in 2006. For this paper, two issues are drawn out in the conclusion: implications of the change for effective transport strategy, and a proposed advance to theoretical conceptualisations of governance. Whilst there is relatively little work on transport governance, there is a substantial body of work on governance per se. The concept 'governance' generally refers to some aspect of the panoply of structures and organisations, both state and non-state, that are engaged in producing government policy outcomes (Jordan et al, 2005). The re-scaling that creates RTPs can be read as a 'hollowing out' (Rhodes, 1997) of post-devolution Scottish state, that is accompanied by a 'filling in' (Goodwin et al, 2005) at the regional level. This has been unevenly carried out, and most RTPs have an ambiguous functional relationship with their constituent local authorities. Four research questions explore: the constraining/enabling effect of the structures; the impact of institutional history; evidence of conflicting interests between scales; and how the empirical evidence relates to existing governance theory. Interviews and documents are analysed within a hybrid framework drawing on Brenner's New State Spaces thesis (2004), Lipietz's notion of 'regional armatures' (1994), as well as collaborative governance (Ansell & Gash, 2008) and trust-building loops (Vangen & Huxham, 2003). The findings suggest that 'hollowing out' and 'filling in' should be extended to encompass a third process of 'overstuffing'. This process is characterised by uncertainty and risk aversion, leading to a 'beltand- braces' approach to governance that actually generates strategic inertia rather than progress.

Jones : Where is everyone going? Analysis of the apparent saturation in car travel [Centre for Transport Studies, Imperial College London / University College London]

ABSTRACT: Recent research both in the UK and the US has identified a levelling-off of the long-term growth in per-capita car travel, preceding both the fuel price increases of the mid-2000s and the more recent economic downturn. Household car ownership, though continuing to increase through the early 2000s, has more recently levelled-off as well. The observation of these changes has stimulated a vigorous debate regarding their explanation and, in particular, their implications for current and future policy. This phenomenon can be explained only in part by changes in socio-demographics (e.g., evolution in the size and composition of the workforce) or growth in alternate methods of travel. Previous research by the authors raised a number of possibilities for further understanding the apparent saturation, with a range of potential implications for future transport policies depending on the salience of the different hypotheses. These hypotheses include the possibility that the levelling-off in car use is associated with structural changes in the influence of factors (such as income, demographics, etc.) on travel demand, changes in operating characteristics of the transport network, or exogenous structural changes in social and economic behaviour (e.g. new types of working arrangements and social networks, diffusion of information technologies, etc.). Descriptive analyses alone cannot resolve between competing hypotheses, nor characterise the relative contribution of different potential explanations to overall patterns of change. For this reason, the aim of this paper is to present the results of dynamic statistical models of car ownership and use based on pseudo panel data extracted from the UK National Travel Survey, over two decades starting from the late 1980s. This research is part of a broader line of enquiry into the determinants, patterns and outcomes associated with car use in the UK.

09B Modelling (V)

Buckland : A WHOLE LIFE VALUE MODEL FOR A PAVEMENT NETWORK [TRL (OU affiliated research centre)]

ABSTRACT: It is accepted good practice in construction that in searching for a sustainable project option both the long-term costs and value benefits should be considered. Whole life cost considers selected cost categories over a set analysis period. The concept of whole life value takes the principles of whole life costing a step forward and represents the balance between whole life costs and the needs and requirements of the stakeholders. Whole life value allows the consideration of more than just the economic factors and aims to include competing factors that drive value. This paper describes the approach being developed to create a whole life value model for use on a pavement network. The concept of „value" within pavement management has been explored to generate an understanding of what is value, what does it mean and how can it be measured. Effort has also been focused on researching value elements for inclusion in a pavement model. This may include developing new methodologies to enable value aspects to be included in the modelling framework. This will provide a tool for a road agency to examine the influence that value parameters can have on the development of a national maintenance programme and assess the whole life value of their pavement network management strategies.

Rhys-Tyler : DERIVATION OF PREDICTIVE MODELS OF VEHICLE EXHAUST EMISSIONS FROM INSTRUMENTED VEHICLE MEASUREMENTS: ANALYTICAL AND STATISTICAL CHALLENGES [Newcastle University]

ABSTRACT: This paper explores some of the analytical and statistical challenges encountered when seeking to derive predictive models of vehicle exhaust emissions from instrumented vehicle measurements. Data at a microscopic temporal resolution (1Hz) from forty drivers on a suburban route is utilised as a case study. A range of analytical issues are highlighted, including temporal synchronisation of dependent and independent variables, determining the most appropriate

temporal sampling resolution, multi-modality in the frequency distribution of exhaust emissions data relating to vehicle operating modes, variability in driver behaviour, and specification of predictive models. Illustrative examples of each issue are presented, utilising the case study as a test case.

