2011 Milton Keynes – Annual Conference

01 Plenary

Goodwin : Value for Money in a Changing Economy [Centre for Transport and Society, UWE Bristol]

ABSTRACT: Nine areas of spending are compared for value for money, using an innovative method allowing for declining marginal benefits as expenditure increases. The comparison includes allowance for radically new expectations of traffic growth, changes in the treatment of taxation, and the increasing importance of benefits other than classical time savings. Quantitative results suggest that local safety measures, smarter choices and cycling schemes offer the best value for money, then some local bus improvements and new light rail schemes. Highways Agency and Local Roads schemes perform very poorly after updating their results for the new circumstances. A greater total transport benefit can be produced even in the context of substantial public expenditure cuts, though that may require changes to the rules for distinguishing capital and revenue spending.. This version of the written paper reports the method and results, and will be updated at the conference with a discussion of the changing political context within which such research can be accommodated or rejected, because of the challenge and support it gives to different vested interests, and its salience for public and political attitudes and expectations.

02A Transport Demand Management and Integration

Roby : THE IMPLICATIONS OF A CHANGE IN BUSINESS TRAVEL POLICY ON THE WIDER ORGANISATION AND PUBLIC POLICY [The Open University]

ABSTRACT: Business travel, although only accounting in the UK in 2008 for 3% of trips and 9% of the UK's domestic distance travelled (Department for Transport, 2009, pp28), form a higher proportion in major cities (15% of mileage in London), where transport networks are most congested. Additionally, business journeys can be time consuming and tiring for the business traveller, affecting work/life balance and productivity, and also costly for businesses and the economy. The carbon emissions from business travel are an important factor due to longer distances travelled and the high proportion of journeys undertaken by air. In some cases business travel can be as much as two thirds of an organisations total carbon emissions. This paper reports the findings of a study designed to understand the motivations and attitudes of key actors in private sector organisations towards business travel. These motivations include: • The increasing importance of business travel on business costs and productivity due to the recession • Reductions in carbon emissions and the links to corporate responsibility • The demands of customers to reduce carbon emissions through the procurement process • The extent to which advancements in virtual communication technologies reduce the need to travel • A greater awareness of the vulnerability of travellers and to business continuity highlighted by the volcanic ash cloud. The insights into these causal factors and an understanding of the business practices that support, and barriers that hinder a reduction in business travel, are important in forecasting and developing public policy to produce a more holistic approach to managing personal travel, for both business travel and the commute. This paper will report some of these insights and discuss how a change in business travel policy can have extensive repercussions within an organisation, resulting in major impacts on business travel behaviour.

Van Ristell : QUANTIFYING THE TRANSPORT-RELATED IMPACTS OF SCHOOL CHOICE POLICY IN THE UK [Loughborough University]

ABSTRACT: School travel is becoming increasingly car-based and this is leading to many environmental and health implications for children all over the world. If parents can be encouraged to allow their children to travel more sustainably, these impacts could be reduced globally. However, if school choice policy continues to be offered, frequent car travel to school can result in the amount of vehicle miles travelled (VMT) and carbon dioxide (CO2) emissions growing further. The aim of this paper is to outline how the school choice policy affects children's travel to school. The study will show how VMT is affected by children not travelling to their nearest school, and how an increase in VMT leads to higher CO2 emissions. This paper will first examine previous literature and reinforce the research gap. A multinomial logit model will then be used with the data to illustrate the current travel behaviour of English children in their journey to school and examine the difference in VMT and CO2 fuel consumption if the 'school choice' policy is removed.

Atkinson : [University of Leeds]
ABSTRACT:

02B Safety (I)
Tolouei (Smeed) : [University College London (UCL)]
ABSTRACT:

Carroll : ENHANCED STATISTICAL ANALYSIS OF HEAD INJURY DATA [TRL]
ABSTRACT: Despite advances in road safety, head injuries still account for many of the most serious and fatal injuries in road traffic accidents. As such, traumatic brain injury is an important global public health problem. Over the past half a century, a wealth of research has been carried out in an effort to determine the principal mechanisms responsible for head injuries. However, there are still conflicting notions on the mechanisms that cause head injuries. A possible explanation for this incoherence is the confounding factors that appear to have been explored insufficiently in prior research work. Therefore, this study analysed the previous head injury research in greater detail. Published head injury research from the past 70 years has been reviewed to: • Collate existing propositions with respect to mechanisms for head injuries, • Catalogue the criteria that could be used to assess head injury risk, • Draw together a dataset of head injury case data; including an assortment (630 cases) of impact types, impact directions, contact surfaces, species (human or monkey), etc., o Compare this dataset with expected results based on previously published assertions, and o Make use of statistical techniques for this analysis Peak linear head acceleration and the Head Injury Criterion (HIC) were found to be reasonable predictors of serious (Abbreviated Injury Scale, AIS ≥ 3) head injury occurrence. However several features of the impact conditions were shown to contribute to the injury outcome. Injury thresholds should take account of the confounding factors such as the specific impact conditions.

Yang : THE GENDER DIFFERENCE WHEN PERFORMING IN-VEHICLE SECONDARY TASKS [Transportation Research Group, School of Civil Engineering and the Environment, University of Southampton]
ABSTRACT: In-Vehicle Information Systems (IVIS) and Advanced Driver Assistant Systems (ADAS) have been used increasingly in recent years. They benefit the drivers by providing, for example, collision warning, traffic information and in-vehicle entertaining, but also raise safety concerns because of the extra workload they may cause, which in turn could impact negatively on driving behaviour. When the workload increases, the individual differences in performance changes can be large. In order to investigate these differences, for example between genders, this research was

conducted by observing drivers' behaviour while performing a set of auditory tasks in real driving situations using an Instrumented Vehicle. Different levels of auditory in-vehicle tasks were designed and tested. 35 drivers (15 females and 20 males) were recruited to drive and perform the secondary tasks in the Instrumented Vehicle on a pre-defined test route. Drivers' primary task performance (e.g. speed and steering wheel movements), secondary task performance, and the subjective rating of the workload they experienced for each task, were recorded and analysed. The results showed that, as the task demand increases, there is a corresponding increase in subjective rating and a decrease in secondary task performance. Female drivers tend to adopt a conservative strategy both in baseline driving and to cope with the extra demand from the secondary tasks by driving at a lower speed and putting less effort on paying attention to keep to a constant speed. This conservative strategy is also reflected by a lower SDLP (Standard Deviation of Lane Position) whilst performing secondary tasks comparing to male drivers. The gender difference is more pronounced when the task levels are higher, with females making more mistakes in performing secondary tasks, and in having large steering wheel turns. The larger steering turns at higher levels may suggest that the driving performance for female drivers is impaired at higher secondary task levels. As can be seen from the results, perform secondary (auditory) tasks while driving can impact negatively on both genders in terms of subjective (or self-reported) workload, secondary task performance and primary driving performance - but to different extents.

02C Bus Systems

Andrews : THE GREY ESCAPE: HOW AND WHY ARE OLDER PEOPLE REALLY USING THEIR FREE BUS PASS? [UWE, University of Plymouth]

ABSTRACT: Since 2008 those aged sixty and above have benefitted from unlimited area-wide free travel by bus after 09:30. The official policy rhetoric supporting implementation of the measure drew significantly upon the need to reduce social exclusion amongst older people. However, despite a substantial increase in the number of concessionary journeys in England and the associated cost liabilities for local authorities and possibly also operators, there is currently only limited understanding of the wide-ranging effects of providing a free pass on bus use, and in particular to whom benefits from the policy accrue. In part this circumstance results from a methodological focus by evaluation studies hitherto that has favoured aggregate-level data, often at the expense of the very rich contextual information that helps us understand how the individual benefits from using the pass. With this in mind, this paper seeks to understand more about the effects (both intended and unintended) of providing a free bus pass to older people. The paper specifically explores how pass users currently use the bus and how this has changed since the provision of free area-wide travel, highlighting the existence of both tangible and intangible benefits arising from the way pass holders use the bus. Second, it examines what the data can tell us about the benefits of the pass to the individual, leading to the finding that the nature and extent of benefits can vary between different groups of pass holders. The paper offers a fresh insight into previously unexplored uses and benefits of the concessionary bus pass. The paper concludes by exploring possible policy implications of the research in the context of the UK"s ageing and growing population.

Franco (Smeed) : PROMOTING PUBLIC TRANSPORT INTERCHANGE TO INCREASE PATRONAGE IN LOCAL BUS NETWORKS AND REDUCE CARBON EMISSIONS [Newcastle University]

ABSTRACT: In the recent years, bus operators have been increasingly challenged by the loss of patronage due to the rise in use of private cars and the resulting congestion, making difficult to maintain a good service performance especially during peak hours. The deregulation of the public transport industry (creating competition) has tended to disconnect services rather than encourage better provision through integration, which requires co-operation between different transport companies. The main aim of this research is to design, construct and use a model which considers, in

addition to the traditional parameters, such as travel time, passenger demand and economic profit, the carbon footprint per person of transport services. In this way the estimated carbon dioxide, CO_2, emissions will be used to quantify the benefits of public transport and the specific role of interchange. In particular, this paper presents the analysis of a case study based on an area of Tyne and Wear where public transport interchange with either bus or metro is possible. Furthermore, in the area studied, the Metro service currently plays a role of competitor to the operation of buses. In anticipation that the drive towards transport sustainability will witness greater use of public transport, two bus surveys were designed to understand the characteristics of the passengers and the factors affecting the performance of the service. Moreover, the detailed information collected including the speed between stops, dwell time at the stop, vehicle type etc, will enable to parameterise a model which can be used to estimate Carbon Dioxide emissions associated with current competitive services as a precursor to bring about change to public transport interchange on the basis of evidence of reduced carbon emissions.

Polyviou : SIMULATION MODELLING OF BUS AND TRAFFIC INCIDENTS FOR BUS FLEET MANAGEMENT PURPOSES USING INTELLIGENT TRANSPORT SYSTEMS [University of Southampton (Transportation Research Group)]

ABSTRACT: Bus operations throughout the world are being equipped increasingly with Intelligent Transport Systems (ITS) such as Automatic Vehicle Location (AVL). AVL can support a variety of functions, including Dynamic Bus Fleet Management (DBFM) which has yet to be established in most bus fleets in the UK in a systematic way. In order to detect the fundamental role of bus and traffic related incidents in bus-based public transport for DBFM purposes, a microscopic simulation model capable of modelling these incidents has been developed and applied to a variety of scenarios. This paper describes the design and development of the model 'SIBUFEM', for modelling bus operations during whole day periods in which incidents of different types can occur. The paper describes the model's functionality, including the use of journey time profiles, passenger-dependent bus stop dwell times and deterministic time-dependent queuing theory. Results focus on key performance measures including but not limited to bus journey times, passenger waiting times and bus delays resulting from various bus and traffic incidents. SIBUFEM has been applied to a main bus corridor in Southampton, with bus flows increased to produce a high frequency service. A base case of 'normal' operations has been established, for comparison with results from a number of incident scenarios, using key model performance parameters of average bus journey time, bus speed and excess waiting time. Incidents vary from bus breakdowns, to traffic incidents such as road-works, traffic accidents and illegal parking; in SIBUFEM they are specified in terms of their location, duration and severity (loss of capacity). The paper presents results from this modelling showing, for example, the extent to which passenger waiting times increase with increasing incident severity and duration. The paper concludes with a discussion on potential DBFM strategies and how the SIBUFEM can be further developed to allow these strategies to be evaluated.

02D Research Methods and Techniques (I)
Kanturska : [Imperial College London]
ABSTRACT:

Petri : FOLLOWING THE ANT: COOPERATION BETWEEN VEHICLES AND INFRASTRUCTURES, INFORMATION AND MEMORY [Imperial College London, ETH Zürich]

ABSTRACT: In this paper we take inspiration from the decentralised (pheromone-based) navigation behaviour observed in ant colonies to propose a mechanism in which the sourcing, dissemination and use of travel time information relies only on the decentralized interaction between individual

travellers and the transport network infrastructure. Recent developments in traffic sensing, positioning and communications technologies have transformed the data environment available to individual travellers and to network managers. These new data offer the potential for a wide range of new information services but also raise important analytical questions. This paper addresses one of these questions – the development of strategies for the dissemination of routeing information to individual travellers. To date, the transport literature has overwhelmingly focused on centralised strategies but these are known to have a number of important theoretical and practical weaknesses. By contrast, we study a decentralised strategy based on peer-to-peer communication between individual travellers and the local transport infrastructure. Through the comparison of different de-centralised strategies, we identify the necessary conditions for the local mechanisms to be effective and show how and under which conditions they are able to relieve congestion, by rerouting travellers on the base of information collected locally and transported by other travellers. In addition, and analogously to the evaporation of ants' pheromone trails, we find that the aging (or removal) of such information is critical for the efficiency of the system. Indeed, the optimal rate for information erasure appears to be bounded by the inverses of the typical update time of travel time information.

