

2007 Leeds – Annual Conference

1.1 - Plenary

Potter : EXPLORING RAIL FUTURES USING SCENARIOS: [Open University]

ABSTRACT: In 1995 the author of this paper undertook a scenario exercise for British Rail to identify priorities for rail science and technology developments under the new privatised regime. Four market-based 2010 scenarios were developed for UK rail transport: cost-driven, quality-driven, technology-driven and environmentally-driven. These helped to identify areas of strategic R&D that were needed to improve rail's competitiveness. It is now over a decade since this scenario exercise took place. This paper, updating an earlier review (Potter and Roy, 2000), revisits the 1995 scenarios and compares them to what actual market strategies emerged within the privatised railway industry. It explores whether the four scenarios did succeed in capturing the range of market responses that emerged from rail privatisation and what lessons this contains for the use of scenarios transport research.

1.2A - Air Transport

Ryley : AN EXAMINATION OF AIR TRAVEL PREFERENCES IN THE EAST MIDLANDS [Loughborough University]

ABSTRACT: Individuals are flying more than ever before and over greater distances. The increase in demand has been assisted by the removal of many barriers to entry for airlines, through liberalisation of air traffic services in the UK during the 1980s. The boom in no-frills, low cost air carriers (e.g. Ryanair, easyJet) has made air travel more affordable, stimulating both leisure and business demand. The paper examines data from an air travel survey of households in the East Midlands. It aims to examine air travel preferences, and how these preferences vary across population segments. Respondents live within the Charnwood Borough Council area, in both the primary town of Loughborough and the surrounding rural area. The household survey has a particular focus on air travel from the region's primary airport, Nottingham East Midlands airport, although the use of other airports is also considered. Air travel choices are explored for leisure weekend breaks or week-long holidays to eight typical low cost airline destinations (Edinburgh, Dublin, Prague, Rome, Berlin, Alicante, Malaga and Faro). The price sensitivity of respondents to changes in air fares is examined. Attitudinal statements are presented to respondents relating to both the economic benefits and the environmental disbenefits of increased air travel. Results will inform a forthcoming EPSRC project concerning the development of stated choice models to assess the propensity to fly, and how this propensity varies across population segments. Research findings are of benefit to aviation policy-makers, airlines and regional airports.

Dennis : We're all going on a summer holiday! Impact of the low-cost scheduled airlines on charter operations and the inclusive tour holiday market [Transport Studies Group, University of Westminster]

ABSTRACT: In the last few years however, the low-cost carriers have encroached on the inclusive tour holiday market by launching scheduled services to holiday centres in the Mediterranean and Alpine regions and also lake resorts in Eastern Europe. The charter airlines were already some of the lowest cost providers of air travel in Europe with high load factors, seating densities and aircraft utilisation. The cost differentials between the charter and low-cost scheduled airlines are assessed and it is demonstrated that the low-cost airlines cannot achieve much advantage. Their main selling

point is greater flexibility. They may also have employed a higher level of differential pricing than is effectively applied to the air component of package holidays.

Dargay : The demand for air travel and air freight in the UK [ITS, University of Leeds]

ABSTRACT: This paper presents the main results of a project on aviation currently being carried out for CfIT in the context of aviation and climate change. The object of the study is to provide a critical review of the empirical literature on the elasticities of demand for air travel and air freight and to examine the implications of the elasticities for the economic, social and environmental impacts of aviation. The paper provides an historic overview of the development of air travel and air freight in Great Britain and a critical review of existing projections of future demand and emissions in both of these markets. The analysis considers journeys by UK and foreign residents, by destination and for leisure and business trips separately. The paper also presents the results of a critical review of the empirical literature on the demand for air travel and air freight, providing empirical evidence concerning price and income elasticities of demand. Studies both for the UK and other countries are included in the literature survey, and transferability of the results to the UK is discussed. "Most-likely" elasticity values for various market segments are presented. The major part of the paper is a presentation of new empirical work carried out for the UK on air passenger and freight demand. The study is based on data from the International Passenger Survey (IPS) for the years 1989 to 2005, CAA data on air freight and various national data sources. The passenger market is segmented into leisure/business and long haul/short haul. A dynamic panel data model is estimated and both short- and long-run fare and income elasticities are presented and compared for the different market segments. The results for the UK are compared with those in the literature review.

1.2B - Assignment Modelling

Chow (Smeed) : ANALYSIS OF DYNAMIC TRAFFIC MODELS AND ASSIGNMENTS [University College London]

ABSTRACT: This paper develops a comprehensive framework for analysing and solving traffic models and assignments in dynamic setting. Traffic models capture the time-varying travel times and flows on a road network and traffic assignments represent the corresponding responses of travellers. There are two different kinds of traffic assignments: dynamic user equilibrium and dynamic system optimum. Under dynamic user equilibrium, traffic is assigned such that for each origin-destination pair in the network, the individual travel costs experienced by each traveller, no matter which combination of travel route and departure time he/she chooses, are equal and minimal. The system optimum assigns traffic such that the total system cost of the network system is minimized. The system optimal traffic pattern provides a useful benchmark for evaluating various transport policy measures such as implementing dynamic road tolls. This system optimal assignment is formulated as a state-dependent optimal control problem. The analysis developed in this paper is novel and it can work with general travel cost functions. Numerical examples are provided for illustration and discussion. Finally, some concluding remarks are given.

Teklu (Smeed) : A Markov Process Model for Frequency-based Transit Assignment with Strict Capacity Constraints [Institute for Transport Studies, University of Leeds]

ABSTRACT: Across the cities of world, a variety of transit services operate differing in the size of vehicles used and their ownership and organization. In terms of vehicle capacities, the spectrum of services ranges from rickshaws to double-decker buses. Some cities have only individually owned vehicles while others have a centrally owned company providing the transit services. A single type of service is provided in some cities while others have a multitude of services with different vehicle types and different ownership and organisational structure, often in competition with one another.

This study was motivated by a transit environment of competing services provided by small individually-owned minibuses; specifically it is concerned with representing passengers' route choices in a unimodal system where the transit vehicles have small capacities (10 – 15 seats). Passengers' route choices and costs in transit networks are forecasted using transit assignment models. Frequency-based transit assignment models describe the transit supply system based on average line headways or frequencies. Representing route choice in such models needs to account for the availability of multiple attractive lines that are available for all or part of passengers' journeys. Spiess & Florian (1989) introduce the notion of optimal strategies that assumes passengers choose a strategy: i.e. passengers have a fixed subset of attractive lines for every stop they might encounter on their trip, and (at each stop) board the first arriving bus from that set. In a slightly more restrictive way, De Cea & Fernandez (1993) define a route as a (fixed) sequence of transfer stops, whereby the set of attractive lines is chosen between each pair of transfer stops to minimize expected travel time, making up what are called route-sections. De Cea & Fernandez require all lines in the attractive set to share the same transfer stops. Representing the effect of strict capacity constraints on passenger cost and route choice forecasts is a challenging issue. In the literature, attempts to model capacity constraints include: BPR congestion functions (e.g. De Cea & Fernandez, 1993, Wu et al., 1994), effective-frequencies (e.g. Cepeda et al., 2006), probability of failure-to-board (Kurauchi et al., 2003), and the loading priorities approach (Hamdouch et al., 2004). The BPR and effective frequency functions are difficult to calibrate, and the latter may not consistently represent the effect of capacity constraints on passenger distribution on the attractive lines and waiting cost estimates. The failure-to-board approach does not account for any increase in waiting costs prior to demand exceeding capacity. The loading priorities approach assumes passengers prefer to board the line with more spare capacity, without considering other in-vehicle costs. Almost all frequency based transit assignment models aggregate the capacity of services (strategies) over the entire modelling period and only constrain the assigned flows to the aggregate capacity without considering whether or not individual vehicle capacities have been exceeded. This does not account for any additional costs that might accrue due to the real capacity limitations of individual vehicles. This paper presents a Markov process model for frequency based transit assignment with strict capacity constraints. Monte Carlo simulation provides stochastic demand (passenger arrivals at stops) and supply (vehicle headways). The model considers the day-to-day dynamics of passengers' route choice and cost experiences; these experiences include failure to board individual vehicles that are full. This Markov process model simulates the evolution of the transit system and its convergence towards a stationary equilibrium probability distribution for the passengers' route cost expectations – the system state variable. A Random Utility Model (RUM) is used to model passengers' route choice, based on their cost expectations that are built up via a learning process model. Theoretical proof of the regularity of the route choice model is given, which ensures the existence of a unique stationary distribution of the state variable regardless of the initial conditions. To obtain realistic estimates of passengers' cost experiences on alternative routes, a simulation model that explicitly considers the stochasticity in passenger and line inter-arrival headways, queuing behaviour at stops, as well as the dependence in flows assigned in consecutive stops is used. FIFO queues are assumed at transit stops. To obtain democratic cost sampling across all alternative routes, ghost objects (probes) are generated at a constant rate and made to travel along them – experiencing any congestion without contributing it. A RUM is proposed to model passengers' route choice, assuming passengers do not have perfect knowledge of the line travel times, and perceive waiting times differently. Passengers' perceived route costs comprise travel time, waiting time, and fares and an error term. Correlations between the travel costs on alternative routes are explicitly modelled. Instead of going through an attractive lines pre-selection stage commonly used in transit assignment models, the route choice model is based on an "all-route-sections" menu, allowing every possible combination of lines, not constraining what passengers include in their choice set of attractive lines. An application of the Markov process model is presented using a small test network. Sensitivity of the model to different model parameters is presented. The model is

compared with the analogous SUE framework (without considering passengers' learning behaviour). Finally, comparisons are made with a stochastic version of the effective frequency approach.

Stewart : Stochastic System Optimisation by Tolling under Stochastic Assignment with Multiple User Classes [Napier University]

ABSTRACT: Recent work has defined a Stochastic System Optimum (SSO) (Maher et al, 2005) and has developed methodologies to determine toll sets in the case of Stochastic User Equilibrium (SUE) (Stewart and Maher, 2006). It is of interest to consider the case for tolling to achieve optimal traffic flows through a network when potentially a different set of link tolls may be applied to different sections of the driving population and the proposed paper will extend the formulation for SSO to include MUCs (where the different groups of drivers are assigned different generalised cost functions to account for the difference in travel time and route constraint between groups), such that total perceived network travel costs for all classes are minimised and will present an objective function for MUCSSO. In stochastic modelling this may be achieved by assigning different values to the dispersion parameter (Maher and Hughes, 1996a), and objective functions for MUCSUE have been defined as extensions of the SUE objective function (Maher and Hughes 1996, Maher 1998). To achieve such a flow pattern under an MUCSUE assignment, link tolls will be applied, which may differ for each user class. Marginal social cost price (MSCP) tolling will be examined for differing user classes, and then the possibility of reduced (or minimal) revenue tolling strategies to produce the same effect will be illustrated. It may be politically desirable to allow that one or more MUCs should be exempt from tolls, and the possibility of producing toll sets that apply to less than the total number of user groups, but still result in the MUCSSO flow pattern being achieved will be considered. The methods used to derive toll sets will be equally applicable to any stochastic assignment method, however logit based assignment will be used to present illustrative results on small toy networks.

1.2C - Choice Modelling & Freight

de Jong : A model of mode and shipment size choice on the Swedish Commodity Flow Survey [ITS, University of Leeds]

ABSTRACT: The Swedish 2001 Commodity Flow Survey is a unique data source in Europe. It includes information about almost 1 mln individual shipments. The US Commodity Flow Survey has been analysed several times, but its Swedish counterpart has not been used for model estimation so far. In a research project at the Institute for Transport Studies, University of Leeds, we have used the Swedish 2001 Commodity Flow Survey to investigate mode choice and shipment size choice. More specifically discrete choice models have been estimated explaining these choices from characteristics of the shipper, the shipment and transport time and cost on the networks. The models estimated include multinomial logit, nested logit and mixed multinomial logit.