Sivakumar : Development of an advanced household activity scheduling methodology for London [Centre for Transport Studies, Imperial College London]

ABSTRACT: In recent years considerable interest has focused on the development of activity-based travel demand modelling techniques as an alternative to conventional trip-based approaches. Amongst the benefits claimed for these approaches are greater behavioural realism and credibility in prediction of travellers' behavioural response, especially to non-marginal policy measures. Work in North America and in some European countries has led to the development and implementation of significant activity-based demand modelling systems, which are being used for operational policy analysis. In the UK however, the practical application of activity based modelling techniques has been much slower. In this paper, we report the first large scale empirical application of an activity-based demand modelling systems for Greater London. The initial application focuses on the development of a household-based activity scheduling model which predicts how individuals select which activities to engage in, for how long and how these activities are scheduled in time. The modelling approach is based on ideas from the TASHA model, originally developed by Roorda and colleagues at the University of Toronto but has been significantly extended to align the treatment of choice behaviour more systematically with random utility theory, relaxing several of the restrictive and deterministic rules in the activity scheduling process. The paper discusses both the processes of data assembly, which combined time use and travel diary data, and the processes of model development and application. Initial results from the empirical application of the model are also presented. This research is part of a broader line of enquiry into understanding the ways in which people's social and economic behaviour in cities result in aggregate energy demands, as an interim step towards developing strategies for improving urban energy efficiency.

09C Environment and Behaviour (I)

Schuitema : PUBLIC SUPPORT FOR STOCKHOLM'S CONGESTION CHARGE: A MATTER OF COLLECTIVE OR SELF-INTEREST? [University of Aberdeen, UK; University of Groningen, The Netherlands]

ABSTRACT: This study examines the relative importance of variables reflecting self-interest (derived from the Theory of Planned Behaviour) and collective considerations (derived form the Norm Activation Model) for the acceptability of the Stockholm congestion charge trial that took place from 3th of January till 31th of July 2006. Two questionnaire studies were conducted among inhabitants of Stockholm, one before the congestion charge was implemented (N=444), and one among a subset of this sample after the trial (N = 143). Results show that the variables reflecting self-interest explained 30% variance in the acceptability before and 25% after the implementation of the congestion charge, which indicates that acceptability of the charge is partly based on rational cost-benefit analyses. We found that variables reflecting collective considerations, in addition to variables reflecting self-interest, explained a substantial additional amount of variance in acceptability judgments before ($\Delta R2 = 20\%$) and after ($\Delta R2 = 18\%$) the congestion charge was implemented, suggesting that collective considerations are important for the acceptability of transport pricing policies over and above rational cost-benefit concerns. Our results indicate that support for transport pricing policies may be enhanced by facilitating reductions in car use and by increasing the awareness of the negative consequences of car use.

Melia (Smeed) : POTENTIAL FOR CARFREE DEVELOPMENT IN THE UK [University of the West of England]

ABSTRACT: This paper aims: to propose a definition and typology of carfree development, to assess the benefits and problems associated with it, to assess the potential demand for 'European style' carfree housing in the UK and the circumstances under which it might be feasible in the UK. Through a review of the literature and study visits to European carfree areas, 3 types of carfree development were identified: the Vauban model, Limited Access model and pedestrianised city centres with substantial residential populations. The study visits supported the claims that carfree developments help to reduce problems created by concentrations of traffic in urban areas. They facilitate active travel and independent play amongst children. Their main problems relate to parking management, although increasing controls in surrounding areas were helping to address this. To assess potential demand in the UK, two surveys were conducted: an online national survey aimed at members of environmental and cycling groups and a postal survey in Camden, London, followed by qualitative telephone interviews with a subset from both surveys. The findings revealed that potential demand for carfree housing is concentrated amongst 'Carfree Choosers' – people who currently live without cars by choice. These are mainly found in the inner areas of larger cities, where the greatest potential for carfree development exists. Some potential may also exist in suburban or exurban centres, where these are well served by multiple public transport connections, including rail.