Dalton : Who encourages us to cycle? A novel approach to researching social influence in UK cycling [University of the West of England]
ABSTRACT: This PhD research is an exciting opportunity to explore an under-researched area of transport and health studies; how gender and social influence relate to cycling behaviour. As well as being cross-disciplinary, it is also novel in the usage of a methodology untried in the transport field prior to this. This involves a two-stage methodology involving interviews with existing cyclists, followed by focus groups with members of their social network (family, friends or colleagues). An exploratory study to test this approach in Bristol was carried out from May to September 2010 and involved interviews with eight existing cyclists and focus groups with some of the social contacts of two of them, who were a mixture of cyclists and non-cyclists. This study shows that methodology does seem to be a feasible, though challenging way of collecting data about this important and not fully comprehended area of travel behaviour. Many lessons have been learned over the timeframe of the exploratory study and skills and knowledge have also been developed and extended around data collection and analysis. Further data is now being collected in Cardiff employing a refined version of the same method involving interviews with 20 - 30 cyclists and focus groups with 5 – 10 groups of their social contacts. It is hoped that the research will make a contribution to the growing body of evidence around the workings of social influence, in a new area. It also has potential to enhance our understanding of why greater numbers of women are not cycling in a UK context and how barriers to this may be overcome in the future.

03A Research Methods and Techniques (II)
Susilo : THE IMPACTS OF HOUSEHOLD STRUCTURE TO THE INDIVIDUAL STOCHASTIC TRAVEL AND OUT OF-HOME ACTIVITY TIME BUDGETS [University of the West of England]
ABSTRACT: The amount of travel time made by households and individuals can be seen as a result of complex daily interactions between household members, influenced by opportunities and constraints which vary from day-to-day. Using Stochastic Frontier Model and dataset from the 2004 UK National Travel Survey, this study examines the unseen stochastic limit and the variations of the individual and household travel time overtime. The results show that most of individuals may have not reach their limit yet to travel and may still be able to spend further time in travel activity. The model and distribution tests show that only full-time workers' out-of-home time expenditure which is actually have reached it limit and the existence of dependent children will reduce the unseen constraints of their out-of-home time thus reduce their ability to engage further at out-of-home

activities. Even after the out-of-home trips taken into account in the analysis, the model shows that the dependent children's in-home responsibility will still reduce the unseen boundary of individual ability to travel and engage at out-of-home activities. The analysis also reveals that some groups of population (e.g. high income households, younger people etc.) have a larger needs of spending minimum travel time and also more bigger time constraints in doing their out-of-home travel and activities, whilst others (e.g. male full-time workers) need less travel time to satisfy their minimum travel needs. This study also suggests that the individual out-of-home time expenditure may be a better budget indicator in drawing the constraints in individual space-time prisms than individual time travel budget.

Han (Smeed) : A Multi-Sensor Data Fusion Framework for Travel Time Estimation [Centre for Transport Studies, Imperial College London]

ABSTRACT: This paper presents the development and testing of new methods of multi-sensor data fusion for the accurate, reliable and robust estimation of travel time. Along with the emerging of new sensor technologies, the much greater volumes of near real time data provided by these new sensor systems create opportunities for significant improvement in travel time estimation. Data fusion as a recent technique leads to a promising solution to this problem. This paper reviewed the state-of-art data fusion approaches and its application in transport domain, and discussed both of opportunities and challenging of applying data fusion into travel time estimation. A Kalman filter based estimation framework in this research is proposed to fuse data from Inductive Loop Detectors (ILDs), Automatic Number Plate Recognition (ANPR) and GPS probes. The framework makes use of well known macroscopic traffic flow model to construct a time-space discrete formulations which can be fitted into Kalman filter estimation process. Due to the linearity of the formulations, the nonlinear version of Kalman filter, extended and unscented Kalman filter, are introduced to perform fusion and estimation process. The proposed framework is validated by simulation and data from real world test site. Besides the effectiveness improvement demonstrated in the validation results, the performance of extended and unscented Kalman filter is also compared and analysed. In the end, the principle conclusions from the work and discusses potential developments and further research challenges are drawn.

Wood : New Techniques for the Visualization of traffic flows: A London Cycle Hire Case Study [giCentre, City University London]

ABSTRACT: Visualizing flows between origins and destinations can be straightforward when dealing with small numbers of journeys. Representing flows as lines embedded in geographic space has commonly been used to map transport flows, especially when geographic patterns are important. However, for larger numbers of flows, this approach produces maps that are difficult to interpret, frequently with long journeys obscuring shorter ones. In this paper we show how two new techniques – the Spatial Treemap and the OD Map can overcome these problems. Using data from the recently launched Barclays Cycle Hire Scheme we map the 360 docking stations situated in central London as a regular grid using a Spatial Treemap. This enables us to represent the status and history of all docking stations (e.g. number of free spaces, docked bikes and use in the previous 24 hours) visually. We show how this form of mapping preserves geographic relationships while using map space efficiently. We demonstrate how visualisation can be used to identify cycle users' behaviour and the intervention required to ensure all stations have free spaces and available bicycles. We show how an OD map can be created using this grid projection to visualise all journeys between all docking stations simultaneously. The OD map visualises each cell of an OD matrix but in its geographic position. We achieve this by mapping stations as a two-level hierarchy – each docking station contains a gridded mini-map of London showing the locations of the start points of all journeys that ended at the station. This allows journey patterns to be identified as they change over

space and time. We illustrate this with data recording all journeys made during one month of the London cycle hire scheme.

03B Traveller Perceptions and Psychology (I)

Cruickshanks : Are Privacy Fears Associated with Intelligent Transport Systems Justified? [University of Southampton]

ABSTRACT: The creation of wide-area, real-time monitoring systems for the road network has the potential to achieve a step change in both our understanding of the evolution of congestion and forecasting/information to minimise its economic consequences. While such comprehensive monitoring systems will provide unprecedented levels of information about the network as a whole, however, they also potentially provide substantial information about individual vehicles and individual travellers. There are therefore concerns within the general public that the potential privacy invasions resulting from this increased monitoring will create a 'Big Brother' or panopticon state. This paper examines whether these fears are justified. While it is shown that people's views on privacy are very heterogeneous (varying from completely unconcerned, to concerned to the point of paranoia), drawing on research conducted into both general privacy and the privacy concerns associated with ecommerce, it is identified that the most appropriate definition of a privacy impact is where the increased monitoring associated with intelligent transport systems (ITS) restricts the perceived freedom of travel that an individual currently experiences. This paper therefore considers how the privacy concerns associated with ITS fall into six distinct areas: the volume and type of data collected; errors in the data collected; unauthorised secondary uses of the data collected; inappropriate use of the data collected; a lack of awareness about what the data will be used for; and a lack of control over who can gain access to the data. By identifying the relative importance of these concerns and their applicability to ITS monitoring, this paper considers whether there is evidence that privacy concerns actually impact people's behaviour or, through contrasts with the potential benefits of increased monitoring, whether there exists a level at which individuals are willing to trade their personal data for an individual, (or potentially even a societal), benefit.

Thickett : COGNITIVE PREFERENCE AND DRIVER SPEED: DO PEOPLE RESPOND DIFFERENTLY TO PICTURES OR WORDS? [Newcastle University]

ABSTRACT: This study investigates how attitudes, demographics and personality traits influence preferred driving speed as determined by verbal or visual information presented in a survey. Gender and age differences were found in attitudes both towards risk-taking and preferred driving speeds on some road types. Age was strongly related to several of the preferred speed measures: however, there were many more significant age differences in preferred speeds in pictorial form than in verbal form and age differences were also found in three of the four attitude factors. Some personality correlates with preferred speeds were found for extraversion, neuroticism and anxiety, although boredom was positively correlated with attitudes, but not related to preferred speeds. The findings are discussed in light of the relevant theories of driver behaviour, personality and cognition. Implications for road signs advising speed limits are also discussed.

Gehres : The Social Element of Commuting: Do Current Workplace Travel Assessments Neglect Health and Wellbeing Considerations? [University of Westminster]

ABSTRACT: Since the Brundtland Report in 1987, 'sustainable development' and its nexus of economic-social-environment have been oft-cited across a range of academic, governmental, and professional bodies. However, it is less clear how successfully these organisations have integrated these three pillars of sustainable development into their organisational assessment criteria. This paper will focus on the integration of the 'social' pillar into the assessment of workplace travel and

specifically in commuting questionnaires. We initially review the effectiveness of several current UK transport surveys, then offer a sample alternative by constructing and trialing a new survey to assess the link between commute satisfaction and respondent wellbeing.

03C Travel Information and Marketing
Avineri : APPLYING BEHAVIOURAL ECONOMICS IN THE DESIGN OF TRAVEL INFORMATION SYSTEMS [University of the West of England, Bristol]

ABSTRACT: Providing information about transport-related attributes such as travel time, travel costs or carbon emissions might be seen not only as a service to the public, but as also an instrument to change their travel behaviour. While rational man theory suggests that individuals base choices on the attributes of the choice set (information content), the way information is being presented (information context) has also a strong effect on travellers' behaviour. "Choice architecture", through the design and incorporation of small features in the environment of choice making ('nudges'), could help individuals to overcome cognitive biases, and to highlight the better choices for them - without restricting their freedom of choice. This paper sketches a few of the more interesting among insights from behavioural economics, and suggests examples of how they might be useful for influencing travel behaviour through the design of travel information and help promoting desired travel options.

Trozzi : [Imperial College London]
ABSTRACT:

Howarth : THE IMPORTANCE OF LOCAL ROAD AUTHORITIES IN CLIMATE CHANGE AWARENESS PROGRAMMES [University of Southampton]

ABSTRACT: Climate awareness programmes aim to inform the public of simple steps that can be made to reduce the environmental impacts of personal travel. However they fail to acknowledge that travel decisions are made at the individual level and that tailored strategies would be more effective at targeting distinct behavioural patterns. Statistics show that unsustainable travel behaviour and global greenhouse gas emissions are growing, and due to the perceived indispensable nature of personal travel, shifts to more sustainable modes remain a challenge. This paper aims to determine how local road authorities could update existing climate change awareness programmes to significantly reduce unsustainable travel. Results from postal questionnaires and focus groups in Hampshire identified travel behaviour characteristics and attitudinal traits which determined the extent to which voluntary travel behaviour changes are possible. Three groups were identified: Sustainably Aspiring Motorised Travellers (43.9%) were environmentally-focused, felt morally responsible and obligated to change their travel behaviour yet they travel principally by car. Sustainably Aspiring Active Travellers (29.8%) were characterised by sustainable attitudes and marked active travelling (i.e. by non-motorised modes). Conversely Environmentally Apathetic Motorised Travellers (26.3%) expressed little concern about their own personal behaviour and saw no point in changing it; this was highlighted by their heavy motorised travelling patterns. These results highlight the existence of three different types of individuals based on a combination of attitudinal and behavioural traits; an important consideration not currently identified in the implementation of climate change awareness programmes. These groups are related to different perceptions of the barriers to behaviour change which are dependent implicitly on perceived personal and social gains and losses. In order to overcome these perceived behavioural barriers and encourage the use of sustainable travel modes within cities therefore, climate change awareness programmes promoting travel behaviour change will likely only be successful when they can be targeted and tailored to specific groupings and crucially conveyed within the direct context that

individual travellers experience. Climate change awareness programmes can then be an extremely useful tool to increase sustainable travel behaviour across cities and this paper demonstrates how local road authorities play an important role as part of such programmes.

03D Airports and Aviation
Mayer : Air Traveller Perceptions Of The Green Image Associated With Airlines [University of Huddersfield, Loughborough University]

ABSTRACT: Environmental issues in air transport have grown in importance over the last few years. Many airlines have been proactive to demonstrate environmental credentials. The aim of this paper is to identify air traveller perceptions of different airlines with regard to green image, as well as how passengers perceive different measures that airlines can introduce to reduce their environmental impact. The research is based on a large quantitative survey, of over 600 air travellers, conducted at Liverpool John Lennon Airport between April and July 2010. The data in this papers stems from a range of Likert Scale questions covering attitudinal statements on airlines, and measures that airlines could adopt to improve their environmental performance. When presented with a list of airlines, about half of the respondents were able to differentiate between airlines based on environmental friendliness. The results show that low-cost airlines in general are not seen as more or less environmentally friendly than full service network airlines. Yet air travellers indicate differences in the environmental image based on individual airlines. Furthermore, results vary depending on whether passengers had flown with a particular airline. Passengers also differentiate between measures that airlines can adopt to reduce the environmental impact of aviation. Using newer aircraft is seen as the most effective way to address the issue. There are also significant attitudinal differences between male and female respondents.

