Travel Behaviour:

A review of recent literature

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IMPACTS OF TRANSIT LED DEVELOPMENT

IN A NEW RAIL CORRIDOR

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1 Introduction

1.1 Purpose of this Review

The purpose of this review is to summarise current knowledge about the factors which influence individual travel behaviour. Specifically, the review supports a current research project studying the impacts of transit led development in a new rail corridor. The review was undertaken to provide a context for publications arising from the research and also to inform the travel behaviour component of the household survey design. The focus here is mainly on empirical work.

1.2 Scope of the Review

This review of travel behaviour literature covers a total of ninety-six papers published during the past five years through conference proceedings or in academic journals such as *Transportation Research* and *Journal of Transport Geography.* The review approach aimed to provide a comprehensive overview of the spatial and socio-demographic variables that may influence travel behaviour paying particular attention to the different research approaches adopted and to differences in geographical scale, types of people sampled and so on. Appendix 3 provides a full breakdown of papers reviewed organised by two matrices: one showing empirical research studies; one showing papers which reviewed the work of others or papers reporting conceptual models.

1.3 Search Strategy

Materials for this review were sourced primarily from electronic journals (Appendix 1 and 2). A list of academic journals which dealt explicitly with travel behaviour issues was compiled, a search schedule created and each journal searched issue by issue for relevant article titles from the last 5 years. Following this preliminary search, approximately 160 journal articles had been located. The

articles went through a screening process which established a set of 99 journal articles specifically related to travel behaviour.

1.4   Overview of research papers

There is wide variability in the nature and intent of the research projects included in the papers reviewed.   For example, the research undertaken varies in geographical extent from the local neighbourhood level in Canberra (Ampt *et al*, 2005) to national and international levels (Hjorthol, 2002 and Marchetti, 1994). National level coverage includes case studies from the Netherlands (Dieleman *et al*, 2002), USA (Guiliano, 2006) and the United Kingdom (Lyons *et al*, 2002). In addition, a number of papers concentrate on the travel behaviour involved in particular types of journey purpose, for example, 'maintenance trips' defined as journeys that include grocery/food shopping, ferrying children to and from school and leisure trips (Anable, 2005), whereas other papers concentrate exclusively on journey-to-work trips alone (Cullinane, 2002). Some papers discuss the use of a particular mode of transport whereas other papers used a travel diary to capture details of all travel modes used within a particular time-period. Hamed & Olaywah (2000) interviewed 1050 participants on their use of buses, servis taxis and private cars in Amman, Jordan. Handy *et al* (2005) focussed on the use of the car as the dominant travel mode to determine if participants drove by choice or necessity as a result of urban form. However, the majority of papers deal with the use of either the car or public transport as the primary mode of transport (Anable & Gatersleben, 2005). A much smaller number of papers focus on pedestrian or cycling activities alone (Cao & Mokhtarian, 2005).

The majority of the papers provide some debate on the role of a variety of factors that influence the choice and frequency of trips. There are two key questions included in the papers, the first being can urban form and landuse influence travel behaviour? (Cervero, 2002; Guiliano, 2003; Handy, 2005; Hensher & King,

2001). The other key question concerns which socio-demographic factors appear to influence travel behaviour? Various authors cite gender, household composition and income, habit and car ownership amongst others as significant factors in influencing travel behaviour (Best & Lanzendorf, 2005, Boarnet & Sarmiento, 1998).

Another issue raised by a number of authors is the role of locational self-selection in the frequency and type of trips undertaken by residents in certain areas. The research of Boarnet & Sarmiento (1998) and Cao *et al* (2006) suggests that people residing in a 'new urbanist' area, for example, are more willing and able to take public transport, walk and cycle to their destination due to their own personal beliefs and philosophy on transport and the environment. Thus, residents have chosen to live in such areas because they are able to undertake those particular travel behaviours which might be regarded as 'deviant' or unusual in more conventional suburbs. In addition, other residents are perceived to share their environmental and transport beliefs and behaviours. Thus they pose the question that it may not be the fact that the spatial form of a 'new urbanist' suburb is increasing the use of more sustainable travel behaviours but the fact the residents who have deliberately selected to live there are more likely to undertake such behaviours anyway.

2 Factors affecting travel behaviour

The research undertaken by the authors of this collection of research papers is varied but can be divided into two broad groups: namely those papers that study the impact of urban form on travel behaviour and those that study socio-demographic and lifestyle factors that may influence travel behaviour. A number of the papers however combine elements of the urban form and socio-demographic debate. The most important socio-demographic variables that influence travel behaviour include age, household composition, income, gender and car ownership. A number of papers also make the distinction between travel for work purposes and those for maintenance purposes as defined previously and how these travel activities will be influenced by urban form and socio-demographic variables.

2.1 Urban Form and Travel Behaviour

Boarnet & Crane (2001) studied the travel activities of 7469 households in Orange County and San Diego in 1993 and 1986. The two-day travel diary and telephone interview provided data for 7649 persons and 32,648 trips in total. The research aimed to determine what influence the landuse patterns of Orange County and San Diego has on travel behaviour. The authors found an extremely complex relationship indicating that land use and design proposals will influence the price of travel and hence the type of trip undertaken. Thus they indicate that urban form can influence travel behaviour. However, in another study by Boarnet & Sarmiento (1998) in Southern California the relationship between landuse variables and travel behaviour was found to be statistically insignificant. It is interesting to note that this project studied non-work car trips over a two-day period only. The research found that the socio-demographic variables were more significant statistically. For example, women, and particularly women with

children, were more likely to make non-work trips than men, and older people made fewer non-work trips.

Cervero (2002) studied travel behaviour in Montgomery County, Maryland using data from the Household Travel Survey of 1994. Cervero studied the impact of 'new urbanist' areas on travel modes, more specifically whether compact, mixed-use and pedestrian-friendly developments could significantly influence travel modes. The author used a normative model which assessed the influence of three core dimensions of the built environment, namely density, diversity and design. The study found that the density and mixture of landuse was a significant influence in determining travel mode particularly in the decision to use public transport, share a car or drive alone. The study shows that higher gross densities lowered the occurrence of solo-commuting, ie driver-only car commuting. In addition, Cervero found that workplace destinations with a higher density of mixed landuse produced a higher level of public transport use. The issues of congested ambient traffic conditions and greater provision of public transport options in these destination areas is discussed but their relative importance and influence is not resolved. However, the influence of urban design was relatively modest. The author does not discuss this in great detail but describes the impact of sidewalk ratio as the most important built environment variable. Thus, areas with a well-developed sidewalk or pavement infrastructure appear to encourage commuters to take the bus or, surprisingly, join a car-pooling or 'vanpooling' initiative (Cervero, 2002).

Goudie (2002) studied the travel behaviours of 408 households in Townsville and Cairns in 1996 – 1997. The research found that location played a large part in fuel consumption and distances travelled. Thus participants located in the outer urban/suburban areas used on average three times more fuel than the more centrally placed participants. Outer urban dwellers had the least sustainable travel behaviours which the author felt posed a challenge for policy-makers,

developers and city planners. Guiliano & Narayan (2003) studied the travel behaviours of US and British populations and found that the US landuse patterns reinforce vehicle dependence particularly in the sprawling suburbs of the major metropolitan regions. The authors suggest that the stronger urban planning and design controls in European countries have led to a more compact and higher density urban form and hence an increased use of public transport. The differences in travel behaviours between the American and British participants in this study were explained by the differences in urban form and household income. The study shows that in the UK the number of daily trip rates is not significantly influenced by income although the distances travelled do increase with income.

Soltani & Primerano (2005) studied 9000 randomly selected households in suburban Adelaide to determine if urban form influenced travel behaviours. The main research question was whether pedestrian-orientated urban environments with high density mixed land use and high quality urban design would reduce car use and hence increase the market share of more sustainable modes of transport. The authors concluded that this was the case although warning of the limited range of suburbs used in the study. Participants in the study were located in only four suburbs of uniform size and density. Thus, the authors warn that it might be misleading to infer that the results would be applicable to the wider metropolitan regions of Adelaide, let alone other metropolitan centres. The study found that low-density, single use, large area zoning usually found in conventional suburbs limited the ability of participants to walk or cycle for their daily travel requirements. Proximity to local shopping and service centres and local networks encouraged a wider choice of sustainable travel modes. Conversely, the location of suburban development away from major activity centres encouraged the use of the private car and decreased the use of other travel modes.

Naess (2003) and Naess & Jensen (2004) studied the influence of residential location on travel behaviour in Norway and Denmark. In particular they studied residential location and the distance from the city centre on travel behaviour and found a number of significant relationships. The closer the participants lived to the centre of the city then the more likely they were to walk or use a cycle to get to the facilities located there.

Srinivasan & Rogers (2005) also studied the impact of urban form on travel behaviour but within two suburbs of Chennai, India. Seventy households including 146 adults aged 16 years or more participated in the study using a one-day travel diary. This paper is of particular interest as little research work has been undertaken on travel behaviour and modal choice in developing countries and India in particular. Two significant variables were accessibility to transport modes and the location of employment opportunities. Participants in the more densely populated areas of central Chennai were more likely to use non-motorised modes of travel (walking and cycle in particular) than those located in peripheral areas. The authors suggest that this is due to the location of employment opportunities located in central Chennai. The location of employment opportunities should be considered in the planning of new housing particularly for low-income households in order to reduce travel times and distances.

Few papers studied rural travel behaviour. One produced by Nutley (2005) studied the travel behaviours of two rural populations in Northern Ireland from 1979 to 2001, namely rural Antrim and North Sperrins. Surveys were undertaken in rural Antrim in 1979, 1989 and 2001 whereas the North Sperrins area was surveyed in 1988 and 2000. It is worth noting that the two areas provide geographical as well cultural differences in that the Antrim area contains a well-developed network of service centres whereas North Sperrins is a marginal and remote area with poor infrastructure and economic opportunities. In addition,

rural Antrim is a predominantly Protestant/Unionist area whereas the North Sperrins area contains a predominantly Catholic/Nationalist population. The questionnaire was modified between surveys and the Antrim area was reduced in size in the 1989 and 2001 surveys. 595 households were interviewed in the Antrim area in 1979 and this reduced to 252 in 1989 and 226 in 2001. 194 households were interviewed in North Sperrins in 1988 and this increased to 208 in 2000. It is unclear whether different households were interviewed in each survey or whether there was any consistency in participants throughout the research time-period. The author found significant changes in travel behaviour over this time-period with a rapid increase in car ownership throughout the 1990s and a substantial reduction in the provision and use of public transport. In addition, whilst trip duration and distances were predominantly local in 1979 this had changed significantly by 2001 to include longer commutes to regional town centres for employment and leisure facilities.