Khandokar : Investigating the association neighbourhood walkability and social capital and it's impact on community health: a case on Braunstone NDC area [Loughborough University]
ABSTRACT: Literature suggests people living in walkable neighbourhoods are more likely to have a higher level of social capital and tend to live longer and healthier, physically and mentally, than those from a car dependent sprawl neighbourhood. Pedestrian-oriented and mixed-use neighbourhoods enable residents to interact with each other while walking and enhance the frequency of visits for causal contacts and interactions. In recent years, there has been a significant fall in the average number of walking trips made per person in the UK. Remoteness of destinations, fear of crime, lack of time, poor walking environment and poor street connectivity are thought to be contributing to the negative attitudes toward walking. Paying attention to comfort and safety of pedestrians as well as the physical and social aspects of a walking environment is likely to have a positive impact on the walking behaviour. This study aims to investigate the relationship between neighbourhood walkability and social capital and it"s impact on community health through a case study on Braunstone New Deal for Communities (BNDC) area located in the outskirts of Leicester, UK. Firstly, the relative walkability of different neighbourhoods within the BNDC area is measured by studying user perspectives on key attributes of the physical and social environments affecting the walking behaviour. A combination of qualitative (e.g. questionnaire survey and workshops with focus groups) and quantitative (e.g. site survey and geospatial analysis) methods are used to identify the key attributes of the walking environment. Secondly, the key aspects of social capital (e.g. trust, social cohesion, participation in social and community activities, etc.) are measured and compared for each of the neighbourhoods. Finally, the association between neighbourhood walkability social capital and community health is evaluated through a statistical analysis. The findings from this research provide a valuable insight into the walking environment of the neighbourhoods and its impact on social capital, which is envisaged to be used by decision makers in designing walkable neighbourhoods and promoting social sustainability.

09D Technology and Techniques (I)
Box : SIGNAL CONTROL USING VEHICLE LOCALIZATION PROBE DATA [University of Southampton]
ABSTRACT: This paper presents a simulation test bed and methodology for evaluating urban signalized junction control algorithms that use localization probe data from all vehicles in the local area. The simulator is based on SIAS Paramics micro-simulation software with bespoke software modules built on top for automatic network generation, localization data processing and signal

control. Localization algorithms tested use a hierarchical structure of auctioning agents. Early tests of control algorithms on an isolated signalized junction indicate performance that compares favourably with the MOVA algorithm using inductive loop data.

Urquhart : USING REAL-WORLD GEOSPATIAL DATA WITH EVOLUTIONARY ALGORITHMS [Edinburgh Napier University]

ABSTRACT: Developments in the field of Geographical Information Systems (GIS) have increased the availability of on-line road network data and associated routing services. The ability to integrate such data and services into web sites and other business systems provides opportunities to further optimise logistics-based scheduling and routing problems. Evolutionary Algorithms (EAs) are one possible technique for solving such problems. EAs are able to produce robust solutions to benchmark problems, but such problems are frequently based on simplistic Euclidean distances. During the evolutionary process EAs will query the data frequently, many of these queries being used to evaluate what transpire to be sub-optimal solutions. The authors' experience suggests that querying of such on-line GIS systems will incur a time penalty and, may also incur a financial cost per query. The storing, or caching, of routing data or the underlying mapping data is not normally permitted by the suppliers of such data, instead it must be reloaded from the data source each time it is required. The author examines the potential to utilise a mixture of GIS-based routing and estimated distances when using an EA to solve a real-world travel planning problem. Experiments within this paper investigate the extent to which Euclidean based calculations may be substituted for GIS queries without determent to the final problem solution. Initial experiments examine the relative differences between journey lengths when using both types of calculation. Experiments with the EA compare two approaches; that of switching from estimated to actual distances during the run and that of evaluating two sub populations using the differing methods. Full conclusions are presented that show it is possible to reduce the calls to the GIS without adversely affecting the final solution. It is hoped that the results presented will increase the adoption of EA based techniques when solving real-world scheduling and routing problems.