Arunotayanun : Taste Heterogeneity and Market Segmentation in Freight Shippers' Mode Choice Behaviour [Imperial College London]

ABSTRACT: The study of choice behaviour in freight transport faces a number of challenges which set it part from the study of choice behaviour in passenger transport. One important difference is the far greater complexity of freight transport systems which results from the enormous diversity of commodity and firm characteristics. Moreover, in contrast to passenger transport, choice behaviour is typically not concentrated in one specific individual but rather distributed jointly over multiple individuals and firms in a logistics chain, each element of which is endowed with particular policies and specialists from different background. Against this background, the objective of this paper is to investigate the prevalence of observed and unobserved heterogeneity in tastes influencing shippers'

mode choice behaviour. The study is based on data from a stated preference exercise undertaken in Java, Indonesia. The data were analysed using a mixed logit model, capable of accommodating random taste heterogeneity and panel effects associated with the stated preference data collection method. The results indicate the presence of significant levels of taste heterogeneity only some of this heterogeneity can be accounted for by conventional commodity-type based segmentations. The analysis goes on to apply latent class methods to identify behaviourally homogeneous segments. This segmentation turns out to depend not only on commodity type but also shipment size and a number of attributes describing the shipper. The implications of these findings are discussed

Fowkes : LEFT: The Right Approach to Aggregate Strategic Freight Transport Modelling? [Institute for Transport Studies, University of Leeds]

ABSTRACT: The present paper reports work to date on a series of aggregate strategic freight transport models named LEFT (i.e. LEeds Freight Transport model) and sets out plans for their future development. Early development was carried out under funding from the ITEeLS project (<http://www.itels.org.uk/The%20Development%20of%20the%20LEFT%20Model.pdf>). Further development has been undertaken as part of the Rail Research UK programme <http://portal.railresearch.org.uk/RRUK/>. The latter project required a freight model in order to test a wide reaching set of scenarios of interest. In particular, transport emission effects were required. LEFT works at the GB national level, includes only two modes (road and rail) and contains no spatial dimension. A near instantaneous freight model is valuable in providing quick estimates of the impacts of various policies at a national level. It can also be valuable as a check against which more complex models can be judged. Mode choice is modelled over 9 distance bands and 7 commodity types, with a further split according to whether or not the traffic was suitable for rail transportation. This yields $2 \times 9 \times 7 = 126$ 'cells'. Mode choice in each cell is estimated based on a logit model using generalised costs. The model accounts for market size effects through composite cost changes. Two 'base' years have been used, 2000 & 2010, with policies merely affecting each year. Much of the paper is given over to results. The paper closes by considering some of the lessons learnt and discussing how some of the needs that remain unmet will be addressed.

1.2D - Safety on Roads

Law : The Role of Medical Care and Technology Improvements in Reducing Motorcyclist Fatalities [Imperial College London]

ABSTRACT: Between 1970 and 2004, there has been a 55% reduction in road fatalities per capita in countries of the Organisation for Economic Cooperation and Development (OECD). However, over the same period, motorcyclist fatalities per capita only decreased 44%. The number of motorcyclist fatalities accounted for an increasing proportion of all road users killed in Greece (+97%), Luxembourg (+25%) and the United States (+25%). Most studies have attributed the motorcycle safety problem to inexperience and unlicensed riders, riding under the influence of drugs or alcohol, bad riding behaviour and poor motorcycle maintenance. This paper analyses the effect of improvements in medical care and technology in reducing motorcyclist fatalities. Data from the International Road and Traffic Accident Database (IRTAD) and OECD health care data for 1970 to 2004 were used. A fixed effects Negative Binomial model is developed to examine the effect of improvements in medical care and technology. Three proxies of medical care and technology changes are considered. These are average length of in-patient stay in the hospital, physicians per capita and infant mortality rate. Results find that all these proxy variables are significant with the expected sign suggesting that improvements in medical care and technology have contributed to reduced motorcyclist fatalities. The results also reveal that increases in gross domestic product (GDP) per capita, motorcycles and non-motorcycle vehicles per capita, motorway length per square kilometre, population aged 15-24 years and aged 65 years or over are correlated with high

motorcyclist fatalities. On the other hand, increases in population aged 25-64 years appears to be associated with decreases in motorcyclist fatalities.

PAI : EXPLORING MOTORCYCLIST INJURY SEVERITY RESULTING FROM APPROACH-TURN COLLISIONS AT THREE-LEGGED JUNCTIONS IN THE UK [Transport Research Institute, Napier University]

ABSTRACT: A study conducted to examine whether a particular crash-type at junctions is more injurious to motorcyclists has been scant in literature. An exception is the study by Pai and Saleh (in press, An analysis of motorcyclist injury severity resulting from various crash configurations at T-junctions in the UK), who suggested that motorcyclists involved in approach-turn crashes were much more injurious than any other crash-type. This paper further develops their study on the analysis of the determinants of motorcyclist injury severity resulting from approach-turn collisions at three-legged junctions, using the data extracted from the STATS19 accident injury database (1991~2004). Two ordered probit models of motorcyclist injury severity were estimated for two different types of approach-turn crashes (i.e. motorcycle that approaching straight/making a turn collides with a vehicle making a turn/approaching from opposite direction) using demographic, vehicle and environmental factors as predictors. The model estimation results uncover several important determinants of injury severity: for example, the effect of automatic signal-measure on injury level was found to vary across two types of approach-turn collisions. Based on the modelling results, this study may provide an important first step toward developing potential countermeasures that could help lessen motorcyclist injury severity resulting from approach-turn collisions.

1.3A - Traffic Flow & Motorcycles

Tran Huu (Smeed) : BUS RAPID TRANSIT IN A MOTORCYCLE ENVIRONMENT-HOW MACRO SIMULATION APPROACH IN SATURN CAN BE USED? [Institute for Transport Studies]

ABSTRACT: Although macro simulation models have been widely used for many years, applications of macro simulation models in heterogeneous traffic still cast some doubt about their accuracy. There is a need to employ some modelling techniques to help macro simulation models to represent heterogeneous traffic flows. Heterogeneous traffic (or mixed traffic) is very common in developing cities in Asia (Vietnam, Thai Lan, Malaysia, Indonesia, India, Taiwan for instance) where there is fast economic growth but also many transport challenges. These cities are considering Bus Rapid Transit (BRT) a solution to tackle transport problems and the question how BRT will work in mixed traffic in those cities is waiting answers This paper focuses on modelling techniques in macro approach to model BRT in heterogeneous traffic. SATURN model was selected as modelling tool. The model was calibrated and validated in mixed traffic condition of Hanoi. Then BRT schemes are put into the model to find out how they work in mixed traffic. Results show that if bus ways are well-designed and there will be a considerable switching from other modes, then traffic flows are improved significantly with both bus and other road users. Bus way however has big impacts in terms of effects on congestion. Route switching flexibility of motorcycles has considerable effects on performance of bus way.

Nguyen (Smeed) : DIFFERENT MODELS OF SATURATION FLOW IN TRAFFIC DOMINATED BY MOTORCYCLES [Institute for Transport Studies, University of Leeds]

ABSTRACT:

Lee (Smeed) : The PCU value of motorcycles in mixed traffic flow [Imperial College London]

ABSTRACT: The aim of this paper is to present a new agent-based simulation model of motorcycle behaviour in mixed traffic flow and to illustrate the application of the model to the estimation of

Passenger Car Unit (PCU) values for motorcycles. PCU values are used in traffic management and transportation planning to calculate the flow volume in mixed traffic. However, due to some peculiar characteristics of motorcycles, their PCU equivalent is difficult to measure. In this study, agent-based modelling is employed to confront this issue as it was found to be a useful tool to deal with such complex phenomena. Three mathematical models focusing on imitating the movements of motorcycles were developed and implemented in the agent-based simulation programme. It was found that the programme can successfully reproduce the particular behaviour of motorcycle in mixed traffic such as filtering, moving to the head of queues and progressing parallel to other vehicles in the same lane. Consequently, the characteristics of the traffic flow can be simulated. Then, a systematic analysis was conducted to measure the PCU values under different scenarios by using this simulation system. The results of this study shows that the PCU values of motorcycles vary according to the congestion level, the vehicle composition and the layout of lanes. The paper concludes by suggesting the best estimate for PCU values in different scenarios. In addition, this study also demonstrates that currently the often used PCU value of 0.5 in transportation planning is inappropriate.

1.3B - Rail

Chen : Dynamic Models of the Demand for Rail Season Tickets [Institute for Transport Studies, University of Leeds]

ABSTRACT: A serious shortcoming of previous studies in railway market is that they did not address the issue how commuting market is different to business travel market and leisure market. The dynamics of these markets would be expected to be different. Commuters who hold season tickets are reluctant to switch to an alternative instantaneously to minimize the disutility due to spending extra money. In addition, it may take a long time for people to change places of residence and work because of various reasons. However, such dynamics do not applicable to people at leisure and business travel market. This paper reports novel research into modelling demand for rail transport with dynamic econometric approaches. The market addressed in the paper is the commuting market. Data were obtained from CAPRI, LENNON, National Statistics Online and Department for Transport (DfT). By the use of time series and cross sectional data, a static model, an error correction model and a partial adjustment model for rail demand were developed, estimated and compared. These two dynamic models have only been used in few studies of the rail market. A number of economic factors on the demand for rail travel in Great Britain were included in the modelling process. These variables include season tickets, car ownership, rail fares, gross value added, generalized journey time, and season dummies. In view of the limitations inherent in the data, although the adjusted of the three models cannot be compared directly, because the error correction model has a different explanatory variable, the estimation result indicates that the performance of the error correction model is poor. Future research would look at leisure market to show how the commuting market differs from the leisure market. Keywords: Commuting market; dynamic models; season tickets; rail transport.

Cowie : X-INEFFICIENCY IN BRITISH RAILWAY ENGINEERING [Napier University]

ABSTRACT: Over the last number of years, British railway engineering has come under ever increasing scrutiny, with general perceptions of massive maintenance cost escalations, a general lack of control over these costs and a significant decline in the safe operation of the network. Very little however has appeared in the academic literature on the subject. This paper examines the first two of these issues. The period 1980 to 2005 is examined under three different infrastructure management regimes - the nationalized British Rail (1980 – 1994), the privatized Railtrack (1996 to 1998) and the not for profit Network Rail (2002 to 2005). Infrastructure costs are broken down into operating, signalling and management costs. The results show that in all categories costs have

increased since privatisation, but in most cases these increases are considerably short of most of the figures reported in the press. Furthermore, some of these cost increases actually began under the nationalised structure. The one major exception however is management costs, which have rocketed. This is found as clear evidence of x-inefficiency in infrastructure provision, however rising operational costs are found to be due to imperfect competition in sub contractor markets driving up costs. The paper concludes that rail infrastructure provision may well now have the worst of both worlds, with the subsidy of the public sector sustaining imperfect competition in the private sector.

Matthews : Rail Infrastructure Charging in Europe - current practices and the latest research
[Institute for Transport Studies, University of Leeds]

ABSTRACT: EU directive 2001/14 mandates the introduction of rail infrastructure charges that are based on marginal cost, though with allowances for specific mark-ups in different circumstances. Its implementation has involved a great deal of effort in different countries to devise suitable charging systems, with a considerable degree of diversity of response. Some countries have adopted very low charges based broadly on short run marginal cost whilst others have adopted much higher charges based broadly on long run marginal cost and incorporating the allowed for mark-ups. Some countries have several different charges disaggregated according to route, train type, time period etc, whilst others have much less disaggregated charging structures. In addition, some countries have adopted charges that are apparently not in line with the directive. What emerges is a wide variety of charging regimes in different parts of the EU which, it is believed, leads to distortions in both the level of rail traffic and the routing of international traffic. The reasons underpinning the different approaches to the directive, and the impact that such a mix of charging regimes has, are important questions to understand in greater depth. Perspectives on these questions are likely to differ between government and industry, and, within the industry, between freight and passenger sectors. New research is also being undertaken in the area of measurement of the marginal social cost of rail infrastructure use which could serve to inform charging levels and structures. Findings from this research, including specific work looking at generalisation of cost estimation, may be an important means of developing a greater degree of consensus on the subject and a greater degree of harmonisation of charging approach across the EU. This paper aims to provide an overview of these linked policy and research developments.

1.3C - Transport Modelling

Avineri : Complexity Theory and Transport Planning: Fractal Traffic Networks [University of the West of England]

ABSTRACT: The transport network can be described a complex system. The conventional process of transport modelling involves generating and analysing a traffic network, which is a sub-network of the physical road network. Many applications of traffic networks models do not carry a full representation of the transport network. Representing the whole network may not be effective or in some cases not feasible, and an obvious conflict appears between the simplicity of the abstract and partial representation of the traffic system, and the accuracy and the completeness of the whole system. Faced with this conflict, many transport modellers choose a compromised solution, representing the network by its major roads, and ignoring (or representing in a more abstract way) the minor roads and links of the system. One may believe that this under-representation of the transport network may not have a major effect on the traffic assignment. This follows an implicit assumption that omitting minor roads will not make much difference on the assignment of traffic volume on the traffic roads, and the performance of the transport system. This paper examines the possibility of applying fractal measures in the modelling of traffic networks, and presents an investigation of the effect of the representation scale of the road hierarchy on the network equilibrium. Complexity aspects of the network topology, and their effect on the user equilibrium

and on the spatial distribution of flows attributed to network capacity improvements, are illustrated using a numeric example. The problem of identifying the appropriate spatial resolution for modelling and analysis of traffic networks is discussed. Conceptual and methodological issues that could be addressed by further research in transport planning are suggested.