2.2 Socio-demographic variables and travel behaviour

A large number of papers studied the impact of socio-demographic variables on travel behaviour and found some significant relationships between travel behaviour and variables such as age, gender, household composition, income,.

Newbold *et al* (2005) studied the travel behaviours of Canadians aged 65 years or more to determine if their travel patterns were different from younger Canadians. Their study used data from the General Social Survey (GSS) of Canada. The GSS is administered by Statistics Canada and is a weighted random sample of the Canadian population including participants aged 15 years and older but excluding participants living in institutions, Aboriginal reserves, Canadian Territories. Newbold's study used data from three cycles of the GSS, namely 1986, 1992 and 1998. The data from approximately 19,000 participants provided a partial confirmation of this research question but recognised that

factors other than age can influence travel behaviour. Older Canadians do make fewer daily trips than younger Canadians but this could be caused by the fact that the participants in the study were no longer employed and hence were no longer making travel-to-work journeys. Thus daily trip numbers and duration decreased significantly due to changes in employment and health status. In addition, there was a greater reliance on the car and a significant reduction in the use of public transport as the principal travel mode compared with younger Canadians. It is worth commenting on the 24-hour travel diary included in the GSS. Participants were not all required to complete their travel diary for the same day of the week or the same day of the year. Thus the travel diaries provide data equally distributed throughout the entire year.

Differences in travel behaviour due to gender was a significant factor in many papers with women recognised as being more likely to adopt sustainable travel behaviours compared with men. Best & Lanzendorf (2005) attempted to determine if there were gender differences in car use and travel patterns for maintenance travel. Overall the authors found that there were no significant differences in the total number of trips or distances travelled between men and women. However, the type or destination of trips did provide some gender differences. They found that women made fewer journeys to work by car and more journeys for maintenance activities such as shopping and child-care. This was also confirmed by Boarnet & Sarmiento (1998) in their study of travel behaviour in southern California. Moriarty & Honnery (2005) studied urban travel in all Australian State capital cities. Although the major emphasis was on studying the relationship between the distance from place of residence to the CBD of each city and the impact on travel behaviour, their study found that women on average travel less often and for shorter distances than men. Olaru et al (2005) studied travel behaviour in the Sydney metropolitan area and found a number of socio-demographic variables influenced travel behaviour. Women were more likely to travel closer to home than men particularly if they came from

a non-English speaking household. Perhaps the strongest link between travel behaviour and gender was found by Polk (2003, 2004) in studies of travel behaviour in Sweden in 1996. Polk found a significant relationship between sustainable travel patterns and gender. Women were more willing to reduce their use of the car than men, more positive towards reducing the environmental impact of travel modes and more positive towards ecological issues. Polk concludes by stating that researchers must consider gender as a factor in attitudinal research on car use.

Household composition and income were also found to be major influences on travel behaviour in a number of papers. Ryley (2005) studied the composition of 2910 households in Edinburgh. His research showed that households with children have distinct travel behaviour characteristics. These households are highly dependent on cars as the primary source of travel mode, own but don't often use cycles, and favour cycle trips predominantly for leisure rather than work journeys. Key stages within the household life cycle that impact on travel behaviours includes gaining employment, having children and retirement. Thus households consisting of students, the unemployed and part-timers without children are most likely to use non-motorised forms of transport. Conversely families consisting of retirees and high-income owners are least likely to use non-motorised forms of transport.

Dieleman *et al* (2002) used the Netherlands National Travel Survey from 1996 to study the travel behaviours of participants aged 12 years or more. The research studied the micro-factors of urban form, household attributes and the residential context. The major findings were that households on higher incomes were more likely to own and use a car and that families with children were more likely to use the car than one-person families. The influence of residential environment, defined by density, diversity and provision of public transport services, on modal choice was also high. Car use was lower than public transport, cycling or walking

in the large and medium-sized cities of Randstad Holland and higher for those households living in suburban and rural areas. The supply of good public transport facilities plus the density and diversity of land use in Randstad Holland reduces car use. In addition, the purpose of the trip influenced the travel mode selected and the distance travelled. The authors found that the largest number of kilometres travelled is for journey-to work trips and for leisure purposes and that the car was the principal mode of choice for both destinations. However, it has to be stated that the Netherlands has a strong culture of cycling and walking for all trips including journey-to-work.

Guiliano (2003), Guiliano & Dargay (2006), and Guiliano & Narayan (2003), found significant differences in travel behaviour between different demographic groups in the USA and the UK. Their data showed that American participants made 4.4 trips per day travelling approximately 31 miles whereas the British participants travelled only 16 miles in 3 trips per day. The method of data collection however varied between the US and the British studies. The US data was collected by telephone using a stratified sample with participants using a one day 'recall' diary. British participants were selected using a stratified random sample based on post code. The British participants were interviewed directly and were required to complete a seven day travel diary. Thus methods of sampling and data collection varied between the two groups. The authors found that participants aged 65 years or older in the UK travelled half the distance and were less likely to travel on any given day than participants aged 18 – 64 years. In the US study, participants aged 65 years or more travelled 60% of the distance of the younger participants. The authors also suggest that lower household incomes in the UK compared with the USA produced lower travel demand and car ownership. Gender, age and household income were all found to influence travel behaviours and that there were significant differences between travel behaviours in the USA and UK. It was found that the significantly higher transport costs in the UK led to a decrease in trips and a heavier reliance on local

goods and services. An interesting comment from their paper suggests that our understanding of travel behaviour tends to be based on the travel behaviours of predominantly white majority populations and that further research is required in ethnic and racial groups.

2.3   Psycho-social variables and travel behaviour

A smaller number of studies examined the influence of various psycho-social attributes on travel behaviour. Hiscock *et al* (2002) studied the perceived psycho-social benefits of car use and ownership. In particular the authors studied the significance of the car as providing protection, autonomy and prestige compared with public transport. This study took place in southern Scotland in early 1999 and included postal questionnaires and in-depth semi-structured interviews with car owners and non-car owners. The results found that there were some psycho-social benefits to car users. Car users felt that they gained protection, autonomy and prestige from their car and car-ownership gave them 'street-cred'. Their car provided them with protection from 'undesirable' people, provided autonomy, convenience and greater access to a greater range of destinations than public transport. Socially desirable attributes such as competence, skill and 'masculinity' were also perceived to be derived from car ownership. People who didn't own cars were felt to be eccentric particularly those who chose to travel by bicycle.

Cullinane (2002) found similar psycho-social perceptions amongst students attending five universities in Hong Kong. The findings are interesting in that car ownership was extremely low amongst the participants, less than 1% owned a car at the time of the study with the overall Hong Kong population having car ownership levels of 49 cars per 1000 population in 1999. Forty percent of participants felt that public transport was plentiful and low-cost in Hong Kong and suppressed their demand for a car.   Few participants felt that they would own a car within the next ten years. However latent demand was high particularly

amongst male students. Male participants were more likely to feel that car ownership would improve their image and their life.

Anable (2005) used the Theory of Planned Behaviour (TPB), a psychological theory of attitude-behaviour relations, to study the behaviours of leisure travellers to a tourism location in England. The TPB assumes that behaviour is guided by behavioural beliefs, normative beliefs and control beliefs. Normative and control beliefs are important in this model as they include beliefs about the expectations of others and the motivations to comply with those expectations. Thus motivational beliefs may modify travel behaviour through perceived social or peer pressure. Control beliefs include the presence of factors which may facilitate or impede that travel behaviour. Anable included a number of other measures including environmental attitudes, efficacy and habit in this study. The study is limited to a particular type of travel behaviour namely a leisure trip to a tourism destination and it would have been interesting to apply this method to a larger sample of participants with a more comprehensive range of travel behaviours.

2.4   The influence of pricing on travel behaviour

Travel cost can also influence travel behaviours. Hensher & King (2001) studied the availability of parking spaces and the cost of parking on travel behaviours in Sydney. Participants were required to consider six alternative scenarios for parking in the CBD, in a park and ride facility, switch to public transport or forego the trip to the CBD altogether. It was found that in 97% of the responses the cost of the parking option was the most significant factor which determined travel mode. A study by Handy *et al* (2005) found similar outcomes despite a very different cohort of participants and methodology. This study used focus groups and face-to-face interviews with students and staff at the University of Austin, Texas to determine if Americans drive by choice or through necessity. Despite the relatively limited nature of the study, four neighbourhoods in the San

Francisco Bay Area yielding 1682 participants, the data suggest that Americans drive due to the price of and lack of suitable modal alternatives. Therefore, the authors suggest that a stronger policy agenda is required to reduce the need for driving through the provision of public transport infrastructure at a suitable cost.

2.5 Overview

Urban form can play a significant part in influencing travel patterns and behaviours. Research shows that low density, single use land zoning produces longer travel journeys and produces a greater reliance on the use of the car as the principal means of transport. Higher density land use with mixed zoning and greater access to sustainable transport modes is more likely to promote sustainable travel behaviours.

A variety of socio-demographic factors also influence travel patterns and behaviours. Research shows that factors such as household composition, age, gender, car ownership, and income all influence the choice of travel mode and the length and duration of the journey. All of these factors are significant but gender and household composition appear to be of particular significance in influencing travel behaviours.

In addition, various psycho-social factors appear to play a part in determining people's travel behaviours and how they perceive their travel choice. Only two papers in this review studied the role of psycho-social factors and their influence in travel behaviour, namely Cullinane (2002) and Hiscock *et al* (2002). However, the authors indicate that these psycho-social variables such as the perception of safety, power and masculinity are significant determinants of travel behaviour. Thus there is a perception that a car can increase your social standing in society and protect you from the more 'undesirable' or 'eccentric' users of public transport.

It is difficult to conclude on the relative influence of urban form variables, socio-demographic and psycho-social factors. There is considerable variability in choice of variables measured in influencing travel behaviour, as is there variability in the way in which survey samples control for these variables.

3   Adopted Research Approaches

The majority of the papers included in this review gathered primary data through the use of a questionnaire survey and a travel diary. A number of the papers accessed data from secondary sources only such as the Netherlands National Travel Survey described by Dieleman *et al* (2002) or the Scottish Household Survey described by Ryley (2005). There is also great variability in the sample size and the method of sampling. Srinivasan & Rogers (2005) used a random stratified sample of 500 households in two suburbs of Chennai to determine which variables affect mode choice and trip frequency. Guiliano & Dargay (2006) accessed the USA National Personal Transportation Survey and the UK National Transport Survey to compare car ownership rates and travel behaviours in the two countries. These two surveys involved over 42,000 households in the USA and 9688 households in the UK. Plaut (2005) studied travel behaviours from the American Housing Survey 2001 which accessed data from 106,000 households. However, Ampt *et al* (2005) interviewed only 102 participants in their survey of household travel behaviour in the Canberra suburbs of Belconnen and Gungahlin. Rose & Ampt (2001) included only 46 participants in their study of car use reduction strategies in Sydney and Adelaide. Thus, the number of participants in the research projects varies considerably from less than one hundred to many thousands.