Budd : Airport Surface Access in the UK: A Management Perspective [Loughborough University]

ABSTRACT: Air passenger traffic in the UK has increased significantly over the last 30 years, and is forecast to continue to grow for the foreseeable future. This has clear implications for airport capacity in the UK, and is expected to pose a number of important challenges for UK airports. A key challenge is likely to involve the management of airport surface access. Currently, airport access is heavily reliant on trips by private car, and while these journeys can bring vital revenues for airports via car parking charges, as demand for air travel continues to grow, surface access systems at many airports are expected to become increasingly constrained. This could lead to congestion on airport roads, overcrowded car parking facilities, reduced local air quality and increased carbon emissions. This is as much an issue in terms of employees accessing the airport as it is passengers. Airport managers must satisfy the varying demands of different surface access users, whilst formulating surface access strategies that maximise both capacity utilisation and revenue generation in a way that is environmentally sustainable. The paper aims to offer an airport management perspective on airport surface access in the UK. Semi-structured interviews with key personnel responsible for surface access management at 14 UK airports revealed a wide variety of surface access issues and management policies. The need to reduce the share of journeys made by private car is identified as a key issue, with a particular focus on reducing 'kiss-and-fly' journeys for passengers, and increasing the availability of public transport options for employees, who may need to access the airport at times not commonly served by public transport. Furthermore, the growth of low-cost carriers in recent years also poses a number of important surface access issues. Passengers flying on low-cost carriers, for example, may be more likely to use public transport to access the airport than passengers flying on other types of carrier.

Jain : VOLCANIC ASH CLOUD DISRUPTION TO AIR TRAVEL [Centre for Transport & Society, University of West England, Institute of Transport and Tourism, University of Central Lancashire]

ABSTRACT: The severity and suddenness of disruption to European air travel caused by the volcanic ash cloud in April exposed the current reliance on air travel for maintaining social, family and business networks. This paper presents the results of an on-line survey of those affected, conducted during and just after the event. It shows how ICTs were used to inform choices, but sometimes failed because service providers were overwhelmed and people away from home could not access them. The impact of the disruption 'rippled' through the home networks of the stranded travellers, as they supported the traveller with practical assistance, information searches and fulfilled the duties they were unable to perform. The paper discusses whether the findings can provide insights into the consequences of reducing the volume of flights for environmental reasons and if the price of fuel increases.

04 Plenary

Guiver : TRAVEL ADJUSTMENTS AFTER ROAD CLOSURE: WORKINGTON [Institute of Transport and Tourism, University of Central Lancashire]

ABSTRACT: The closure of all roads links between south and north Workington following the floods of November 2009 produced an unusual travel situation. Provision of a frequent and free train service and the erection of a footbridge brought good access between both parts of the town by foot, cycle and train, but a heavily congested 18 mile detour by road. This paper describes the findings of a survey of over 400 Workington residents about how they adapted and how that has affected the way they travel now that road connections have been restored. Adaptations included changing mode, time of travel and changing destinations. Many respondents report personal hardships, including loss of job, health impacts, reduced family visits to relations and the stress caused by extra travelling time. The paper also describes adaptations by organisations and authorities such as providing feederbus services, opening a temporary supermarket and offering different worksites or changed hours to help their employees. The paper considers how the severing of connections required services to be rethought. The discussion questions whether the findings are relevant to more predictable changes such as rising fuel prices and climate change mitigation measures.

05A Transport Policy

Schwanen : ANALYSING SCIENTIFIC RESEARCH ABOUT TRANSPORT AND CLIMATE CHANGE MITIGATION [University of Oxford, University of Aberdeen]

ABSTRACT: This paper examines how transport academics have so far engaged with climate change mitigation in transport and why they have followed the identified trajectories. We suggest that work to date has focused on the effects of improvements in transport technologies, changes in the price of transport, physical infrastructure provision, behavioural change and alternative institutional arrangements for governing transport systems. Yet, a tendency to foreground and favour technological and economic pathways towards decarbonisation can be identified. In terms of research methodologies, positivist and quantitative analysis prevails, although there are signs of experimentation with post-positivist epistemologies and participatory methods. These particular engagements with climate change mitigation reflect mutually reinforcing tendencies within and beyond the academic transport community. We first draw on a revised version of Thomas Kuhn's philosophy of science to explore path dependencies within transport studies, which are at least partly responsible for the predisposition towards quantitative modelling and technology, pricing and infrastructure oriented interventions in transport systems. We then employ the governmentality perspective to examine how transport academics' engagements with climate change mitigation

depend on and align with more general understandings of climate change in UK society and beyond. The analysis makes clear that ecological modernisation and neo-liberal governmentality more generally provide the context for the current focus on and belief in technological, behaviour change, and especially market-based mitigation strategies. While current research trajectories are important and insightful, we also believe that they marginalise alternative ways of knowing and thinking about climate change mitigation in transport, which is a situation to be avoided.

Cavoli : EU POLICIES: WHAT IMPACT ON URBAN TRANSPORT? [University College London]
ABSTRACT: The study looks at the impact that European Union legislation and policies have on transport policy, planning and operation in cities. The aim of the study is to find out how binding (e.g. EU Directives or Regulations) and non binding (e.g. Community Guidelines or Funding) policies initiated by different Directorate Generals (DGs) in the EU Commission have impacted transport policies at city level, specifically in the United Kingdom (UK), France and Spain. The study will identify EU legislation and policies coming from different DGs that directly or indirectly affect local transport policies. This project will also seek to understand how legislation and policy filter down from the supranational level to national and sub-national levels in different countries. Outcomes and outputs directly or indirectly resulting from EU legislation in the field of urban transport will be assessed. Finally an evaluation will be conducted on the local impact of the directive on Air Quality, the 20-20-20 CO2 targets and a funding programme from the Seventh Framework Programme for Research and Technological Development. This paper will report results from initial qualitative interviews with key actors at different levels of government in the UK, France and Spain and will map out the areas in which DGs indirectly and directly influence transport policy.

Taeihagh : Formulating a policy package: what to start with? A new technique for the ranking of policy measures [University of Oxford]
ABSTRACT: A way forward to increase the success of policies which is increasingly discussed is the formulation of a policy package, rather than a combination of measures considered and deployed in isolation. Policy measures are the building blocks of policy packages and primary measures - those policy measures that can directly affect the policy objectives – are the foundations of every package. In the process of formulating a policy package to address a certain policy problem, which is briefly discussed in this paper, an important step is deciding 'what to start with' given the range of primary measures available. This essentially involves a process of ranking the alternatives, commonly done using multi-criteria decision making (MCDM) techniques. In this paper a new methodology for analysis and ranking of policy measures is introduced which combines network analysis and MCDM tools. This methodology not only considers the internal properties of the measures but also their interactions with other potential measures. Consideration of such interactions provides additional insights into the process of policy formulation and can help the domain experts and policymakers to better assess the policy measures and to understand the complexities involved. This new methodology is applied in this paper to the formulation of a policy to increase Walking and Cycling. The results demonstrate the advantages of such a method over the traditional MCDM ranking and the usefulness of the information provided by the policy measure network in the visualisation and analysis of the network structures. Such visualisation can clearly identify for policy makers the effects of the interaction between the measures and of their centrality on their likely effectiveness in influencing the policy targets or their (in)efficiency with respect to implementation and their dependence on other measures.

05B Safety (II)

Darby : INFORMING FLEET ROAD SAFETY POLICY USING CRASH CLUSTERING [Edinburgh Napier & Loughborough]

ABSTRACT: It has been estimated that 25% of collisions on UK roads involve someone driving for work and across the EU 34% of work fatalities involve road traffic or transport accidents. These collisions are not confined to large trucks but include many smaller vehicles where driving is secondary to the employees' main task. In general employees driving for work have an increased risk of involvement in a fatal or serious road traffic accident. Increasingly fleet management has focused on safety and the behaviour of drivers rather than asset management and cost control. Studies have shown that changing the behaviour of both drivers and the rest of the organisation can make a large improvement in safety. This paper reports on a study undertaken of a large UK company which has improved the safety record of its employees while driving for work. This study is based on the analysis of detailed insurance claims data from a fleet of approximately 40,000 vehicles. The company has made significant progress in applying a range of strategies to driver safety. What is clear is that a one size fits all approach to driver safety cannot be expected to work in all cases, with many drivers engaged in a variety of roles. As part of the research drivers were clustered using latent class analysis based on crash profiles. A multinomial logit model was then used to predict crash severity within each class thus identifying previously obscured driver risk dependencies. It is concluded that specific interventions could be aimed at the risks faced by these drivers and that this approach may aid the company in continuing to improve its safety record.

Altwaijri : ANALYSING THE SEVERITY OF TRAFFIC CRASHES IN RIYADH CITY USING STATISTICAL MODELS [Loughborough University]

ABSTRACT: The primary objective of this paper is to explore factors affecting the severity of road injury crashes in Riyadh city, Kingdom of Saudi Arabia. Crash data for Riyadh city were collected from the Higher Commission for the Development of Riyadh (HCDR) for a period of five years from 1426H to 1429H (roughly corresponding to 2004-2008). Injury crash severity data were classified into three categories: fatal, serious-injury and slight-injury. Two nominal response models have been developed: a standard multinomial logit model (MNL) and a mixed logit model to injury-related crash data. Due to a severe underreporting problem on the slight injury crashes binary and mixed binary logistic regression models were also estimated for two categories of severity: fatal and serious crashes. The results from both multinomial and binary response models are found to be fairly consistent but the results from the random parameters model seem more reasonable. Age and nationality of the driver, wet road surface and dark lighting conditions, single vehicle crashes, number of casualties, and the interaction between nationality and excessive speed are associated with increased probability of fatal crashes. Road density the interaction between age and nationality are associated with decreased probability of fatal crashes. More specifically, the probability of having a fatal crash increases with the age of the driver and Saudi drivers (relative to non-Saudi drivers) are associated with the probability of fatal crashes (relative to serious injury crashes). There is no effect of age in slight injury crashes relative to the serious injury crashes. A crash involving a single vehicle is found to be more severe than a crash involving a multiple vehicles.

05C Local Transit Systems

Russell : [Visiting Scholar (December 2010- June 2011) Centre for Transport & Society, University of the West of England]
ABSTRACT:

Fonzone : [Imperial College London]
ABSTRACT:

Lee : Using Census data to examine the impacts on work mode choice and car ownership of English light rail schemes opened between 1991 and 2001 [Cardiff University]

ABSTRACT: There appears to have been very little use of Census data to examine transport policy impacts. Whereas English Census journey data refers only to work trips, it provides travel mode and origin-destination information at reasonably small geographic scales. The decennial interval of Census data is also suitable for examining medium- to-long-term changes in travel behaviour. The paper examines the impacts of light rail schemes opened between 1991 and 2001 in four English cities on car ownership and travel mode along the rail corridors. We attempt to isolate the effects of the new services by comparing the changes in the new light rail corridors with those in 'control' areas. Control areas represent what would have occurred in the light rail corridors if the schemes had not been built. The control areas are selected on the basis of: car ownership, the distance from the city centre and the relative importance of rail in commuting as in 1991. Findings include: a) despite the fact most of the schemes have achieved and even exceeded the forecast ridership over time, the proportion of households owning multiple cars increased in the light rail corridors and typically by more than in the control areas; b) the growing rail shares in the light rail corridors have mainly been at the expense of bus trips; c) the evidence for light rail reducing car use is less clear than expected.

