ENABLING SUSTAINABLE MOBILITIES: SOCIAL, CULTURAL AND EXPERIENTIAL DIMENSIONS, AND THE ROLE OF PLANNING.

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ABSTRACT

This paper re-examines the role of urban planning in enabling sustainable mobility. It pulls together a number of developing areas of work, assembling and interpreting the existing evidence on the influence of urban structure at different spatial scales on travel patterns, and the inter-relationships with socio-economic, attitudinal and other contextual characteristics. It includes data analysis using the Great Britain National Travel Survey. The commentary is developed in the light of the developing mobilities literature – covering the social, cultural and experiential dimensions of travel.

The end objective in further integrating settlement structure and transport is to move beyond the current discourse, to enable and *achieve* more sustainable travel patterns, whilst creating attractive areas for living. The development location and transport investment decisions made today are critical; they will influence travel patterns for many years to come. However, the important caveat made is that the integrated planning and transport topic needs to take a much wider perspective, set within a wider understanding of the motivations for mobilities. The paper is placed within the context of climate change, and the need to respond more effectively to strategic policy objectives. It concludes by considering some possible future directions for transport and urban planning, in theory and practice.

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INTRODUCTION

This paper re-examines a much loved, often ignored, and sometimes controversial topic: the role of urban planning in enabling sustainable mobility. It pulls together a number of developing disciplinary fields, including the findings from a recent study on urban structure and the demand for travel, carried out for the UK Commission for Integrated Transport (Hickman et al., 2009)[1]. It considers this work in the light of the developing mobilities literature (e.g. Cresswell, 2006; Sheller and Urry, 2006; Urry, 2007), which is beginning to examine in more detail the rationale behind travel behaviours.

The end objective in further integrating settlement structure and transport is to move beyond the current discourse, to enable and *achieve* more sustainable travel patterns, within the context of creating attractive areas for living. The central arguments pursued within this paper are (1) to conceive the integrated urban planning and transport nexus as part of a wider rationale for sustainability mobilities, and also (2) to re-articulate the role of urban form and layout in setting the 'envelope of possibilities' in travel decision-making.

An analytical framework is presented for understanding the influence of urban structure on travel and to interpret the existing evidence, as available, using the Great Britain National Travel Survey. The coverage includes urban structure (density, settlement size, jobs-housing balance, accessibility, street layout) and travel patterns (travel distance, mode), and considers the inter-relationships with socio-economic, attitudinal and other contextual characteristics. The commentary is developed to consider the wider social and cultural aspects of mobility, and the potential experiential and practical dimensions to decision-making. The paper concludes by re-considering the role of urban planning in enabling sustainable mobilities and some possible future directions for theory and practice.

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[1] The 'Planning for Sustainable Travel' summary guide and wider study papers are available at www.plan4sustainabletravel.org

POSITIONING THE ARGUMENT

The difficulty for researchers and practitioners in the sustainable transport planning field is that we are still dealing largely with car dependence[2] (Goodwin, 1995), current and prospective – at least in the industrialised western countries, and increasingly so in Asia. Sustainable travel – in the form of walking, cycling, public transport and low emission vehicle use – is very much a niche activity relative to the distance travelled by car. Many people have built, or are likely to build, their way of life around the use of the car, including the location of home, workplace and access to family, friends and activities. Others have less discretion as to their lifestyle progression, but still usually have little option but to move around in their cars. In the large majority of households the car is central to people's lives, more than a utility item, and important to meeting social and psychological needs (Lucas and Jones, 2009). The car is perceived as a facilitator of 'freedom' and 'independence' by many people. There are very few examples of achieving successful mode shift on a substantial scale, or across multiple population groups. This is the challenge facing practitioners if large scale reductions in car use are to be achieved.

Early analysis of car dependence in the UK suggests there are 5-10 percent of car owners whose commitment to cars is marginal, and perhaps a third would like to travel less by car if circumstances allowed. Between 50-80 percent of car owners perceive themselves to be 'generally dependent' on car use for their lifestyles. A smaller proportion of specific car trips, around 10-30 percent, can be identified as 'strictly necessary and with no alternative'. The concept of car dependence is also viewed as a temporal process, with potential for change over time, as 'constraints intensify or relax' (Goodwin, 1995) – so there is an opportunity for change; but we don't seem to be grasping this. The explanation may partly relate to funding and implementation issues, inertia in still pursuing conventional [highway] network capacity improvements, but there is also a lack of understanding of the complexity of mobility practices and facility for change. The attractiveness of the car and complex rationality for use, differing by individual circumstances, means that reducing its use is not a simple task. The 50-80 percent category of general dependence remains extremely significant.

The need to make transport more environmentally sustainable has prompted a diverse literature. There are a number of complementary and positive areas of work being pursued, and a new impetus is developing (Banister, 2008). Many transport planners are encouraging sustainable travel network options and some positive results are evident from 'smarter choice' initiatives (Cairns et al., 2008, Sloman et al., 2010), but these remain at the localised scale in terms of implementation. Urban designers and master planners are also designing

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2 The nature of 'car dependence' is broad – covering reliance in trips (there is no other form of transport available), car reliant activities (carrying heavy goods or undertaking multi-destination trips), car reliant locations (remote), car reliant persons (limited mobility), car convenient journeys (alternatives modes are available, but perceived as less attractive), car dependent persons (a statement of status or self esteem), car addiction (those who talk incessantly about cars and whose life revolves around the need to drive), a car reliant society (high observed levels of car use, where people without cars are excluded from essential activities) (Lucas and Jones, 2009).

more attractive urban areas for living with a marked change in the quality of urban life in the UK over the last 10-15 years.

Alongside, urban structure and mobility appear to be linked and there has been much examination of the potential relationships – clearly the location of activities (e.g. homes and workplaces and other activities) has some impact on travel, providing the 'physical rationale' for travel. However their effective 'integration' has been the subject of much debate over a lengthy period (e.g. Newman and Kenworthy, 1989 and 1999; Breheny, 1992; Cervero, 1989, 1996a, 1996b, 2002; Cervero and Kockelman, 1997; Kitamura et al, 1997; Handy, 1995; Banister et al., 1997; Headicar and Curtis, 1998; Hall and Ward, 1998; Boarnet and Crane, 1999; Ewing and Cervero, 2001; Stead, 2001; Krizek, 2003; Schwanen and Mokhtarian, 2005a, 2005b; Hickman et al., 2009; Hickman et al., 2010).