Hao : NEURAL NETWORKS AND THE MULTINOMIAL LOGIT MODEL FOR PUBLIC TRANSPORT FARE PAYMENT CHOICES: A HYBRID APPROACH [Institute for Transport Studies]

ABSTRACT: Recently, as one of feasible alternatives for multinomial logit models (MNL), artificial neural network (ANN) method has received increasing attention and has applied to a variety of preference/choice problems in transportation studies. This paper is based on the context of public transport fare payment choices (i.e., cash, travel cards and smart cards) and the stated preference data. Initial estimation results have been worked out by pure MNL models. In addition, as an alternative of logit models, a standard ANN model also is introduced in this paper. For improving the model performance on market share prediction in choice modelling, a hybrid model is developed through combining the neural network technique and standard MNL model. A feedforward artificial neural network structure is employed with Softmax output units and shared weights, which can be viewed as the generalisation of the MNL model. Meanwhile, comparisons of outcomes among the hybrid model, standard ANN model and the pure MNL model are made to check the significance of estimation from these three methods. Through these comparisons, it is noteworthy that although the hybrid model could suffer from interpretability problem of the outcomes (weights and bias in ANN methods), it is a useful method to analyse choice behaviour with considering the factor of uncertainty when large amount of survey data are readily available. Through the comparison, it can be concluded that the hybrid model's performance on forecasting market share is better than the ANN and logit models.

1.3D - Transport & Social Exclusion

McGrath : The Mobility of Low Income Households in the Greater Belfast Area [University of Ulster]

ABSTRACT: In Belfast, there are wide differentials in access to transport across sectors of the city and also within various social groups. For a significant section of the urban population their travel choice is restricted, which may create barriers to education, employment opportunities and shape future generations. Providing all groups in society with equitable access to services and amenities is a key concern and is framed in U.K. Government policy (DETR, 1998). This paper presents findings and the key issues which affect such groups, many of whom live in areas that are the most deprived in Northern Ireland. Evidence from the literature reveals those different groups in society who experience transport poverty (Church, 2001; Hine, 2001). The elderly, disabled, children, women and lone parents can suffer from transport disadvantage, limiting their horizons and full inclusion in society. Little research exists on the relationship between low-income households, their patterns and travel behaviour, which needs to be clearly understood to address the problems of transport disadvantage. While car ownership is increasing even for low-income households, the study also highlights the role of the community based para-transit black taxi use. This taxibus service along fixed routes, is unique to Belfast, and operates in the most deprived parts of the city. Other findings include travel experiences through interface areas, public transport, car use, walking and cycling in lower income communities. The current trends in travel, policy and practice, may create wider inequalities and opportunities for those communities. It is to be expected that financial, social and environmental pressures on urban transport will increase, leading to limited travel opportunities, which may affect lower-income households disproportionately. This paper contributes to the better understanding of the relationship between access to transport and the effect it has on the constraints, opportunities and lifestyle of inhabitants.

Lamont : Understanding and Addressing Dyslexia in Travel Information Provision [University of the West of England, Bristol]

ABSTRACT: Examination of cross-disciplinary literature has revealed that the cognitive (rather than physical) accessibility barriers to transport faced by individuals with dyslexia appear to be the subject of limited research. Accordingly, the research upon which this paper has drawn has sought to explore and highlight the needs and usability issues that these individuals encounter during a journey lifecycle. The paper will present findings from a series of focus groups and online discussions with dyslexic individuals coupled with available insights from the literature. The research has highlighted a large number of practical difficulties in the task of travelling and travel information use, because these individuals are trying to function in a world created by non-dyslexics for non-dyslexics. This often leads to stress, thus aggravating the symptoms of dyslexia. Many of the difficulties are arguably also experienced more widely by non-dyslexics, but the fundamentality of dyslexia exacerbates problems so that those with dyslexia feel the effects more frequently and severely. The paper calls for greater attention to be given to the needs of dyslexics in the design of travel information provision and suggests that this will potentially benefit a much wider group of people.

Muir : AN INVESTIGATION INTO THE RELATIONSHIP BETWEEN PEDESTRIAN CASUALTIES AND DEPRIVATION [Institute for Transport Studies, Leeds University]

ABSTRACT: Pedestrians in the most socio-economically deprived areas are up to five times more likely to be killed in road traffic accidents than those in the least deprived areas. Research into reasons for this association found that a number of factors associated with both deprived areas and people partly explain disparities in pedestrian casualty rates by deprivation, but the relative importance of these factors remain unknown, and others are yet to be investigated. The main aim of the study is therefore to assess the relative contribution to higher casualty rates in deprived areas of a range of factors relating to area and person deprivation. Using GIS mapping and data sources including STATS 19 data, census information and Indices of Multiple Deprivation, this paper presents an initial analysis of links between pedestrian casualties and deprivation in the Leeds and Bradford area. The paper also presents a brief outline of the study methodology, which includes constructing an accident prediction model, using questionnaire surveys to obtain information on pedestrian attitude and behaviour, and a GPS survey monitoring distances walked by pedestrians in order to calculate exposure to risk.

2.1A - Freight & Logistics

Woodburn : Wagonload rail freight: is there a future? [University of Westminster]

ABSTRACT: Rail freight tends to be best suited to direct trainload movements from terminal to terminal, where its strengths in moving large volumes can be exploited. In developed countries, such as Britain, these high volume flows have declined with the reduction in heavy industrial activity and the shift towards more dispersed freight movements in a more consumer-driven economy. Rail freight typically is viewed as not being a viable option for the smaller volume flows that have resulted, particularly if they are non-unitised. A major rail freight growth area in recent years has been of direct trainloads of containers and swapbodies, but there is little documented evidence that conventional wagonload traffic has increased and there has been a lack of strategic direction in service provision for these flows. However, an increase in rail's share of this market could assist in meeting environmental, social and, indeed, economic objectives. This paper evaluates British experience in the non-unitised wagonload (or less-than-trainload) rail freight market and identifies the opportunities for and barriers to growth. This market has undergone considerable change in the last 15 years, with the withdrawal of dedicated Speedlink wagonload services, the reintroduction of a network under the Enterprise banner, its integration with Channel Tunnel wagonload services after

rail privatisation and ongoing incremental changes in network coverage, service provision and commodities carried. The paper combines this desk-based research with the evaluation of key positive and negative experiences of wagonload rail freight services that were identified through interviews with a range of customers and rail freight terminal operators. Finally, a strategy to actively develop the wagonload network is proposed. This includes an assessment of the extent to which principles from similar operations (notably the growth of road-based pallet networks) can be transferred to the rail freight sector.

Maurer : USING STRATEGIC SUPPLY CHAIN MANAGEMENT SOFTWARE IN THE CONTEXT OF FREIGHT DEMAND MODELLING [Institute for Transport Studies, University of Leeds]

ABSTRACT: Current freight demand forecasting is mostly based on the four-stage model which has its origins in passenger demand modelling. However, logistics managers face a cost driven trade-off between the transport of goods over larger distances from few centralised depots on the one hand, and deliveries from many decentralised depots in greater proximity to their customers on the other hand. Commercial logistics software packages assist decision-makers in network optimization including the choice of the optimal number, location and size of depots. Such decisions in strategic planning greatly impact on the transport activity but are not sufficiently considered in national freight demand models. To address this issue it is suggested to interface a mode split model for freight transport with a strategic supply chain management model in order to represent logistical decisions. The increased accuracy of freight demand estimates can promote the use of these models in policy analysis, for example the achievement of environmental targets in transport. The paper describes how commercial logistics software can be used to model freight movements by road during one representative year in Great Britain. Key words: freight demand forecasting, supply chain management, transport policy

Angeloudis : Application of Robust Optimisation Techniques to Automated Container Terminals [Imperial College London]

ABSTRACT: Over recent years, there has been an increasing interest in automated operations of container terminals throughout Western Europe, starting with ECT in Rotterdam and culminating with Altenwerder in Hamburg. The format for automated container terminal operations is centred on the use of Automated Guided Vehicles for horizontal container movements and Automated Stacking Cranes for vertical movements. To justify the large initial investment required to develop such ports it has to be guaranteed that they will offer a significant operational and performance advantage over alternative setups. With the sheer size and unpredictability of the operations taking place at any time, in order to achieve the needed performance levels movements in the terminal have to be optimally pre-planned and coordinated, thus resulting to a highly complex optimisation problem. Optimisation methods used in recent automated container terminals operate by decomposing key aspects of the problem into different subproblems, a practice that is known to lead to sub-optimal solutions in this context. We develop a new control algorithm that jointly optimises most of the problem aspects, based in robust optimisation methods and implement them in prototype terminal control software. Robust optimisation involves the definition of intervals for key parameters, like the start time and duration for individual container movements, and then looks for a solution that minimises maximum regret with respect to particular realisations of parameters. The overall control objective, namely the minimisation of ship loading times, provides the measure of regret. The optimisation takes future events into account through a rolling planning horizon, using intervals to allow for their uncertainty.

2.1B - Transport & the Environment

Song (Smeed) : THE ENVIRONMENTAL IMPLICATIONS OF E-COMMERCE- THE IMPACTS OF MISSED FIRST-TIME HOME DELIVERIES [University of Southampton]

ABSTRACT: The increased use of the Internet has seen a move towards electronic commerce in both the business and consumer sectors. The impacts of this in terms of wider transport and consumer trends are not greatly understood. One major concern is the system wide implications of e-commerce on the environment, the business-to-consumer (B2C) home-delivery element of which forms the focus of this research. Using data on home delivery transactions from a cross-section of householders in Winchester (UK), this paper examines the environmental impacts of attended CDPs for reducing both customer and carrier kilometres associated with missed first-time home deliveries. Internet shopping frees customers from the temporal and spatial constraints of high street shopping, providing more choice and reducing product search time. Research suggests that 22 home deliveries are received on average per household per year, using operating statistics from fifteen leading carriers, and that the market for express delivery services has increased by 41% since 1998. The number of parcels delivered to UK households in 2005 as a result of internet shopping alone is estimated to be 400 million. Given these increases in delivery vehicle movements, of increasing concern are the numbers of failed home deliveries, estimated to range between 12% and 60%, where no-one is at the delivery address to receive the package. The reasons for delivery failures are considered to be largely due to lifestyle changes (the growth in single-person households, flexible working patterns and higher female employment levels) which have resulted in up to half of UK homes being empty between 09:00 and 16:00 during weekdays. With such a large proportion of first time home delivery failures, a series of unattended and attended 'collection/delivery points' (CDP) solutions have emerged allowing carriers to drop consignments into communal locker banks, individual locker boxes, or 'attended' premises such as convenience stores, petrol stations and post offices. The extent to which e-commerce activities will impact on transport is uncertain. A reduction in householder shopping trips through increased Internet shopping could positively impact on the environment. However, replacing high-street shopping with Internet shopping shifts the travel required to deliver purchased goods from the customer to the e-retailer, with an uncertain net impact. Scheduled deliveries provided by a retailer may be more efficient than multiple householder trips using private transport. E-commerce could bring about a reduction in shopping trips, but householder travel may not be reduced overall as individuals may use their new found free time to undertake additional leisure or business trip generating activities. In order to identify people's attitudes towards home shopping and delivery services, a questionnaire was designed as part of the EU-funded MIRACLES project, including frequency of purchases, experience of missed deliveries and attitudes towards the local CDP concept. The questionnaire was posted in September 2004 to 1600 households in Winchester, Hampshire, UK. A total of 790 questionnaires were completed and returned. Using survey data on home delivery transactions from a cross-section of householders in Winchester, the environmental implications of several home delivery methods, i.e. traditional delivery model, attended delivery model using a CDP concept and self-service model were investigated. In the traditional model, goods are ordered by the customer and delivered to a location of their choosing using relatively narrow time windows defined by the e-retailer. If the delivery fails because no-one is at the address to receive the item, it is returned to the carrier's depot and a notification card left at the customer's address describing various re-delivery options. Some carriers make an automatic free re-delivery attempt on the following day. If the second attempt to deliver also fails, the customer has to collect a failed home delivery from the carrier's depot or pay for a re-delivery. In the attended CDP model, the missed delivery will be diverted to the nearest CDP (e.g. a convenience store, post office, garage) relative to the customer's home. The customer is left a notification card detailing the address of the CDP and the collection instructions, after which, the customer is free to collect the item. In the self-service model, the customer drives to Winchester city centre, parks in a town centre car park and visits the shops on foot. All the goods purchased are taken back home by car. The research uses a routing package, Route LogiX, to optimize the carrier's route around a sample of the delivery and redelivery addresses in Winchester, taken from the survey

respondents. For the traditional delivery method the carrier has to visit additional addresses, representing the failed redeliveries from the previous day. For the attended delivery method each CDP is visited immediately after all of the addresses in the CDP catchment area has been visited. Customer driving distance is calculated based on the number of first-time missed deliveries, the average round trip distance from the householder's home to the CDP or carrier's depot and the proportion of people traveling by car. The distance driven, types of vehicles and fuel used have a significant impact on traffic emissions. The environmental costs are estimated using the customer and carrier driving distances from each home delivery model and the emission factors for carbon dioxide and carbon for a family sized petrol car and a diesel engined goods vehicle. These are 172g/km CO₂, 47g/km C and 268g/km CO₂, 73g/km C respectively. The environmental costs of the two home delivery models are compared with the high-street shopping model where customers travel using their own vehicles. The results suggest that a home-delivery service could reduce transport emissions on a typical shopping day by between 48 and 52%, compared to the 'high-street' shopping model. Based on the assumption that householders' vehicles account for 51% of the overall emissions from road transport, and 19.5% of overall road traffic is related to shopping trips, such a reduction in shopping related travel could reduce annual UK transport related emissions by between 0.86 and 0.93% (6 to 7 million tonnes of carbon equivalent). This assumes that the emissions from shopping travel account for 1.8% of total emissions in the UK.