05D Modelling (I)

AL-JAMEEL : EMPIRICAL STUDY OF DRIVERS' BEHAVIOUR AT WEAVING SECTIONS [Salford University]

ABSTRACT: Motorway capacity is constrained by turbulent sections such as merging, diverging and weaving areas. A motorway weaving section is a segment of the road in which an on-ramp is followed by an off-ramp with limited spacing between them. Various equations have been adopted to determine the capacity of such weaving sections. Some of these include factors such as weaving ratio (R), volume ratio (VR) and weaving configuration which influence the weaving capacity. In this paper, drivers' behaviours at weaving sections were studied in order to assess the effect on capacity of such sections and to aid in the development of a micro-simulation model to evaluate the performance of these sections for various configurations. Factors such as VR, R, the upstream traffic characteristics, the frequency of lane changes (FLC), the percentage of the pre-segregation for the upstream traffic of weaving section and the length of weaving section were investigated. Therefore, seven sites of weaving sections with different configurations and lengths have been selected. The results of the analysed data indicated that the FLC differs according to the configuration of the weaving section. For example, in the case of ramp weaving sections (i.e. lane gain/lane drop), the results indicated that the maximum FLC in every 76 metres (i.e. equivalent to 250 feet) within the weaving section is up to 1500 per hour. This value was found to be much higher than those reported in other studies. In addition, the effective length that is used by those weaving vehicles is also influenced by the type of weaving configuration. For short weaving sections (i.e. 150 metres or less) the effective length is basically the whole length, whereas, for relatively longer weaving sections (i.e. 300 metres or more), the effective length is found to be equal to 200 metres or less.

Taylor : AN APPROACH TO TIME-DEPENDENT MODELLING OF QUEUES IN MULTIPLE LANES WITH TURNING MOVEMENTS [University College London]

ABSTRACT: Urban road networks are dominated by junctions with turning movements. Well-established methods exist to calculate capacities of these movements from geometry and volume information, and well-established analytical queue models exist to estimate queue sizes according to demand, capacity and queuing process. However, there is currently no standard analytical, as opposed to empirical or micro-simulation, method to account for interaction of movements sharing

a lane or using adjacent lanes. This paper looks at these questions starting with the basic observation that if a junction approach is divided into two lanes, with fully shared service, the queue size in each lane should be on average half that of the queue on a single lane with the same overall demand and capacity. But in the Pollaczek-Khinchin formula, provided the process is fixed, queue size depends only on the ratio of demand to capacity, making the total queue apparently double that on the individual lanes. While it can be argued that service sharing is an idealisation or even unrealistic, it may still serve as an approximation where there is some interaction of service between neighbouring lanes. It is shown that modification of process statistics on individual lanes is insufficient. Pointers are laid to possible lines of further study, for example by extending the M/M/c or G/G/c multi-server queue models. However, these models seem unable to address all features of the problem. In practical applications, a balance has to be struck between theoretical rigour, accuracy, flexibility and efficiency. The paper develops a simple generalised analytical model and computational method to predict queue sizes in the general case of a two lane approach with turning movements, taking account of lane sharing by different movements, and time-dependence. Modelled and event-based micro-simulation results are compared, showing that model accuracy is comparable with the inherent uncertainty of the outputs.

Al-Obaedi (Smeed) : DEVELOPMENT OF TRAFFIC MICRO-SIMULATION MODEL FOR MOTORWAY MERGES AND RAMP METERING [University of Salford]
ABSTRACT: Traffic congestion has increased rapidly in recent decades mainly due to a sharp increase in vehicles using the road network. In order to deal with motorway congestion, traffic signal devices (ramp metering) installed on motorway entrances (slip-roads) have increasingly been applied on UK motorway sites on a part-time basis to regulate the entering traffic. This paper presents a newly developed micro-simulation model for motorway merge traffic in order to deal with some relating issues with ramp metering design and its effectiveness. The model deals with general as well as more specific drivers' behavioural tasks, such as their cooperative nature in allowing others to merge in front of them either by decelerating or shifting to other lanes (yielding) in the vicinity of motorway merge sections. The main criteria of this model is in applying the car following, lane changing and gap acceptance rules. The model is capable of representing the fact that merging traffic does seldom stop at the end of the acceleration (auxiliary) lane, as observation from a variety of sites suggest. All parts of the model have been calibrated and validated using real traffic data. The Motorway Incident Detection and Automatic Signalising (MIDAS) data for 2, 3 and 4 lane motorways have been used as the main source of data for the process of calibration and validation. Also, the model has been compared with the Paramics micro-simulation software using the same MIDAS data. The newly developed model has been used to assess the maximum traffic that can merge prior to the occurrence of traffic congestion for different percentages of heavy goods vehicles (HGVs) in the traffic stream. The model has also been applied in calibrating and assessing the effectiveness of some ramp metering algorithms including Demand-Capacity, ALINEA and ANCONA algorithms.

06A New Transport Technologies
Lees-Miller (Smeed) : Proactive Empty Vehicle Redistribution for Personal Rapid Transit and Taxis [University of Bristol]
ABSTRACT: The empty vehicle redistribution (EVR) problem is to decide when and where to move empty vehicles in a Personal Rapid Transit or taxi system. These decisions are made in real time by an EVR algorithm. A reactive EVR algorithm moves empty vehicles only in response to known requests; in contrast, a proactive EVR algorithm moves empty vehicles in anticipation of future requests. A problem with reactive algorithms is that idle vehicles tend to wait far from where they will later be needed, which causes long passenger waiting times. This paper describes two new proactive EVR algorithms, called Sampling and Voting (SV) and Dynamic Transportation Problem

(DTP), that move empty vehicles proactively based on demand estimates from historical data. It also develops methods for assessing the performance of EVR algorithms absolutely in terms of both throughput and passenger waiting times. In simulation tests, the proposed algorithms provide lower passenger waiting times than other algorithms in the literature, and proactive movement of empty vehicles significantly reduces waiting times, usually with a modest increase in empty vehicle travel.

Pridmore : A REVIEW OF SCENARIOS FOR TRANSPORT IN A CARBON CONSTRAINED 2050 [European Commission, Joint Research Centre, Institute for Environment and Sustainability and University of Aberdeen, the Centre for Transport Research]

ABSTRACT: In light of the role that the transport sector holds as a growing source of Greenhouse Gas emissions, an emerging literature addresses how it could contribute to reduction targets by 2050. This paper reports on an overview of the scenarios-based literature, to identify the key areas of commonality and departure. First, it reviews the role that the transport sector is expected to take, here, the importance of its contribution is clear. Second, it reports on the expectations for different modes in achieving carbon reductions within the sector. For instance, the greatest reductions are expected to come from the private road passenger transport. This reflects changes that occur under business as usual scenarios - the stabilisation of car traffic and growth in other sectors, but also signals the availability of measures to reduce emissions. Third, it considers the contribution from and the key measures identified. Technological change is expected to contribute between 60% and 85% of total transport emissions savings. The studies differ on how this change could be achieved. In the private road transport sector assumptions on the use of sustainable biofuels, carbon neutral electricity and new technologies are key. Changes in other modes, including air and shipping focus on biofuels and improvements in conventional vehicle technology. The electrification of rail is a consistent theme in the studies. Finally, behavioural change though largely confined to the private road passenger and aviation sectors, is concluded to be an essential ingredient in most studies, contributing between 15 to 40% of savings.

Simpson : ROUTE VARIABILITY: A REACTIVE OR PROACTIVE DECISION? [UCL]

ABSTRACT: The revolution in travel surveys instigated by the advent of Global Positioning Systems (GPS) is only just beginning to be fully comprehended. GPS allows more spatially detailed travel surveys over a greater length of time without an undue increase in burden for participants, creating new opportunities to explore route variation within individual habitual travel. Previous work on variability in day to day travel patterns faced difficulties in getting enough data of high enough quality to be of value. Huff & Hanson (1990) found many individuals were exhibiting more than one type of daily pattern within their habitual travel behaviour, classifying the sources as systematic, ephemeral and structural. Large scale analysis as to the nature of each variation sources has until now been difficult. Ipsos MORI is a media consultancy firm in the UK, currently undertaking a project to create a model to predict individuals' exposure to billboard advertising. Ipsos MORI chose a GPS methodology to observe the actual routes of 20 thousand individuals for ten days over three years and have opened up this vast dataset to UCL. This paper aims to assess the suitability of this dataset to study route variation within individual travel behaviour with several questions examined: whether ten days is sufficient to be able to identify a substantial proportion of variations; is the quality of the data sufficient given location inaccuracies, problems getting readings from startup and delays; the effect of burden and drop-off over the longer methodology period. Using focus-group methodology to establish the types and frequencies of route variations taking place, the paper extends Hanson & Huff's classification of the source of travel variation to include external and internal factors giving rise to reactive and proactive route variation respectively.

06B Walking and Cycling (I)
Hammond : AN EVALUATION OF CHILD PEDESTRIAN TRAINING IN THE UK: THE SCOPE FOR INTERACTIVE TECHNOLOGIES TO AID TEACHING [University of Southampton, Transportation Research Group]

ABSTRACT: Sixty four per cent of the children killed or seriously injured (KSI) on the roads of Great Britain are child pedestrians. Recognition of this issue by the Department for Transport resulted in the introduction of a pilot child pedestrian training scheme, "Kerbcraft", from 2002-2007. Kerbcraft, which aimed to teach roadside pedestrian skills, was trialled in 75 local authorities across England and Scotland, and was successful in improving child pedestrian behaviour at the roadside. This paper presents the findings from a new survey of these 75 local authorities, identifying what training is currently given, in what ways the learning and delivery mechanisms have changed since the original pilot, and the extent to which scheme evaluation and interactive gaming are and could be used in child pedestrian training. The results suggest that the majority of local authorities continued to provide pedestrian training but in an adapted form; often shortening schemes without considering the resulting impact on participants' knowledge and skills acquisition. Accompanied by a widespread lack of effective evaluation it is difficult to ascertain the effectiveness of these schemes compared to Kerbcraft. Given central government road safety funding cuts of 40%, along with a lack of effective evaluation, child pedestrian training could be one area at risk, and supplementary materials may be required to add value to training schemes in the future. This paper argues that interactive video environments could be one addition to the range of training aids available to child pedestrians.

Gordon : THE USE OF NTS DATA TO HELP DEVELOP CYCLE COUNT METHODOLOGIES [The University of Bolton]

ABSTRACT: Accurate estimation of bicycle traffic volumes and trends is important in transport monitoring and planning. As well as manual counts, automatic cycle counters are increasingly being used. Nationally, the government measures levels of cycling activity from information collected in the National Travel Survey (NTS), and the National Road Traffic Estimates (NRTE). The Department for Transport has been concerned about monitoring mechanisms for some time (Department of Transport, 2004) and accepts that surveys tend to under-record the level of cycling activity nationally (Department of Transport, 2005). In particular, students and young men are under-recorded in the National Travel Survey (Anderson et al., 2008), and the lack of surveying of traffic on minor roads leads to an under-reporting of cycle activity, as around four fifths of cycling occurs on this type of road (Department for Transport, 2007). In addition to recording detailed information about journeys, the NTS also records information about the individuals making those trips. Information is given by gender, age and ethnicity, and questions are asked regarding cycling behaviour. The paper presents an analysis of bicycle use from NTS data with a view to informing on methodologies for trend modelling from count data. This will include a review of journey length, time spent travelling, journey purpose, journey start time, day of the week, and journey by Government Office Region. Consideration will then be given to such matters as the required spread and classification of counter sites and potential techniques for grouping the different types of counters. The paper also presents an overview of time series analysis and other statistical methods, a number of methods that have been reviewed in order to find an appropriate technique for handling missing data, and an assessment of how time series analysis may be useful in determining how automatic cycle count data may be analysed to detect changes in levels of cycling over time.

Angeloudis : TOWARDS A REPOSITIONING ALGORITHM FOR BIKE SHARING SCHEMES [Imperial College]

ABSTRACT: Several bike sharing schemes have been deployed around the world over the last decade, with one launching in London over the summer of 2010. A common operational problem

with such schemes is the availability of adequate bikes (enough to satisfy demand from users wishing to depart from an area) as well as empty spaces (in order to accommodate demand from users arriving to an area and wishing to part with their bikes). Arrival and departure patterns are found to vary significantly during the course of each day and the week. To meet both types of demand, bike scheme operators commonly deploy teams that work around the clock repositioning bikes among bike stations throughout the city. Using the London bike sharing scheme as a case study and utilising bike availability data collected from the Transport for London website, we seek to establish bike travel patterns. We then proceed with the development of a bike repositioning algorithm that meets both types of demand while seeking to minimise operational cost. The latter is determined by the amount of teams operating at any time, distance travelled and the amount of bikes that need to be moved across the city as part of this process.