There is continued discussion, and in parts much scepticism, as to the scale of impact of urban form on travel (Gordon and Richardson, 1989, 1995, 1997; Echenique et al., 2009). The latest research on this topic is providing more clarity in statistical terms, with a focus on multi-variate analysis and some assessment of the more difficult empirical issues, such as co-linearity (variables are inter-related), causality (impacts may be two-way) and attitudinal/'self selection' issues (whether particular location decisions are associated with certain travel behaviours, or whether people with particular types of attitude are attracted to certain urban forms [Cervero and Duncan, 2002; Bohte et al., 2009, Naess, 2009, Cao et al., 2009, Levinson and Krizek, 2008]). Others note the importance of effective public transport network planning, particularly in suburban and exurban areas (Mees, 2010), perhaps beyond the role of urban planning. There is also a further dimension in the influence of electronic interaction rather than [or alongside] physical travel (Castells, 2000; Hall and Pain, 2006).

In parallel, a number of cultural geographers and sociologists have begun to examine the social and cultural dimensions of travel and mobility, including car use. This emergent 'mobility turn' tends to conceive of car use and mobility as more than a movement between an origin and destination, but as practiced (something we do) and sensed (something we feel) with assemblages (networks) of people, devices, rules, norms and other elements (e.g. Sheller, 2004; Urry, 2000; Cresswell, 2006; Urry, 2007; Dennis and Urry, 2009). Hence we are beginning to explore the complexities of life, and travel within this.

The attraction here is that an enhanced understanding of the complex rationale for car use may assist in efforts to reduce car use, potentially at the aggregate level if efforts can be scaled up. At the very least we should be able to further understand the extent to which people may be inclined to reduce car use, switch to other modes and change their trip destinations. A very important driver here, one that gives a much greater weight to this type of argument, is that of climate change. Ambitious targets have been adopted internationally, e.g. the UK has committed itself to an 80% reduction in cross sectoral carbon dioxide (CO_2) emissions by 2050, on a 1990 base (Climate Change Act, 2008). The transport sector needs to start playing a more significant role in delivering these ambitions (Banister and Hickman, 2009; Sperling and Gordon, 2009; Hickman et al., 2010). Perhaps a number of drivers for change are beginning to align.

URBAN STRUCTURE AND TRAVEL

Over the years it has become common practice to analyse the role of urban structure and its impact on travel behaviour. Travel behaviour is typically considered in empirical analyses as related to various land use, socio-economic and sometimes attitudinal variables (e.g. Kitamura et al. 1997; Stead 2001; Cervero 2002; Schwanen and Mokhtarian 2005a; Pinjari et al. 2007; Mokhtarian and Cao 2008; Hickman and Banister, 2007; Hickman et al., 2009). Travel behaviour is defined variously as mode choice, distance travelled, the number of trips taken and even composite metrics such as energy consumption or CO2 emissions. Conscious choice behaviour is assumed where individuals and household try to satisfy their activity needs by maximizing their preferences, whilst considering constraints on available time and money budgets and mobility resources. An analytical framework can be put forward for this type of work (Figure 1), and consisting of:

'Independent' variables such as:
1. Demographic and socio-economic factors, including gender, age, household structure, personal or household income, educational attainment and car availability.
2. Urban structure and layout. Factors have been analysed at a variety of spatial scales, ranging from the metropolitan to the street level.
3. The objective and/or subjectively experienced configuration of transport infrastructure. Commonly analysed factors include the (actual or perceived) distance to public transport or highways and level-of-service/public transport accessibility.
4. Attitudinal characteristics (i.e. the disposition towards and cognitive and affective evaluation of particular modes of travel, locations for living and working), lifestyle orientation (i.e. the disposition towards work, family life and leisure) and personality characteristics.

'Dependent' variables:
5. Travel behaviour, including mode choice, distance travelled, the number of trips taken, occupancy, and even composite metrics such as energy consumption or CO2 emissions

There is sometimes consideration of the costs of travel in terms of monetary price and travel time required, reliability and transport infrastructure provision (multi modal and traffic demand management measures, parking) as independent variables (e.g., Cervero, 2002; Limtanakool et al., 2006). Some studies have also considered dependent variables by journey purpose (e.g., Kitamura et al., 1997; Limtanakool et al., 2006).

Figure 1: Urban Form and Travel Relationships - An Analytical Framework
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Within this framework, a number of relationships between urban structure and travel can be identified using the latest Great Britain National Travel Survey (NTS) (DfT, 2008, combined

data 2002-06)[3]. Residential population density (county level), settlement size and type (various size categories), public transport accessibility (Accession model cohorts), various socio-economic characteristics (including income, sex) and trip type are all significantly related to travel distance and mode share (Table 1). The analysis is however limited to a small number of variables and to bi-variate and multi-variate relationships due to the nature and coverage of the NTS. Census data is added to allow demographic analysis.

Density: there is (broadly) an inverse linear relationship between density and travel, where increased density is associated with reduced travel distance, particularly by car (Figure 2). However, the 15-30 and 30-50 persons per hectare (pph) density bands (which embrace most built-up areas) have similar per capita travel, hence the trends within the mid-density ranges are not that clear.

Car drivers in Great Britain average 3,660 miles per annum (51 percent mode share) in areas that have an average density of 2.5 pph. In London, a lower average distance travelled by car is evident at 1,876 miles per annum (35 percent mode share, and a higher average density of 46 pph). The car driver and passenger mode share also reduces markedly, from 83 percent at densities of 5-15 pph to 44 percent at densities over 50 pph. Distance and mode share by public transport increases with density, particularly over 30 pph. Walking distance is similar over most densities but greater in the highest density category of over 50 pph.

Figure 2: Density and Travel
INSERT
(National Travel Survey, 2002-06)

Settlement size/area type: there is (broadly) an inverse linear relationship with increased average distance travelled as settlement size decreases. The largest differential in Great Britain is between inner London (an average of 4,673 miles per person per annum) and rural areas (an average of 9,806 miles per annum). Outer London performs more like the other metropolitan areas in terms of average distance travelled. The highest distances travelled in non-rural areas are found in the smaller urban areas, particularly those with a population under 25,000 (Figure 3).

The car driver mode share also increases, so that residents of rural areas have a per capita car driver mileage over 50 percent higher than the national average. The highest distances travelled in non-rural areas, both in total and as car driver, are found in the smaller urban areas, particularly with a population under 25,000.

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[3] The 2008 National Travel Survey (NTS) is the latest in a series of household surveys designed to provide a databank of personal travel information for Great Britain. The NTS has been running continuously since 1988, following previous ad-hoc surveys. In 2008, data was collected from over 8,000 households, covering around 19,000 individuals. The survey is designed to pick up long term trends. Data from the survey comes from two sources: interviews with people in their homes, and a diary that they keep for a week to record their travel. The NTS is not carried out on the same households, hence does not allow panel analysis – this would be more suitable in assessing causality and directionality issues.