Wadud (Smeed) : THE DISTRIBUTIONAL CONSEQUENCES OF TRADABLE CARBON PERMITS IN THE ROAD TRANSPORT SECTOR [Imperial College London]

ABSTRACT: The personal road transport sector is one of the largest and fastest growing sources of CO₂ emissions. This paper investigates a tradable permit policy for mitigating carbon emissions from personal road transport and discusses various issues of permit allocation. As tradable permits will effectively raise the price of fuel, the policy has important distributional implications. The distribution of burden depends on permit allocation strategies and on the consumer response to an increase in price. The behavioural response varies among different segments of the population depending on their travel needs, which in turn are contingent upon their income, location of residence and other factors. A model previously estimated by Wadud et. al. (2007) with group-wise aggregated US consumer expenditure survey data for 20 years provides behavioural responses for different income groups. The resulting welfare distribution is evaluated in this paper. Different permit allocation schemes are also considered in the analysis. It has been found that an equal allocation to every individual makes the policy fairly progressive among different income groups.

North : Characterising the impact of traffic calming and driving style on real-world emissions from a light-duty diesel vehicle [Imperial College London]

ABSTRACT: Traffic calming initiatives, including the use of discrete road humps are used to reduce the average speed of traffic in UK residential areas. However, they may also induce a driving pattern characterised by a series of decelerations and accelerations when negotiating the road humps. Such driving patterns have been found to lead to sharp increases in pollutant emissions from vehicles. Consequently road humps may lead to localised pollutant emission "hot-spots". This paper investigates the extent of this impact over a test route in London, featuring a sequence of six road humps, by comparing it to a similar length of un-calmed road. Three different driver behaviour patterns were devised to represent "aggressive", "normal", and "calm" driving styles. Data were obtained from a light-duty diesel test vehicle fitted with a navigation device, a link to record data from the engine management system (EMS) and an on-board emissions monitoring system. All configurations with speed humps were found to increase peak emission levels. Driver behaviour was also found to have a significant impact on emission levels, with the aggressive strategy leading to the largest increase over the baseline case. The recorded EMS data were then used in conjunction with a microscopic emissions model to estimate the emission rates over the same driving cycles. The

microscopic model was calibrated with data for this test vehicle and found to reproduce the measured emissions well, although some discrepancies were noted at high emission rates. This work demonstrates that the introduction of road humps for traffic calming may also lead to a significant increase in emissions of local air pollution, especially where drivers adopt aggressive driving styles. As a result, the trade-off between the benefits of achieving a traffic speed reduction and the potential for locally increased emissions should be explicitly made during the planning process.

2.1C - Economics of Activities

Hu : Measuring the Utility of an Activity in the Context of Electronic [Imperial College London]

ABSTRACT: In recent years considerable interest has focused on the potential benefits for transport modelling and appraisal of moving from trip-based on activity-based models of travel demand, and significant developments have been made. A key element in most activity based modelling approaches is the interplay between the utility obtained from participating in activities undertaken at different times and locations and the disutility associated with travelling to these activities. Thus the issue of how to measure the utility of an activity is of central importance. The conventional approach adopted in the activity based modelling literature is to conceive of the utility of an activity as a function of its duration and timing, sometimes modified by contextual and personal characteristics. This reflects both the importance of scheduling considerations in most activity based frameworks and the fact that for activities undertaken in a physical, face-to-face context, duration and timing are indeed likely to be major components of the overall benefit that individuals derive from participation. However, this is not necessarily true in the case of activities involving the use of electronic and mobile service, such as e-shopping, e-banking and other forms of e- and m-commerce. In these cases, the strong connection between the utility derived from an activity and its timing and duration is weakened and may in some cases be broken altogether. In this paper we propose a new approach to measuring the utility of activity participation, which is based on idea of an activity production function. This function explicitly identifies the inputs (e.g., time, money, technology etc.) necessary to perform an activity and the outputs derived from the activity (wages, consumption of goods etc.). We show how this approach generalises existing activity utility models and we demonstrate how it can easily extended to deal with activities performed in electronic and mobile contexts. Theoretical and empirical implications are identified and discussed.

Kirby : The relative costs of travel by train and car, and the effect of the productive use of travel-time [Napier University]

ABSTRACT: Virgin Trains commissioned this study in order to explore the relative costs of travelling by train or by car on a consistent basis, hoping to correct the sometimes misleading information in the media. A particular concern was quantifying the benefits to an employer of productive time whilst travelling. For each of three city-pairs (Manchester to London, Birmingham to London and Manchester to Birmingham), 30 origin-destination pairs of postcodes were generated by a randomisation process and entered into Transport Direct to estimate the journey times by public transport and by car; a "Park and Ride" variant was also established. Average fares and salaries were established for First and Standard Class business travellers, with motoring costs based on the Inland Revenue's approved mileage allowance. Time use data from the Autumn 2004 National Rail Passenger Survey yielded the proportion of business travellers for whom work/study was a major activity and a minor activity. A technique was devised to estimate the time spent on each activity, and thus the value of the productive time on a train. Productive time by mobile phone usage by car drivers was assumed the same as that for train users. The cost of non-productive time whilst travelling took account of the proportion of the travel time in working hours. The value of the productive time on a train was found to at least cancel out the cost of the fares, for both First and Standard Class travellers. The study has implications for value-of-time estimation, in particular

implying the need to re-assess the methods proposed by Hensher (1977) for assessing the value of business travel time.

2.1D - Land Use & Location

Levinson : Network Circuitry and the Location of Home and Work [University of Minnesota, Imperial College]

ABSTRACT: In an urban context people travel between places of residence and work destinations via transportation networks. Transportation studies that involve measurements of distances between residence and work locations tend to use Euclidean distances rather than Network distances. This is due to the historic difficulty in calculating network distances and based on assumptions that differences between Euclidean distance and network distance tend to be constant. This assumption is true only when variation in the network is minor and when self-selection is not present. In this paper we use circuitry, the ratio of network to Euclidean distance, as a tool to better understand the choice of residential location relative to work. This is done using two methods of defining origins and destinations in the Twin Cities metropolitan region. The first method of selection is based on actual choice of residence and work locations. The second is based on a randomly selected dataset of origins and destinations in the same region. The findings of the study show circuitry measured through randomly selected origins and destinations differ from circuitry measured from actual origins and destinations. Workers tend to reside in areas where the circuitry is lower, applying intelligence to their location decisions. We posit this because locators wish to achieve the largest residential lot at the shortest commute time. This finding reveals an important issue related to resident choice and location theory and how resident workers tend to locate in an urban context.

Jahanshahi : COMPARATIVE STUDY OF THE INTERACTION BETWEEN LAND USE AND TRANSPORT [Institute for Transport Studies, Leeds University]

ABSTRACT: This comparative study is motivated by the need for more empirical research on the causes of the contradictory findings in the recent studies on the effects of urban form on travel patterns. This research aims to examine the relationship between land use factors and travel patterns in Tehran and Shiraz (as representatives of developing cities) and comparing the results with those which have been evidenced in the UK and US cities. The research will take account of the fact that possible reasons for recent contradictory findings include differences in locations studied, in methodologies used and in the scales at which the studies have been analysed. The research will also explore the evolution of travel patterns over time. This study has been done in two scales; macro (aggregate) and micro (disaggregate). At the aggregate scale, the relationship between average travel distance with population density as land use factor and age, household structure and car availability as socioeconomic factors are examined at the ward level. 1994 Tehran travel survey and Statistical Centre of Iran database are used to extract travel, socioeconomic and land use data. The first results suggest that density has significant effect on average travel distance when socioeconomic effects are controlled for. By adding Shiraz (The other metropolitan city in Iran) into the case study it becomes possible to compare two cities with some similarities but also some key differences. A quantitative/qualitative survey was used at disaggregate scale of the study to help investigating causal rather than descriptive relationships between changes in travel behaviour and land use patterns. Around 200 people were interviewed in the first stage in Tehran. The questionnaire forms were designed in a way to extract respondents' perceived accessibility to various amenities, socioeconomic characteristics and travel behaviour in four time periods: the time of interview, just before moving to their current house, just before changing to their current workplace and 5 years ago. Their travel attitudes are also collected as another factor which should be controlled in examining accessibility-travel patterns connection. At disaggregate level, the survey

tool is fairly novel (See Handy et al. (2005) for using a similar approach) and the paper concludes by looking at practical and methodological concerns regarding its use.

Aditjandra : RELATIONSHIPS BETWEEN URBAN FORM AND TRAVEL BEHAVIOUR: A CASE STUDY OF SUBURBAN VS TRADITIONAL NEIGHBOURHOODS IN NORTH TYNESIDE, NORTH EAST ENGLAND WITH SPECIFIC REFERENCE TO THE ACCESSIBILITY ATTRIBUTE [Transport Operations Research Group]

ABSTRACT: This paper will report the initial analysis from British evidence of the relationships between urban form and transport. The relationships were modelled in a four dimensional aspects of land-use and transport which includes built environment, attitude and preference, socio-economic and travel pattern characteristics. The objective is to have a better understanding of the relationships between dimensions. The built environment and attitude and preference statements were developed from the adaptation of the work of Handy et.al. (2005). The methodology involves a questionnaire technique to obtain primary data from the pilot study which has included 200 residential households in Battle Hill and Cullercoats, North Tyneside, Tyne and Wear, North East England. Battle Hill (IMD: 24,456), a newer residential area (built from 1970s), is characterised with cul-de-sac branches along the circular arterial road within public bus corridor; whilst Cullercoats (IMD: 26,501), an older residential area (built mostly before 1940s), has a grid and permeable road characteristics and is located adjacent to a Metro light rail station. Some 38.5% response rate of questionnaire returned back which allows a convincing pilot study analysis. The residents of Cullercoats perceived better accessibility than the residents in Battle Hill although the reported weekly distance travel of Cullercoats' residents was 30% lower than in Battle Hill.

2.2A - Economy & Sustainability

Laird (Smeed) : COMMUTING COSTS AND THEIR WIDER ECONOMIC IMPACT [Institute for Transport Studies]

ABSTRACT: This research found strong evidence that wage compensation for commuting occurs, though this only partially compensates for the commuting costs incurred. There is also evidence to suggest that the marginal level of compensation varies by gender, with men receiving full compensation for marginal changes in their commute whilst women do not. The evidence on land market compensation for commuting on the other hand was inconclusive. A key finding of this study is that despite this wage compensation transport policy has little impact on wages through labour supply. This contrasts with the literature on agglomeration effects. The apparent inelasticity of wages to commuting costs arises as an important behavioural response to a change in commuting costs is to change household location or job - thereby altering commuting distances.

Marsden : THE IMPACTS OF A SUSTAINABILITY APPRAISAL ON TRANSPORT STRATEGY SELECTION [Institute for Transport Studies, Leeds University]

ABSTRACT: There is great concern about the long-term 'sustainability' of the transport sector both nationally and globally. Much work has focussed on the development of indicator sets to monitor changes in the sustainability of transport over time (Litman, 2005). However, in reviewing indicators for sustainability in 2003 Gudmundsson (p.200) concluded that "Even a perfect indicator system for sustainable mobility may be of little relevance if it has no bearing on actual decisions taken". The research described in this paper attempts to answer these concerns by bringing together modelling tools to try and forecast the impacts of a range of transport strategies across the three pillars of sustainability (economy, environment and social). The paper begins by defining key concepts and describing the framework for sustainability appraisal, including how it differs to existing frameworks. The framework was presented to 14 key stakeholders including four central government departments (transport, planning, finance and environment), practitioners and pressure groups. The

outcomes of these discussions and modifications made to the proposed framework are presented. A practical implementation of the framework has subsequently been undertaken for a large Metropolitan area in England. Three scenarios examining differing levels of investment in the transport system, degrees of behavioural change and demand management measures are presented. Of particular interest is the attempt to link a strategic land-use transport interaction model to a GIS-based model of accessibility and social deprivation. The findings suggest that there are serious gaps in our capabilities in capturing sustainability impacts under economic, social and environmental headings. Despite this, the process proposed identified some conflicts between the types of scenarios scoring positively under current appraisal methods and those proposed. This suggests the need for a broader consideration of the impacts of strategies, including the long-term direction of change such as that proposed.