Velaga (Smeed) : ENHANCEMENT OF A MAP-MATCHING ALGORITHM AND DEVELOPMENT OF AN INTEGRITY METHOD FOR INTELLIGENT TRANSPORT SYSTEMS APPLICATIONS [Loughborough University]

ABSTRACT: A vehicle navigation module providing real-time precise vehicle location on a digital map, is becoming one of the most important requirements of any location-based Intelligent Transportation Systems (ITS) service. Any error in the final output of navigation systems may severely degrade the performance of the ITS service. For example, wrong vehicle location identification in an emergency vehicle routing ITS service may confuse the driver and delay an ambulance arrival at the accident site. This makes the service ineffective. Moreover, when the system is not reliable the user should be notified. The main objective of this paper is set to improve a topological mapmatching algorithm and to develop a user-level integrity monitoring method for location-based ITS applications. Map-matching (MM) algorithms integrate positioning data from navigation sensors (such as GPS, dead-reckoning (DR) system) with a digital map in order to identify firstly, the road link on which a vehicle is travelling from a set of candidate links; and secondly, to determine the vehicle's precise location on that segment. The integrity monitoring process of a navigation system provides a level of confidence (trust) to the users. This is accomplished by considering the error sources associated with raw positioning fixes, digital map and MM process. In this study, errors in a topological map-matching algorithm are determined using an extensive positioning data (62,887 positioning points) collected in three different countries (UK, USA and India). After map-matching, each mismatching case was examined and a number of strategies were identified to correct these mismatches enabling enhancement of the topological mapmatching algorithm. A user-level integrity method, which takes into account all error sources associated with a

navigation system is developed. Errors associated with the space segment are examined using a measurement domain Receiver Autonomous Integrity Monitoring (RAIM) method. Then, the integrity of the enhanced map-matching algorithm is carried out by considering a distance residual and a heading residual. These two residuals have the capability to correctly identify the road segment. Here, the uncertainty associated with a digital map has also taken into account. Two knowledge-based fuzzy inference systems are developed to measure the integrity scale. Two independent datasets collected in central and suburban areas of Nottingham, UK, are used to evaluate the performances of the enhanced map-matching algorithm and the integrity method. A reference (true) trajectory is obtained from a carrier-phase GPS receiver integrated with a highgrade Inertial Navigation Systems (INS). It is identified that the enhanced topological map-matching algorithm correctly identified road segments 98.7% of the time which is an increase of 2.2% compared with the performance before the enhancement. This is significant for liability and safetycritical ITS applications. The developed integrity method has the capability of providing 98.13% valid warnings to the users and outperforms existing integrity methods.

10A Policy Issues (II)

Hamiduddin : MOBILITY VERSUS COMMUNITY? EXPLORING THE SOCIAL IMPLICATIONS OF CAR-REDUCED HOUSING [University College London]

ABSTRACT: By restricting car access and infrastructure, car-reduced and car-free housing schemes have recently sought to create socially conducive spaces which limit the need to travel through proximity to mixed land uses and public transportation. In so-doing, such developments have provided a means to approach environmental, social and economic sustainability agendas and have thus become the subject of widespread interest. However, research into the social implications of such housing is limited and it is not clear whether the mobility needs of a fully representative community can be met. This paper examines the rationale for car-reduced housing and proposes a tripartite research framework upon which the results of two pilot studies into social and mobility aspects are discussed. Several strong lines for research emerge from the pilot studies. The next stage of empirical work will seek to build on these findings in order to assess the extent to which car reduction measures can combine universally acceptable levels of mobility with enhanced levels of community development.

Galilea (Smeed) : Comparing the Success of Public-Private Partnerships in Transport between Developed and Developing Countries [University College London]

ABSTRACT: Public-private partnerships (PPPs) have changed the way countries now finance and provide public infrastructure. A PPP is a framework based on a long-term alliance between public bodies and private sector for the delivery and provision of a public infrastructure. A PPP scheme is often financed and operated by a private party in return for revenues (paid by the government or the users of the infrastructure). Investments under PPP agreements are seen as a means of attracting private investment and filling the infrastructure gap between what is needed and what the government can afford. This type of partnership has been employed in a wide range of projects in the transport sector. But PPPs also involve a duality in its conception that endangers its success. On the one hand, the public body that it is promoting a PPP for a certain project is looking to alleviate a market failure and achieve social goals. On the other hand, the private party in charge of the delivery and provision of the PPP will seek to maximize its own profits. The goals from the public body and the private may prove to be conflicting, thus the PPP's success is not granted. This has proven to be true regardless of a country's developing level. The main aim of this paper is to study the factors behind the success or failure of transport PPP projects, focusing on the difference between schemes in developing and developed countries regarding national experience, the presence of private investors, and the influence of multilateral lenders. In order to analyze the