The method of data collection varied considerably including face-to-face structured or semi-structured interviews, postal questionnaires, questionnaires handed out at transport nodes such as taxi ranks or car-parks, telephone surveys and on-line questionnaires. Hamed and Olaywah (2000) in their survey of bus, taxi and car use in Amman, Jordan handed out the questionnaire to a random sample of travellers at taxi ranks, bus stations and to private car commuters. In a similar fashion, Loo (2002) undertook roadside interviews of 2220 local residents of the Yuen Long New Town in Hong Kong to determine the potential impact of

the construction of strategic roads on travel behaviour and patterns. Shailes *et al* (2001) interviewed 232 tourists at a variety of tourist attractions and facilities throughout Cornwall, England to determine whether traffic congestion had caused them to modify their travel patterns. Hensher & King (2001) in their study of the influence of parking availability and travel mode handed out questionnaires to car-park users with a mail-back facility. In addition, they undertook face-to-face interviews with a random sample of bus and train users within the Sydney metropolitan area. Of the 2860 questionnaires handed out to car-park users 416 were returned by post, a response rate of only 16.1%. Hiscock *et al* (2002)studied the psycho-social benefits of car useage for their owners in southern Scotland. The initial survey involved 3250 postal questionnaires followed by a second stage of face-to-face in-depth and semi-structured interviews of car-owning and non-car owning participants. A somewhat different approach was undertaken by Kingham *et al* (2001) in their study of journey-to work trips by employees in two car production factories in Hertfordshire, England. This research study attached the questionnaire to the pay-slips and participants were able to return the completed questionnaire within the company's internal mail system.

A number of research projects used a postal questionnaire to gather primary data with variable response rates. Mokhtarian & Salomon (2001) used a fourteen page postal questionnaire in their study of travel as derived demand in the San Francisco Bay area. The initial mail-out of 8000 questionnaire forms produced 1900 returns, a response rate of less than 25%. Polk (2004) used a postal questionnaire in a random sample of participants to determine if gender played a role in daily car use and willingness to reduce that car use. The project initially contacted 2000 potential participants and managed to achieve a response rate of 61% by the use of three follow-up letters to encourage questionnaire completion. Conversely Richardson *et al* (2005) only managed to obtain 1347 completed questionnaires from 30,000 households that were contacted in the north-eastern

suburbs of Melbourne. However, this project, which was an attempt to modify travel behaviour through a TravelSmart project, used face-to-face interviews and telephone interviews rather than the postal questionnaires that Polk adopted.

A small number of studies dispensed with the questionnaire or travel diary and concentrated on data collection through the use of focus group activities alone. Stone *et al* (2003) in their study of non-car trips in Bunbury, Western Australia used a series of semi-structured, non-directed, focus groups. Fourteen focus groups took place involving 83 participants aged between 18 – 59 years.

However, the most common method of data collection is the use of the travel diary. A clear majority of research projects used a travel diary to gather data on trips and behaviour. The number of days recorded in the travel diary varied widely, although the one-day or two-day travel diary appears to be most common. Many researchers including Boarnet & Crane (2001); Bowman & Ben-Akiva (2001); Guiliano (2003); Kunert & Follmer (2002), Newbold *et al* (2005) use the one day or twenty-four hour travel diary. Boarnet & Crane (2001) used both a one-day and a two-day travel diary in their study of travel behaviour in southern California. It is worth noting that participants were allocated specific days of the week in which to record their trips. Thus trip-making for every day of the week was represented in the final dataset. However, a number of projects used a two-day travel diary including Soltani & Primerano (2005), Bhat & Lockwood (2004) and Vande Walle & Steenberghen (2006). A small number of research projects used a seven-day diary including Garvill *et al* (2003) and Kenyon (2006). The longest period covered within a single travel diary was used in a study by Schlich & Axhausen in their study of travel behaviour in Karlsruhe and Halle/Salle in Germany. Participants were required to keep a travel diary for a period of six weeks recording all their travel movements during that time. A total of 52,273 trips were recorded by the 361 participants taking part in the project. A number of projects used variations on the one-day or two-day travel diary. Zacharias

(2005) in a study of travel in four Shanghai suburbs required participants to record their most recent trip as well as details of their usual daily trips. It is worth noting though that in several projects participants were required to repeat their travel diary on a number of occasions throughout the project. Garvill *et al* (2003) required participants to complete a seven-day travel diary three times between October and December 1999. Kenyon (2006) also required 100 participants to complete a seven-day travel diary three times at six month intervals in March 2004, October 2004 and March 2005.

Few of the papers specified which day or days of the week the travel diary covered. A number of projects including Longworth & Wilson (2005) refer to journey-to-work travel diaries implying but not stating that the trips take place on a Monday to Friday. Goudie (2002) in his study of the influence of location on travel behaviour in northern Queensland requested that the travel diary should record trips taken on a Friday only rather than any other day of the week. Many of the papers specify the month or season of the year within which the travel data was recorded. Thus Loo (2002) gathered data between 2 – 24 June 1998 whilst Lee & McNally (2003) gathered their data between April – June 2000. Kunert & Follmer (2005) refer to the travel diary taking place in summer 2001 while Kwan (2000) refers to spring and autumn 1994 as well as winter 1995. It is surprising that there is not more debate about the time of year and the day of the week that the travel diaries cover in the papers reviewed as it would be surprising if travel patterns didn't vary on a weekly or monthly basis. In addition, a number of papers such as Anable (2005) are more concerned with maintenance trips rather than journey-to-work trips yet fail to provide this information about their data collection. It is also worth noting that some papers use the term 'activity diaries' interchangeably with 'travel diaries' with no definition of the terms. It is implied that the activities recorded require some form of travel but this is not always stated.

In addition, projects have taken a number of different approaches to determine which household members should complete the travel diary or questionnaire. Schwanen and Mokhtarian (2005) required only one randomly selected adult per household to complete the postal questionnaire in their study of commuting in four suburbs of the San Francisco Bay area. Of the 8000 questionnaires posted to participants only 1358 were able to be used in the data analysis. It is unclear whether the authors selected the adult participant or if it was self-selection within the household. In addition, the paper did not include a definition of 'adulthood' in this context so it is unclear whether the participating adult was 16, 18 or 21 years or older, the main income-earner etc. In a study undertaken by Steg et al (2001) in Groningen and Rotterdam participants had to own a valid driving licence in order to complete the questionnaire. Interestingly these questionnaires were delivered and completed in a group setting, however the size and other details of this approach are not described. Khattak & Rodriguez (2005) in their study of travel behaviour in the New Urbanist suburbs of Chapel Hill and Carrboro in North Carolina included household participants aged 16 years or more in a seven-day travel diary. Hjorthol (2002) required participants to be aged 13 years or more whereas Polk (2004) required participants to be aged between 18 and 80 years. The US Nationwide Personal Transportation Survey used by Giuliano (2003) requires participants to be aged 5 years or more at the time of the survey. Newbold et al (2005) studied the travel behaviours of Canada's older population and required participants to be 65 years of age or more at the time of the travel diary. Thus there is wide variety in the age of participants and household members who were invited to take part in the research projects.

Finally, Larson & Poist (2004) provide an interesting overview of all papers using a postal questionnaire included in the 'Transportation' journal between 1992 and 2003. The paper noted that 106,300 questionnaires had been mailed in the papers reviewed and that response rates had declined significantly since 1992. The authors include a number of strategies that they feel could improve response

rates including providing well-designed questionnaires, avoiding overt references to government involvement, including stamped, addressed envelopes, providing a deadline for questionnaire return and avoiding requests for sensitive personal and financial information. They also express caution in including financial rewards or prizes for participation in the survey and taking special care with any follow-up communications which aim to encourage participation.

4 Key issues for further research

The papers included in this review are diverse in geographical location and scale, content and intent. However a number of clear themes are apparent and should influence the nature of project methodology, data collection and analysis. It is clear that a range of factors can influence travel behaviours; broadly speaking these are urban form, socio-demographic and psycho-social factors. Most research projects have focussed on only two of these groupings namely urban form and socio-demographics. The few projects that have studied psycho-social variables have collected some socio-demographic date but have not focussed on urban form. Thus it could be argued that there is merit in designing a research methodology that includes all three of these elements to determine the variables that influence travel behaviour.

4.1 Data Collection methods

Firstly, the nature of data collection is critical. Various methods have been used in the projects including face-to-face interviews and focus groups of a structured and semi-structured nature, postal and telephone questionnaires as well as web-based questionnaires. It is apparent that response rates have been declining in postal questionnaires since 1992 and this trend may well be apparent for the other data collection methods. A number of strategies have been suggested to improve response rates and have met with some success. A number of factors may improve response rates including:

a)   well-designed questionnaires,
b)   avoiding overt references to government involvement,
c)   inclusion of stamped, addressed envelopes,
d)   providing a deadline for questionnaire return and,
e)   avoiding requests for sensitive personal and financial information

Follow-up contact by phone or letter can increase response rates significantly from levels as low as 16% to as high as 61%.

4.2   Sample Selection

Sample size, method of sampling and travel diaries varied considerably in the papers reviewed. It is surprising that there was so little debate in any of the papers involving these key elements of the research activities. In particular the length of time that participants were required to record their travel behaviours varied from one-day to six weeks. In a number of papers participants were not even required to record their travel behaviours for the same day. In the General Social Survey of Canada described by Newbold et al (2005) participants record their travel behaviour for a single day of the year. However this was not the same day of the year for every participant and, in fact, travel on every day of the year is represented in this survey.

It would seem that selection of the travel diary day(s) needs to be considered carefully as certain days may produce atypical travel behaviours. Thus selecting a Saturday or Sunday may cause maintenance trips to dominate at the expense of the journey-to-work trips. Particular weekdays, particularly Thursdays and Fridays, are associated with late-night shopping in many shopping centres which again could skew the data. A seven day travel diary should collect data on all the journey-to-work and maintenance trips. Month of the year is another important issue however as factors such as school holidays, public holidays etc can provide trip data which is not representative of 'normal' patterns of behaviour.