JIWATTANAKULPAISARN (Smeed) : HIGHWAY INVESTMENT AND JOB GROWTH: A CAUSALITY TEST IN A PANEL VECTOR AUTOREGRESSIVE FRAMEWORK [Centre for Transport Studies, Imperial College London]

ABSTRACT: The provision of transport infrastructure has been hypothesised to induce economic growth and development. However, it is also possible that both regions with a growing economy or, alternatively, lagging economic performance, would both be targets for public investment in transport infrastructure, albeit for different reasons. A major reason for the latter investment is to stimulate employment, while the former is intended to provide infrastructure for growing employment. The objective of this paper is to examine these effects using Granger causality models between highway infrastructure and employment within the US. We estimate dynamic panel data models in a vector autoregressive framework using time-series cross-sectional data on lane miles of roadway capacity and employment in private industries for 48 contiguous states. Our analysis reveals evidence of state employment growth temporally influenced by annual growth in the provision of major highways, rather than the other way around.

2.2B - Local Transport Planning

Mulley : TRAVEL TO WORK STUDIES: HOW ANALYSIS OF CENSUS DATA CAN GIVE INSIGHTS TO THE LOCAL ECONOMY [University of Newcastle upon Tyne]

ABSTRACT: Travel planning within a local authority is dependent on knowing where residents work and how they access employment. Inflows and outflows for a particular local authority can give rise to a need to approach travel planning to work from different angles: for example, if a local authority both imports and exports the same type of workers, there may be a case for better targeting of policies to job-seekers and to employers to minimise such migration (even if it is on a daily basis). Using South Tyneside Metropolitan Council as a case-study, this paper considers the existing literature on travel to work patterns and concludes that outflows from South Tyneside are to some extent due to the employment profile of the district, which may lead better-qualified and more mobile residents to seek employment in other areas. By contrast, the higher rate of part-time work may restrict many local residents, particularly women, in their commuting distance. Using the literature review as the foundation, the paper moves to a more detailed analysis of the travel patterns at ward level and key employment destinations using output level census data and includes a detailed discussion of mode of transport used. This highlights a number of issues with respect to travel to work flows and transport availability. The main conclusion is that there appear to be certain structural effects in the distribution of population and employment of South Tyneside which may make access to appropriate work opportunities difficult, particularly for non-car users. The paper concludes that a better understanding of what does happen in a district can influence the successful targeting of a travel plan for the area.

Bryan : Smartcard Data Analysis [Newcastle University]

ABSTRACT: The sustainability of transport is a key policy driver for governments around the world as the challenge to reduce the negative impact of transport operations increases in priority on their agenda. Part of this agenda is to encourage a modal shift by reducing the dependence on the private car through increasing the appeal of public transport. The use of smartcard technology in public transport has a great potential for increasing appeal and contributing to modal shift as it provides seamless, convenient, user-friendly ticketing with the prospective for many everyday add-on applications (such as library access or payment for small purchases), enhancing the convenience for the user and in turn making the business case for investing in this new technology more robust. An additional feature of smartcard systems which could greatly improve the business case for smartcard investment and deployment, but is not yet being utilised to its full potential, is the vast amount of data gathered during operation. Each time the card is used the passenger behaviour, such as the boarding and alighting location and times, is collected. This provides the possibility for a much more coherent and in-depth understanding of user demand. As such, the aim of this study is to question whether, with additional knowledge of how travellers use public transport (captured from smartcard data analysis), it is possible to create a service based entirely on meeting users' demands. To test this theory, Nottinghamshire County Council (NCC) has provided a set of real, anonymous, smartcard usage data, derived over a two month period from its concessionary smartcard scheme, the freedom card, used on a network of bus routes connecting at key interchange points. The data set was analysed to investigate what information could be valuable and used to determine the customer trends, which collectively build up a consolidated network journey profile. To demonstrate how the findings could be useful a tool was developed using GIS (Geographical Information Systems) to graphically illustrate the smartcard usage at boarding and alighting points and passenger interchange between services. Although there is scope for additional work, this study has resulted in observed behavioural patterns compiled to create customer journey profiles that can be displayed visually. This could in turn be used for planning and managing a service that is responsive and relevant to user needs, giving public transport the facelift it desperately needs, but also encouraging and facilitating the modal shift that is required for the sustainable development of the transport industry.

Sherwin : THE BRISTOL SOUTHVILLE HOME ZONE: HIGHWAY OR SOCIAL ENGINEERING? [University of the West of England]

ABSTRACT: In November 2005, the authors were commissioned to conduct an independent evaluation of the implementation process and outcomes of the Southville Home Zone (HZ) project, one of the 61 schemes supported by the Department for Transport (DfT)'s HZ Challenge fund. The evaluation employed a mixed methodology (household surveys, stakeholder interviews, focus groups, and observation). The paper discusses successes and problems identified in the consultation, implementation, and realisation phases, focussing on those aspects which are generalisable to other contexts. Overall it is concluded that 'retrofit' HZ schemes are particularly difficult to realise, both in terms of achieving a consensus about how the streets should be reshaped, but also in terms of value for money. Hence, public investment in retrofit HZ schemes should be targeted at neighbourhoods exhibiting multiple deprivation, where benefits are more likely to justify the costs of implementation.

2.2C - Issues in Transport Modelling

Sillaparcharn (Smeed) : TREATMENT OF UNCERTAINTY IN NATIONAL TRANSPORT MODELS: GENERAL APPROACH AND APPLICATION TO THAILAND [Institute for Transport Studies, University of Leeds]

ABSTRACT: National transport models, as a procedure for forecasting traffic at a national scale, have been constructed for a number of countries from the 1980s. These models would be used in

planning, analysing and evaluating projects aimed at solving transport and traffic problems at the national level. Such models would be used for investigation of national policy issues over a long period and therefore are subjected to a wide range of uncertainties and a question about their accuracy is raised. Their users will find it helpful to have an indication of the uncertainties around the central estimate. This paper aims to evaluate the errors during the development of a national transport model for Thailand focusing primarily on input errors (e.g. on the future incomes and the projected population) and model specification errors, which may come from model structure, functional form and variable specification. In order to do so, the treatment of uncertainty in selected European national transport models, such as the UK National Road Traffic Forecasts (1997), the UK National Transport Model (2003), the Netherlands National Model System and the Norwegian National Transport Model, is reviewed. This paper examines the impact of uncertainty in a sequential transport demand model with vehicle ownership components. Outputs from the vehicle ownership model act as inputs for a trip generation model. The number trips generated will be determined which destination they go to and which mode of transport they choose in a combined destination and mode choice model and for trips by car, they will be further determined which highway route they use in a traffic and assignment model. Travel times from the assignment model are fed back into the combined destination and mode choice model and then the number of trips are re-distributed and re-modal split. In addition, this paper also aims to examine the propagation of uncertainty across model stages as well as at each model stage over time. A sensitivity analysis is used to model uncertainty in both demographic and socioeconomic inputs to the national transport model, as well as uncertainty in various model parameters. The results suggest that while several model inputs may affect model outputs in the short run, only those inputs that have a cumulative effect such as forecasted population and GDP, are likely to have a significant impact on outputs in the long run. In addition, since inputs and parameter estimates are uncertain, transportation modellers would better to update a long-range modelling forecast regularly to evolve as new information becomes available and policymakers should be informed about uncertainties in their decision-making. This work represents a step in this direction.

Smith : Future transportation modelling [University of York]

ABSTRACT: Stating and solving traffic models is a central part of modern transportation planning. This paper will list the various models which have arisen, including dynamic equilibrium models, rather general variable demand models; gravity models; strategic models; and non-equilibrium dynamic models. Then the paper will discuss how different real life "schemes" might be assessed using these different models. We will discuss the suitability of the model for the scheme and give some illustrative examples. This discussion will then be extended so as to include various assessment methodologies and how these fit various kinds of scheme and various kinds of models. The paper will discuss possible solution methods for the models considered. This discussion will include (1) the case where various different equilibrium models (assignment, demand and land-use for example) are used in combination; (2) the case where the various sub-models are combined into a single model; and (3) the case where optimal values of control parameters are sought. The paper will put these considerations into an up-to-date practical context: utilising (a) the webtag documents provided on the DfT website; (b) the outcomes of two meetings to discuss the future of transportation modelling; (c) the latest research on solution methods and (d) the latest optimisation research. Finally the paper will conclude by seeking to give some recommendations as to how transportation modelling might most beneficially evolve; these recommendations will emerge from the prior discussions in the paper. COMMENT: Overall the paper will seek to cover a great deal of ground; but the paper will seek a light touch by using simple examples wherever possible, by being pretty selective about those matters discussed in detail; and by being parsimonious in all things.

Timms : METAPHOR, RHETORIC, NARRATIVE AND AESTHETICS IN TRANSPORT MODELLING [ITS, University of Leeds]

ABSTRACT: The main aim of this paper is to encourage debate about the nature of transport modelling, in terms of past and current practice, and with respect to how it might be practiced in the future. It does so firstly by considering the underlying philosophies of science (apparently) adopted by transport modellers. The conclusion is that a new philosophy of science needs to be developed, which is more in tune with how transport modelling is actually carried out (as opposed to how early transport modellers thought it ought to be carried out). It is recommended that such a new philosophy perceives transport modelling as a linguistic activity within the overall context of transport planning, which is in turn considered as a communication process. The paper outlines and illustrates four main approaches that could be taken in this respect, analysing transport models from metaphorical, rhetorical, narrative and aesthetic perspectives. The analysis covers a period of more than 50 years, from the 1950s until the present day. Conclusions are drawn upon the possible future research directions that might follow from the analysis provided in the paper.

2.2D - Safety & Accidents

Evans : Fatal European train accidents 1967-2005 [Imperial College London]

ABSTRACT: Fatal train collisions and derailments are important events. They are well documented in Great Britain, mainly due to the work of HM Railway Inspectorate over many decades. However, there are no comprehensive data on fatal train accidents in Europe, even though the railways of Europe may have much to learn from each other, and rail safety regulation is currently tending to move from the level of national governments towards the institutions of the European Union. Given the public interest in railway accidents, the many fatal collisions and derailments are reported in the press. Furthermore, there are now available long runs of electronically searchable newspaper archives, notably in Britain of The Times. This makes it possible to explore the possibility of constructing and analysing a dataset of European fatal railway accidents based on press reports. The following three tasks are necessary to do this. (1) Defining search terms and using these to extract accounts of relevant railway accidents; (2) Estimating the numbers of accidents and fatalities that are missing from these press reports by country; (3) Using the results to analyse the comparative safety performance of Great Britain and other European railways This paper presents the results of an exploratory study of doing this. The number of fatal collisions and derailments resulting in fatalities to train occupants in the EU15 plus Switzerland and Norway in 1967 to 2005 is estimated to have been about 700, of which 450 were reported in the English press, and 250 were not. Of these, about 90 occurred in Great Britain. The fatal accident rate per train-km has fallen substantially over the period both in Britain and in the rest of Europe.

Almatawah : AN INVESTIGATION OF DRIVERS' ATTITUDES TOWARDS SAFETY IN KUWAIT [University of Southampton]

ABSTRACT: Statistics show that the fatality rate in the State of Kuwait is more than twice that in the U K and the number of traffic accidents in Kuwait is increasing each year. In 1992, there were 16,017 traffic accidents, with 2,012 people injured and 279 killed. By 2005, the number of accidents had increased to 55,035 with 863 injuries and 451 fatalities. This paper presents the findings of a study of a substantial road accident data base for Kuwait and a supplementary questionnaire survey to further understand related driver behaviour. Police accident reports relating to fatality and injury for the year (2002) were collected from the General Traffic Department to obtain an overview of the situation. These clearly showed that, as was been found elsewhere, human behaviour and driver errors are the main contributory factors. A questionnaire survey was undertaken to obtain a more in depth understanding of driver behaviour and attitudes towards traffic regulations, which might relate to road accidents and the potential acceptability of remedial measures. The questions were

developed to be suitable for the traffic environment and culture in Kuwait and 1,528 completed questionnaires were recorded. A road accident prediction model was developed linking behaviour and attitudes with a number of factors such as age, sex, nationality, education level, marital status, driver education, driver training, usual speed on motorways, number of dangerous offences per year, years' driving experience, and drivers' perceptions of the effectiveness of enforcement to total accident rate. The Generalized Linear Model (GLM) approach (one of the most appropriate models for accident analysis) was used. It was found that driver attitude towards traffic regulations, enforcement, the number of critical traffic violations, and age were significant contributory factors. The result will be used to influence future policy towards driving education, training and enforcement in Kuwait.

