

## **Abstracts in lieu of full conference papers**

### **Peter Jones - Sustainable Mobility - the (non-transport) missing dimension**

#### **Abstract**

The UK government, the European Commission, the United Nations and many other bodies have called for the development of policies to encourage 'sustainable mobility', but most of these initiatives focus on the supporting transport systems and associated infrastructure (e.g. oil supply systems, or the electricity grid). Since most travel is acknowledged to be a derived demand, ignoring the resulting interactions with other sectors makes it much more difficult to achieve the goal of sustainable patterns of mobility. I take the latter to include both the use of low carbon or carbon free modes of transport, and a reduction in the overall level of travel demand, at certain times and places.

Transport policies and practices are relatively effective at dealing with the allocation of a given level of travel demand among routes in a transport network, and (to a lesser extent) in influencing the distribution of demand among different modes of transport, but they carry much less leverage in affecting the overall level of travel expressed in person kilometres. The latter is a function of trip rates multiplied by average trip lengths. While travel costs can have some influence on overall demand, it is much more strongly influenced by business – and social – practices in other sectors. Indeed, travel demand models often base person and household trip rate estimates primarily on socio-demographic factors, and not wider influences.

This paper explores what taking a broader approach to achieving sustainable mobility would entail, both in principle and in practice, at three levels. First, at a conceptual level, it considers what are the main drivers behind different components of overall levels of travel demand, how these relate to decisions taken in different sectors of the economy, and in what ways these sectors could change their policies and practices in order to facilitate sustainable mobility. As part of this, the scope for travel substitution is considered. The case is also made for exploring scenarios which would involve simultaneous changes across several sectors, that could lead to more major changes in behaviour that would facilitate more sustainable living patterns, in general.

Next, at a methodological level, the paper considers the extent to which existing transport techniques are suited to encompassing these wider issues, or whether they would need to be enhanced by drawing on methods employed in other disciplines and sectors, or would require new methodologies to be developed.

Third, the paper considers current governance and institutional arrangements in the UK, whether they are 'fit for purpose' within this wider framework for achieving sustainable mobility, and in what ways they might be modified in order to reduce barriers to the delivery of sustainable mobility.

### **Emma Bill - Are computer animation visualisation materials useful to promote active travel?**

Transport and public health researchers have a shared interest in the promotion of active modes of transport. Walking and cycling are activities that may help achieve health benefits, contributing to wider sustainability goals. Visualisation might be an instrument to support behaviour change, leading to modal shift reductions in traffic and pollution.

Visualisation technology has been used for a variety of different intentions. Sheppard (2012) discusses the use of dramatic visual imagery to communicate the remote impacts of climate change. Similarly, visualisation has been used in scenario modelling and the representation of walking and cycling futures (Timms et al. 2011). The problem remains that, "...the technical possibilities [of visualisations] currently exceed the knowledge of their correct application". Therefore, "Standardized methods and guidelines for producing and applying 3D landscape visualizations", are required (Hayek, 2011). Little is known

about how visualisation can be used to change behaviour as part of an intervention. This aim of this paper is to understand whether visualisation is useful to encourage active travel.

Participants were asked to watch a visualisation of a new walking and cycling route in Glasgow. The visualisation included an existing segregated cycling facility and a to-be-completed pedestrian and cyclist bridge. Two focus groups considered employee and organization perspectives on visualisation. Purposive sampling explored the different views of sedentary employees (n=5) and those who stand throughout the working day (n=3), representing different levels of autonomy and hierarchy in an organization.

The results suggested that visualisation underestimates the experiential and embodied aspects of travel informing the decision-making process. Workplace roles, activities and cultures might inform the effectiveness of visualisation to encourage non-motorized modes of transport. Visualisation demonstrating infrastructure change should consider how other dimensions of mobility, including, how the social and regulatory environments, (Pooley et al. 2011) might be represented to potential users of the route.

### **Lucy Mahoney - Modes and Moods: A Comparative Study**

There is increasing interest amongst academics and policymakers on the subject of happiness and public wellbeing. Within a transport context, one aspect would be to examine the experiences and effects different transport modes have on our happiness whilst moving, and the potential impact on activities outside of the actual process of travel. From this we can examine the spillover effects of transportation mode choice, to look at the impact these modes have on peoples' moods during their daily activities. This paper longitudinally investigates happiness and wellbeing amongst a cohort of people taking part in a larger travel survey (see [www.iconnect.ac.uk](http://www.iconnect.ac.uk)). The first wave of results demonstrate that there are strong associations between happiness and wellbeing, and various travel modes suggesting that attention to factors that influence journey experience by policy makers and transport organisations could potentially contribute to improvement in overall national happiness. The second wave of data will examine changes in wellbeing and happiness overtime seeking to identify the relationship to transportation mode.