4.3 Survey Instruments and Design

Most research projects have gathered primary data by the use of a travel, activity or accessibility diary. These are variable in length and include one-day, two-day, seven-day and six-week travel diaries. Many of the projects which used the shorter travel diaries tended to repeat data collection on a number of occasions, at different times of the week and months of the year. Few of the papers mention the day of the week on which the travel behaviour was recorded which is a surprising omission given that different projects recorded different types of travel behaviour. Whilst some projects studied journey-to-work trips others recorded maintenance trips alone. Thus the time of week and time of year for data collection is critical. Lack of discussion on this topic seems to be a surprising omission. In addition, the projects lacked consistency in the age of participants and household members who were included in data collection. In some surveys all household members over the age of 5 years were included in data collection. In other projects participants had to be over 16 years of age, over 18 years of age, or own a valid driving licence. In a number of surveys only one adult completed the questionnaire or answered on behalf of the remaining household members. Thus a range of participants were included in these research projects.

A range of variables has been identified as being highly significant in influencing travel patterns and behaviour. These can be divided into two broad groups, namely those physical factors of urban form and secondly the more general socio-demographic and psycho-social factors which influence travel behaviour. Thus any research project should attempt to identify the physical factors such as population density, landuse, zoning, access to services and transport infrastructure, distance from CBD and employment opportunities which influence travel behaviours. The range of socio-demographic factors is more complex and

includes gender, household income, household composition, car ownership, and age amongst other variables. In addition, various psycho-social factors are significant in influencing travel behaviour especially when linked to factors such as age and gender. Thus the feelings of power, status, protection and desirability are all factors which have been shown to influence travel behaviour and should be included in any survey.

4.4 Precinct Selection

Many of the papers evaluated the location of the participants to determine what impact location or urban form might have on the selection of travel mode. A number of the most important variables include:

- o Size of urban centre where participants reside – small, medium or large
- o Urban v. rural location of participants
- o Location of residence in urban areas – inner, middle or outer suburban location
- o Density and mixture of urban landuse in residential and destination areas – esp employment and recreational facilities.
- o Proximity of residence to shopping facilities and other maintenance destinations
- o Density of sidewalk/pavement infrastructure
- o Cost of travel options including parking fees

4.5 Socio-demographic variables

Many of the papers reviewed discussed the importance of a range of socio-demographic variables that can influence the choice of travel mode and the frequency of trips. The most important variables are the following:

- Gender
- Age
- Income
- Employment status
- Retirement status
- Educational status

- Ethnicity

- English or Non-English speaking background

- Car ownership including number of cars in household

- Household composition
    - Includes presence or absence of children, age of children, students, number of adults in employment

4.6   Psycho-social variables

A range of psycho-social variables have been identified as playing some part in influencing travel behaviour many of which appear to be dominant in car-owning younger males.   Those papers which identified these psycho-social variables tended to use subjective and qualitative measures and discussed the following:

- Feelings of power

- Feelings of achieving 'street cred'

- Safety

- Protection from socially undesirable groups

- Feelings of prestige within peer group

- Identification with selected peer group

- Feelings of greater autonomy

- Perceptions of greater skill and competence through car ownership

- Perceptions of greater masculinity among male car-owners – interestingly no mention of greater femininity amongst female car-owners and users

- Non car-owners/users deemed to be 'eccentric' and hence undesirable

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Appendix 1: Search Strategy

Possible search terms		
Key terms & variants		
Travel behaviour	**Mode choice**	**Choice**
Possible synonyms		
Transportation Accessibility Self selection	Car use Walking transportation	Preference Selection Decision

<table>
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Transport Journals

- Transport Policy (Science Direct)
- Transportation Research Part A: Policy and Practice (Science Direct)
- Transportation Research Part B: Methodological (Science Direct)
- Transportation Research Part D: Transport and Environment (Science Direct)
- Journal of Transport Geography (Science Direct Library Catalogue)
- Transport Reviews (Meta Press – Library Catalogue)
- Transportation (SpringerLink – Library Catalogue)
- Transportation Journal (ProQuest – Library Catalogue)
- Transportation Planning and Technology (Meta Press – Library Catalogue)
- Transportation Science (ProQuest – Library Catalogue)
- Planning Practice and Research (Meta Press – Library Catalogue)
- World Transport Policy & Practice http://www.eco-logica.co.uk/WTPPhome.html
- International Planning Studies (Meta Press (Taylor & Francis Group) –

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Search record

Searched all transport journals issue by issue.

Web

- Moving through nets: The physical and social dimensions of travel

- 10th International Conference on Travel Behaviour Research
http://www.ivt.baug.ethz.ch/allgemein/iatbr2003.html

- Australasian Transport Research Forum (ATRF)
http://www.patrec.org/atrf/index.php

- PATREC Research Forum 2005
http://www.patrec.org/atrf/index.php

- TOD Conference 2005
http://www.patrec.org/atrf/index.php

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Library Catalogue) Transportation Research Part E: Logistics and Transportation Review (Science Direct)	

Appendix 2: Search Record

Transport Policy (Science Direct)

	Vol. 8 (2001)	Vol. 9 (2002)	Vol. 10 (2003)	Vol. 11 (2004)	Vol. 12 (2005)	Vol. 13 (2006)
Issue 1	☐	☐	☐	☐	☐	☐
Issue 2	☐	☐	☐	☐	☐	
Issue 3	☐	☐	☐	☐	☐	
Issue 4	☐	☐	☐	☐	☐	
Issue 5					☐	
Issue 6					☐	

Transportation Research Part A: Policy and Practice (Science Direct)

	Vol. 35 (2001)	Vol. 36 (2002)	Vol. 37 (2003)	Vol. 38 (2004)	Vol. 39 (2005)	Vol. 40 (2006)
Issue 1	☐	☐	☐	☐	☐	☐
Issue 2	☐	☐	☐	☐	☐	☐
Issue 3	☐	☐	☐	☐	☐	☐
Issue 4	☐	☐	☐	☐	☐	☐
Issue 5	☐	☐	☐	☐	☐	☐
Issue 6	☐	☐	☐	☐	☐	

Issue 7	☐	☐	☐	☐	☐	
Issue 8	☐	☐	☐	☐	☐	
Issue 9	☐	☐	☐	☐	☐	
Issue 10	☐	☐	☐	☐	☐	

Transportation Research Part B: Methodological (Science Direct)

	Vol. 35 (2001)	Vol. 36 (2002)	Vol. 37 (2003)	Vol. 38 (2004)	Vol. 39 (2005)	Vol. 40 (2006)
Issue 1	☐	☐	☐	☐	☐	☐
Issue 2	☐	☐	☐	☐	☐	☐
Issue 3	☐	☐	☐	☐	☐	☐
Issue 4	☐	☐	☐	☐	☐	☐
Issue 5	☐	☐	☐	☐	☐	☐
Issue 6	☐	☐	☐	☐	☐	
Issue 7	☐	☐	☐	☐	☐	
Issue 8	☐	☐	☐	☐	☐	
Issue 9	☐	☐	☐	☐	☐	
Issue 10	☐	☐	☐	☐	☐	

Transportation Research Part D: Transport and Environment (Science Direct)

	Vol. 6 (2001)	Vol. 7 (2002)	Vol. 8 (2003)	Vol. 9 (2004)	Vol. 10 (2005)	Vol. 11 (2006)
Issue 1	☐	☐	☐	☐	☐	☐
Issue 2	☐	☐	☐	☐	☐	☐
Issue 3	☐	☐	☐	☐	☐	
Issue 4	☐	☐	☐	☐	☐	
Issue 5	☐	☐	☐	☐	☐	
Issue 6	☐	☐	☐	☐	☐	

Transportation Research Part E: Logistics and Transportation Review (Science Direct)

	Vol. 37 (2001)	Vol. 38 (2002)	Vol. 39 (2003)	Vol. 40 (2004)	Vol. 41 (2005)	Vol. 42 (2006)
Issue 1	☐	☐	☐	☐	☐	☐
Issue 2	☐	☐	☐	☐	☐	☐
Issue 3	☐	☐	☐	☐	☐	
Issue 4	☐	☐	☐	☐	☐	
Issue 5	☐	☐	☐	☐	☐	
Issue 6	☐	☐	☐	☐	☐	

Transport Reviews (Meta Press – Library Catalogue)

	Vol.21 (2001)	Vol. 22 (2002)	Vol. 23 (2003)	Vol. 24 (2004)	Vol. 25 (2005)	Vol. 26(2006)
Issue 1	☐	☐	☐	☐	☐	☐
Issue 2	☐	☐	☐	☐	☐	☐
Issue 3	☐	☐	☐	☐	☐	
Issue 4	☐	☐	☐	☐	☐	
Issue 5				☐	☐	

Issue 6	▓		☐	☐	▓

Transportation (SpringerLink – Library Catalogue)

	Vol.28 (2001)	Vol. 29 (2002)	Vol. 30 (2003)	Vol. 31 (2004)	Vol. 32 (2005)	Vol. 33 (2006)
Issue 1	☐	☐	☐	☐	☐	☐
Issue 2	☐	☐	☐	☐	☐	▓
Issue 3	☐	☐	☐	☐	☐	▓
Issue 4	☐	☐	☐	☐	☐	▓
Issue 5	▓	▓	▓	▓	☐	▓
Issue 6	▓	▓	▓	▓	☐	▓

Transportation Journal (ProQuest – Library Catalogue)

	Vol.40 (2001)	Vol. 41 (2002)	Vol. 42 (2003)	Vol. 43 (2004)	Vol. 44 (2005)	Vol. 45 (2006)
Issue 1	☐	☐	☐	☐	☐	☐
Issue 2	☐	☐	☐	☐	☐	☐
Issue 3	☐	☐	☐	☐	☐	☐
Issue 4	☐	☐	☐	☐	☐	☐

Transportation Planning and Technology (Meta Press – Library Catalogue)

	N/A	Vol. 25 (2002)	Vol. 26 (2003)	Vol. 27 (2004)	Vol. 28 (2005)	
Issue 1	▓	☐	☐	☐	☐	
Issue 2	▓	☐	☐	☐	☐	
Issue 3	▓	☐	☐	☐	☐	
Issue 4	▓	☐	☐	☐	☐	
Issue 5	▓	▓	☐	☐	☐	
Issue 6	▓	▓	☐	☐	▓	

Transportation Science (ProQuest – Library Catalogue)

	Vol. 35 (2001)	Vol. 36 (2002)	Vol. 37 (2003)	Vol. 38 (2004)	Vol. 39 (2005)
Issue 1	☐	☐	☐	☐	☐
Issue 2	☐	☐	☐	☐	☐
Issue 3	☐	☐	☐	☐	☐
Issue 4	☐	☐	☐	☐	☐

Planning Practice and Research (Meta Press – Library Catalogue)

	Vol. 16 (2001)	Vol. 17 (2002)	Vol. 18 (2003)	Vol. 19 (2004)	Vol. 20 (2005)
Issue 1	☐	☐	☐	☐	☐
Issue 2	☐	☐	☐	☐	☐
Issue 3	☐	☐	☐	☐	▓
Issue 4	☐	☐	☐	☐	▓