Quddus : Time Series Count Data Models: An Empirical Application to Traffic Accidents
[Loughborough University]

ABSTRACT: Count data are primarily categorised as cross-sectional, time series, and panel. Over the past decade, Poisson and Negative Binomial (NB) models have been used widely to analyse cross-sectional and time series count data, and random effect and fixed effect Poisson and NB models have been used to analyse panel count data. However, recent literature suggests that although the underlying distributional assumptions of these models are appropriate for cross-sectional count data, they are not capable of taking into account the effect of serial correlation often found in time series count data. Real-valued time series models, such as the autoregressive integrated moving average (ARIMA) model have been used in many applications over the last few decades. However, when modelling non-negative integer-valued data such as traffic accidents at a junction over time, such models may be inappropriate. This is mainly due to the normality assumption of errors in the ARIMA model. The primary objective of this paper is to introduce the new class of integer-valued autoregressive (INAR) models for the time series analysis of traffic accidents in England. Different types of time series count data are considered: aggregated time series data where both the spatial and temporal units of observation are relatively large and disaggregated time series data where both the spatial and temporal units are relatively small. The performance of the INAR models is compared with the class ARIMA models. The results suggest that the performance of these two classes of models is quite similar in terms of coefficient estimates and goodness of fit for the case of aggregated time series traffic accident data. This is because the mean of the counts is high in which case the normal approximations and the ARIMA model may be satisfactory. However, the performance of INAR Poisson models is found to be much better than that of the ARIMA model for the case of the disaggregated time series traffic accident data where the counts is relatively low.

2.3A - Road Pricing

Shepherd : DESIGNING ROAD PRICING CORDONS [ITS LEEDS]

ABSTRACT: Despite over 40 years' research into congestion charging cordons around Europe and Asia, there is little technical advice on where best to place charging boundaries. Most designs are based on a mix of professional and political judgment, with little consideration of the effectiveness of alternative locations. This paper describes two approaches for designing cordons. The first method is a genetic algorithm (GA) based approach. On an application to Edinburgh, this approach resulted in larger benefits over judgemental designs. While this approach is promising, complexities can potentially increase with the size of the network. The alternative approach lies in the middle ground between judgement and the optimal design approach of GA. It was developed from an observation during our earlier study that charges on only a few of the highest marginal cost links could result in a high proportion of the system optimum or first best benefits achievable with charges on all links. Often a cordon cannot be formed from these "high cost" links but the flows which use these links can be traced through the network using a "select link analysis". This

information can be used to design a closed cordon which charges a high proportion of these flows. This paper will demonstrate this approach for networks of Edinburgh and Cambridge and discuss the implications of moving from the buffer to simulation mode within the SATURN modelling package.

Koh : SECOND BEST TOLL AND CAPACITY OPTIMISATION IN NETWORKS [ITS LEEDS]

ABSTRACT: There have been many recent studies into the theoretical solution of the second-best toll problem whereby a set of tolls are optimised for a pre-defined set of links. This paper looks at the constraint cutting approach due to Lawphongpanich and Hearn (2004), which redefines the variation inequality condition of deterministic user equilibrium as a system of inequality conditions using extreme points of the feasible flow region. The approach is shown to work even when there exist discontinuities due to changes in active path sets, thus improving on a method based on the KKT conditions of the traffic equilibrium as studied previously. In addition, the approach is extended to deal with the joint problem of optimising tolls and capacity investments. Our results show that the method can be applied in most cases for small sized networks but that the algorithm can fail due to problems with the Sequential Quadratic Programming adopted which, in some cases, is unable to handle highly non-linear inequality constraints.

Quddus : Technologies for Implementing Variable Road Pricing Policies [Loughborough University and Imperial College London]

ABSTRACT: A technically and economically feasible charging should be based on quantities that are readily and accurately measurable as well as directly variable to the amount of road use. The factors that one may use to determine the charges for road use is referred to as the Variable Road User Charging Indicators (VRUCI). By considering both the associated costs of a trip and the operational requirements for a feasible road pricing scheme, the most potential VRUCI are identified in this paper. These are: geographic area, road class, distance, time, emissions, driving behaviour, and vehicle occupancy. The selection of technologies and techniques to measure these variables largely depends on the accuracies required by the charge model. Current literature suggests that existing technologies and techniques are not capable of measuring all of these variables for relatively stringent requirements. This paper identifies feasible technologies and develops techniques to measure these potential VRUCI in real-time with high accuracies. The possible indicator variants related to geographic area are city, urban, suburban, and rural which are easily obtained from a land-use database. A spatial road network database is employed to attain the type of road class. The actual distance travelled by the vehicle is obtained from a navigation module supported by the integration of GPS, dead reckoning (DR), and spatial road network data. This integration is normally known as a map matching (MM) algorithm. Extensive field tests were carried out and the results suggest that a fuzzy logic based map matching algorithm developed by the authors in their earlier work has potential to provide an accuracy of 5 m (95% of the time). This navigation module is also used to measure time of trip and duration of trip indicators. A statistical model is developed to measure various vehicle exhaust emissions (e.g., PM, NO_x and CO) in real-time using the data from the engine management systems (e.g., clutch & brake pedal presses, accelerator position (%), engine speed, fuel flow, vehicle speed, and acceleration). This model has been validated by the use of on-board emissions monitoring devices.

2.3B - Stated Preference Design

Ibáñez : [Institute for Transport Studies, University of Leeds & School of Engineering, University of Seville]

ABSTRACT:

Lu (Smeed) : THE IMPACT OF PERCEPTION ON THE INCENTIVE TO BIAS IN SP RESPONSES [Institute for Transport Studies, University of Leeds]

ABSTRACT: Stated Preference (SP) methods have been used extensively in transport research and elsewhere both for demand forecasting purposes and to value the importance attached to different product features and travel attributes. A great deal of scepticism surrounded the methods in the early years of application, to the extent that studies addressed the issue of the extent to which the results from SP methods validated against comparable Revealed Preference evidence (MVA/ITS/TSU 1987; Louviere, 1988). SP is now very much an accepted method of travel behaviour analysis. However, there are instances where the findings of SP studies are a cause for concern, as we shall demonstrate. Alongside the broader acceptance and wider application of SP methods, some practitioners (Bates, 1998; Ampt et al. 2000; Wardman and Shires, 2001; Arentze et al. 2003) have argued for greater openness in discussing what they see as significant concerns surrounding SP. This paper, based on work undertaken for a PhD thesis, provides a contribution in that spirit, specifically addressing the issue of the strategic biasing of SP responses (Bonsall 1986). This paper reviews and explores incentives for respondents to strategically bias their answers in order to influence policy makers. The paper examines two hypotheses concerning bias in SP responses, relating to task complexity and the presence of specific anti-bias warnings in the questionnaire. By introducing post-questionnaire questions (Powe, et al. 2005) on respondents' perception, the paper probes the decision process of respondents and explores the influence of perception on the SP responses. Section 1 of this paper summarises concerns surrounding the extent to which the responses to hypothetical questions reliably reflect individuals' true preferences when there is an incentive to bias responses. The discussion is illustrated with examples from research in the transport field. Section 2 suggests methods to amend incentive to bias and proposes two research hypotheses. Section 3 describes the design of the SP exercises and the data collection process whilst section 4 reports the SP results for commuters' valuation of new trains in Greater Manchester. The paper aims to identify the influence of different designs on the pattern of SP responses and to explore means of identifying and reducing strategic bias.

Daly : NEW INSIGHTS INTO ISSUES IN THE DESIGN OF STATED CHOICE EXPERIMENTS [ITS, University of Leeds]

ABSTRACT: A feature of Stated Choice experiments, like many stated preference procedures, is that the efficiency of data collection can be enhanced by careful design of the presentations made to individuals. That is, while maintaining realism, the accuracy of parameters can be enhanced (for a given number of respondents and responses) by careful choice of the attributes of the alternatives between which respondents are asked to express preference. In particular, this paper considers the appropriate levels of the attributes and the way in which these should be correlated between experiments. Two specific issues are addressed. 1. The property of orthogonality among the attributes has been found to be undesirable in some recent work. However, the paper shows that the criterion of D-optimality, which is widely used to optimise SC designs, relates closely to a specific form of orthogonality in the design. 2. The concept of an optimum level of probability of choice to present to respondents, sometimes called 'magic p', can be extended to multiple attributes but is not always possible to achieve. This is explained and information is given about the efficiency of different approaches in different contexts. In some instances, however, D-optimality may not be appropriate and alternative criteria are considered and their consequences for design are indicated. These criteria can also lead to designs featuring 'magic p'. Finally, attention is given to the issue of the stability of the design to the prior information on which it is based.

2.3C - Traffic Flow

Carey : A review of flow-density functions [Queen's University]

ABSTRACT: Flow density functions are used to model traffic flows on single links and are increasingly used in analytic modelling of flows on networks. When they are used in the latter context, a triangular or trapezoidal form of flow density function has generally been used, though in other contexts the flow density function is generally treated as a nonlinear function. We review the wide range of flow density functions that have been proposed over time, and the properties of each of these. We also note that flow-density functions can be derived from speed-density functions, speed-flow or flow-speed functions, various types of travel time functions, etc. Hence we consider various functional forms that have been proposed or used in the literature for each of these, and from each of these we derive the implied flow-density function and its properties. In travel time functions we include the travel time functions that have been used for some decades in static traffic assignment models and travel time functions that are used in some dynamic traffic assignment models. Having reviewed the properties of many different flow-density functions, we try to select the most credible or useable forms of these. As selection criteria use the essential or desirable properties of flow-density functions, and also whether the functional form is consistent with estimates of the values of certain basic traffic parameters (free flow speed, flow speed at jam density, (jam density (?), ratio of critical density to jam density). Many flow density functions (and many speed-density functions and travel time functions) do not allow any acceptable value for some of these parameters.

Krishnan : Predicting traffic flows on urban road networks [Imperial College London]

ABSTRACT: Short-term prediction of traffic flows is an important component of Advanced Traveller Information Systems (ATIS) with prediction capability and forms a useful input for traffic management. A common way to predict traffic flows is to infer flow patterns based on time-of-day and day-of-week using historic flow information and use it as a basis for forecasting flows. These static prediction profiles yield inaccurate results when the state of the road network changes, e.g. during incidents, or when special events alter the regular flow patterns. It is under these changed conditions that travellers rely on ATIS systems to provide them with useful information, and reliable flow prediction under these conditions is an important problem. A robust framework to model the spatio-temporal evolution of traffic on the road network accounting network performance changes is proposed in this paper. Calibrated spatio-temporal regression models have been used to predict network-wide traffic flow previously; such models capture the spatial evolution of traffic over the network and the speed of such evolution simultaneously. The proposed framework improves upon such models by capturing the spatial and temporal flow evolutions separately. While the spatial evolution captures recurring travel patterns which can be deduced from historic flow data, temporal evolution depends on current travel time on the network. Hence, the proposed flow prediction framework is essentially a hybrid model which uses travel time estimates to predict the temporal evolution of traffic flow and historic trends to predict its spatial evolution. The framework will be tested using ASTRID data from London to predict flows on urban arterial links in London.

2.3D - Traveller Information

Habib Pathan : Traveler Response Towards Advanced Traveler Information Systems (ATIS) In Bangkok [Institute for Transport Studies]

ABSTRACT: This research aimed to develop driver behavior models that can be used to analyze the effect of different types of ATIS on the traffic in a busy commuter corridor in Bangkok, the Second Stage Expressway locally known as the Si Rat Expressway. The main objective of this research was to explore how travelers behave under unexpected congestions and how they might respond to qualitative, quantitative and prescriptive information. Data were collected on travelers' diversion propensity under congestion through a survey of expressway commuters of Bangkok. Past diversion decisions were explored by revealed preference survey. Moreover, responses to different types of hypothetical ATIS scenarios were explored by using stated preferences. Logit models of traveler

response were developed from both stated and revealed preference data accounting for biases inherent in the SP responses. The analysis suggested that accurate delay and prescriptive information significantly affects drivers' willingness to divert. Other significant factors included expected delay on usual route, travel time, congestion level, socio-economic characteristics and information sources. On the other hand, the effects of ATIS were assessed by implementing the findings of the behavioral models into the traffic simulations enabling evaluate its impacts on transportation system performance. The results indicated that spatial location and type of incident are important factors which affected mobility of expressway users differently. It was also found that longer the duration of incident, the more adverse effect it has on network performance. The impacts of ATIS in dealing with recurring congestion were also found encouraging.

guo (Smeed) : Using Immersive Video as a Rapid Prototyping Tool to Evaluate Future Traveller Information System [Newcastle University]

ABSTRACT: Increased car use in many urban areas has led to growing traffic congestion, which not only threatens economic growth but also results in poor air quality, noise and global warming. Empirical studies suggest that using traveller information to influence travel choices is one way to address the problem. The existing information infrastructure cannot meet the increasing demands for well-customised, context-aware, timely and adequate information services and promise always-on access. However, emerging technologies can help us to solve the problem by bring us towards a pervasive computing era where minute computers are to be embedded into everyday objects, invisibly and ubiquitously. Future traveller information systems (TIS) supported by pervasive computing are being considered as the next generation of traveller information systems. However, large scale deployments of pervasive computing environments do not yet exist. Building models or mock-ups of future TISs is expensive and time-consuming. This paper introduces current research at Newcastle University which is using immersive video as a rapid prototyping tool to investigate the impacts of future TIS scenarios on travel choices. Immersive video has the potential to enhance the fidelity of user experiences for a laboratory study by reconstructing a dynamic and realistic environment in a laboratory. This paper describes the creation of immersive video and presents the preliminary development process of using immersive video as a evaluation tool.