Figure 3: Settlement Size and Travel
INSERT
(National Travel Survey, 2002-06)

Accessibility: average annual travel distances reduce as public transport accessibility (accessibility to a composite of key services) increases over the 70 percent threshold, with the exception of remote areas with poor accessibility where travel distances are also relatively low. Areas with very good levels of accessibility (over 80 percent) have lower levels of car use and higher proportions of public transport, walking and cycling (Figure 4).

Individuals resident in areas with the lowest levels of public transport accessibility to key services have amongst the lowest annual travel distances (6,838 miles per annum England) and relative mode shares of bus and train travel (10 percent) with accompanying high levels of car related travel (82 percent). For regions with the highest levels of public transport accessibility to key services the relative mode share of bus and train travel is highest (26 percent) with the corresponding mode share of car related travel being lowest (65 percent).

Figure 4: Accessibility and Travel
INSERT
(National Travel Survey, 2002-06)

Multi-Variate Analysis
The multi-variate analysis provided in Table 1 highlights how the range and combination of urban structure and socio-economic variables contribute to changes in travel. Again the NTS is used, with aggregate data 2002-06. Travel distance is expressed as a function of land use, journey type and socio-economic characteristics. Where possible (given the non-continuous nature of some of the variables) natural logs were taken to allow for direct elasticities to be estimated. Reflecting the analysis of Stead (2001), many of the land use and socio-economic variables are significantly correlated with journey distance. Land use characteristics (settlement size, population density, public transport accessibility, jobs-housing ratio) account for 11 percent of the variation in travel distance. Socio-economic characteristics account for 3 percent of the variation in travel distance, which is less than usually seen in these types of analyses (Stead, 2001; Hickman and Banister, 2007). The range of effect is measured by estimating separate regressions for each of the variable types, excluding all other variables. This leads to four separate R^2 values, three for the restricted models: land-use (R^2_{R1}), journey type (R^2_{R2}) and socio-economic (R^2_{R3}) as well as one for the unrestricted model (R^2_{UR}). The scale of analysis used (say at the national, regional, local or individual levels) is important to the results as well as other empirical specifications (e.g. number of classes within or continuity of variables).

Table 1: Linear Regression Analysis
INSERT
(National Travel Survey, 2002-06)

Reflecting this paradigm, 11 key themes have been drawn together for use, at the practitioner level, in using spatial planning as an 'enabler' of sustainable travel (Hickman et al., 2009). The interventions run across the range of scales, developing previous work (Cervero and Kockelman, 1997; Cervero et al., 2009). The main argument made is in the importance of strategic level analysis with an emphasis on development location – this is the scale that affects travel most – as well as the usual focus on internal design layout. Figure 5 gives an example of policy approach at the strategic level in terms of development location.

- Theme 1: Settlement Size
- Theme 2: Strategic Development Location (Figure 5)
- Theme 3: Strategic Transport Network
- Theme 4: Density
- Theme 5: Jobs-Housing Balance
- Theme 6: Accessibility to Key Facilities
- Theme 7: Development Site Location
- Theme 8: Mixed Use
- Theme 9: Neighbourhood Design and Street Layout
- Theme 10: Traffic Demand Management (TDM)
- Theme 11: Parking

Figure 5: Strategic Development Location
INSERT

The above evidence suggests, at least to some, that spatial planning, and by implication the planning system, has a limited impact on travel patterns. The policy implication would be that unplanned, dispersed development could take place and that there would be little impact on travel patterns. This is not a tenable position. The bi-variate and multi-variate analysis give an indication of the likely scale of relationships, and there are certainly identifiable and significant relationships between a range of urban structure variables and travel. The strategic location and form of development according to the above themes supports sustainable travel behaviours. It also has strong potential co-benefits in terms of supporting agglomeration, vitality and competitiveness within urban areas. However the analysis does not help in understanding the causality and directionality issues, nor the differences within the population.

Over the last few years there has been an increasing focus of analysis on attitudinal related issues, particularly the importance of self selection. People self select their residential location in a conventional manner – people with higher incomes self select more expensive houses (and may over-ride other land use variables in doing so). The difficulty for researchers is when self selection is based on variables that are not observed, such as unmeasured attitudes and other social factors (Van Wee, 2009). Certainly attitudes towards modes can be expected to influence the locational choice of residential, workplace and other activities. Panel analysis is required for this type of understanding, using the same households before and after a move, but even here the results will only allow inference. There are likely to be differences in interaction, including self selection effects, between very

different contexts – say in California and the more compact parts of the UK and rest of Europe; but the current research also doesn't yet shed light on these issues. The existence of attitudinal and self selection issues however does not predicate against the building of neighbourhoods according to the criteria discussed above. The viewpoint from Naess (2009) seems to stand – if people self select to meet their travel [or other] preferences, it is self evident that 'urban structure matters'.

A central point therefore is that urban form and layout appears to set the 'envelope of possibilities' for travel (Hickman et al., 2009), and this is modified according to network, attitudinal and other factors. This relationship differs by individual and at the aggregate level according to context and analytical scale and method (Hickman, 2007). Importantly, land use planning is also a tool available for use within public policy, hence can be used to move towards policy goals. In an era where achieving sustainable lifestyles has become increasingly important, where funding constraints are likely to mitigate against major network enhancements, the effective use of the spatial planning toolkit becomes more critical. The location and form of development at the strategic level appears to be where most gains can be made. Greater regional and/or sub-regional analysis of the impacts of locational decisions appears important, with new settlement growth location understood in terms of the likely impact on the surrounding labour market catchments.

A WIDER MOBILITIES RATIONALE

While the above analytical framework is very useful, it is also characterised by several limitations. This is primarily because other factors driving or impinging on people's mobility practices are not directly taken into account in studies of the relations between urban structure and travel patterns. Lucas and Jones (2009) describe the motivations that may underlie choice processes, mediated through social factors, personal beliefs, attitudes and values, information and marketing (Figure 6). This type of understanding is important; studies that do not account for these additional factors may over-estimate the degree to which urban structure drives people's mobility practices, or indeed under-estimate if synergetic issues are evident. It can also be taken further by considering recent developments in travel demand analysis and the mobilities literature.

Figure 6: The Personal Factors Influencing Car Use Behaviours
INSERT
(Lucas and Jones, 2009)

The Social and Cultural Aspects of Mobility
Travel for commuting and shopping has long been given most attention in travel demand analysis. In recent years, however, transport researchers have begun to examine travel for social purposes in much greater depth (e.g. Carrasco and Miller, 2006, 2009; Larsen et al., 2006; Dugundji et al., 2008; Ohnmacht, 2009; Tillema et al., 2010). One insight gained from this work that people's travel and communication behaviour is closely interdependent with the structure and spatial dimensions of their social networks. While those may not be independent from urban structure, the emergent work on social travel makes it clear that

social networks deserve more attention as mediators in the urban form and travel demand relationships.