06C Research Methods and Techniques (III)

Hodge : Short-term traffic prediction using a binary neural network [University of York, Imperial College London]

ABSTRACT: This paper presents a binary neural network algorithm for short-term traffic flow prediction. The algorithm can process both univariate and multivariate data from a single traffic sensor using time series prediction (temporal lags) and can combine information from multiple traffic sensors with time series prediction (spatial-temporal lags). The algorithm provides Intelligent Decision Support (IDS) for road network managers to proactively manage problems on the network as the predictions generated may be used to determine if traffic control interventions need to be applied. The algorithm can operate in near-real-time and dynamically; using data from UTC or UTMC systems. It is based on the Advanced Uncertain Reasoning Architecture (AURA) k-nearest neighbour prediction algorithm, which is designed for scalability and fast performance. The AURA k-NN predictor outperforms other machine learning techniques with respect to prediction accuracy and is able to train and predict rapidly. The basic AURA k-NN time series prediction algorithm was extended by incorporating average daily profiles and variable weighting into the prediction in this paper. The average daily profile of a variable is calculated as the average reading of the variable for a particular time of day and day of the week after removing outliers. When data vectors are matched in the AURA k-NN, the daily profile adds an extra dimension to the match. This process was further enhanced by weighting the profile using variable weighting to vary the profile's significance. It is shown that incorporating these two additional aspects improves the accuracy of the prediction compared to the standard AURA k-NN, resulting in a very fast and accurate traffic prediction tool.

Hessami : Multi-modal Transportation as a System of Systems [City University London]

ABSTRACT: In the last ten years a lot of interest has been given to the concept of "System of Systems" which has emerged in many and diverge fields of applications. The term has been linked to problems of complex nature, but so far it has been used in a very loose way, by different communities with no special effort to give it a precise definition and link it to the rigorous methodologies concepts and tools of the Mathematical System Theory. Establishing the links with the traditional approaches is essential, if we are to transfer and appropriately develop powerful and established analytical tools to a field that is unstructured and where very little progress has been made as far as development of a generic and unifying methodology. The area of Transportation has a number of challenging problems which may be addressed within the new framework of "System of Systems". Studying complex problems in Transportation such as increasing capacity of transportation systems under increased demand and strict financial constraints requires methodologies for System Segregation, which really implies development of methodologies for complex system problem decomposition, as well as understanding deeply the implications of the "System of Systems" nature of many of the transportation problems. The main objective of this

paper is to make an attempt to place the loose concept of "System of Systems" within the standard framework of Systems Theory that is suitable for some further formal development and then relate the concept to issues related to transportation. To achieve this, we need to demonstrate the links and highlight the differences with the well established concepts, developed for the traditional engineering paradigms and analyze the context of the emerging paradigms. A central issue to the study of "System of Systems" are issues of decomposition of such problems in a way that facilitates their study. To achieve this we use concepts from Intelligent Manufacturing and in particular the Holonic Manufacturing paradigm [56].

Armstrong : Identifying Critical Links in a Transport Network: A Measure Based Approaches versus a Structural Approach [Intstitute for Transport Studies]

ABSTRACT: Road networks play an integral part in our day-to-day lives, whether used for commuting, for haulage of groceries or for our emergency services. Consequently, should a road in the network be degraded in some way, it could easily have a massive impact on our day-to-day lives. In planning for network degradation, it is useful to know which links in a network will impact most on the performance of the network as a whole when degraded in some way. Typically, the more disruption to the network as a whole that a link causes when degraded, the more critical the link is considered to the operation of that network. As discussed in the abstract, two distinct approaches have been taken in the literature so far into identifying how critical a link is to a transport system: a Performance Measure based approach and a Structural Approach. Much of the literature to date has utilised the Measure-Based approach under the assumption of user equilibrium, an assumption which we will propose, in this setting of short-term network vulnerability, is fundamentally flawed. In this paper we look at a Measure-Based Approach in the form of the Nagurney Qiang (NQ) measure (2008 [9]) under User Equilibrium in a simple single OD-pair, multiple route network and ask whether this and similar measure-based approaches go into too much detail to give meaningful results (that is, precision without accuracy). We then compare and contrast this method with an alternative (less detailed) Structural Approach in the form of a method based on the Max-Flow Min-Cut Theorem as proposed by Ford and Fulkersson (1956 [3]) in which minimum cut sets are used to identify the critical links within a network. We propose that this Min-Cut method gives a good approximation to the NQ measure in ranking links in order of criticality in a network, whilst omitting the detail and so the intensive calculations required in computing the NQ measure.

06D Environmental Appraisal

Rhys-Tyler : Informing air quality management strategies using vehicle exhaust emissions data from remote sensing: A case study of London. [Newcastle University]

ABSTRACT: Atmospheric pollutants have been the subject of regulation through national and international legislation for a number of years. In London, nitrogen dioxide and atmospheric particulates are the two main pollutants of concern within the draft Air Quality Strategy produced by the Greater London Authority. Most particulate emissions come from road transport (engine emissions, and tyre and brake wear). Road transport and heating systems are the main sources of nitrogen dioxide. A major survey of road vehicle exhaust emissions was carried out in London in 2008 using roadside remote sensing techniques. The surveys sampled the 'in-use' exhaust emissions of over 50,000 vehicles at 13 sites. Vehicles were uniquely identified from automatic number plate recognition data using the Driver and Vehicle Licensing Agency database. This permitted the characterisation of exhaust emissions by vehicle category, age, fuel type, engine capacity, and other parameters. Analysis of the data, combined with estimates of vehicle kilometres travelled, allows the estimation of the relative contribution of individual vehicle categories to the air quality problem. This provides an evidential basis for policy development and management interventions. The analysis highlights the growing significance of the 'dieselisation' of the passenger car fleet, and the

non-linear relationship between emissions of oxides of nitrogen and vehicle age in diesel cars. Interesting insights are also provided into the exhaust emissions characteristics of the public transport fleet, and the highly dynamic nature of the situation overall through time. The Greater London Authority is currently considering a range of policy interventions within the Air Quality Strategy, including extending the scope of the existing Low Emission Zone standards, introducing an age limit for taxis, and adopting tougher emissions standards for buses.

Chong (Smeed) : NUMERICAL AND EXPERIMENTAL STUDIES OF SONIC CRYSTAL (SC) NOISE BARRIERS [Open University]

ABSTRACT: Road transportation is essential to our everyday life, but over the years the number of motorised vehicles is constantly increasing. Although we receive a great deal of benefit from road vehicles, their negative impact in terms of road traffic noise could contribute to health issues such as cardiovascular disease and also generally affect the quality of life for people (ie. sleep disturbance and communication). Mitigation of this environmental problem requires noise reduction technologies for motor vehicles, tires, road surfaces, road structures, sound insulation of roadside buildings between source and receiver as well as legislative and administrative systems for noise assessment and control. One of the techniques for mitigating traffic noise is the use of specially designed barriers. In the UK, £5 million are spent annually on highway noise barrier schemes with the intention to provide between 5 and 10 decibels (dB) reduction within the protected areas. A conventional noise barrier is an airtight and sufficiently dense wall which blocks the direct propagation path from the noise source to the receiver. In this paper, we investigate an alternative road traffic noise barrier using an array of periodically arranged vertical cylinders known as a Sonic Crystal (SC). The name 'sonic crystal' is the result of the analogous effects on electromagnetic wave propagation in photonic crystals in the field of optics. Such SCs exhibit a selective sound attenuation in particular frequency bands, called stop bands related to the spacing and size of the cylinders placed in air which makes an important attribute for exploiting them as noise barriers. These stop bands result from multiple scattering within the cylinder array and the large contrast in physical properties (ie. density and speed of sound) between the cylinders and air. The frequencies at which the band gaps occur can be calculated using Bragg's law of diffraction which dictates that the lowest frequency is given by the speed of sound in air divided by twice the centre-to-centre spacing between the cylinders called the lattice constant. The position of stop bands can be tuned to the desired frequency intervals by changing the lattice constant, making them attractive as a noise barrier. The performance of barriers used along highways is affected by temporal effects from moving traffic, vehicle composition and speed. According to the relevant British Standards (BS EN 1793-3, 1998), the normalised traffic noise spectrum expressed in A-weighted decibels (dBA) lies between 100 Hz to 5 kHz, with the main noise energy centred at 1 kHz. Frequently the acoustical efficiency of noise barriers is expressed as the difference between the sound levels before and after the insertion of the barrier which is called the insertion loss (IL). For SC to be effective as a road traffic noise barrier, methods must be found of reducing the angle dependence of the stop bands and ensuring that the first stop band corresponds to the main peak in the traffic noise spectrum. If this can be done, then the aesthetic quality of barriers and their environmental impact (European Parliament, 2002) might also favour SC barriers. The possibility of using a densely-packed periodic array of suitable trees such as bamboo, means that SC can be 'green' to the environment. The appearance of an SC noise barrier might have a rather positive aesthetic impact. After all, the interest in using SC as barriers started with the discovery that a 'sculpture' consisting of vertical parallel cylinders acted as a sound barrier. In addition to multiple scattering mechanism that can lead to band gaps, one of the strategies for improving the band gaps is the use of acoustic resonance for example making each cylinder in the form of a Helmholtz resonators. Such design allows increasing insertion loss (IL) in the low-frequency range if the tube cavity resonances occur at frequencies below the main stop band. Both numerical and experimental results in terms of the acoustic IL of an array of circular tubes using Polyvinyl Chloride (PVC) are reported. Vertical slits are

made along the length of tubes to make use of the cavity resonance effect. Experimental data are obtained for the IL spectra of an array of slit cylinders in an anechoic (echo free) chamber and at a larger scale at outdoors. The Finite Element Method (FEM) software, COMSOL Multiphysics is used to model numerically the frequency response for the experimental results. Theoretical and experimental results show the existence of the Bragg band gaps. A significant improvement is observed if there are slits which induce an additional band gap due to the cavity resonance. Such resonant arrays are found to give rise to relatively angle-independent stop bands in a useful range of frequencies. The results provided by the FEM analysis show good agreement with the experimental data.

bashir : TRAFFIC NOISE CONTROL BY SURFACE ROUGHNESS [Department of Design, Development, Environment and Materials, the Open University,Milton Keynes, MK7 6AA, UK]
ABSTRACT: Growing demand on transportation and road network has resulted in increased levels of annoyance from road traffic noise. Research in more efficient and effective methods of mitigating the effects of traffic noise is ongoing. This paper presents work on utilising the ground surfaces near the road for noise mitigation purposes. In particular, the deliberate introduction of roughness on acoustically-hard (smooth) surfaces is investigated. Given sufficient space such a passive method of noise reduction can be more cost-effective and visually less intrusive than, for example, erecting noise barriers. In laboratory measurements periodic arrays of strips of different cross-section are used to introduce roughness over a smooth, acoustically hard glass surface. Spectra of Excess Attenuation (EA), sound attenuation over and above that achieved by distance spreading, are measured. It is shown that periodic roughness extends the range of frequencies at which the sound is attenuated and raises the possibility of tuning the attenuation due to a rough hard ground surface to fit a particular noise source such as road traffic noise. Numerical models such as multiple scattering theory, Boundary Element and Finite Element methods are used to make predictions of the EA and compare with measurements.

07 Plenary
Box : MACHINE LEARNING IN SIGNALIZED JUNCTION CONTROL ALGORITHMS [University of Southampton]
ABSTRACT: Machine learning techniques can be applied to develop signalized junction control algorithms that can learn control strategies from examples of good control and from experience. This paper discusses the conceptual differences between the conventional approach to signal control and the machine learning approach. An example is presented where a junction control agent was developed to learn strategies from a human expert. This learning junction agent uses localization probe data from vehicles and a system of bids to describe the state of the network. The junction agent learns from the human expert by employing a Neural Network to classify its bid space based on evidence of the human's decision making. Simulation experiments are used to evaluate the performance of learning junction agent and these show that the agent can outperform the High Bid signal control system both in terms of delay and in terms of equitability. The paper concludes with a discussion on how the approach described above can be extended to allow the junction control agent to learn from observational data and experience using reinforcement learning.

08A Rural Transport
Cooper : A BOOKING PORTAL FOR SHARED TRANSPORT IN RURAL AREAS [Edinburgh Napier University, Mobisoft UK, Aberdeen University]

ABSTRACT: Although Demand Responsive Transport (DRT) has developed in a number of urban and rural areas, solutions are local with no mechanism to offer services further afield. Furthermore, transport providers, particularly smaller ones, cannot offer their services to the users easily, even though demand and spare capacity exist, as they cannot afford to invest in advanced scheduling systems. This paper describes the development of a DRT Management Portal (OpenDRT) which will match the demand for shared transport to the supply and allow passengers to actually book transport at a variety of levels of integration up to and including real-time. The technical solution developed within the project will be trialled live in Scotland, testing acceptability to operators and interoperability with other DRT planning tools and demonstrating how existing operators can interface to their current systems and new, smaller, operators can offer their services directly.