World Transport Policy & Practice http://www.eco-logica.co.uk/WTPPhome.html

	Vol. 7 (2001)	Vol. 8 (2002)	Vol. 9 (2003)	Vol. 10 (2004)	Vol. 10 (2005)
Issue 1	☐	☐	☐	☐	☐

International Planning Studies (Meta Press (Taylor & Francis Group) – Library Catalogue)

	Vol. 6 (2001)	Vol. 7 (2002)	Vol. 8 (2003)	Vol. 9 (2004)	Vol. 10 (2005)
Issue 1	☐	☐	☐	☐	☐
Issue 2	☐	☐	☐	☐	☐
Issue 3	☐	☐	☐	☐	☐
Issue 4	☐	☐	☐	☐	☐

Journal of Transport Geography (Science Direct – Library Catalogue)

	Vol. 9 (2001)	Vol. 10 (2002)	Vol. 11 (2003)	Vol. 12 (2004)	Vol. 13 (2005)	(2006)
Issue 1	☐	☐	☐	☐	☐	☐
Issue 2	☐	☐	☐	☐	☐	☐
Issue 3	☐	☐	☐	☐	☐	☐
Issue 4	☐	☐	☐	☐	☐	☐

Appendix 3: Literature Review Matrix – Empirical Research

Authors	Location	Methods of analysis	Survey Time-period	Respondents	Research aims	Research issues	Outcomes
Alcantara de Vasconcellos, E. (Sub: 6/1/04; Acc: 1/12/04)	Sao Paulo metropolitan area, Brazil	Four origin-destination surveys; one every 10 years. 1 day travel diary used	1967-1997	30, 000	What factors have shaped transport and traffic in the Sao Paulo Metro region over the 1967-97 period?	Transport method has changed over time to buses and then predominantly cars.	Population increase x 2. Public transport had severe supply and quality issues, substantial fare increases, congestion, pollution and traffic accidents all increase. Public policy continues to be unsustainable.
Ampt, E., Stopher, P. & Wundke, J. (Date not included: 28th Australasian Transport Research Forum)	Belconnen & Gungahlin, (Canberra), Australia	Interviewing households; owners and renters about to move, owners and renters recently moved.	Late 2003	102 participants	Are households more open to change their travel behaviour patterns when they have just experienced a significant event such as moving house?	Study concentrates more on methodology than travel behaviour outcomes	Pilot study only. Clear need to talk with participants face-to-face to get any travel behaviour change. Works best in conjunction with large groups of movers ie Defence forces. Pre-move intervention is most likely to bring about change.
Anable, J. (Sub: 7/04/04; Acc: 16/11/04)	Two National Trust properties (Dunham Massey, Quarry Bank Mill) near Manchester, England	Theory of planned behaviour	Not stated. Late 1990s or early 2000s?	Initial intercept survey (N = 1222). Postal/provided questionnaire (N = 666).	Aimed to study behavioural influences on car-based travel.	Day trip travel to leisure attractions	6 pyschographic groups identified with unique sets of preferences, attitudes and behaviours ('Malcontented motorists', 'Complacent car addicts', 'Aspiring environmentalists', 'Die-hard drivers', 'Car-less crusaders', ' Reluctant riders') . Socio-demographic factors play little part on travel profiles. Same travel behaviour can take place for very different reasons. Same attitudes can lead to very different behaviours.

Anable, J. & Gatersleben, B. (Sub: 26/02/04; Acc: 3/09/04)	University of Surrey staff & students, Local council employees, two national trust properties as above.	On-line travel questionnaire; intercept survey and postal questionnaire	Not stated. Late 1990s or early 2000s?	235 on-line questionnaire respondents; Initial intercept survey (N = 1196). Postal/provided questionnaire (N = 666).	Aims to study instrumental (cost, convenience etc) and affective (freedom, relaxation, excitement) factors on work and leisure journeys by different travel modes	For commuter journeys instrumental factors such as convenience are most important. For leisure journeys, instrumental and affective factors are almost equally important	Potential flaw in research method as two dissimilar groups surveyed. Results 'should be treated with caution'.
Axhausen, K. W., Zimmermann, A., Schönfelder, S., Rindsfüser, G., & Haupt, T. (Transportation 29: 95-124, 2002)	Karlsruhe and Halle, Germany	Paper-based diary plus face-to-face interviews; six-week travel diary	Autumn 1999	139 households representing 317 persons aged 6 years or more	What are the rhythms in the travel behaviour of the participants?	Project uses a continuous 6-week travel diary to study the dynamic nature of travel behaviour – can learning and change and rhythms and routine be identified in the survey?	Detailed dataset provides behavioural and external influences on travel inc trip costs and activity expenditures. Conclusion is rather broad advocates the use of the 6-week travel diary to provide a comprehensive overview of regular and irregular trips.
Best, H. & Lanzendorf, M. (Journal of Transport Geography 13 (2005) 109 – 121)	Cologne, Germany	Face-to-face interviews	April to July 1997	949	Are there gender differences in car use and travel patterns for 'maintenance' travel?	Maintenance means work and travel related to the physical and emotional reproduction of labour power and society. (not sleeping and pure leisure)	On an aggregate level there seems no difference overall but YES when broken down. Women make fewer journeys for work and more for non-employed maintenance work ie shopping and child care. Substantially higher use of cars by men. Still a transport disadvantage for women.

Bhat, C. R. & Lockwood, A. (Sub: 23/07/03; Acc: 6/04/04)	San Francisco Bay area, California, USA	Primary data source: San Francisco Bay Area Travel Survey (BATS) inc 2-day activity diary; secondary data from Metropolitan transportation Commission for land-use zones and demographics	2000	15,000 households originally in BATS – reduced to 3232 out-of-home weekend recreational episodes from 2341 individuals aged 16 years or more	What are the determinants of physically active out-of-home recreational pursuits and travel? Weekend-based rather than weekday based.	Uses a multinomial logit formulation to examine out-of-home recreational episode type participation inc individual and household socio-economic data, location and seasonal effects	Full-time employees have a higher rate of participation in physically-active pursuits and a lower rate of physically active travel-related rec. activities. Young adults (16-17) have low part. rates in physically active recreation. Car ownership decreases participation while bike ownership increase part in physically active pursuits. Location effects do not directly impact on rec. activity rate participation. Seasonality is not important. High individual variation in recreation preferences.
Bhat, C. R. & Srinivasan, S. (Sub: 22/07/03: Acc: 19/04/04)	San Francisco Bay area, California, USA	Primary data source: San Francisco Bay Area Travel Survey (BATS); inc 2-day activity diary; secondary data from Metropolitan transportation Commission for land-use zones and demographics	2000	15,000 households originally in BATS – reduced to 5545 individuals for this study in 2859 households.	An examination of the frequency of participation of individuals in out-of-home non-work and non-school episodes over the weekend.	Uses the STOPS model for analysis. Studies 7 main out-of-home activities inc shopping, personal business, community activities, pick-up/drop-off activities etc	Household and individual socio-economics factors are important, - esp. income, bike ownership, household structure, gender, employment status, internet use, location etc. Car ownership and urban form do not have a stat. significant impact on stop-making propensity for any of the activities. May be due to self-selection if individuals and households into areas based on their travel preferences.

Boarnet, M. & Crane, R. (Sub: 7/12/98: Acc: 17/03/2000)	Orange County/Los Angeles & San Diego, California, USA	OC/LA – Two day travel diary; San Diego – telephone interview detailing all non-auto trips during one day	Orange County/Los Angeles – 1993; San Diego - 1986	OC/LA – 769; San Diego – 2754 households yielding data for 7469 persons and 32,648 trips	What is the influence of landuse on travel behaviour?	A common research question. But the relationship (if any) is extremely complex and previous research results are often inaccurate and biased due to flawed research methodology. Research is often aimed at reducing travel by car	Mixed results from published work but linkages between urban form and TB are complex. Factors studied include pop. density, street network density, land use mix. Geographic scale is important for the research study. Can design changes cause changes in individual travel? Do people choose their residential location in part because of their desired driving patterns? Urban design may influence travel behaviour at the margin
Boarnet, M. G. & Sarmiento, S. (Paper received in final form: December 1997)	Southern California – but presumably same sample as above paper	Two day travel diary	1993	769	Does land-use policy affect travel behaviour for non-work trips?	Research used a variety of socio-demographic variables and landuse characteristics to model non-work auto trips over a 2-day period	Land-use variables are statistically insignificant apart from scale: women make more non-work trips, older people make fewer non-work trips, households with more kids make more non-work trips. HH income is significantly positive at the 10% level. Again, residents may choose their location based on their desired driving patterns.
Bowman, J.L. & Ben-Akiva, M. E. (Sub: 17/01/97: Acc: 12/07/99)	Boston, Massachusetts, USA	24 hour household travel diary	1991	Unclear – refers to 1474, 2873, 3758 and 4546 observations; but this refers to particular types of travel activity	Research produces an integrated activity-based discrete choice model system of an individual's activity and travel schedule to forecast urban passenger travel demand.	Research uses the 'tour' method of defining travel ie travel from home to one or more activity locations and back home again. This is an econometric model of travel activity spanning individual choice over a 24 hour period.	Research outcomes are difficult to interpret from this paper but certain factors can be important and their influence modelled such as time of day and mode specific trips. Don't like this paper.

Buliung, R. N. & Kanaroglou, P. S. (Journal of Transport Geography 14 (2006) 35-51)	Portland, Oregon, USA	1994/95 Portland Household Activity and Travel Behaviour Survey	1994/95	PHATBS involves 4451 households inc 9471 respondents undertaking 122,348 activities and 67,891 trips	Research uses a GIS object-orientated system to explore household level activity and travel behaviour.	Uses the ArcGIS Geodatabase to model spatial locations visited by family members over a particular time-period.	Study was looking more at the use of GIS as a tool as much as determining relationships between spatial location and travel behaviour. GIs effectively reduces complexity of household level activity and TB. Model needs to be refined.
Cao, X., Handy, S. L. & Mokhtarian, P. L. (Transportation (2006) 33: 1 -20)	Austin, Texas, USA	Postal questionnaire – random sample to 6000 households	1995	1368 (23% response rate)	What is the impact of the built environment on pedestrian travel behaviour?	Data was collected from 6 middle-income suburbs of Austin at various distances from city centre. Suburbs built in early 20th C, between 1950 – 1970 and after 1970; very different physical layouts in each.	Impact of built environment on TB may depend on the purpose of the trip ie utilitarian or recreational purposes. Connection between BE and TB may be a function of residential location choice. Residential self-selection is the most important factor for walking to a destination.
Cao, X. & Mokhtarian, P. L. (Sub: 3/09/04: Acc: 4/03/05)	San Francisco Bay Area, California, USA	Postal questionnaire – 8000 random sample	1998	1904 (23.8% response rate)	How do individuals adapt their personal travel behaviour?	Included all trips inc travel to work and for leisure purposes. Included info on attitudes to travel, socio-demographics, personality traits, lifestyle mobility constraints, mobility etc.	Study looks at objective and subjective components of travel. An individual's adaptation process will be affected by a wide range of qualitative and experiential variables which are often ignored or omitted by policy makers.
Cervero, R. (Transportation Research Part D 7 (2002) 265 – 284)	Montgomery County, Maryland, USA	Primary data: Household Travel Survey 1994; plus other non-specified database sources	1994	Not-specified exactly; but reduced from 5167 observations recorded in HTS	Can compact, mixed-use and walk-friendly urban development significantly influence travel modes?	Uses a normative model that weighs the influence of 3 core dimensions of the BE (inc density, diversity and design) and factors related to travel cost and socio-economic attributes of travellers	Intensities and mixtures of land use significantly influence decisions to drive-alone, share a ride, or use public transport. One of the most important urban design variables is sidewalk/pavement infrastructure. Well-developed sidewalk infrastructure encourages bus or vanpooling.