Travel, however, is social in more ways than as a facilitator of intermittent face-to-face contact. Social contact with others is also one of the key mechanisms through which cultures of mobility are distributed and reproduced[4]. It is in and through exchanges with others that people come into contact with norms and aspirations regarding what counts as 'good' or 'appropriate' behaviour with regard to travelling or everyday activities. Norms and aspirations become internalised into a person's system of beliefs and pre-cognitive instincts and reflexes. Social contact, then, is key to a person's socialisation and acculturation, and this has significant implications for the travel behaviour and urban structure relationships. At least two examples can be provided in support of this argument.

First, drawing on Ajzen's (1991) theory of planned behaviour, social psychologists have shown that social norms favouring car use relative to travel by other modes of transport contribute to the formation of the personal norm regarding transport modes, the intention to travel by car and of car travel habits (e.g. Bamberg and Schmidt, 2003; Haustein and Hunecke, 2007). Recent work has also shown that all these constructs are dependent on travel socialisation during childhood and adolescence (Haustein et al., 2008). The effects of social norms on the link between urban structure and travel behaviour are, however, ambiguous. On the one hand, if such norms favour car travel, then they may imply that people in high-density, mixed-used and other contexts where public transport, walking and cycling are 'objectively' realistic alternatives to the car (in terms of travel time, cost, effort, etc.) will not even begin to think about using these modes. On the other hand, social norms that favour non-car travel can make other modes of travel more acceptable and an expression of 'good taste' and a certain lifestyle. These norms can change a person's intention to travel by car and/or reduce their car travel habits (Matthies et al., 2006), and thus help to realise compact urbanisation's potential to make transport more sustainable. The key question then becomes how such social norms can be disseminated and allowed to proliferate further.

Second, cultural geographers and sociologists have shown the car to be indispensable to some existing parenting cultures (Dowling, 2000; Sheller, 2004; Jarvis, 2005). For instance, Dowling (2000) has shown that for suburban mothers in Sydney (Australia) the car is not merely a management tool that allows mothers to juggle the space-time conflicts imposed by employment, family and personal needs and exacerbated by Sydney's sprawling geography. Rather it is crucial to the implementation of culturally constituted notions of 'good mothering', in doing what is best for your children. Thus, these mothers use the car – even if other transport modes were available – because it allows them to drive their children not to the nearest school or nursery, but to that place which is most attuned to their children's needs and parents' aspirations. There are of course counter examples, but for the mainstream this is likely to be the case. The car is used because of the safety it provides – both in terms of traffic safety and 'stranger danger' – and because the car trip provides a moment of 'intimacy' with their children (see also Laurier et al., 2008). Dowling's study pertains to a

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[4] Other key mechanisms relate to the media (TV, Internet, newspapers, advertising, etc) and education.

specific population segment but it does suggest that adapting or retrofitting existing urban structures or building new compact developments may not be sufficient to make travel patterns more sustainable; social norms and cultures of mobility need to co-evolve.

The Experiential and Practical Dimensions of Mobility

The work by Dowling and others suggest that the extent to which travel behaviour and urban structure link can be analysed within a (boundedly) rational choice framework are limited. The rational dimensions of travel behaviour – i.e. travel as the result of conscious trading of costs and benefits in a wide sense, and travel as habitual to economise on the effort of deliberative choice process prior to each and every trip (cf. Verplanken et al., 1997; Gärling and Axhausen, 2003), are important. However, there are also 'more-than-rational' aspects and these matter to the discussion on urban structure and sustainable transport.

Car use has important affective and emotional dimensions, as previous research by transport researchers (Mokhtarian et al., 2001; Steg, 2005) and others within the new mobilities paradigm (Sheller, 2004) have shown. The associations of car travel with feelings of freedom, control, power and even 'pure joy' are manifestations of these affective dimensions. It is highly likely that such dimensions make people, or at least certain cohorts of society, much more reluctant to give up driving than most rational choice theories would predict[5].

Further, travelling by car can be viewed as a specific way of 'being in the world', of experiencing the world in which people are situated. Drawing on the work of the French philosopher Merleau-Ponty, we can say that the car functions as an 'extended sense organ' through which people have come to perceive the world they live in (Merleau-Ponty, 1962) – i.e., the streets, neighbourhoods, landscapes they traverse, their interactions with other road users, the road-side advertisements tailored to car travellers, etc. This perception is visual in many ways, but also involves the olfactory (smell) and auditory senses and even touch. Most of this sensory perception may take place below the threshold of consciousness (Connolly, 2002). The whole spectrum of perceptions helps to make the world familiar, and in certain ways inhabitable, and constitutes the basis for how people cognitively understand their 'lifeworld'. For most people in Western industrialised countries, the car is inextricably bound up with their understandings, beliefs, aspirations, dreams and imaginations with regard to transport and also non-transport matters. The influence of the car runs much deeper than transport researchers conventionally consider. A better grasp of the complex and wide-ranging effects that car use has for individual subjectivities may help us to better understand to what degree and how changes to urban structures can make transport more sustainable.

Finally, we can recognise that travelling by car not only allows people to complete complex sequences of activities that are distributed in space and time but also to do particular things whilst travelling. Several dimensions can be identified to this behaviour 'on-the-move'. First, drawing on Goffman (1959), we can say that people use car trips as a 'backstage' between

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[5] Work in the prospect theory tradition (Kahneman and Tversky, 2000) would be an exception. This rational choice framework could accommodate this reluctance via the phenomenon of loss aversion. However, work in the prospect theory tradition observes and accommodates that losses loom larger than equivalent gains in people's choice behaviour but is less successful in providing detailed explanations of why losses loom larger.

the 'front stages' of employment, family life or face-to-face contact with others. For some, the car may also be front stage. The car trip can be a time of transition, of unwinding, relaxing, singing, reflecting and preparing for 'the performance' at the next front stage. It is for these reasons that some studies find people prefer a certain time commuting (Blumen, 2000; Redmond and Mokhtarian, 2001).   The car certainly offers particular affordances (Gibson, 1977) to unwind and prepare that differ from those offered by other transport modes. Buses or trains offer a similar, but subtly different experience, often where people self-regulate their behaviour and are constrained because of the (expected) presence of and social influence by others.