factors that might affect the success of a transport PPP project, a discrete choice framework is used with data from transport sector projects from developing countries and developed countries. The dependent variable is a binary variable, taking the value one if the PPP project is successful and zero if it is unsuccessful. The main explanatory variables are country's past experience with PPPs, variables that characterize a PPP (total investment, type of transport sub-sector), number of sponsors, number of multilateral lenders, country's corruption index, country's democratic accountability index, country's income level, and other macroeconomic variables. So, in order to estimate the regressions, a generalized linear model is used in the form of a logit model. The results of the study highlight the importance of the foundation provided by national experience, especially in the case of PPP projects in the developing world. Not only does national macroeconomic experience appear to have a relevant role, but so also does its past experience (either positive or negative) of transport PPP projects. An interesting finding of the analysis is that the perception of a country's level of corruption and democratic accountability has significant bearing on the final outcome of a PPP project in a developing country, but not so in a PPP agreement done in a developed one. Also, the region and sub-sector of the PPP project seem to play an important role in its success. A country's past experience in PPP agreements in transport is important for developed and developing countries, not only in attracting new investment projects, but also in instilling greater confidence in the success of present projects. This also means that developing countries with poor past experience, or no past at all, will find it more problematical to complete successful PPP projects. However, if multilateral lenders want to promote PPP investments in the developing world, they should support projects in countries with limited or no experience and help them set up a regulatory and/or legislative framework for PPP projects. The perception of a country's level of corruption and democratic accountability appears to be relevant in the final outcome of a PPP project in the developing world. Developing countries with governments perceived as corrupted will hardly find international investors (often those with the most experience in this type of project) or even capable ones willing to construct and/or supply the project. Moreover, usually the company selected could be the one with the higher bribe and/or with the best political connection, rather than the most capable one. On the other hand, projects developed in developing countries with governments perceived as having low democratic accountability can achieve better performance than projects in countries perceived as having higher democratic accountability. In this case, it seems that autarchies may have a better capacity to assist PPP projects, if needed, than in the case of alternating democracies. The importance of the region where the project is located has proven to be relevant for developing countries, making Latin American projects more attractive for success, and thus for future investors. Although European and African projects in the developing world do not have a poor record in terms of their success, they do have less experience in PPP agreements in transport, and this situation could be damaging their score (in relation to Latin American projects). Development agencies should focus on these regions, not only to allow them to grow in terms of experience, but also to help them define a regulatory framework for PPP projects.

10B Modelling (VI)
Carmichael : The impacts of the natural landscape and man-made barriers on individual travel mode choice in three English cities [Highways Agency / University of the West of England]
ABSTRACT: Using data from the baseline surveys of the Department for Transport's three "Sustainable Travel Towns" Darlington, Peterborough and Worcester, this study explores the influence of landscape form on mode choice. Multinomial logit models are used to examine the influence of urban form, landscape form, and socio-economic factors on individual travel mode choice. The analysis suggests that the presence of sloping terrain and barriers, such as railways and rivers, decrease the attractiveness of non-motorised modes. Housing density (which is often the focus of government policy) did not consistently influence mode choice but employment density did. It is clear that omitting landscape factors from mode choice models could have implications on the

decision making process and mis-represent policy options, often to the detriment of encouraging the use of non-motorised modes. This research highlights the relevance and importance of including data on both the built and natural environment in mode choice studies.

Hill : Using real-time aggregated data sets to continually improve prediction by neural networks [Newcastle University]

ABSTRACT: Typically for traffic related pollution parameter prediction in neural networks only a single, or at most a small number of data sources are used. However, in MESSAGE (Mobile Environmental Sensing System Across Grid Environments) there are numerous spatially diverse data sources providing time-series data over deployment periods of days to several months, all of which is gathered and stored in real time in a single unified database. This is in contrast to the typical on-street measurement systems currently in place, which are either in present in small numbers (such as AURN cabins) or do not have easily accessible raw data (SCOOT). By running initial low level predictions across all the multiple data sources available it is possible to single out data sources which "contribute" the most to the first order effects of a neural network predictive model, thus identifying the data sources which are most relevant for the specified model. Due to the aggregated and real-time nature of the database it is possible to automatically and specifically engineer the data source pre-selection needed by the neural network in a continuous and changing manner. This leads to a continually improving system of prediction which responds to changes in the measured system by selecting and deselecting data sources and the associated neural network map. The feasibility of this novel approach will be demonstrated using continuous data streams from MESSAGE in the city of Leicester where a concentrated deployment of pervasive sensors, including AURN and Met data, has led to multiple connected data sources. It can be seen that for different time and different time periods, different neural network mappings are required for the optimum prediction levels. With the system showing the ability to automatically switch to the appropriate neural network map.