### **Emmanuel Ayodele - A STUDY OF THE POTENTIAL USE OF BLUETOOTH SENSOR DATA IN DELIVERING SUSTAINABLE TRANSPORT NETWORKS**

Population growth, enhanced quality of life opportunities and increase desire to travel are the major challenges in the delivery of sustainability in urban areas. In fact, traffic and related emissions represent a threat to the economy, a risk to human life and contribute to climate change. The UK Government has set stringent air quality and carbon emissions targets, however, air pollution levels and carbon emissions continue to rise despite new engine and vehicle technologies. A key element of management of transport systems for sustainability will be to manage a shift in demand to public transport and non-motorised modes. This may be achieved by gathering information concerning people movements and raising awareness of suitable alternatives. Currently, SCOOT (Split Cycle and Offset Optimisation Technique) is one of the intelligent transport systems (ITS) used to monitor traffic and whilst it provides a wealth of data it is restricted to vehicles travelling in signal controlled areas. On the other hand, Bluetooth, a wireless communication system, has been identified as a possible low-cost system that can be deployed to gather not only important traffic information (such as density, speed, travel time) across networks but also movement of people irrespective of mode.

This paper aims to demonstrate the potential of Bluetooth data to classify network users (such as commuters, occasional) as well as in identifying pattern of movements across the network improving O-D matrix estimation and understanding travel habits.

This research focuses on the analysis of data collected from a Bluetooth sensor array deployed in an Air Quality Management Area in Manchester. The study area is a SCOOT region and a site where low-cost environmental pervasive sensors have been deployed.

Bluetooth data captured over a period of one month has been analysed and compared against SCOOT messages and analysed in conjunction with pollution levels. Results will be presented.

### **Margaret Bell - Scientific Evidence to Support Business Models to Drive Future Sustainable Transport Solutions**

By 2050, UK population is projected to reach 80m (ONS, 2009), the overwhelming majority of which are anticipated to continue to live in cities. Nationally, urban areas are likely to become more densely populated surrounded by expanding urban areas, with increasing resource demands. Interactions within cities, across urban areas and with surrounding cities, towns and 'rural' areas will place new and different demands on infrastructure, whether it be housing, energy, waste collection, ecosystem services but more importantly transport.

Growth in urban populations coincides with an unprecedented requirement for an 80% cut in greenhouse gas emissions on 1990 levels by 2050 (DECC, 2009). This poses huge challenges alongside the targets set by the EU Air Quality Directive (2008/50/EC) which are being exceeded throughout the UK and demanding substantial fines. Scientific evidence clearly shows that technologies to reduce tailpipe emissions have not entirely been successful. Tax incentives, to encourage sales of diesel cars with higher mpg are responsible for more nitrogen dioxide episodes. UK government now acknowledges that future air quality targets need to be aligned with climate change measures (DEFRA, 2010). This puts energy demand reduction and low-carbon energy supply at the forefront of managing future urban environments.

In the context of this glimpse at some of the conflicts in policy; forty years of good quality fundamental research in UK Universities has sought to both inform and evaluate transport policy. But in the main, Government policy is reactive, changing with the times, moving forward for the better but often on reflection for the worse. This paper consolidates transport research outputs and takes a look 'outside the box' and proposes a different way forward – one that informs business models for investment to create jobs and empower business sectors to deliver the sustainable transport solutions for future urban areas.

### **Simon Box - 30 cars, figure of 8, 1 show - Large scale proving ground experiments to investigate junction control**

An experiment was conducted using the 'InnovITS' proving ground in Nuneaton. Thirty cars with volunteer drivers were asked to drive around a tight closed road circuit causing them to pass repeatedly through a cross-roads junction from all directions. The junction was signalized. In different phases of the experiment the traffic lights were controlled by either an automated system or by a human using remote control. All vehicles in the test were instrumented using GPS and bluetooth. Video footage from eight different cameras was also recorded.

The goal of the experiment was to collect data to validate the results of earlier work carried out in computer simulation. This earlier work indicated that human controllers could outperform commonly used automated systems.

This paper examines some of the issues that arise when trying to simulate an urban road junction in this manner. For example results are presented indicating a significant difference in the delay to vehicles at the junction depending on whether the drivers were instructed to follow a fixed route or a random route of their choice.

The paper also presents a detailed analysis of the sensor data and video footage to measure the performance of the junction under the different modes of control. The results support the conclusion that humans can be effective junction controllers and learning why this is can lead to improved automated controller design.