Shergold : Rural Car Dependence: An Emerging Barrier To Community Activity For Older People? [University of the West of England]

ABSTRACT: Community activity is identified as a key contributor to quality of life for many older people, and mobility is central to its facilitation. Following the premise that community activity enables the accumulation of social capital within a community, a link is proposed between 'mobility capital' and the sustainability of that community. As older people comprise a growing share of rural populations, they are of increasing importance to both kinds of capital within those communities. However, their mobility is problematic, due to limitations in physical capacities and access to transport. This paper also contends that rural mobility issues are compounded by an increasing focus, in policy and practice, on the car as a mobility solution. To explore this hypothesis, the engagement with community activity of a sample of rural elders living in Southwest England and Wales is examined, drawing on a survey and semi-structured interviews. Key findings were that car availability was important in seniors achieving 'connectedness', although by no means a panacea, and that most journeys for community activity were shorter than 1.5 km. Given the importance of activities to wellbeing it is therefore concluded that more emphasis should be placed in rural transport policy on facilitating short-range travel for social purposes, including walking, cycling and the use of mobility scooters.

Kamruzzaman : RURAL ACTIVITY SPACES AND TRANSPORT DISADVANTAGE: QUALITATIVE ANALYSIS OF QUANTITATIVE MODELS INTEGRATING TIME AND SPACE [University of Ulster]

ABSTRACT: Current knowledge about the relationship between transport disadvantage and activity space size is limited to urban areas, and as a result, very little is known to date about this link in a rural context. In addition, although research has identified transport disadvantaged groups based on their size of activity spaces, these studies have, however, not empirically explained such differences and the result is often a poor identification of the problems facing disadvantaged groups. Research has shown that transport disadvantage varies over time. The static nature of analysis using the activity space concept in previous research studies has lacked the ability to identify transport disadvantage in time. Activity space is a dynamic concept; and therefore possesses a great potential in capturing temporal variations in behaviour and access opportunities. This research derives measures of the size and fullness of activity spaces for 157 individuals for weekdays, weekends, and for a week using weekly activity-travel diary data from three case study areas located in rural Northern Ireland. Four focus groups were also conducted in order to triangulate the quantitative findings and to explain the differences between different socio-spatial groups. The findings of this research show that despite having a smaller sized activity space, individuals were not disadvantaged because they were able to access their required activities locally. Car-ownership was found to be an important life line in rural areas. Temporal disaggregation of the data reveals that this is true only on weekends due to a lack of public transport services. In addition, despite activity spaces being at a similar size, the fullness of activity spaces of low-income individuals was found to be significantly lower compared to their high-income counterparts. Focus group data shows that financial

constraint, poor connections both between public transport services and between transport routes and opportunities forced individuals to participate in activities located along the main transport corridors.

08B Walking and Cycling (II)
Mahoney : The Effects and Changes in Travel Behaviour and Net Pollutant Emissions in Response to Physical Interventions for Walking and Cycling [Oxford University]

ABSTRACT: Evidence of anthropocentric climate change demands a fundamental shift towards less carbon intensive modes of transport. UK private road transport is estimated to account for over one quarter (27%) of CO2 emissions and is one of the few sectors where emission rates are still growing. There is increasing potential for walking and cycling and the role they could play in reducing carbon emissions. Most car journeys are short; 57% of trips are under 5 miles. The literature suggests that walking and cycling has the potential to change travel behaviour away from motorised modes, but there is a lack of credible evidence on the net effects of carbon and infrastructural interventions on population-based levels of walking and cycling. Policies towards promoting a more integrated and sustainable transport system highlight the contribution of walking and cycling towards a low carbon transport system with additional benefits to individual health and more liveable communities. The important question for policymakers and practitioners however is how to increase the modal share of these sustainable transportation modes. One approach is the implementation of localised physical interventions targeted at replacing short car journeys with walking and cycling. Connect2, developed by the sustainable transport organisation Sustrans, is an example of this approach. This ambitious UK wide project aims to transform local travel in 79 communities by creating new crossings and bridges to overcome barriers to walking and cycling such as busy roads, rivers and railways. Through the use of a mixed-method case study approach this research aims to investigate, the effects and changes in travel behaviour and carbon emissions at the household and local levels of a number of Connect2 case study sites. The purpose of this paper therefore is to discuss expected results of the project"s pilot study to be conducted in Cardiff, Wales. It aims to examine and highlight anticipated challenges presented in the process and discuss how the results will ensure the study evolves reliably and practically. The collected information and data shall be analysed to ensure feasibility and validity of the study and derive outcomes such as travel behaviour change, net change in carbon emissions and identify policy implications. The qualitative data for this study will be collected from respondents through household interviews and contextual fieldwork. Using this in-depth approach, it is anticipated that the study"s methodology and the insights into intra-household dynamics will reveal the degree to which this kind of physical intervention is successful for whom, for what purposes and in which type of contexts.

Bartle : INFORMATION-SHARING, COMMUNITY-BUILDING AND TRUST: A CASE-STUDY AMONGST COMMUTER CYCLISTS [University of the West of England]

ABSTRACT: Research into the use and behavioural effects of travel information has concentrated on top-down information from transport providers, but little is known about the role of informal information, shared through word-of-mouth, in everyday travel behaviour. Through our social interactions about travel we may exert not only an informational influence on one another (building our knowledge of other people's experiences into our active travel choices), but also a more subtle normative influence: conveying information about norms of behaviour within a particular social milieu. Drawing on theories of normative and informational social influence and self-categorisation, this paper explores some of the social processes occurring when a small group of commuter cyclists interacted with one another through a specially designed, map-based website over six weeks, sharing their routes and other cycling-related information. A mixed-method approach was adopted, comprising observation of website interactions, participant questionnaires and in-depth interviews.

Although the main narrative on the website and in participants' subsequent reflections concerned the practical use of the information posted, a key finding was the role which the case-study system also played in building, or reinforcing a sense of "community" (group identification). Different, but overlapping aspects of this concept were detected: belonging to a community of cyclists generally, an emerging community of cyclists within the project, or a work-based community in which participants identified with one another as fellow workers rather than "cyclists". Community-building was found to be associated with high levels of trust amongst group members. Thus it was found that the process of sharing information could perform not only a functional role in diffusing practical travel information, but also a social one whereby perceived in-group membership reinforced positive views of cycling as a commuter mode. Both roles were thought to offer particular encouragement to those who were new to cycling or new to a particular workplace, suggesting that web-based information-sharing might be developed as a useful tool within contexts such as workplace travel plans.

Chatterjee : [University of the West of England]
ABSTRACT:

08C Accessibility and Spatial Planning

Beyazit (Smeed) : Unequal mobilities in Istanbul: An analytical approach to understanding the relationships between transport infrastructure, mobility and equality within urban areas [University of Oxford - Transport Studies Unit]

ABSTRACT: Although there is a growing interest on the issue of 'transport mobility and equality' in the last couple of years, the distributional effects of transport infrastructure investments on mobility and its consequences on equality have not been widely explored. The purpose of this paper is to propose a methodology in order to investigate the relationship between investments in transport infrastructure, mobilities and socio-economic structure of cities. The paper uses mobility patterns and socio-economic demographics of Istanbul to explore these issues.

Asad : THE EFFECTS OF RESIDENTIAL LAND USE PARAMETERS POPULATION, LOCATION AND CAR OWNERSHIP ON PRODUCTION TRIP RATES [School of Computing, Science and Engineering / University of Salford]

ABSTRACT: The spatial distribution of people's activities has made travel an essential part of the daily rhythm of our life today. This causal interaction between transportation and land use gives rise to the so-called land-use/transportation system (LUTS). Adequate understanding of this reversible relationship has recently become a necessity for traffic planners, developers, and local governments. In this paper, the potential effects of population, location, and car ownership trip rate parameters are studied in order to investigate their possible impacts on the trip-making patterns for residential site developments. Trics 2009(a) (Trip Rate Information Computer System), being one of the nationally recognised trip generation systems in the UK, is the databank for both the site-specific and trip survey information for selected residential land use subcategories. Production trip rates are calculated for total persons (all modes) and total vehicles counts, with dwelling units as a unit of analysis. Experience has shown that there is substantial variability in observed trip rates, even for apparently similar sites. Furthermore, conventional application of Trics does not include statistical analysis, so that the validity of the results is uncertain. This study extends previous rigorous statistical analysis of residential travel demand forecasting by the author and employs ANOVA (Analysis of Variance) techniques to find out whether the selected parameters have significant effects on residential trip rates.

08D Low Carbon Vehicles

Brady : THE INTRODUCTION OF ELECTRIC VEHICLES TO IRELAND: A SOCIOECONOMIC ANALYSIS [Trinity College Dublin]

ABSTRACT: The objective of this paper is to undertake a social cost-benefit analysis of the proposed deployment of 230,000 electric vehicles in Ireland by 2020. It analyses the socio-economic costs and benefits of this policy by comparing the environmental benefits, expressed in monetary value, with the associated reduction in tax revenues and the cost of the government's electric vehicle grant scheme. The 10% adoption of electric vehicles in Ireland will result in a monetary loss in the region of €324 million ($457 million) for the government (in the order of 0.5-1% of total tax revenue expressed at 2009 levels). The primary reason for this is due to losses in all sources of tax revenue due to the electric vehicle penetration rates required to achieve an appreciable reduction in greenhouse gas emissions.

Daina : THE VALUATION OF LOW CARBON VEHICLE ATTRIBUTES AMONGST POTENTIAL EARLY ADOPTERS [Imperial College]

ABSTRACT: Considerable interest is currently focused on the potential of various low carbon vehicle (LCV) technologies (such as electric and hybrid vehicles) to reduce the contribution of the transport sector to greenhouse gas emissions. Governments and regulators seeking to stimulate the development of LCV markets therefore require insight into the factors likely to be effective in triggering early-adopters of LCV technologies. While many market studies have been carried out in the United States since the 1980s in order to understand how vehicle attributes influence the purchase decisions of early adopters, the UK and European LCV market still needs deeper understanding. In this paper we present the results of a modelling study which aims to characterise the value placed by individuals on various vehicle attributes. The models developed are based on stated preference data collected in 2006 in a study undertaken with a UK sample of potential early adopters of LCVs. Mixed Logit models are used to characterise observed and unobserved heterogeneity in attribute valuations.

Morton : ELECTRIC VEHICLES: WILL CONSUMERS GET CHARGED UP? [University of Aberdeen]

ABSTRACT: Climate change programmes around the globe are relying heavily on the electrification of private transport to achieve carbon reduction targets. Currently, the main focus is on electric vehicles (EVs) in particular, which are novel technologies, including fully electric, plug-in hybrid and range extended electric vehicles. In general, mainstream consumers have no experience with EVs. This presents a significant challenge to the investigation and prediction of the consumer response to such vehicles. In order to accelerate the market, more evidence is needed on the willingness of consumers to respond to this technology and under what combination of fuel prices, incentives, infrastructure provision, technical performance, individual and societal norms success is most likely to be achieved. This paper presents a systematic review of the international evidence to understand consumer behaviour relating to the uptake of cars in general and EVs in particular. The literature falls into two broad categories (i) theoretical texts relating to socio-technical transitions, instrumental, symbolic and affective motives and consumer segmentation; (ii) empirical evidence based on (a) qualitative and conventional questionnaire surveys eliciting consumer attitudes and perceptions of (alternatively fuelled) vehicle attributes; (b) revealed and stated preference surveys of consumer behaviour regarding a variety of vehicle powertrains and (c) consumer responses to EVs before and after (small-scale) vehicle trials. In order to synthesise this evidence, this paper will present a conceptual framework of EV adoption to incorporate the socio-psychological, functional and symbolic motives present in the literature. Moreover, insights as to how behavioural antecedents are likely to prevail in different consumer segments will be included, which goes beyond the typical diffusion theory classification of early adopters and mainstream consumers. Suggestions

as to novel research methodologies are also offered. The results presented will underpin future primary data collection being undertaken by the authors as part of the Consumers and Vehicles sub-project of the Energy Technologies Plug-in Vehicle Economics and Infrastructure programme and as part of a PhD project funded by the UK Energy Research Centre.