Second, cars can provide specific opportunities to use travel time productively. Multi-tasking (the conduct of multiple activities simultaneously) is perhaps more widespread on public transport trips (cf. Lyons et al., 2007; Tillema et al., 2009) but also occurs in cars. Ethnographic work has shown that certain people use the car as a mobile office (Laurier 2002, 2004). Schwanen and Kwan (2008) have noted how wireless communication technologies afford car drivers – especially in congested road conditions – to maintain social contact and have conversations with their partners, relatives and others in distant places. This kind of digitally mediated contact with physically distant places is likely to increase significantly with the further development of wireless technologies (Sheller and Urry, 2006). Other work by Laurier and colleagues has examined the socialities of persons within a car – i.e. how the car is a space in which driver and passengers 'build a bond' by negotiating traffic collectively, in which children are educated, in which colleagues talk about work and so extend the office into the car, in which co-travellers have (sometimes thoughtful) conversations about 'difficult' topics (Laurier, 2005; Laurier et al., 2008)., or indeed just 'pass the time'. Work along these lines again illustrate that cars provide possibilities in these regards, not identically replicated in other transport modes. For others, the reverse may be true – the time queuing in congested traffic is 'stressful' and perceived as 'dead' or 'wasted time'. The long commute may only be persisted with for a short period of time. Hence the experience is different by individual. However, the evidence demonstrates that car travel – certainly for a significant cohort of the population – is not always necessarily wasted time, and not something that people are willing to give up, even if they had the opportunity to travel using other modes or to not travel at all.

There is a similar body of material on the social and cultural aspects of public transport, walking and cycling mobilities; including work on walking (Middleton, 2009), cycling (Spinney, 2006, 2009), train (Watts, 2008; Bissell 2009, 2010) and on alternative mobilities more generally (Vannini, 2009). Sheller (2010) and others within the mobilities literature consider the transition towards sustainable mobility. There also exists 'alternative' mobility cultures – where life is carried out as, a positive choice, to drop off the children, access work, shopping and other activities, and with occasional use of the car – but these are niche markets or, even, counter-cultures. As yet, they are certainly not mainstream. The key points here are the [very] pervasive nature of the car within the cultural constitution of society and the significance of the challenge in moving towards a post-car society. Building compact, polycentric societies is important, but not nearly enough – more profound cultural

shifts are required as well, and these are matters that much of the mainstream body of transport research and practice simply glosses over far too quickly.

SYNTHESIS, AND IMPLICATIONS FOR THEORY AND PRACTICE

The challenge of climate change gives this picture a different feel. The 80% target reduction in CO_2 emissions as adopted in the UK is the level that appears to be consistent with holding climate change at acceptable levels (Stern, 2009). The major difficulty will be in understanding the impacts of policy interventions, and indeed in getting even anywhere near the required levels of reduction (Hickman et al., 2010). Certainly the current trends are not promising. This paper has brought together some of the emerging literature and trends, and attempted to argue for progressions in thinking: to conceive the integrated urban planning and transport nexus as part of a wider rationale for sustainability mobilities, and also to re-articulate the role of urban form and layout in setting the 'envelope of possibilities' in travel decision-making. Figure 7 puts forward a framework for understanding the potential wider influences on travel.

Figure 7: Urban Form as Part of the Understanding of Mobilities
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We conclude by speculating about the issues raised in the previous discussion, with some important implications for future developments in theory and practice. The conventional transport economic analysis has placed most emphasis on the importance of time and cost, and on the rationality of decisions based on utilitarian notions of choice. This is clearly only a partial understanding, but has provided the main thinking behind the conventional analysis and modelling of patterns of travel. It does not adequately address the challenges of achieving sustainable mobilities. The role of urban planning and land use factors are also important, but again only as part of a wider storyline. Land use acts in an indirect manner, supporting the conventional economic reasoning. Urban planning has the potential to offer greater, or at least a different, choice of destinations and activities, depending on the location and form of development chosen through strategy development. Land use factors, as identified through the multi-variate analysis, appear to explain around 10-20% of the variation in travel. There is a range of potential interventions available to decision-makers, and at different scales – including strategic development location, density, jobs-housing balance, accessibility, mix of use and street layout.

A consideration of the wider literature emphasises issues such as self selection, risk aversion and causality; and also the existence of habits, social norms and expectations as being key contributors to travel behaviour. Transport plays an important role in everyday life; sometimes a central role. The social role of the car and other forms of transport are only just beginning to be examined, largely in the light of frustrated attempts to reduce car use. Some points appear to be emerging:

1. The importance of social networks and their structure – these may reduce the sensitivity of travel behaviour to urban structure, as people are less likely to minimise travel effort and want to meet people wherever they live or happen to be. There is, as yet, little evidence to suggest that social networks are more compact in more compact urban forms, indeed the reverse may exist. People in urban areas are likely to value the potential for face-to-face social interaction and the nature of opportunities, and may have large social networks as a result. There may also be a threshold effect with city size – with the larger settlements discouraging peri-urban travel, with travel patterns largely constrained to parts of the city.

2. The level of 'discernity' in activity choice is likely to have increased over time, particularly in retail-related travel (the influence of rising disposable incomes, marketing and advertising and changing aspirations), and education and health (public policy and changing aspirations).

3. There is an emerging relationship between physical and e-social interaction, possibly moving beyond the assumed limited substitution effect. The recent rapid growth in e-social networking perhaps illustrates the potential for change in other spheres in the near future, with a much more pervasive 'network society' offering some potential for reducing physical travel. The potential for substitution is perhaps greatest in less accessible, remote areas, but again the emerging trends are not well understood as yet.

4. Norms can be effective vehicles for making travel more sustainable (and this is already implied in the conceptual framework).

5. Policies can pay much more attention to what people do 'on the move'. Rather than thinking of travel time as 'valueless' and something to be minimised, the potential to use travel time productively (certainly by non-car modes) can be maximised as part of policy interventions. 'Productively' needs to be understood in a broad sense, not only in providing wireless ICT on trains, light rapid transit and buses and to better equip the design of vehicles and interchanges to the needs of business and other travellers (the time waiting for a train can, for example, be transformed markedly into more useful and enjoyable use). There are many opportunities in maximising the possibilities that public transport offers for relaxing, sleeping, meeting new (and sometimes exciting) people, and whatever else people would like to do. This entails many new research questions: how do we design and equip vehicles as 'back stages' and simultaneously as 'front stages' (the extended office and meeting room, café and restaurant). There are similar issues in reconfiguring the wider modes, including cycling infrastructure and the technology of the cycle itself.