10C Environment and Behaviour (II)

Clark : THE PROCESS OF HOUSEHOLD CAR OWNERSHIP CHANGE: A QUALITATIVE ANALYSIS OF REAL WORLD ACCOUNTS [University of the West of England]

ABSTRACT: This paper presents an analysis of qualitative evidence arising from 15 in-depth household interviews which investigated how and why car ownership states, needs and desires change over time. The aim of the interviews was to explore the motivations for transitions between zero and one car (including the process of entering car ownership for the first time) and vice versa, and between one and two cars and vice versa. The paper begins with a short review outlining gaps in knowledge of car ownership behaviour. This provides the rationale for the selection of depth interviews as a means of exploring the process of household car ownership change. An analytical framework which advances the new concepts of 'car access surplus' and 'car access deficit' is then introduced. The paper then presents a six stage cycle for understanding the process of car ownership change. This frames a discussion of the key interview findings, such as the following: - changes in car ownership levels do not appear to be strategically planned - households respond to particular trigger events and changing circumstances according to their spending power, lifestyle preferences and opportunities and constraints arising from the built and social environments; - given the now wide availability of reliable and affordable second-hand cars, many car ownership transactions appear to be prompted by opportunistic acquisitions occurring through social or family networks; and - the availability of and propensity to use alternative means of mobility (e.g. bicycles or adequate public transport), which may emerge as an adaptation response to a change in household circumstances, can act to suppress the need for a second (or indeed first) car.

Aditjandra : THE RELATIONSHIP BETWEEN URBAN FORM AND TRAVEL BEHAVIOUR: A COMPARISON BETWEEN RESULTS FROM A MACRO AND MICRO ANALYSIS IN THE TYNE AND WEAR METROPOLITAN CONURBATION [Centre for Transport Research, University of Aberdeen]

ABSTRACT: Recent literature documents that there is a changing nature of the role of land-use and transport integrated models when used to inform local authorities in making decisions. One of the arguments is that the integrated model is inadequately equipped to address the widening range of transportation goals including promoting environmental preservation, reducing social inequities and improving quality of life. Furthermore, such models are often said to put too much emphasis on targeting the requirements of policies for regional economic growth. The paper offered here looks in detail at output from two different studies with the same research question and using the same case study area in Tyne and Wear, North East England. The research question was to what extent urban form can be shaped to meet targets for a future sustainable urban environment. The regional (macro) integrated transport and land-use data are derived from the recently completed EPSRC SOLUTIONS project for the Tyne and Wear City and Region. This is compared with local travel behaviour data derived from a recently completed PhD study looking at the micro neighbourhood scale. The comparison shows that both studies revealed that spatial strategy and urban form characteristics play a limited role in changing travel behaviour. However, whilst the macro study was found to be limited in understanding the impact of urban form on travel behaviour, the micro study demonstrated that attitudes play a bigger role than urban form characteristics in influencing the patterns of car travel but this is not captured in macro level model. Furthermore, the lack detail in representing slow modes in the macro model also limits the ability of such models to capture sustainable travel behaviour. This points to a need for more research looking into how to better model travel behaviour in a regional context.

10D Technology and Techniques (II)

Bell : THE ROLE OF PERVASIVE SENSOR DEPLOYMENTS IN THE EVALUATION PROCESSES FOR TRAFFIC DEMAND MANAGEMENT STRATEGIES (TDMS) [Newcastle University]