09A Travel Behaviour

Steven : Has the introduction of the Cycle to Work scheme increased levels of cycling to work? [University of the West of England]

ABSTRACT: In today's society, there is an even more apparent need to find solutions to two real causes for concern, where traffic congestion can bare so many adverse consequences, and where levels of obesity are higher than before, the quest to stem the flow of these plagues of modern day living is undeniable. This research considers whether the use of a financial incentive has been an effective and useful tool in achieving at least one of these goals. The overarching aim of this study is to establish the value of the Cycle to Work (tax-free) Bike scheme in encouraging people to cycle to work. Using primary data, collected from 248 scheme participants and 101 non-participants, it attempts to identify whether there was a change in travel behaviour among scheme participants and to what extent; and to evaluate if publicity and promotion of the scheme encouraged scheme participation. The study also investigates which socio-economic and other factors influence the propensity to participate in the scheme, and explores the correlation between stages of behaviour change and a person's intention to cycle.

Hubers : THE UNUSUAL SUSPECTS: THE IMPACT OF NON-TRANSPORT TECHNOLOGIES ON SOCIAL PRACTICES AND TRAVEL DEMAND [Centre for Transport & Society (CTS), University of the West of England, Bristol - Centre for Mobilities Research (CeMoRe), Lancaster University]

ABSTRACT: Despite cases in which travel is undertaken purely for its own sake, travel is usually considered to be derived from a need or desire to participate in a wide range of activities – accessing people, goods, services and opportunities. People's schedules of activities in turn are derived from social practices (and the patterning of land use that affects where and when activities can take place). Travel demand, in part, is shaped directly and indirectly through the emergence of various kinds of technologies. Until now, discussion of emerging technologies in the transport literature has focussed on the impact of: (i) transport technologies (designed to assist traffic management and the movement of people through the transport system); and (ii) information and communication technologies (ICTs, that enable a substitution for or reorganisation of travel in time and space). This paper introduces a third type of technologies labelled 'non-transport technologies' reflecting technologies that shape social practices causing indirect impacts on travel demand. The invention of refrigeration, for example, enabled storing food for longer periods both in shops and in homes. This facilitated weekly rather than daily shopping and was allied to economies of scale for retailers in the form of out of town supermarkets. The paper briefly outlines the interpretation of travel demand within transport studies and then goes on to examine some selected examples of past, present and future non-transport technologies exposing the possible indirect influences they can have on travel demand. This exposes that travel demand is not so much derived as embedded within networks of objects and social practices. The paper concludes with discussion of how non-transport technologies may or may not be embraced in transport debates and the policy framework. In particular there is contemplation surrounding the question of how social practices, facilitated by non-transport technologies, might adapt in a setting where travel demand becomes more restricted.

Khorgami : ACTIVITY-BASED DEMAND MODELLING: TOWARDS A COMPREHENSIVE ANALYSIS AND MODELLING OF ACTIVITIES [University College London]

ABSTRACT: Review of the literature in activity-based demand modelling reveals that the developed research in activity generation and scheduling mainly assumes that an individual only takes part in one activity per non-home locations (stops1). Activity-travel demand models developed using conventional travel diaries, use trip-based survey data as a proxy for out-of-home activity data. This assumes that the traveller only takes part in one activity per non-home destination. Also, existing activity-based models using the activity diaries only consider the occurrence of one activity per out-of-home location for individuals. In occasions which individual takes part in more than one activity, these models assume that one of the activities can be the main activity and the rest are nonmain activities. The non-main activities are totally excluded in the process of modelling. The exclusion of non-main activities leads to an overestimation of the duration of main activities and an underestimation of the frequency of total daily activities. Moreover, the decision making rules for selecting the main activity at each location have not been explicitly explained in the existing activity based demand models. The analysis on the 2000 UK National Time Use Survey (TUS) shows that there is an average of 1.26 primary activities per (non-home) stop and on average, individuals take part in more than one primary activity at 20% of stops. According to the analysis results, the percentage of the total amount of time spent at each stop on the 'main' activity, in cases where there are multiple primary activities is about 80%, assuming the main activity is the 'longest duration' activity at the stop. Discussing the analysis results, a conceptual framework for activity-based demand modelling is introduced.

09B Modelling (II)
Hassan : Improving Pedestrian Facilities at Signalised Crossing [University of Southampton]
ABSTRACT: Traffic signal control systems are usually designed to maximise vehicle capacity and minimise vehicle delay with the needs of pedestrians considered separately as necessary. In this context, this research is carried out to improve the signal control at pedestrian crossings by taking account of the total delay to all road users including pedestrians. Upstream pedestrian detection and improved control at pedestrian crossing facilities have been identified as potential alternatives that might enhance pedestrian amenity. These new possibilities are being evaluated using the micro-simulation software VISSIM. Research to date has shown that the VISSIM model is suitable for such evaluation. In this research, the latest signal controlled pedestrian crossing facility, the Puffin, has been modelled and tested. The Puffin model then forms a base control strategy against which new strategies are being evaluated. Travel times and delay of vehicles and pedestrians will be taken as key measures of effectiveness of the new scenarios performance. This PhD research is expected to enhance pedestrian amenity by reducing pedestrian waiting time and might be achieved without increasing other road user delays significantly.

Hill : WEATHER BASED TRAFFIC ASSIGNMENT TO REDUCE LOCAL POLLUTION HOTSPOTS [Newcastle University]
ABSTRACT: Traffic rerouting has typically been advised to avoid congestion and thus increase traffic flow through a city. A side effect of this may be a reduction in congestion and consequential pollution hotspots. However, if spare capacity exists in the system, it is possible to further reduce pollution locally by relocating traffic congestion to areas of high emission dispersion within the city. High dispersion will typically occur in urban canyons that are perpendicular to the wind direction. Urban canyons which are perpendicular to wind direction will form pockets of pollutants on side of the side of street from the recirculation effect caused by the dynamics of wind/canyon interaction. However, the injection of fresh air into the leeward side of the street leads to increased mixing and hence dispersion. Streets parallel to the wind do not form recirculation pockets which can lead to stagnation during low wind speeds, especially over long street lengths. The basic idea was tested using a simplified micro-simulation model before further work was carried out. For the second trial

the traffic network and route assignments were randomly generated from within SUMO and modelled over multiple 10 hour cycles. The dispersion of the emissions was modelled using the Operational Street Parameter Model (OSPM) for a selection of meteorological variables. R was used to complete the analysis. It was found that for a traffic network with spare capacity it is possible to reroute vehicles so that the general emissions over the entire city were largely unchanged but the build up of dangerous pollutants in recirculation zones is reduced. By tracking the movements of pedestrians within the network it is shown that the impact on pedestrians, from potentially dangerous pollutants, is also reduced due to the increased dispersion.

Zhang : Calibration of bus parameters in microsimulation modelling - an exploratory approach using sec-by-sec bus speed data [TRG, University of Southampton]

ABSTRACT: The state-of-practice method to test the validity of a microsimulation model is to compare the simulated outputs against real data on a macroscopic level such as average traffic flow and link speed. Calibration normally refers to the process of altering some parameter values such as headway, reaction time and other model parameters, in order to obtain a valid simulation output. This approach may at some extent have neglected the validity of vehicle behaviour at a microscopic level such as vehicles' instantaneous and individual speed and acceleration, which consequently has restricted its further application such as in instantaneous emission models, due to accuracy and credibility issues. This paper attempts to investigate the kinematic characteristics of bus driving in urban roads from second-by-second bus speed data from London iBus project. Characteristics of bus driving behaviour under different traffic conditions and from different drivers are compared. From this point this paper calibrates some vehicle parameters for buses defined in Gipps car-following model (1981). Gipps model is embedded in a microscopic simulation package- Aimsun, which is used for this study. Bus parameters considered in this paper include speed acceptance level, maximum acceleration and normal-maximum deceleration rate (Definitions for these parameters see the end of section 1). Distributions of these parameters in urban London area are analysed and values of these parameters for Gipps model in Aimsun are suggested. A comparison case study of bus emission prediction using an instantaneous emission model is then conducted by applying different values of bus parameters.

09C Safety (III)
Hibberd : REDUCING DISTRACTION-RELATED VEHICLE CRASHES – EVIDENCE FROM THE PSYCHOLOGICAL REFRACTORY PERIOD PARADIGM [University of Leeds]

ABSTRACT: Background: Drivers are required to engage with various in-vehicle tasks whilst performing the primary task of controlling and navigating their vehicle. Rapid development of in-vehicle technologies has caused an increase in the number and complexity of in-vehicle tasks. Driver distraction from these tasks has a negative impact on longitudinal control of the vehicle including brake reaction time. The precise magnitude of the impairment has not been quantified. Method: The effect of a surrogate in-vehicle distracter task on braking response was investigated using the Psychological Refractory Period paradigm. A driving simulator study was conducted in which participants were presented with an in-vehicle task with variable delay to a subsequent braking task. The stimulus and response modality of the in-vehicle task was varied. Speeded responses were required to both tasks. The purpose of the study was to determine the 'task-free' interval required before a braking event to ensure safe braking performance. Results: Brake reaction time was slower following an in-vehicle task, with the delay in performance increasing with decreasing temporal separation of the two tasks – the psychological refractory period effect. Additional slowing was observed with particular in-vehicle task modalities. Conclusion: This study demonstrates a fundamental human performance limitation in the multi-tasking driving environment. Braking performance is delayed when the driver has to perform an in-vehicle task in the preceding 350

milliseconds. The maximum delay observed equates to an increase in stopping distance of 5.41 metres at 70 mph. Application: These results illustrate two potential methods for reducing the negative effects of distraction on driving performance; in particular the increased occurrence of rear-end collisions. Driver safety could be improved through the management of in-vehicle task timing and selection of appropriate task modalities. Issues with implementation of the results are discussed.

Panchasara : Driven to distraction - a study of the impact of music tempo and genre on driver behaviour [University of Leeds]
ABSTRACT: Despite the near ubiquity of in-car music, research into the impact of music on driver-behaviour is relatively sparse and somewhat divided. For example, there is evidence to show that music can both enhance and detract from driver-performance. This paper sets out the findings of a study to explore, specifically, how variations in music tempo and genre influence driver behaviour. The study focused on younger drivers and utilized the Leeds University desk-top driving simulator to gather behavioural data on a sample of subjects, in conjunction with a self-completion questionnaire. Using the simulator, subjects drove a simulated route involving a variety of 'easy' and 'difficult' driving conditions whilst listening to a carefully selected range of music designed to take in fast and slow examples of the most popular music genres (as well as some driving with no music as a control). Each subject subsequently completed a questionnaire designed to complement and supplement the simulator data. Particular attention is given to potential impacts on driver-behaviour in relation to road safety, with some consideration of what it might be possible to do to mitigate any negative impacts.

batool (Smeed) : ROAD SAFETY ISSUES OF PAKISTAN: AN EXPLORATORY QUALITATIVE STUDY [Institute for Transport Studies, University of Leeds]
ABSTRACT: Pakistan is the world's sixth most populous country and has one of the highest road accident rates with most of the victims being pedestrians, cyclists, motorcyclists and passengers on public transport. This paper presents the results of a qualitative study of road safety issues in Pakistan which was carried out with the intent to develop better understanding of the road safety profile of the country and its emerging issues. A study was exploratory in nature, based on semi-structured interviews, and targeted concerned government officials, academics and general driving population to investigate their perception of factors provoking deviant driving styles in the country. Interviews were tape-recorded and analysed using a 'template analysis' technique. The analysis revealed institutional issues, execution issues, physical and operational issues, behavioural issues and those related to road safety research and accident data bank as salient themes lowering safety standards. This has suggested to carry out reforms at institutional, physical and operational levels and the need to bring change at a societal level through behavioural transformation, intensive traffic monitoring and law enforcement, along with conduction of road safety related research work.

09D Rail Transport
Grigorchenkov : Modelling energy system impacts of flywheel uptake in rail transport [City University London]
ABSTRACT: Rail transportation has a well-established reputation as being an energy efficient and environmentally friendly form of transport. This is achieved essentially due to low rolling resistance and aerodynamic drag per passenger kilometre. However, rail vehicles are heavy and when making journeys with frequent stops, the quantity of energy used for acceleration which is subsequently wasted in braking is substantial. It is possible to recover some of this energy if propulsion is electric but this is typically limited and inefficient. As well as the loss of energy and unnecessary generation

of CO2, the release of energy generated by braking into the ambient air is one of the major causes of overheating in subterranean railway systems. Modern flywheels have been proposed as an efficient and cost effective solution to the problems above and can be highly complementary to electric propulsion systems equipped with regenerative braking. As an alternative to feeding the braking energy back to the power supply system, flywheels allow this energy to be stored on board and reused for a subsequent acceleration cycle. This paper presents an analysis of flywheel electro-mechanical battery requirements for a rapid rail transit service, and quantifies some of possible benefits by considering the transportation system as a whole. Of particular interest is the case for London Underground, one of the largest electricity consumers in the UK. Meeting future demands for additional capacity, whilst cutting costs and tunnel heating, are major challenges for LU. The efficient use of energy is fundamental to the problems, and can be improved considerably by using technically feasible flywheels. Additional benefits of flywheel energy storage, such as optimisation of power supply, simplification of infrastructure, reduction of carbon dioxide emissions and released electricity generation capacity are also explored in this paper.