Clay, M. J. & Mokhtarian, P. L. (Transportation Planning and Technology, June 2004, Vol. 27. No. 3. pp 181 – 209)	San Francisco Bay Area, California, USA. (North SF, Concord, Pleasant Hill)	Postal questionnaire – 8000 random sample	May 1998	1282	What variables play a part in determining an individual's personal travel management?	Paper explores individuals' adoption and consideration of 17 travel-related alternatives in relation to socio-demographic, mobility, travel-related attitude, personality and lifestyle variables.	Some predictable results – those who like to travel and want to do more are less likely to consider travel-reducing strategies, woman are more likely to consider/adopt 'costly' travel strategies, those with higher mobility were more likely to adopt travel maintaining (more fuel-efficient car for example) as well as travel-reducing strategies. Need for further research on TB
Cullinane, S. (Sub: 1/03/01; Acc: 1/09/01)	Hong Kong, China	Face-to-face questionnaire – students from 5 HK universities	December 2000	389	Is there a relationship between car ownership and public transport adoption? (Paper title states provision but seems to refer to adoption)	Study focuses on travel behaviour of Hong Kong students where PT is plentiful and cheap and car ownership and use is low. Is there a difference between attitudes and actions/behaviour? Car ownership in 1999 is 49 per 1000. PT profitable in HK and fares are low.	Car ownership low amongst participants (>1%). Unlikely to buy car in next 10 years but latent demand is high esp. among male students. No link between where they lived and desire to purchase car. 40% felt PT so good that they didn't need to buy a car. Males more likely to feel that car ownership would add to their lives and image. PT seen to be good and cheap and suppressing demand for cars.
Dieleman, F. M., Dijst, M. & Burghouwt, G. (Urban Studies, Vol. 39, No. 3, 507 – 527, 2002. Paper first received July 2002; in final form, April 2001)	The Netherlands	Netherlands National Travel Survey (OVG); running since1978; since 1995 70,000 households interviewed on TB each month	1996 data only	People aged 12 years or above	What are the micro-factors of urban form, household attributes and residential context that determine travel behaviour?	5 main travel modes selected – walking, cycling, PT, private car, other; modal choice and travel distance studied; 3 household factors including no. of adults, and household type,	People with↑ incomes a re more likely to own and use a car, families with kids are more likely to use car than one-person families, purpose of trip influences travel mode and distance

Garvill, J., Marell, A. & Nordlund, A. (Transportation 30; 63 – 79, 2003)	Umeå, Sweden	Questionnaire and 7-day travel diary; each completed 3 times	October – December 1999	60 households comprising 115 subjects; of which 66 were in an experimental group and 54 in the control group	What impact does an increase in travel mode choice have on travel behaviour and uptake of that mode?	Participants divided into experimental and control group. Experimental group were exposed to a stronger choice of travel mode and expected to display stronger relationships as a result.	No significant change in relationship between attitude and behaviour, and no sig change between habit and behaviour. Temporary↓ in car use in experimental group.
Giuliano, G. (Sub: 15/03/01; Acc: 12/04/02)	USA nation-wide	Primary date: 1995 US Nationwide Personal Transportation Survey (NPTS) DATA; 1 day travel diary for persons aged 5 years or more via phone survey	1995	1995 data is USA wide consisting of 42,000 households; 95,000 (actually 95,360) persons and 400,000 person-trips. Trips longer than 75 miles were excluded.	Is there a relationship between residential location and travel among ethnic and racial groups?	Research attempted to decide whether TB differences are independent of race and ethnicity or due to location and socio-economic factors. Ethnic groups inc Blacks, Hispanics, Asians and Whites.	Sig differences between ethnic and racial group TB. Gender, age and household income impact upon TB, metro location is not related to daily travel. Residential neighbourhood characteristics have different impacts across race/ethnic groups. Understanding of TB is based on white majority pop TB.
Giuliano, G. & Dargay, J. (Sub in revised form: 1/02/05: Acc: 1/03/05)	USA-national; UK – national	USA – Nationwide Personal Transportation Survey (NPTS) inc telephone survey and 1 day travel diary; UK – National Transport Survey (NTS) inc personal interviews and 7-day travel diary	USA – 1995; UK – 1995/97	USA – 42,033 households representing 95,360 persons aged 5 years or more; UK – 9688 households representing 23,167 all persons in household	A comparison between car ownership, travel and land use in USA and GB.	Used data from national surveys in both countries. Different travel diary methods may mean results should be used with caution.	Differences in TB are explained by differences in demographics between US and GB; lower household income in GB; and country specific difference sin car ownership and use, transport supply and some other factors. Metro size affects travel only in major US conurbs, daily travel distance is inversely related to local pop density. Higher transport costs in GB lead to ↓ in travel and more use of local goods and services.

Giuliano, G. & Narayan, D. (Sub: August 2002; Acc: April 2003)	USA-national; UK – national	USA – Nationwide Personal Transportation Survey (NPTS) inc telephone survey and 1 day travel diary; UK – National Transport Survey (NTS) inc personal interviews and 7-day travel diary	USA – 1995; UK – 1995/97	USA – 42,033 households representing 95,360 persons aged 5 years or more; UK – 9688 households representing 23,167 all persons in household	As above – an exploration of relationship between landuse [patterns and individual mobility	As above	US landuse patterns reinforce vehicle dependence. Stronger controls in Europe lead to more compact urban form and ↑ use of public transport. Diffs in number of trips and miles travelled are explained by differences in urban form and household income.
Goudie, D. (Journal of Transportation Geography 10 (2002) 287 – 301)	Cairns and Townsville, Queensland, Australia	Face-to-face with questionnaire – 'long and complex, taking over 35 minutes to complete'; 1 day travel diary (one Friday)	Townsville – late 1996; Cairns – early 1997	408 households providing 3500 trips recorded	Does your household location influence your TB? TB and values for inner, middle and outer urban zones in north Queensland.	Stratified sampling based on distance from the CBD of two north Queensland towns.	Outer urban dwellers use x3 fuel of their more centrally placed counterparts. Least sustainable urban travel therefore a challenge for policy, developers and city planners.
Hamed, M. M. & Olaywah, H. H. (Cities, Vol. 17, No. 1, pp 63 – 71, 2000)	Amman, Jordan	Questionnaire; data collected from two major bus and servis taxi stations and distributed on buses, servis taxis and to private car commuters	July 1996	1050 personal interviews undertaken – 350 for bus commuters, 350 for servis taxi commuters and 350 for private car commuters	What variables influence your choice of travel mode?	Choice models used for travel-to-work and after-work activity travel activities	Complex findings due to different travel modes – young children influence car users departure times; bus and taxi commuters pursue household maintenance activities; previous day's waiting period determines next day's travel mode choice; distance is important; complex range of findings.

Handy, S., Cao, X. & Mokhtarian, P. (Transportation Research Part D 10 (2005) 427 – 444)	North California - Rincon Valley, Junior College, Natomas, Midtown, Modesto Suburban, Modesto Central, Mountain View, Sunnyvale	Postal questionnaire – 12 pages on travel behaviour	late 2003	6746 addresses provided 1682 responses (24.5% response rate)	Does neighbourhood design influence travel behaviour or do travel preferences influence the choice of neighbourhood? If cities use land use policies to bring residents closer to destinations and provide viable alternatives to driving, will people drive less and thereby reduce emissions?	Studies smart growth communities in northern California. Survey took place over a number of weeks and was of a quasi-longitudinal nature.	Differences in travel behaviour between suburban and traditional neighbourhood residents are largely explained by attitudes and preferences. Residents living close to destinations are less likely to drive. But some evidence to show that changes in travel behaviour and changes in the BE show significant associations, even when attitudes have been accounted for.
Handy, S., Weston, L. & Mokhtarian, P. L. (Sub: 3/03/04; Acc: 7/09/04)	University of Texas at Austin	Focus groups and face-to-face interviews of University employees and students	Focus groups - May and June 2002: in-depth one-on-one interviews May – July 2003.	3 focus groups; 43 interview participants	Do Americans drive by choice or through necessity?	Develops a framework for exploring choice-necessity boundaries based on potential reasons for and source of 'excess driving'. Very qualitative/narrative style interviews.	Early results, but suggest need for policy to address individual and community-level concerns. Policy need to reduce the need for driving ie PT, ↑ cycling and pedestrian infrastructure. Pricing policy might ↓driving. Need for more research on what factors create 'excess' driving.
Hensher, D. A. & King, J. (Sub: 15/02/99; Acc: 16/08/99)	Sydney, Australia	6 page questionnaire handed out to car park users with mail-back facility; face-to-face interviews with bus and train users	1998	2860 questionnaires handed out to car-park users with 416 returned (16.1% response rate); 200 public transport users interviewed (100 for bus, 100 for train)	Does the availability of parking places and the cost of those places play a role in people driving to the Sydney CBD?	Participants were asked to consider 6 alternative; 3 parking locations in the CBD, park outside CBD with PT available, switch to PT, forego trip to CBD altogether.	Cost of parking appears to be the major determinant. Change in CBD parking share attributable to supply by time of day is less than 3% compared to 97% attributable to parking price.