ABSTRACT: This paper describes a new approach, which is designed to be able to evaluate the impacts of TDMS (Traffic Demand Management Strategies) on congestion and the environment. Performance measures will be based on a combination of data from pervasive sensors, namely motes measuring pollution, carbon monoxide [CO] and nitrogen dioxide [NO2], and noise, and legacy systems including SCOOT (Split Cycle Offset Optimisation Technique), traffic loop detectors, AURN (Automatic Urban and Rural Network) and meteorological conditions. The proposed framework has been evaluated using a case study area in Leicester. Analysis of pollutant levels measured by inexpensive static (located on street furniture) pervasive sensors known as motes, will be presented in the paper. Next the process by which the SCOOT data is used to validate parameters of traffic simulation models (congestion states, flows, origindestinations, etc) will be shown. The microsimulation model is used to predict tailpipe emission, taking into account the second by second drive cycles and the canyon model OSPM is then used to predict pollutant concentrations in the canyon at positions that coincide with the motes. Using the SCOOT data for flow and a speed estimate based on delay and independent estimate of emissions and concentrations is produced and compared with that derived by AiMSUn and measured by the motes. In this way an in-depth understanding of the spatial and temporal changes in the congestion and associated carbon monoxide across an area due to recurrent congestion occurring at the shoulders of a football event was made possible. The limitations of the both the AIMSUN and SCOOT derived pollutant estimators were explained. The results of this work showed that both AIMSUN and the SCOOT based estimates emissions estimates along with the Ospm model and measured meteorological conditions can provide estimates of roadside concentrations in a Canyon with a level of statistical confidence reflected by the regression coefficient R2=0.70. Given that this is a first attempt at developing a real-time Canyon model and there is scope to address the shortfalls identified in this work the results

presented in this paper show much promise. The paper has highlighted the benefits of pervasive sensors and how they can compliment legacy systems through their flexibility in covering detection gaps in existing urban networks.

Krishnan : A COMPUTATAIONALLY EFFICIENT METHOD FOR ONLINE IDENTIFICATION OF TRAFFIC CONTROL INTERVENTION MEASURES [Imperial College London, University of York]

ABSTRACT: Adaptive traffic control systems such as SCOOT and SCATS are designed to respond to changes in traffic conditions and provide heuristically optimised traffic signal settings. However, these systems make gradual changes to signal settings in response to changing traffic conditions. In the EPSRC and TSB funded FREEFLOW project, a tool is being designed to rapidly identify severe traffic problems using traffic sensor data and recommend traffic signal plans and UTC parameters that have worked well in the past under similar traffic conditions for immediate implementation. This paper will present an overview of this tool, called the Intelligent Decision Support (IDS),that is designed to complement adaptive traffic control systems. The IDS is essentially a learning based system. It requires an historic database of traffic sensor data and traffic control intervention data for the application area as a knowledge base. The IDS, when deployed online, will monitor traffic sensor data to determine if the network is congested using traffic state estimation models. When IDS identifies congestion in the network, the historic database is queried for similar congestion events, where the similarity is based on both the severity and the spatial pattern of congestion. Traffic control interventions implemented during similar congestion events in the historic database are then evaluated for their effectiveness to mitigate congestion. The most effective traffic control interventions are recommended by IDS for implementation, along with an associated confidence indicator. The IDS is designed to work online against large historic datasets, and is based on traffic state estimation models developed at Imperial College London and pattern matching tools developed at the University of York. The IDS is tested offline using Inductive Loop Detector (ILD) data obtained from the ASTRID system and traffic control intervention data obtained from the UTC system at Transport for London (TfL) during its development. This paper presents the preliminary results using TfL data and outlines future research avenues in the development of IDS.

11 Plenary

Marsden : OPPORTUNITIES AND OPTIONS FOR TRANSPORT POLICY [Leeds, Aberdeen, Southampton, Loughborough, Oxford, UWE]

ABSTRACT: UK transport policy is entering arguably its most challenging period. The 12 years since 1997 has seen record levels of investment in local and national transport systems. There have been notable policy innovations such as the London Congestion Charge and requirements for nationwide School Travel Plans. There have been some successful policy outcomes such as increased rail patronage, serious accident reductions and improved air quality in many places and yet the problems of congestion, climate change, inclusion, obesity and equality are more severe now than at any previous time. The period from 2010 will be characterised by significant and sustained cuts in public expenditure and transport cannot expect to escape from these. It follows that business as usual is not actually an option - so, what are the policy options for transport which parties seeking to govern need to consider? This paper is a think piece developed through collaboration between academics across a range of policy areas including governance, behavioural and social trends, energy and the environment, social equity and equal opportunities, public acceptability and freight. The paper sets out an analysis of the problems using the Driving Forces, State, Response framework. The Response comprises an assessment of five policies which should be started, five which should be stopped and four which should be applied more intensively. The selections demonstrate both strengths and weaknesses in the current policy set and suggest the need for a much broader debate

about where next if the next decade is not to be a cut-price 'business as usual' approach which takes the UK further away from a sustainable transport system.