There are some potentially profound implications here. Urban structure is important to travel but only as a necessary condition for more sustainable travel. Policy interventions should be tailored more to people's specific circumstances (there are some efforts already in terms of personal mobility management) rather than providing a one-size-fits-all approach – this is essentially what urban structure-related policies currently do, spatially and in relation to individuals and/or population cohorts. Interventions can also target changes in norms, especially in relation to 'good' travel practices -- i.e. bring new norms into circulation and disseminate behaviours that promote sustainable travel practices. It is instructive to look at

policies in other fields where 'undesirable' behaviours have been targeted successfully, smoking and to a lesser degree alcohol are examples. Some of the interventions required may need to be radical, perhaps a ban on car advertisements should be considered or reminders of the detrimental effects of driving such as those printed on cigarette packs could be used. Carbon rationing may become a central informative and enabling measure. These would be far from uncontroversial, and there would be a strong lobby against such measures, but perhaps these types of interventions are needed given the immense challenges faced. The idea is to intervene not just in people's rational decisions to travel by car or other means, but to try and modify their instinctive, pre-cognitive reliance on cars (Conolly, 2002).

In time, policy levers can be better shaped to influence social and cultural beliefs, alongside the conventional network and cost changes, and urban planning dimensions. This suggests a greater role for dialogue and participation, and here transport planning is very weak in practice – certainly in comparison to the urban design field, where design charettes and other workshop formats are well tested and much more effective and participative than the conventional transport strategy or major project consultation exercise. Changes to modelling approaches, particularly demand modelling, and institutional structures will also become important to reflect the emerging analytical framework. Moving beyond the state of general car dependence will be the focus of much effort in future years; the sustainable mobility imperative requires some major innovations in thinking.

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TABLES

Table 1: Regression Analysis

Variable	General Model		Journey Variables	Land Use Variables	Socio-Economic Variables
City, 50-250k	-0.038	***		☑	
City, 25-50k	-0.040	***		☑	
City, 25k or less	0.119	***		☑	
County population density	0.001			☑	
Public transport accessibility	0.004	***		☑	
Income	0.203	***			☑
Sex (female)	-0.145	***			☑
Jobs-to-housing ratio	0.131	***		☑	
Journey made by car	0.448	***	☑		
Car access	-0.065	***			☑
Business trip	0.423	***	☑		
Education trip	-0.529	***	☑		
Escort education trip	-0.930	***	☑		
Shopping trip	-0.386	***	☑		
Other escort trip	-0.509	***	☑		
Other personal business trip	-0.491	***	☑		
Visit friends at private home trip	-0.161	***	☑		
Visit friends elsewhere trip	-0.226	***	☑		
Entertain/public activity trip	-0.211	***	☑		
Sport participate trip	-0.347	***	☑		
Holiday base trip	1.159	***	☑		
Day trip	0.195	***	☑		
Year	0.010	***			☑
Constant	6.742	***			
Adjusted R-squared	0.125		0.006	0.110	0.033

Observations	1,292,333			
Range of effect (contribution)				
Min		0.000	0.086	0.010
Max		0.006	0.110	0.033

Notes:
***=Significant at 1%, **=Significant at 5%, *=significant at 10%
Base is 'other trip' in city of population >250k