This work was in part funded by the BBC who filmed the experiment for an article which appeared on the "One Show" in August 2012. As a result there is some high quality film of the experiment to accompany the talk.

### **Imelda Haran - Investigating sleep deprivation of older drivers - a seven night sleep diary**

Road Traffic Collisions (RTCs) are not necessarily the main cause of death or injury for older people, nonetheless relative to their proportion of the overall driver population persons aged sixty-five years and above are over-represented in RTCs. Moreover, as population demographics depict an ageing but many are 'active' population the number of drivers aged 65+ is projected to increase significantly over the course of the next forty years. As a consequence, this segment of the driver population of travel behaviour patterns and associated road safety assumes greater pertinence.

The aim of this study is to investigate the magnitude of collision risk among older drivers to establish if age is an actual indicator in collision involvement. Older drivers are exposed to greater risk of collision involvement as a result of their sleep patterns and ailments due to aging. A content analysis of the literature depicting the general sleep patterns of this target group highlights the changes in sleep/wake patterns with aging. Indeed, it has been proven on many occasions that the sleep of the elderly is different than that of younger people. Whilst this is significant in respect of driver safety other factors must also be considered such as activity, stress, strength, stamina, mobility and cognition

The sleep diary extrapolates information regarding sleep patterns, activity levels, stress levels and lifestyle and explores any linkage related to the impact upon driver performance and collision risk. These replies were essential to build a clearer picture of individual habits and induced fatigue. The seven night sleep diary requested information on sleep patterns, disturbed sleep and average nightly sleep and further exploited the area of sleep quality and daytime sleepiness.

### **Karen Anderton - Mapping the UK low emission vehicle policy landscape**

This paper is concerned with the organisational governance of the low carbon vehicle regime in the UK. It focuses on the emerging relationships and governance structures developed through current activities to decarbonise the transport infrastructure.

Efforts have been underway for several years in the UK to prime the low carbon vehicle market and associated infrastructure required to promote efficient alternatives to the internal combustion engine. Such activities have been conducted through a host of public, private and non-profit organisations working together to understand the appetite for and barriers to uptake of alternatively-fuelled vehicles. The main objective of this paper was to map and understand the roles played by these various organisations. As such the interactions between: car and energy industries, transport, research and energy departments of government, national and local/city governments and civil society were investigated through conducting semi-structured interviews with participants from these diverse sectors . It was important to ascertain an understanding of particular roles assumed by certain entities and whether there is clarity between parties as to where ultimate responsibility lies within the project/policy delivery teams.

Initiatives such as the 'Plugged-in Places' scheme – which is deploying electric vehicle pilot projects across selected metropolitan areas and regions – amongst others, were examined to explore whether such projects inform policy development and strategic direction in the roll-out of future infrastructure.

Any 'bottlenecks' or 'gaps' in the development and implementation of policies associated with delivering alternatively-fuelled vehicles were also identified. Finally, the level of engagement of 'mainstream/leading' car companies versus niche/SME enterprises was considered, as well as the impact of EU regulation and policy over activities in the UK.

## **Ayan Chakravartty - Application of advanced Hazard based statistical model to investigate trends in the duration of poor air quality events**

The detrimental effect of air pollution, over recent decades, has been well researched but still it remains one of the major environmental issues in modern society. In UK air pollution is an attributable factor for approximately 30,000 to 50,000 premature deaths every year with a cost implication of up to £20 billion a year to society. Even though local government traffic management initiatives and policies have been implemented to address air quality, reports from Department for Environment, Food and Rural Affairs (DEFRA) suggest that the number of Air Quality Management Areas (AQMA), has increased steadily between 2003 and 2010 and approximately 90% of those declared AQMAs are due to road transport. 40 out of the 43 assessment zones in the UK are failing to meet the EU targets and UK Government faced legal challenges in 2010 due to breaches in Directive 2008/50/EC for particulate matter, PM10 and NO<sub>2</sub>, nitrogen dioxide, pollutants.

This paper investigates the variations in the level of NO<sub>2</sub> measured at the Automatic Urban and Rural (AURN) monitoring station between years 2001 – 2011 in Newcastle to develop fundamental understandings of the persistence of hourly NO<sub>2</sub> levels above 40 µg/m<sup>3</sup> using hazard theory as a mechanism to understand the failure rate of NO<sub>2</sub> event durations. Results of the non-parametric hazard function, which doesn't consider effects of parameters such as seasonal (spring, summer, autumn and winter), time of the day, day of the week, traffic flow regimes, meteorological conditions, successfully revealed anticipated year on year changes (fuel duty, vehicle technologies) proving the hazard model approach an effective tool exposing underlying relationships governing air quality event durations. This paper will present the next phase of the research which adopts the parametric and compares with the non-parametric hazard model results and thus to provide the scientific evidence of causes of features revealed in air quality data.