Hiscock, R., Macintyre, S., Kearns, A. & Ellaway, A. (Transportation Research Part D 7 (2002) 119 – 135)	Glasgow and Clyde Valley Structure Plan Area (inc Hamilton, Paisley, Dumbarton, Cumbernauld, Kilpatrick Hills, South Clydeside, Central Scotland Forest)	Face-to-face interviews with 50% car-owning, 50% non-car-owning. In-depth and open-ended interviews	February and May 1999	This is the second-part of a two-part research study. Part 1 involved approx 3250 postal questionnaires. Part 2 was qualitative and number of interviewees not stated.	Do cars provide psycho-social benefits to their users?	Research based on in-depth interviews with a sample of car owners and non-car owners in the West of Scotland. (How much would climate and income play a part in this? – my comments)	Partial Yes. Protection, autonomy and prestige MAY help to explain people's attachment to cars. Car owners are healthier than non-car owners. Cars seen to provide protection from undesirable people, provide autonomy, convenient, reliable and provide access to more destinations than PT. Confer prestige and other socially desirable attributes such as competence, skill and masculinity.
Hjorthol, R. J. (Sub: 13/06/00; Acc: 28/02/01)	Norway – national	Norwegian national personal travel survey (NPTS); survey studying use of information and communication technology at home	1997/98	NPTS – random sample of 8800 people aged 13 years or more; same respondents for second survey	Is their any relationship between daily travel inc mode of travel and use of the home computer?	Uses national level data for Norway as well as mail survey of use of IT.	No. Access to and use of IT does not have a significant impact on TB. Appears to give greater flexibility to where they work but does not reduce the travel activity. Might make fewer work trips but does not reduce total number of daily trips. Does↓ rush - hour traffic.
Holtzclaw, J., Clear, R., Dittmar, H., Goldstein, D. & Haas, P. (Sub: 1999: Acc in final form: 1/03/00)	Chicago, Los Angeles, San Francisco, USA	Unclear but data seems to have been compiled from the 'census and regional planning organisations'.	1990 census data used; other databases not stated or dated	Total participants not stated but data from 314 Dram-Empal zones in Chicago, 1459 Travel Analysis Zones in Southern California and 1047 zones Travel Analysis zones in San Francisco metro area used.	Is car ownership and use a function of neighbourhood and socio-economic variables?	Research used three metro areas to test theory.	Yes. Car ownership is a function of residential density, per capita income, average family size and availability of PT. Average distance travelled is a strong function of density, income, JJ size and OT and a weaker function of pedestrian and bike friendliness of community.

Kenyon, S. (Journal of Transport Geography 14 (2006) 123 – 134)	Southwest England	Longitudinal travel diary study – 7 day 'travel' diary administered 3 times at 6-month intervals. (28 pages each)	March 2004, October 2004 and March 2005.	Approx 100 participants (these are her words)	Research tests a new methodology using an accessibility diary to record travel patterns and use of new technologies esp. Internet. Confusing paper as author uses the terms travel, activity and accessibility diary. Diary recorded travel, activities such as reading, going to cinema, and access to Internet.	Paper focuses on the accessibility diary technique, assessing efficacy with reference to focus groups, interview and questionnaire data.	Paper suggests there is a dilemma facing Transport research; how to obtain complex enough data to advance understanding of the subject but develop methodologies that are simple to use, and maximise data quality and response rates.
Khattak, A. J. & Rodriguez, D. (Sub: 25/11/04; Acc in revised form 21/01/05)	Chapel Hill and Carrboro, North Carolina, USA	Postal questionnaire of household members aged 16 years or more inc 7 day travel diary	Not stated but definitely post 1995	New urbanist suburb (Chapel Hill) – 188 respondents; conventional suburb (Carrboro) - 122 respondents	Do residents substitute walking for car trips, do they make more trips overall, what is the role of self-selection of residents in these developments?	Focuses on travel in neo-traditionalist or New Urbanist neighbourhoods in North Carolina	Depends on structure and type of family unit to some extent. Single-family HHs in NU areas make similar number of total trips but fewer car journeys, external trips and fewer miles travelled than families in traditional suburbs. This is true even after accounting for socio-demographic factors and resident self-selection. NU HHs tend to prefer walking over driving.
Kingham, S., Dickinson, J. & Copsey, S. (Sub: 1/08/99; Acc: 1/01/01)	Hertfordshire, England – employees at Mitsubishi Electric Europe and Matra BAe Dynamics.	Journey to work surveys using self-completed questionnaires attached to payslips and returned in internal mail	Mitsubishi – late-1998: Matra BAe – early 1999	Mitsubishi – 131 returned (41% response rate); Matra BAe – 831 returned (46% response rate)	What factors influence modal choice in travel-to-work trips? Can people be encouraged to use more sustainable modes of transport?	Study limited to commuting habits of employees in 2 companies only.	Overwhelming use of car for travel-to-work journeys. 2% and 7% cycle in the firms, 0% and 3% use PT. Appears genuine willingness to use alternative travel modes. Barriers: perception that viable transport alternatives are not there and that people live too far to cycle or use PT to get to work.

Krizek, K. J. (Transportation 30: 387 – 410, 2003)	Seattle, Washington State, USA	Data taken from Puget Sound Transportation Study (PSTP); conducted annually since 1990; 2 day travel diary for each household member aged 15 years or more + socio-economic data; other databases used inc census data	1990 US Census data, 1997 US Census Tiger files, year of PTPS data not stated	1,811 households	How do neighbourhoods with more accessible land use patterns, higher densities and more maintenance-travel destinations relate to household travel patterns?	Paper divided into 3 sections; first part describes travel modes available, second part provides behavioural overview of HH travel; third part discusses relationship between trip type and neighbourhood access.	HHs living in areas with high levels of transport modes complete more trips and make fewer stops per trip. Make more simple trips for work and maintenance. Make shorter trips for maintenance but still a large number outside suburb for maintenance. Higher levels of transport mode influence trips but does not spur HHs to complete errands close to home.
Kunert, U. & Follmer, R. (Transport Reviews, Vol. 25, No. 4, 415 – 431, July 2005)	Germany – national	National Travel Survey; 1 day travel diary plus socio-economic questionnaire	Summer 2001 for pilot; 2002 form main NTS	Pilot study involved 2400 households participated representing 5900 individuals with 17,800 trips. Main NTS involved 25,000 households inc people aged 14 years or more.	Paper discusses process needed to make empirical-based decisions on the main design characteristics of the German National Travel Survey	Process based paper. Some results included from the data collected in the pilot study	Selected results include string correlation between income and car ownership, out-of-home travel trips highest on weekdays (90% of pop,) and lower on weekend (Sat – 82% and Sun-75%). No of trips highest on Fridays (3.8) and lowest on Sundays (2.2). Non-car owners make the highest no of PT trips. As soon as there is a car in the HH then it is the dominant form of travel.
Kuppam, A. R. & Pendyala, R. M. (Transportation 28:33-54, 2001)	Washington, DC, USA	Computer-assisted telephone interviews; 1-day activity diary	1994	656 commuters	An analysis of commuters' activity and travel patterns using activity-based travel survey data.	Used structural equations modelling methodology to determine relationship between commuter demographics etc and trip chaining.	Strong relationship between socio-economics, activity engagement info and travel behaviour. Results consistent with most other lit.

Kwan, M. (Transportation Research Part C 8 (2000) 185 – 203)	Portland, Oregon	2-day travel diary plus 3D GIS databases inc Portland landuse	Spring and autumn 1994, winter 1995	7090 households recruited with 4451 households responding representing 10,084 individuals. Inc 71,808 trips	Paper describes various GIS-based 3D geovisualisation methods for dealing with spatial and temporal dimensions of human activity-travel patterns	Attempts to improve GIS – travel diary integration whilst avoiding interpretative complexity of multi-variate pattern generalisation or recognition methods	Various advantages created in this study. Study recognised significance of temporal dimension and its interaction with spatial dimension in structuring daily space-time travel patterns. 3D GIS can help with formulation of more realistic computational or behavioural travel models.
Lee, M. S. & McNally, M. G. (Sub: 27/09/02); Acc: 14/05/03)	Irvine, California	Self-administered computer survey instrument used (REACT!). Data collected on household activity scheduling over 7 days	April – June, 2000	72 adults inc students	How to understand travel behaviour through an understanding of the process of activity scheduling?	Used a computerised survey instrument to collect HH activity scheduling data, includes activity schedule from intention to final outcome for a weekly period.	Activities of shorter duration are more likely to be opportunistically inserted into a schedule anchored by longer duration trips. Many trip-chains are formed opportunistically. Travel time to reach activity is positively related to scheduling horizon for activity. More distant stops planned earlier than closer locations.
Longworth, T. & Wilson, C. (No date included: 28th Australasian Transport Research Forum)	Sydney, Australia	2001 Census Journey to Work data used. Journey to work data collected only.	2001	Data from 811 travel zones in Sydney used	Paper explores journey to work info for Sydney to understand the degree of variability of mode choice and characteristics of home and destination.	Makes the suggestion that if↑ non-car mode share is a good thing and if particular levels of non-car mode choice are already achieved in some parts of Sydney then ↑ non-car mode share in other parts of Sydney is possible	Some poor results using correlation coefficients with existing transport planning initiatives (Sydney Fishmarket, Town Hall, St Marys) and mode choice of origin zones for the journey to work. Need to fine-grain the analysis using a lower level of geographic aggregation, further segment the data.

Loo, B. P. Y. (Sub: 20/09/99; Acc: 15/06/00)	Yuen Long new town, Hong Kong	Roadside interviews using questionnaires	2 – 24 June, 1998	2220 residents	What is the potential impact of a strategic highway (Route 3) on new town development (Yuen Long new town, Hong Kong)?	Uses the conceptual model of Sell et al.	Perception of transport improvements were sig. associated with personal (socio-cultural) attributes such as gender, age, occupation, HH income. Impact of Route 3 in terms of travel choice most marked in teenagers and female residents. Increased their travel using Route 3 for shopping and social/recreational purposes.
Loukopoulos, P., Jakobsson, C., Gärling, T., Schneider, C. M. & Fujii, S. (Transportation Research Part D 9 (2004) 263 – 280)	Göteburg University, Sweden	Study 1 – questionnaire sent out to select participants for focus groups; Study 2 – email sent to participants with access to electronic questionnaire	Not stated	Study 1 – 40(?) participants in focus groups; Study 2 – 600 randomly selected employees with 291 responses (52.6% response rate)	Can travel demand management measures be used to encourage car users to set car-reduction goals even when other travel options are limited?	Uses a focus group approach to see creativity of non-car adaptation alternatives, followed by Internet questionnaire.	Effects of travel demand management measures and trip purposes on the setting of car-use reduction goals are small. Cost minimisation goal seems to dictate stated choice of adaptation alternatives. Further research needed.
Lu, X. & Pas, E. I. (Sub: 18/02/97; Acc: 23/01/98)	Oregon/Southwest Washington	Oregon-Southwest Washington Activity and Travel Survey – 2 day travel and activity diary retrieved via telephone interview + household and socio-economic data	1994/95	2230 households involving persons 16 years of age or more resulting in 2514 individuals	What is the relationship, if any, between socio-demographics, activity participation (amount of time spent on different activities) and travel behaviour?	Uses a structural equation modelling methodology with activity participation and TB endogenous to the model.	TB can be explained better by including activity participation endogenously in the model than through socio-demographics alone. Reveals relationship between in-home and out-of-home activity participation and TB. Need to examine direct, indirect and total affects in the model.