Farg : CONCEPTUALISING BARRIERS TO TRAVEL INFORMATION USE [Centre for Transport and Society]

ABSTRACT: Since the 1998 UK government Transport White Paper which emphasized improving public transport and information for passengers, there have been considerable developments in the provision of travel information. Simultaneously, the use of the Internet and of mobile information and communication devices has increased tremendously. Various forms of travel information now exist which enable people to make better informed travel choices. In consequence, many people have the possibility of planning door-to-door multimodal journeys. However, while certain information services are reporting annual enquiries running into the millions, there is still a high number of non-users. Lack of awareness is only one of a series of barriers to travel information use. For service providers to realise the full potential of their services it is important that such barriers are overcome, yet little is known about their precise nature. The aim of this paper is to present a social-psychological theoretical framework (based on the Extended Model of Goal-directed Behaviour) that addresses barriers to travel information use. The model is founded on the notion that behaviours are selected because of their perceived usefulness in achieving a goal. Individuals develop a motivation to act (behavioural desire, such as using travel information) which is affected by: habit, attitudes, anticipated emotions (feelings that occur in the case of goal achievement or failure), perceived behavioural control (an individuals' confidence in undertaking a particular behaviour), and subjective norms (perceived social pressure exerted by important others to perform or not to perform a behaviour). Situational factors (such as characteristics of journeys and travel

information services) are added to the model to account for the context in which a certain travel choice is made. Thus, barriers to travel information use might be tackled more effectively in the future by a better understanding of people's behaviour.

3.1A - Issues in Transport Appraisal

Lyons : A HUMAN PERSPECTIVE ON THE DAILY COMMUTE: COSTS, BENEFITS AND TRADE-OFFS [University of the West of England, Bristol]

ABSTRACT: The average worker in Britain spends 139 hours per year commuting – the equivalent of 19 standard working days. While the average distance and time taken for journeys to work has been steadily increasing, the average number of journeys has been decreasing at a similar rate. The aggregate picture inevitably masks an array of underlying trends. This paper offers a multi-perspective examination of commuting drawing upon literature in transport, planning, geography, economics, psychology, sociology and medicine. It examines statistical evidence on trends in commuting travel behaviour and finds that one in 25 commuters now travel to work in excess of 100 kms (both ways) and one in ten commuters now spend over two hours per day travelling to and from work. It explores the different impacts (economic, health and social) that commuting has on the individuals that conduct it and seeks to better understand the role of commuting for individuals in today's society. The paper finishes its examination by reviewing the commute experience itself including attitudes towards it and use of time during the journey. The paper concludes by highlighting a dilemma facing transport planning and policy. There are social, economic and financial benefits from an improved travel experience for people with long commute journeys, yet improving travel experience may itself contribute to the trend towards long distance commuting.

Parkhurst : ROAD PRICING AND THE SOCIAL DIMENSION OF SUSTAINABILITY [University of the West of England]

ABSTRACT: With national road pricing (RP) now being referred to by transport ministers in the UK as a matter of 'when and how' rather than 'if', there is political interest in a number of aspects of making road pricing a reality. One such aspect is how far RP schemes might have different consequences for different social groups, and whether these differences might amount to significant changes in social justice. The identification of changes would be important both in terms of determining the contribution of RP to greater social inclusion and in influencing public opinion in general about the fairness and equity of RP, and hence its overall acceptability as a policy overall. The present paper applies Jones' (2004) distinction between social equity and spatial equity considerations in examining the extent to which studies to date inform the debate as to whether RP increases or reduces social justice. Evidence is reviewed which supports the possibility of either outcome, depending on circumstances, but with the few examples of reduced equity arising from a combination of social and spatial factors which may be hard to disaggregate in practice.

Cherchi : Income Effects in the Evaluation of User Benefits Using [Imperial College London]

ABSTRACT: The role played by income in the evaluation of the benefits of policy interventions has long been a source of contention in economics, and in recent years renewed interest has developed in this issue in several areas of public policy analysis. By contrast, in the field of transport policy analysis, income effects are still generally ignored, on the grounds that (a) the proportion of total expenditure allocated to transport is not significant and (b) the policy measures being considered usually entail relatively marginal changes. However, recent work especially in development countries, has cast doubt on these justifications. Moreover, with governments around the world actively considering more aggressive transport pricing policies of various types and with growing concerns over the security and price of energy supplies, such a situation may in the future no longer

be confined just to developing countries. Against this backdrop, it is clearly desirable to understand the implications of including or not income effects in the specification of travel demand models and in the calculation of user benefits, and in particular, at what level of expenditure on transport income effects cease to be ignorable. The aim of this paper is to address these issues through a series of numerical experiments using quasi simulated data designed to be characteristic of UK conditions. The use of simulated data allows us to control for other aspects of model specification error, so as to focus the analysis more sharply on the issue of income effects. Our results indicate that the error in the benefit measure due to disregarding income effects depends on the ratio between the cost of the alternative and the income that each individual can effectively spend on that specific trip. This error can be large (more than 30%) for low income groups and could have significant impacts on appraisal outcomes.

3.1B - Behavioural Modelling

Nellthorp : The funding game: performance incentives for Local Transport Plans [Institute for Transport Studies, University of Leeds]

ABSTRACT: This paper examines the recently introduced performance-based funding system for English local transport authorities, using game theory to help analyse: how the overall structure of the system incentivises the players; how the detailed features of the system affect its incentive properties and its effectiveness; and what alternative incentive systems might be considered by a government department wishing to achieve the best possible performance at local level. The researchers' initial task was to understand and document the real game as it is currently played, and this was done with the assistance of interviews with key individuals in the Department for Transport and English local authorities (Kelly et al, 2006). Next, game theory models were reviewed for relevance/applicability, and two possible analogues were found for the Local Transport Plan game: the rank order tournament of Lazear and Rosen (1981) or the rent-seeking contest (Tullock, 1980). Ultimately, Clark and Riis' (1998) multi-player, multi-prize model of the rent-seeking contest was adopted and the game was solved for the 85 player Local Transport Plan case. Using the results, an analysis is given of the current LTP game, including its overall structure and specific features. Our findings point to the prize structure (how many prizes and how 'graduated') as a key issue in the design of optimal incentives in this application. The existence of a 'level playing field' for competition between different local authorities is another issue which has a large bearing on the optimal incentive structure – and which DfT has given attention to in practice. Finally, we assess alternative possible incentive structures in the paper, including their possible application to the LTP game and the conditions under which the game theory work suggests they are most likely to be successful.

Sunitiyoso : MODELLING THE INFLUENCE OF SOCIAL INTERACTION AND SOCIAL LEARNING ON TRAVELLERS' BEHAVIOUR USING INDUCTIVE METHODOLOGY [Centre for Transport & Society, University of the West of England]

ABSTRACT: This study aims to investigate the influence of social interaction and social learning on travellers' behaviour using an inductive methodology. The methodology utilizes laboratory and simulation experiments. A social dilemma situation which is formulated in a hypothetical employer-based demand management measure is used as the case study. The laboratory experiment is used to demonstrate the dynamic processes of travellers on making repeated travel decisions. It also allows investigation of the dynamics of each individual's behaviour as well as the group behaviour. Analyses on group and individual behaviours of travellers provide some indications about the existence of some types of social and individual learning mechanism in their decision making. The results of the laboratory experiment also provide basic information for developing a simulation model in the next stage of the study. The simulation experiment utilizes an agent-based simulation model to simulate and analyse behaviours of individuals in larger environments, larger group sizes,

longer time periods, and various situational settings. The simulation experiments provide indications, which are supported by evidences obtained from the laboratory experiment, that social information may have both positive and negative effects on individuals' behaviour, depending on the form of social learning mechanisms that are used by individuals.

Michea : Evaluating Alternatives to Expected Utility Theory [Imperial College London]

ABSTRACT: In recent years there has been a growing recognition that conventional models of travellers' decision making need to be extended to accommodate the fact that travellers are often uncertain regarding the outcome of their decisions. The classical approach to the study of risky choice is expected utility theory (EUT). However, EUT is known to have several weaknesses as a descriptive theory of human behaviour and many alternative theories have been proposed and some are beginning to be applied in the field of travel behaviour research. However, to date most of this work has been conducted on small samples of respondents and few studies have attempted to distinguish between or jointly accommodated the consequences of uncertainty affecting the decision maker regarding states of the transport system and uncertainty affecting the analysts regarding the perceptions and preferences of the decision maker. Nor is there any significant experience in the transport literature of the comparative performance of alternative non-expected utility theories. The objective of this paper is to address these issues using data from a large, naturalistic stated preference exercise in which respondents were faced with a series of choices between alternative hypothetical unreliable train services. This paper presents a systematic comparison of EUT and four alternatives – Prospective Reference Theory, Weighted Utility Theory, Rank-dependent EUT and Cumulative Prospect Theory. The comparison uses data from a large, naturalistic stated preference exercise in which respondents were faced with a series of choices between alternative hypothetical unreliable train services. The results indicate that each of the alternative theories offers some additional insight and empirical improvement compared to EUT.

3.1C - Traffic Modelling

Maher : MODELLING SIGNALISED ROUNDABOUTS USING TRANSYT [Napier university]

ABSTRACT: TRANSYT has been used for optimising signal timings in signalised networks for over 30 years. It consists of a deterministic, macroscopic traffic model that evaluates the performance index (PI) for any given set of timings (cycle time, greens and offsets) and an optimiser that employs a "hill climbing" method that seeks to minimise the PI. One well-known weakness of the traffic model is that it treats queues as if they stacked vertically at the stop line, so that it does not model "blocking back". However, TRANSYT11 incorporates a "limit queue" facility that attempts to mitigate the problem by adding a penalty term to the PI when the queue length on a link exceeds a given value. The paper investigates the effectiveness of the limit queue facility when TRANSYT is applied in circumstances where blocking back is a serious possibility: that of a relatively small, but busy, 6-arm signalised roundabout. In these investigations it emerges that the optimiser is surprisingly ineffective in finding the global minimum, and that the PI value of the final solution depends very much on the (arbitrary) initial timings provided by the user in the input file. Whilst it is well-known that the hill climbing method cannot guarantee to find the global optimum, the extent of this variability in PI values is remarkable and far beyond what previous studies had found. The degree of variability is partly due to the use of the limit queue facility and also to the short length of the circulating links. A simple procedure, employing TRANSYT's batch run facility, is devised to ensure that the solution produced is, with a high probability, close to the global optimum. The effect of the limit queue facility is then investigated by comparing the solution found when the facility is switched "on" with that when it is switched "off". Some small differences are found, so that it appears that the facility does have the effect of modifying signal timings in circumstances when blocking back may likely, but equally it has the unfortunate effect of making the TRANSYT optimiser perform very poorly. The

paper then discusses the wider issue of techniques for global optimisation in transport problems and makes some preliminary investigations into a new approach called the cross-entropy method which has potential application in a wide variety of combinatorial optimisation problems.