## **Robin Hickman - THE SEAMLESS PUBLIC TRANSPORT JOURNEY: AFFECTIVE AND INSTRUMENTAL**

Investment in public transport and other transport modes tends to be based largely on travel as an instrumental experience, i.e. we seek to speed travel up, make more convenient, or try to change the cost of travel. The quality of the journey, particularly the affective factors (such as happiness, 'stress' and wider experiential factors), are less understood in terms of their importance to travel.

We consider these issues, in relation to the public transport journey, drawing on the SYNAPTIC project (Synergy of New Advanced Public Transport Solutions Improving Connectivity in North West Europe, <http://www.synaptic-cluster.eu>), funded by the EU INTERREG IVB Programme.

The paper is based on a series of surveys of regional and international journeys carried out in North West Europe to reveal journey satisfaction by node/interchange and link (13 regional and 12 international journeys; 187 node surveys, 207 link surveys). A design exercise is carried at a key regional interchange (Preston) to highlight the potential for an enhanced passenger experience when journeying through the station. Finally, an animation is developed of the potential 'seamless public transport journey in 2030'.

The interchange generally suffers from the weakest satisfaction scores, alongside access to and from the first and last node (typically the station), thus proving to be the 'weakest link' in the door-to-door journey. The animated seamless public transport journey 2030 draws on international practice, particularly from the Netherlands, Switzerland and Germany, to highlight the possibilities for an improved journey experience. The findings can be important to interchange design and transit orientated development practice, and also appraisal, where affective factors in travel choice and experience can be given much greater weight in decision-making.

## **Ioannis Tsapakis - Prediction of Urban Traffic Flows - City of London Case Study**

Improving the accuracy of traffic flow predictions is a task of significant interest for practitioners due to its diverse benefits and applications in transportation engineering. The aim of this study is twofold. Firstly, to 'correct' traffic flows recorded by SCOOT detectors, comparing them against more reliable flows measured from Automatic Traffic Counters (ATC). Secondly, to predict urban traffic volumes by developing 'global' models without using pure traffic flows. The study data include 13 variables and have been collected for seventeen links in central London using different technologies, such as GPS devices. In order to address the aforementioned aims, several models were developed employing four methods: Generalized Linear Models (GLZ), Support Vector Regression (SVR), k-Nearest-Neighbours (KNN), and Dynamic Recurrent Neural Networks (DRNN). The models' performance was validated employing three metrics: R<sup>2</sup>, Mean Absolute Percentage Error (MAPE) and Average Coefficient of Variation (ACV). A preliminary analysis showed that the inherent MAPE in SCOOT flows was found to be 14.4% and the corresponding ACV 10.7%. The highest MAPE and ACV improvement in the accuracy of SCOOT flows was 52% and 54% respectively and was achieved using parametric non-linear GLZ models. On the contrary, the non-parametric 'global' DRNN models were more successful in predicting traffic flows without using pure traffic volume data, improving the MAPE threshold by 4% and that of the ACV by 37%. The results revealed the nonlinearity in the relationship between ATC flows and the independent variables that can be more effectively captured by nonlinear models regardless of the method examined.

### **Adel Bolbol - A Spatio-Temporal Approach for Identifying the Sample Size for GPS-Based Travel Surveys: A Case Study of London's Road Network**

GPS-based travel surveys hold many attractive features that make such surveys very attractive for travel behaviour studies. However, the sample size calculation procedure for such surveys is more complicated compared to well-known and widely applied conventional household one/two-day travel surveys. The higher cost of GPS surveys requires scrutiny at the sample size planning stage to ensure cost effectiveness. Calculating the most effective sample size for this inference mainly depends on the "variability" of the variables that a survey is designed to investigate. Hence, we use speed as an example of these observed variables. Since different surveys target different study areas for different temporal periods, we calculate different sample sizes for different spatio-temporal granularities of different modes. Primary analysis of intra-modal variability (variation within each mode of transport) suggests that motorised modes require by far much higher sample sizes than non-motorised modes, and hence, we focus on bus and car modes for this study. We use road network journey time data for the city of London to calculate appropriate sample sizes for travel surveys designed either for a specific period-of-the-day, day-of-the-week or month-of-the-year. We also use different transportation analysis zones (central, inner and outer London) to demonstrate the spatial variability of the data over these different survey durations. Then we finally calculate and analyse the range of required sample sizes for GPS-based travel surveys that are aimed at different spatio-temporal granularities in which the study is being conducted for different motorised modes of transport.