FIGURES

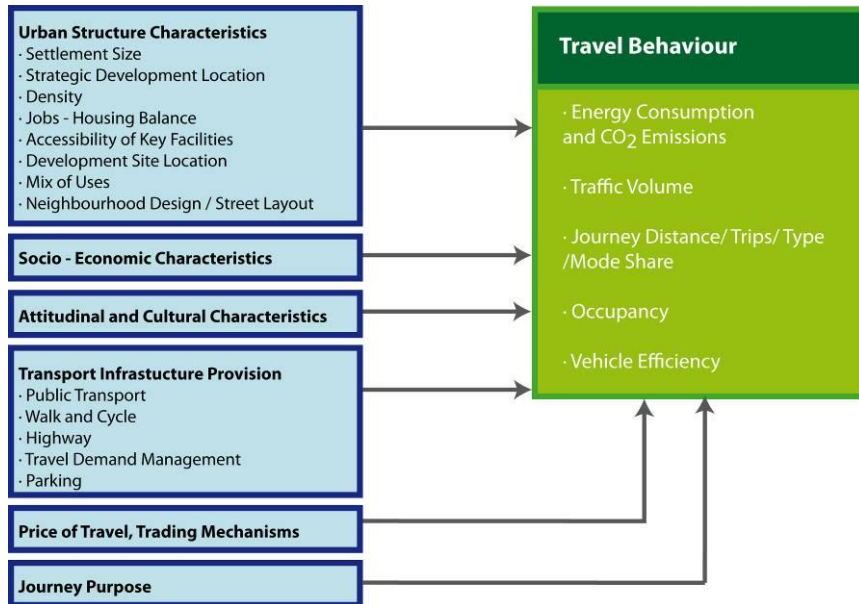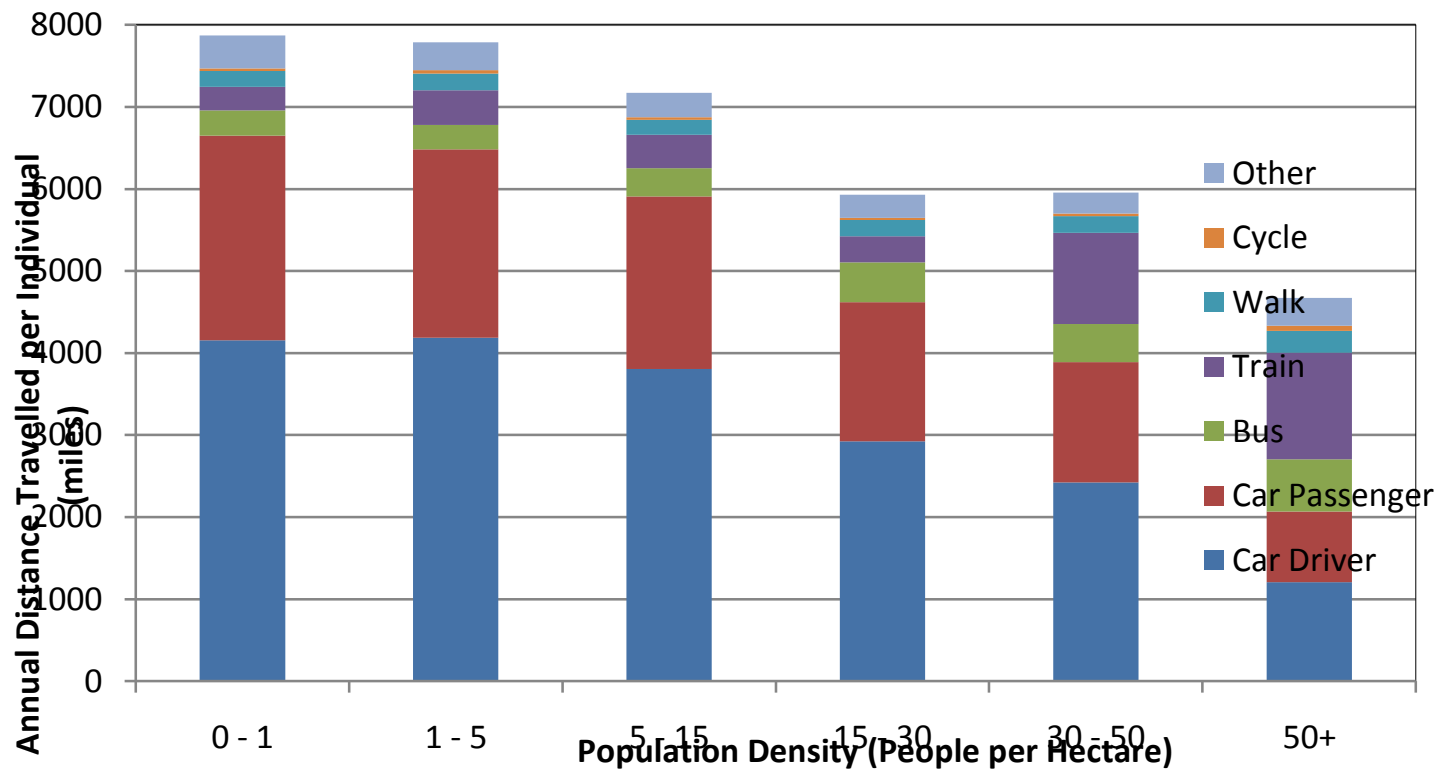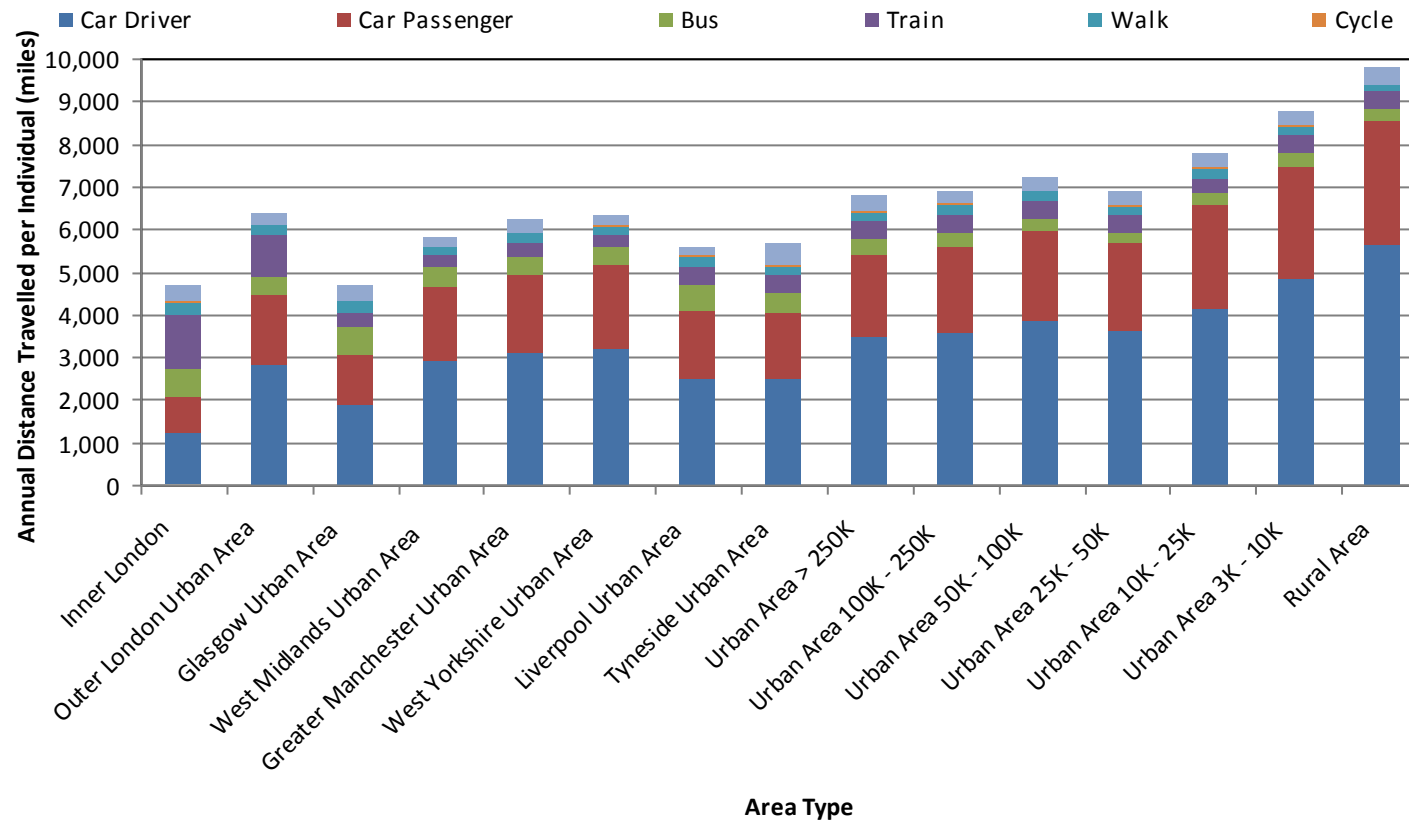**Figure 1: Urban Form and Travel Relationships - An Analytical Framework**