Matthews : [University of Leeds]
ABSTRACT:

Wan Hassan : The Impact of Station Car Park and On-Train Overcrowding towards the Rail Demand [University of Southampton]
ABSTRACT: This research concerns the relationship between on-train and station car park overcrowding and the impact on rail travel demand, using Revealed Preference (RP) and Stated Preference (SP) methods. A Stated Preference experiment has been designed to consider several attributes (such as parking cost, parking capacity, rail fare and on train seat availability) where the respondents are asked to make a choice between two rail travel scenarios. This survey has been run amongst rail users from three stations within Hampshire (Southampton Airport Parkway, Winchester and Basingstoke) that access rail services by car. A logistic regression analysis is used in order to determine the significant variables that may affect respondents' preferences. The paper will also explain the importance of bringing both overcrowding issues together.

10A Traveller Perceptions and Psychology (II)

Kaparias : A behavioural analysis technique for vehicle-pedestrian interactions [Imperial College London]
ABSTRACT: This paper describes the development and implementation of behavioural criteria in order to analyse the conduct of pedestrians and vehicles when they are required to interact with each other, with particular interest to shared space street design. The new behavioural analysis technique has been developed by identifying the fundamental principles that underpin existing traffic analyses, such as traffic conflicts techniques, and adapting those to a framework that describes the mindset and rationale of road users in shared space. With the help of video footage, the technique is then used to conduct a before-study on London's Exhibition Road site, on which a shared space scheme is currently being implemented. With the main goals being to assess the pedestrians' confidence and the vehicles' tolerance/patience when forced to interact with each other, behavioural trends are related to instantaneous characteristics of the vehicle flow (vehicle approach speed traffic density). The data produced are used to develop generalised behavioural relationships for pedestrian-vehicle interactions, as well as location-specific conclusions for the Exhibition Road site. The results demonstrate the strong influence of traffic density on the behaviour of pedestrians and vehicles alike: crowded road space makes road users feel uncomfortable and as a result they are more alert to potential hazards around them. Also, high vehicle approach speed is

found to be consistent with an aggressive driving style, with motorists travelling at high speeds being less courteous to pedestrians. The paper presents the analysis and results in full.

Waygood : THE EFFECT OF LOSS FRAMING ON THE PERCEIVED DIFFERENCE OF CO2 AMOUNTS: IMPLICATIONS FOR ADVANCED TRAVEL INFORMATION SYSTEMS (ATIS) [University of the West of England]

ABSTRACT: The provision of information on carbon dioxide (CO2) generated by transport to the traveller can be seen as an instrument to increase the likelihood of more sustainable choices being made by individuals. However, little attention has been paid to the design of such information. Loss framing is one technique that could potentially highlight desirable choices, and affect motivation, intention and travel choice behaviour, but its application has not been studied in the context of CO2 information. Loss framing refers to semantically restructuring (framing) a choice so that the tendency for people to avoid losses (loss aversion) guides them to a particular choice. Although loss framing has been found effective in fields like health and home energy use, those considerations had personal impact and dealt with familiar information. Unfortunately, CO2 is a relatively new concept which most people likely don't have experience with and the effects of climate change have external costs rather than personal 'loss' and therefore sustainable mobility choices could be seen as a social dilemma. Therefore, it is not clear whether loss framing would be affective in altering an individual's perceptions. In order to test that, a survey was developed to examine the effect of loss framing on perceived differences between travel-related CO2 amounts. The findings imply that loss framing could be used to highlight differences in CO2 amounts and thus influence decisions through the design of travel-related choices. Advanced Traveller Information Systems (ATIS) designers would structure the presentation of information so that the less (socially) desirable choices had their increased CO2 (the loss) highlighted.

10B Freight and Logistics

Ballantyne : AN ANALYSIS OF LOCAL AUTHORITY VIEWS AND TREATMENT OF URBAN FREIGHT IN THE UK [Institute for Transport Studies, University of Leeds]

ABSTRACT: Freight transport is critical in sustaining and growing the urban economy. For the efficient and effective distribution of goods a balanced set of policies that meets the needs of all stakeholders and all users of the urban road network, including residents, businesses and suppliers is crucial. The European Commission (2009) predicts that the proportion of the European population residing in urban areas will continue to grow for the foreseeable future, and hence the demand for goods and services in those areas continues to rise. Despite these predictions, there remains a strong impression that the requirements of freight distribution and logistics operations are often neglected in urban transport policies and strategies drawn up by local authorities. This paper presents an analysis of some of the findings from eleven in-depth qualitative interviews with representatives from local transport authorities across the UK. The research finds that whilst local authorities acknowledge the importance of urban freight to the local economy they know surprisingly little about it. Only half of the authorities interviewed held detailed information on freight and, on further analysis this tends to be about major freight generators and heavily used routes rather than being an understanding of freight movements across the area. Coupled with a relatively limited level of engagement with freight operators through formal partnerships and consultation processes, the mechanisms for including freight issues in the planning process remain unclear. Further work will consider the problem from the perspective of the freight operators.

Plant : BEHAVIOURAL ANTECEDENTS OF INTER-FIRM LINKAGES IN THE IRISH ROAD FREIGHT INDUSTRY [University of Glamorgan; Dublin Institute of Technology]

ABSTRACT: The Irish road haulage industry exhibits a structure dominated by single-vehicle owner-managed operators and the European Union has made a commitment to promoting sustainable mobility through advanced transport logistics. Ireland's transport policies sustain its trade-dependent economy and this study can help inform those policies. This paper addresses the attitudes of operators towards collaborative alliances. A theoretical framework of behavioural economics is presented and a conceptual model based on it was employed for extracting attitudes. Non-economic factors were explored as key influencers of decision-making. The Theory of Planned Behaviour (TPB) was used as the foundation of the research methodology. A mixed-method survey approach involving qualitative and quantitative methods was used. Content analysis of the qualitative interviews was carried out in order to develop a list of modal accessible beliefs. A structured postal questionnaire was utilised as the primary research instrument. Structural Equation Modelling was applied in order to model the key influencers on owner-managers' intentions to perform collaborative activities.

10C Transport/Land Use Planning
Melia : The Paradox of Intensification [University of the West of England]
ABSTRACT: Urban intensification as part of a smart growth strategy can facilitate low energy transport modes and reduce overall car use, with benefits to the global environment but evidence suggests the effect will be less than proportional. Hence, in locations where intensification occurs, greater concentrations of traffic tend to occur, and this worsens local environmental conditions. This phenomenon is defined below as the 'paradox of intensification'. The consequent challenges for planners and policymakers which arise are considered. The analysis suggests that a compromise involving limited intensification would merely redistribute the balance between the two sets of problems: global and local. It is concluded that urban intensification should be accompanied by more radical measures to constrain traffic generation within intensified areas.

Ieromonachou : OLYMPIC LEGACY PLANNING DILEMMA - DESIGNING TRANSPORT SYSTEMS FOR BEYOND THE GAMES [University of Greenwich/Open University]
ABSTRACT: A major part of the infrastructure programme for the London 2012 Olympics is to provide a legacy that will play a major part in supporting regeneration in the Lower Lea Valley area. Any investment in transport infrastructure must be justified by future use. Legacy use of post-Olympic sports and transport facilities is but one example of a potential solution to the urban planning dilemma, and possibly an easier one to consider. It would be grossly inefficient to build roads and networks that are under-utilised post-Olympics or that need large further investment in order to make them useful after the Games. However, there is little evidence that past Games have delivered benefits to those people and places most in need. Indication of a sustainable and positive legacy from previous Olympic Games is mixed and uneven – for example in terms of improvements to housing and transport, as well as in terms of community and cultural facilities. This paper attempts to pre-empt answers for questions such as: How can well-specified short-term design requirements be combined with the flexibility to address long-term transport needs? How do we know that what we perceive as legacy now will be considered as such in 10 or 30 or 50 years? The paper examines the proposed sustainable transport provision for the London 2012 Olympics and its intended legacy role in economic and social regeneration across East London. A framework is presented, based on a scorecard system, to evaluate the London Olympics transport infrastructure design conundrum. The scorecard factors concerning past host cities include: Aspiration, Urban renewal, Environment, City economy, Tourism, Sports and Community Participation, Disability awareness, Employment, Skills. Part of the dilemma in these types of measurements is the act of hindsight; the impact of the Games is not clearly known until long after the Games are complete.

10D Transport Management

Marsden : INNOVATION AND DIFFUSION THEORY: APPLICATION TO LOCAL TRANSPORT POLICY [ITS - University of Leeds]

ABSTRACT: It is broadly accepted that a business as usual planning future will lead to deteriorations in congestion and social inclusion and lead to failures in attainment of air quality and climate change goals. This implies a need to develop or transfer from elsewhere policies and practices that will deliver a step-change in impact. Innovation theory and the theory of the diffusion of innovations offers some useful insights into the conditions that are necessary for innovations to flourish and breakthrough beyond niche status. In particular, this article focuses on the role of governance mechanisms in facilitating the development of innovations and supporting their subsequent roll-out (to the extent they are deemed successful). Examples of governing by enabling and by authority are provided and discussed. The paper concludes that more resources should be targeted at the innovation and early adoption phases of innovation than is currently the case. Beyond that, the ability of authorities to engage in knowledge exchange becomes critical and this is significantly threatened by the downsizing of local government. Alternative exchange mechanisms are discussed to counter the potential impacts of the financial crisis.

Merkert : Do mergers and acquisitions help airlines to survive in competitive environments? [Cranfield University]

ABSTRACT: Mergers and acquisitions are often seen as a very effective way of surviving in the currently very competitive environments of many aviation markets. Airlines merge or acquire each other for a number of reasons. Often the rationale is simply to get access/slots to key airports (such as Lufthansa/bmi), in other cases airlines hope to leverage synergies and to extend their networks (such as BA/Iberia or KLM/Air France). In the US a number of airlines were saved from financial default by the takeover of another airline, so even antitrust authorities sometimes agree to mergers although in almost all cases they result in less competition in the relevant markets. A number of unsuccessful mergers as a result of for example poor due diligence, clashing company cultures or union resistance make mergers and acquisition not a magic universal measure for successful growth and airline management. This paper is particularly concerned with the growth that many airlines see as mandatory to survive in aviation markets. While it may make sense to grow and benefit from economies of scale, which is easiest and fastest through mergers and acquisitions, at some point airlines may become too large to produce efficiently. This paper applies a non-parametric DEA efficiency analysis to more than 50 international airlines to evaluate whether big is always beautiful, and if not at what point it would make sense from a scale efficiency point of view to not grow any further. This would be of particular interest to the US, where airlines are already quite big and where United Airlines and Continental are just about to merge to an even bigger airline.

11 Plenary

Bell : Comprehensive analysis of traffic congestion over a decade to evaluate carbon emissions impacts of transport policy [Newcastle University]

ABSTRACT: Since 1987 Leicester City Council has invested in SCOOT systems to better manage the traffic aiming to reduce congestion impacts. In 1992 Leicester became the first Instrumented city in the UK and still represents an unique source of traffic and air quality information. Currently with nearly 600 SCOOT links operating and several air quality monitoring stations (AURN, roadside pollution monitors etc.) spread over the city data records are collected and stored in real-time. At Newcastle University the historic information over the recent 15 years (traffic and air quality) has been uploaded into a PostgresSQL database and is being analysed to gain an understanding of how traffic patterns, and more specifically congestion, have responded to the introduction of Transport

policies and traffic management scheme implementation, demographic and land use changes as well as the more short term events such as road works and accidents, for instance. This paper presents the comprehensive analysis of the historic database across a region of Leicester using bespoke automatic statistical techniques. This knowledge is used along with a congestion sensitive carbon dioxide emissions algorithm, fleet compositions and emissions factors based on available literature, to estimate the CO_2 emission over time and most importantly to quantify the 1990 CO_2 emission base case. This represents the crucial information to refer all the future scenarios aiming to reduce CO_2 emission by 80% by 2050.