Yousif : VALIDATION OF A MATHEMATICAL MODEL TO ESTIMATE TURNING MOVEMENTS AT ROUNDABOUTS USING FIELD DATA [University of Salford & University of Baghdad]

ABSTRACT: In this paper, a mathematical model was presented and used to determine turning movements at roundabouts based on field data. Assumptions were made in order to simplify the model; such as no U_turns from and to the same arm of a roundabout, total traffic into the roundabout is equal to total traffic out of the roundabout and traffic is homogenous (i.e. mainly consisting of cars). Using Gaussian elimination, turning movements could be estimated for 3_ 4_ and 5_ arm roundabouts for the indeterminate traffic stream movements when inflows and outflows for each arm of the roundabout is known together with a flow stream on one internal circulating (weaving) section between any two arms of the roundabout. The model has practical use in reducing the number of detectors or counters (whether automatic, videoing techniques or manual methods are in use) which are needed in collecting data to determine the estimated flows from and to the different parts of a roundabout. The reduction in the number of detectors (or traffic counts) could be due to site limitations caused by faulty or limited number of counters used, inaccessible sections for obtaining video images for later analysis (e.g. presence of sharp bends, buildings or large trees obscuring vision). The benefits in cut saving costs could be significant in terms of time and man-power needed on site, and this could depend on the amount of traffic flow through the roundabout. The model was validated against data obtained from different sites and the results were found to be satisfactory. Key words: mathematical model, turning movement, roundabouts

Schmoecker : Bellman-Zadeh control of a major intersection considering vehicles and pedestrians [Imperial College London]

ABSTRACT: Traffic signal control systems like SCOOT aim to minimise delays for vehicles by adjusting the duration of the different cycle stages. Further there are many examples of junctions where stages are extended or shortened to give priority to public transport. The idea is to minimise the delay taking into account the larger number of passengers in buses compared to cars. A further step forward would be to minimise the delay taking into account all people trying to cross a junction. This means that the total delay considering car and bus passengers as well as pedestrians should be minimised. This type of junction would be truly "people-controlled". This paper will present a case study where the existing Marylebone Road-Baker Street intersection control is replaced from vehicle-controlled to people-controlled. At this intersection in Central London the pedestrian and vehicle flows are both high. The modelled area is extended to 6 junctions on Marylebone Road in order to reflect delays that might occur due to changes in the signal-offset. The microsimulation tool used is VISSIM with the actuated control programmed in the C-like VAP language. The main idea of the signal control is to call the pedestrian phase early if the number of pedestrians waiting justifies this. The signal control uses fuzzy-logic and the membership functions are set to optimise according to Bellman and Zadeh's principle of fuzzy decisions making. The main difficulty to achieve any people-actuated control is how to measure pedestrian-demand accurately. This will be discussed and the sensitivity of the signal control optimisation to accuracy in data collected from video or loop detectors will be considered. Further, non-compliance of pedestrians and its impact on signal control optimisation will be discussed. Observations from this junction show that a large proportion of pedestrians are crossing the junctions during red.

3.1D - Need & Exclusion

Adnan : NEED BASED PARADIGM TO MODEL HOUSEHOLD TRAVEL DECISION [Institute for Transport Studies]

ABSTRACT: The transportation planning process incorporates representative travel demand models for making comprehensive travel forecast. Recent research has been more focused on understanding of underlying behavioural norms of individual travel and as a result activity based approach gaining huge attention. This paper demonstrates phenomenon of travel decision in a rural household of developing countries by introducing need threshold concept to further strengthen behavioural premise of activity based approach. In the modelling framework rural household has been considered as basic entity for analysis, and considers individual as member of household, who are responsible for fulfilling household needs through respective activity participation. Need threshold is defined as the stage of the need accumulation process of any need associated to travel at which household takes a decision to fulfil that need. Consequently a need is then transformed in an activity when a household member selected given his/her role within the household. This concept provides representation of household economic parameters i.e. size, structure, life style, income and preference within modelling framework and gives insight to understand household consumption pattern with time. A travel-activity data set collected from 400 households of rural areas of Pakistan, has been analyzed and used to develop empirical formulation of need threshold concept in order to help model this phenomenon. The empirical analysis showed result in accordance with the developed framework and provide useful insight into understanding of underlying notions in travel decisions.

Minnaert (Smeed) : Social tourism: a potential policy to reduce social exclusion? The effects of visitor-related social tourism for low income groups on personal and family development [University of Westminster]

ABSTRACT: Abstract: social tourism is often presented by charities and governmental organisations as a potential means to counter social exclusion. It has more specifically been linked to potential benefits such as improvements in family relations, a more pro-active attitude to life, an improvement in the academic performance of children etc. Even though this argument is often used when promoting social tourism, there is very little research evidence that supports these claims. This research concentrates on visitor-related social tourism for low-income groups, and the effects a social holiday can have on the daily lives of the families who are offered these holidays. The paper reports on qualitative two-stage research that has been conducted with participants of social holidays in the UK and their welfare agents. It will present findings as to how far holidays can assist with the integration of socially excluded, and this on different levels: family relations, parenting, pro-social attitudes, mental and physical health and community involvement are examples of categories used to measure change. Different types of holidays will also be compared to analyse the merits and limitations of each type (individual family holidays versus group holidays).

Su (Smeed) : MODE CHOICE OF OLDER PEOPLE FOR SHOPPING TRAVEL [Imperial College]

ABSTRACT: With the population aging in many countries, older people's travel is recently getting more attention in the transportation literature. However our understanding of factors influencing their mode choice is still limited. In this research the focus is on mode choice for shopping trips as these are the most frequent trips of older people. The study is not limited to shopping trips, but also investigates the mode choice of the trips after shopping trips. Two types of models—the multinomial logit model and the mixed logit model—are fitted to LATS data to estimate the effects of various factors on the mode choice of older people for shopping travel. The appropriateness of these models and the implications of the findings are discussed.

3.2A - Competition & Co-operation

McHardy : ON PRIVATE INCENTIVES TO PROVIDE JOINED-UP NETWORKS [University of Sheffield & University of Hull]

ABSTRACT: In this paper we consider whether the appropriate incentives exist for the market to provide services which are in the social interest and, most importantly, are economically viable (profit is non-negative). We employ a simple three-sector model of public transport and identify the conditions under which a monopoly operator would and would not provide a 'complete' or joined-up network of economically viable services. In the case of incomplete network provision we look at the possibility of alternative ownership and regulatory regimes with effective policies including the threat of competition (inducing the desired result without duplicating fixed costs) on a subset of the network.

Singh : Competition in Rail Freight Transport: Can it Work in a Vertically Integrated System? [Institute for Transport Studies, University of Leeds]

ABSTRACT: This paper analyses the policy followed by the Indian Railways in opening up its intermodal freight segment to competition. This approach attempts to promote competition within the existing structure of integrated monopoly operation. The paper reports on a survey carried out after the policy announcement amongst new entrants to explore the principal barriers to competitive entry and draws some tentative conclusions about the Indian Railway model of deregulation. Access to land for terminals and uncertainty of haulage charges have emerged as crucial barriers although they have not deterred entry. The principal advantage of this model is ease of implementation but one possible constraint is the limited possibility of cost reduction.

3.2B - Cycling

Wells : Accessibility Planning for Cyclists [Transportation Research Group, University of Southampton]

ABSTRACT: The UK Government's Accessibility Planning initiative aims to improve access to healthcare, jobs, shops, services and community facilities by non-car methods of travel, particularly for disadvantaged groups and areas. Every local authority in the UK is now required to report against a number of indicators in their Local Transport Plan and Local Development Framework, commonly the distance or time needed to access a particular location by walking, cycling and public transport. Accessibility for pedestrians and cyclists is typically measured using a crow-fly distance or the shortest distance on the road network, but these methods do not account for either cycle and pedestrian routes away from the road network, which improve accessibility, or physical and psychological barriers to movement, which reduce accessibility. This paper details a study of cyclists in Southampton, UK, which used Geographical Information Systems to compare the commonly used crow-fly and road network estimates with actual travel distances for cyclists, to assess whether improved distance measures could be derived to give better measures of accessibility. Using a case study of a large shopping centre, the use of crow-fly distance measures was found to significantly overestimate accessibility, suggesting that local authorities using crow-fly distance measures should be extremely cautious when presenting and analysing results. Using measures based on the road network alone was shown to slightly underestimate accessibility, with the error increasing as the number of cycle routes and other routes available to cyclists increases. By creating a weighted average of the crow-fly and road network distance measurements, a better estimate of true shortest cycling distances was achieved. By effectively creating a road network based accessibility polygon and then expanding it slightly to account for the likely presence of cycle routes without having to know their exact locations, this paper describes a methodology for local authorities to improve the

accuracy of accessibility assessments until networks including detailed cycle routes and other routes available to cyclists become available.

Parkin : Policy implications of results from an aggregate model of cycle use in the UK [University of Bolton]

ABSTRACT: A model has been constructed that relates the proportion of bicycle journeys to work for English and Welsh wards to relevant socio-economic, transport and physical variables. The model uses 2001 census data and is based on the logit model with a saturation level estimated by the model. Socio-economic class, ethnicity and income deprivation influence cycle use, and their effects point to issues of culture and conformity as being important. While females may be more aware of risk, it is possibly the attractiveness and comfort of off-road routes which could be an important choice factor. Greater distance to work, hilliness and the physical condition of the road are linked with lower levels of cycling and confirm the importance of comfort and effort as attributes of cycling which need to be accounted for in mode and route choice models. An upper bound of journeys to work by bicycle of broadly 50% has been estimated. The development of the model is presented elsewhere, and this paper considers the model's policy implications for promoting cycling.

3.2C - Route Guidance

Kaparias : A time-dependent risk-averse algorithm for reliable in-vehicle navigation [Centre for Transport Studies, Imperial College London]

ABSTRACT: This paper presents a methodology, in order to increase the reliability of the route suggestions in in-vehicle navigation systems. Based on the A* path finding algorithm and Chen's link penalty method, the procedure involves penalising links with a high risk of being congested and obtaining a set of reliable route suggestions. Time-dependence of travel times is considered by adapting the Flow Speed Model technique accordingly. Modifications to the structure of the path finding algorithms are also made, so as to account for real road network features. Finally, experiments using simulated travel time and reliability data are carried out on a road network and the results are discussed.

Park : ADAPTIVE ROUTE CHOICE MODELS FOR INTELLIGENT ROUTE GUIDANCE [Imperial College]

ABSTRACT: This study presents two approaches to developing adaptive route choice models; a rule-based approach and a utility maximisation approach. While the rule-based approach is to discover regularities observed in route choice behaviour using a decision tree algorithm, the C4.5 algorithm, a multinomial logit model is formulated by the utility maximisation approach. The adaptive processes of both models are executed by iteratively updating previous models with data stored by the time, whenever the user's actual choices are difference from the predicted choices. In order to examine the adaptability of the models and to compare strengths and weaknesses of each approach, experiments are carried out. The results of the experiments indicate the applicability of the models in personalised route guidance. It appears that the rule-based approach has an advantage because of the intelligible structure of the model, which enables to inspect and approve route selection rules.

3.2D - Demand Responsive Transport

Laws : DRT SCHEMES IN ENGLAND AND WALES AND CONSIDERATIONS FOR THE FUTURE [Loughborough University]

ABSTRACT: Local Authority administered Demand Responsive Transport (DRT) schemes have become increasingly prevalent in England and Wales in recent years, in part as a result of the growth

in the availability of Government funding. However insufficient research has been undertaken to date into the nature of these schemes and their performance which makes it difficult to predict their future role. In this respect, a survey was undertaken in order to collect data on the background, operation and performance of DRT schemes in England and Wales. It found that DRT schemes are often designed in an attempt to tackle social problems caused by poor accessibility, that they took time to become established, to achieve their objectives and to reach an acceptable performance in terms of level of subsidy. The paper concludes that Local Authority led DRT schemes do have a role to play but that lessons learnt from schemes currently in operation must be heeded by those contemplating new scheme development.

Phonphitakchai : MODELLING USAGE RATE OF DRT SERVICE: DISCRETE CHOICE MODEL WITH LATENT VARIABLES [Newcastle University]

ABSTRACT: Demand Responsive Transport (DRT) is a relatively new form of public transport provision; it is an intermediate form, some where between bus and taxi. DRT has an important role to improve social inclusion where the conventional public transport is untenable, e.g. low demand areas, special transport services. To develop greater understanding in DRT services, this research will apply discrete choice analysis with latent variables to model the usage rate of the LinkUp DRT service in Tyne and Wear, UK. The assumption of the model is that each passenger has an underlying utility for using the LinkUp service. This study hypothesises that socio-demographics, travel characteristics, and attitudes and perceptions toward the LinkUp service of the passengers affect their utility. The attitudinal and perceptual data are constructed as three latent variables; awareness, satisfaction, and relative advantage, and then incorporated in a discrete choice model. The interpretation of the empirical result of the model should provide some useful information for implementation and development of DRT services.

3.3 - Plenary

Noland : An Analysis of Trip Chaining Among Older London Residents [Imperial College London]

ABSTRACT: This paper examines the trip chaining complexity of individuals in London. We adopt two definitions of trip chaining. One based on a 30 minute dwell time rule and a second based on home-to-home tours. Our focus is on the complexity of the trip chains as measured by the number of stops on a given tour. The analysis uses the London Area Travel Survey and examines the factors associated with trip chaining for people aged over 60. A comparison with those aged under 60 reveals that older people on average make more complex tours. Through descriptive analysis and ordered probit regression models we examine how reported levels of disability effect their trip chaining and we examine household demographic characteristics as well as proxies for accessibility, such as local population density. The analysis shows that disabilities do not necessarily lead to reduced tour complexity except when disabilities become so severe that independent travel is not possible. Our use of different tour definitions reveals that in particular home-to-home tours are more complex than tours with other starting points or destinations.