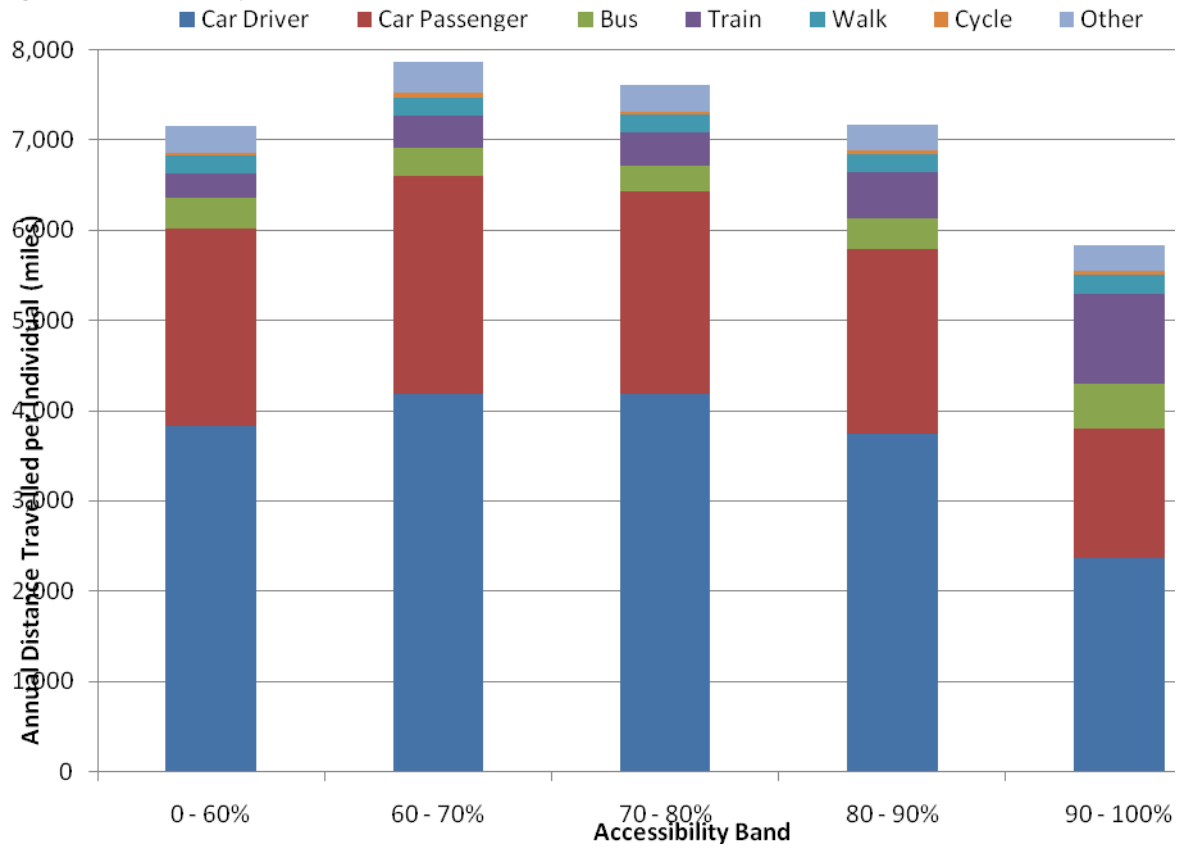**Figure 2: Density and Travel**

(DfT, National Travel Survey, 2002-06)

Figure 3: Settlement Size and Travel

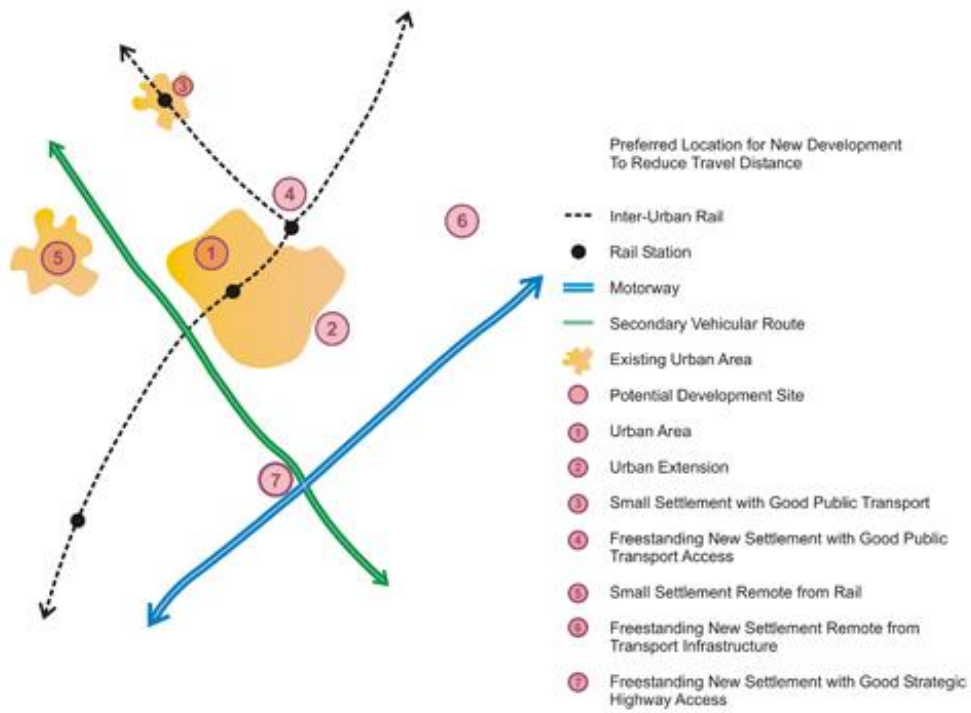(DfT, National Travel Survey, 2002-06)

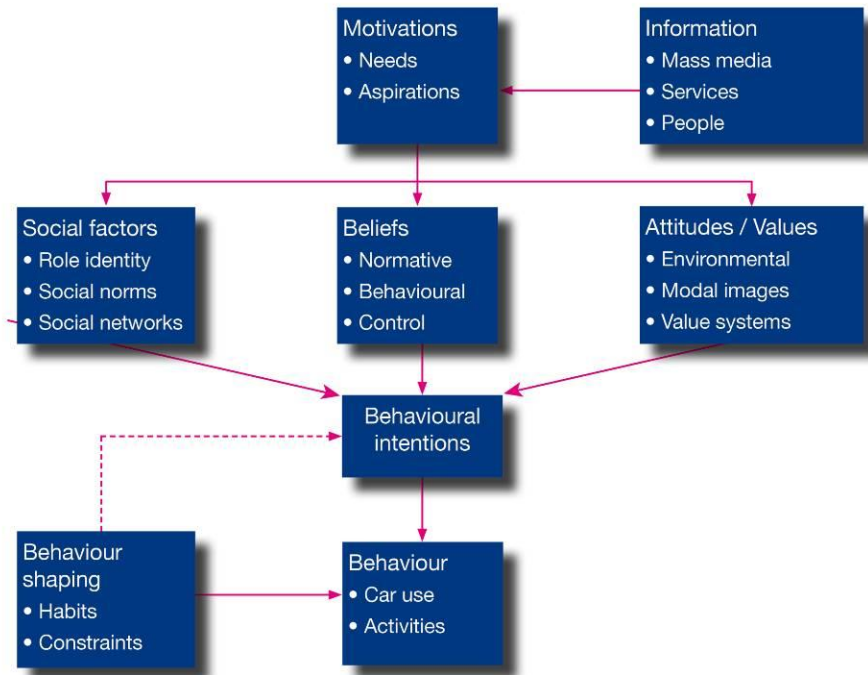**Figure 4: Accessibility and Travel**

(DfT, National Travel Survey, 2002-06)

Figure 5: Strategic Development Location and Travel

Figure 6: The Personal Factors Influencing Car Use Behaviours

(Lucas and Jones, 2009)

Figure 7: Urban Planning Within a Mobilities Framework