Lyons, G., Chatterjee, K., Beecroft, M. & Marsden G. (Transport Policy 9 (2002) 17 – 27)	UK - nationwide	Scenario planning approach to explore future of society and lifestyles	3 year time period – unclear start date	Unclear as not stated	How do changes in the fabric of society and its values impact on travel demand? Defined as changes to population and households, employment, lifestyles, politics and social organisation, and the environment.	Stems from the Transport Vision Network, an international network of young professional from academia consultancy and government in the UK. trg.soton.ac.uk/ research/TVNetwork	Travel demand recognises that despite↑ in Internet use, total travel is unlikely to decline. Collective transport should be encouraged where it serves major urban centres and major corridors. Individ. transport will dominate elsewhere. Policy-makers must improve efficiency of individ transport. Travel users should pay full cost of their mobility.
Mackett, R. L. (Sub: 1/01/01; Acc: 1/07/01)	London, Leeds, Ipswich, Hertford, Dorset.	Household and personal data, 2-dat travel diary, face-to-face interview	Survey undertaken in second half of 1998	2488 households approached with 48.1% response rate ; in-depth interviews with 377 people	What policies and personal actions will attract motorists out of their cars into alternatives for short trips?	Research based on surveys undertaken by the UK Dept of Environment, Transport and the Regions.	Research looks at the various events that car drivers say would attract them to alternatives. Improving PT would encourage them out of cars ie route improvement, safety, better walking and showering facilities at work, more bus-shelters, better neighbourhood planning.
Martens, K. (Transportation Research Part D 9 (2004) 281 – 294)	Netherlands, Germany and UK	Uses data from a variety of research projects; details of methodology used not stated	Netherlands – from 1999; Germany – from 1997; UK – from 1996	Variety of different data sources used; no details of participants.	Can the bike be used as part of a feeder mode or 'bike-and-ride' travel mode?	Paper discusses bike-and-ride in Netherlands, Germany and UK – three countries with very different bike cultures and infrastructure	Majority of bikers travel between 2 -5 km to a PT stop/station. Longer access for faster modes of PT ie train. Work and education are main travel motives. Bike-train combo dominates work access and work-education the slower access. Car availability hardly influences bike-train combo – but stronger influence on slower modes of transport

Metz, D. (Sub: 28/07/04; Acc: 25/02/05; available online: 27/06/05)	UK	Data used from GB National Travel Survey	Includes NTS data from 1972/73, 2003, 199/2001 etc	No details provided on NTS participant rates	Should journey quality be studied as a factor influencing changes on travel behaviour?	Main travel variables do not seem to be changing significantly – average travel time, trip rate, %of HH income spent on travel. Therefore, what factors are influencing growth in personal travel?	Travel time is steady at one hour per person per day; 1000 trips pp pa; expenditure is constant; HH income x2 over last 30 years. Transport policy needs to make sure that in personal income doesn't exacerbate env. impacts. Need to improve the QUALITY (defined as comfort, reliability, safety and security) of the travel rather than average speed.
Mokhtarian, P. L. & Salomon, I. (Sub: 24/06/99; Acc: 20/01/00)	San Francisco Bay area	14 page postal questionnaire inc socio-economic questions and travel attitude.	Not stated	8000 surveys with 1900 residents responses (25% response rate)	Is travel a derived demand?	Uses data from 1900 residents in San Francisco Bay. Research has clear implications for transport policy – need to incorporate the desirability of travel in itself ie as a good utility.	Not necessarily, in some circumstances travel is desired for its own sake. May enjoy the sense of speed, motion, control, enjoyment of beauty even in mandatory or maintenance trips. Travel is the activity not the by-product of another activity.
Moriarty, P. & Honnery, D. (No date included: 28th Australasian Transport Research Forum)	Sydney, Brisbane, Melbourne, Adelaide, Perth, Hobart	Review of secondary urban travel data	1947 onwards	Variety of data sources used, no information on participation rates	What are the key determinants of urban travel in Australia?	Paper attempts to understand why people travel by various modes esp. in the context of shifting people to more environmentally – friendly modes of transport	For PT, the average distance a resident lives from the CBD is a major factor in travel mode choice. Predict that in the future PT will once again become the dominant travel mode in large urban centres. Mentions gender issues etc – females travel less on average than males.

Morton, A. & Mees, P. (No date included: 28th Australasian Transport Research Forum)	Alamein – a suburb of Melbourne, Australia	Part of TravelSmart pilot study – not stated how survey was undertaken	Survey undertaken in 2003	6465 households in Alamein plus control group of 413 households from same area	An assessment of the Melbourne Travel Behaviour Modification pilot study: Too good to be true?	TBM programmes shift responsibility and cost of solving transport problems from the government and policy-makers to the public. Very popular with governments as a result. Uses a partial social psychology approach to TB modification.	Must include human factors in any study of TB modification. Potentially confusing results from study include a 12%↓ in PT use in control group over time period – not stat significant. Evaluation of TBM progs should be undertaken by independent parties, assessment of TB change should not be on a self-reporting basis – use census data, PT boarding data, ped flows instead, use different survey methodologies.
Moudon, A. V., Lee, C., Cheadle, A. D., Collier, C. W. Johnson, D., Schmid, T. L. & Weather, R. D. (Transportation Research Part D 10 (2005) 245 – 261)	King County, Washington, USA	Uses data from the Walkable and Bikable Communities project; telephone survey – GIS land use data from King County assessor's office inc Commercial Building Records Description database ABD Parcel Record Description database	Telephone survey undertaken in summer and early autumn 2002; date of GIS data not stated	608 respondents aged 18 years or more selected randomly	Who cycles and what are the perceived and actual built environmental conditions associated with the likelihood of cycling in neighbourhoods?	Study of cycling behaviour in King County, Washington using primary data and GIS analysis. Controls for socio-demographic variables.	Perceived and objective env. conditions DO contribute to cycling. Proximity to trails, presence of offices, clinics/hospitals (?), cafes are sig env. variables. Presence of bike lanes, traffic speed and volume, slope, block size and parks are insignificant variables. Non-linear rel between cycling and perception of traffic problems and auto-oriented facilities. Cycling is an individual choice independent from environment support. Need to improve actual and perceived environmental conditions.

Næss, P. & Jensen, O. B. (Sub: October 2002; Acc: November 2003)	Frederikshavn, Denmark	Questionnaire survey + qualitative interviews	June 1999	Questionnaire surveys in 11 residential areas (11 residents/households? – not clear); 6 qualitative household interviews	Can urban structure influence TB even in a small town (approx. 30,000 pop.)?	Uses qualitative interviews to gain some primary data. Socio-econ variables are important – gender, preference, car ownership, environmental attitudes etc. Nice causal model diagram included in paper on page 49.	Yes – even when you account for socio-economic and attitudinal factors. Distance from residence to downtown area and accessibility to key services and facilities is an important factor. Average travel distance changes sig. when residence is 5 km from town centre increasing from 84 to 156 km travelled per week.
Newbold, K. B., Scott, D. M., Spinney, J. E. L., Kanaroglou, P. & Páez, A. (Journal of Transport Geography 13 (2005) 340 – 351)	Canada	Data from General Social Survey (GSS); weighted random sample via telephone survey. Includes 1 day travel diary data.	GSS undertaken in 1986, 1992 and 1998	1986 survey - 9946 respondents; 1992 survey – 2006 respondents; 1998 survey – 2667 respondents	Do Canada's older population (65+) have different travel patterns compared with younger Canadians?	1 in 5 Canadians will be 65 years or older (Stats Canada, 2001). Little research undertaken on their travel patterns.	Partial YES, but slightly confusing conclusion and abstract. Older Canadians made 2.7 trips per day in 1986 and 3.3 trips per day in 1998. But trip count, trip duration decreases significantly (?). Change is work and health-related. Use of car as principal travel mode increases significantly. ↓ in PT use.
Nutley, S. (Journal of Transport Geography 13 (2005) 247 – 263)	Two rural areas of Northern Ireland – North Sperrins and Antrim	Longitudinal survey using questionnaires	Antrim – 1979; Antrim 1989 and 2001 (slightly smaller area than 1979 study); North Sperrins – 1988 and 2000	Antrim (1979) – 595 households; Sperrins (1988) – 194 households; Sperrins (2000) – 208; Antrim (1989) – 252; Antrim (2001) - 226	It is possible to gain an understanding of social/spatial change in a rural area? Is it also possible to understand the development of appropriate policies relating to transport and travel behaviour?	Few longitudinal projects have been undertaken over this duration esp. within rural areas. Monitoring rural travel behaviour in two rural areas of Northern Ireland between 1979 and 2001.	Significant changes in TB over time-period inc changes in PT, local services, car ownership, travel distances, travel mode used, travel frequencies. 1990s saw rapid ↑ in car ownership, complex changes in travel patterns and longer travel distances, more commuting to towns, change in rural employment structure, abrupt reduction in PT.

O'Fallon, C., Sullivan, C. & Hensher, D. A. (Sub: 21/07/02; Acc: 30/03/03)	Auckland, Wellington, Christchurch, New Zealand	Face-to-face questionnaire interviews	Auckland and Wellington – mid 1999; Christchurch – mid 2001	732 completed valid questionnaires equally divided between three urban centres	What are the constraints on travel mode choice for morning car commuters?	Research attempts to determine the constraints on TM choice for morning commuters. Attempts to quantify the impact of a range of policy tools (Sticks and carrots) for 3 main urban centres in NZ	Major constraints on TM choice include need to take children to school, need for car during day. Policy 'sticks' appear to work better than carrots in changing TM, ie measures discouraging car use work better than improved PT or availability of bike lanes.
Olaru, D., Smith, N. & Peachman, J. (No date included: 28th Australasian Transport Research Forum)	Greater Sydney urban area	Rolling survey of household travel (HTS) undertaken by NSW Transport and Population Data Centre	Pooled data set from 1997 – 2002	Not stated	How do transport services satisfy accessibility and activity space? At least this is what I think the paper is about!	Paper looks at the dispersal of travel activities to determine accessibility enjoyed by an individual or HH. Uses temporal and spatial approach to map travel activities throughout the week.	Wide variety of findings; men have wider activity spaces than women, woman travel closer to home, non-English speakers have↓ activity space, owning a driving licence x 2 activity space, home-working↓ AS, old age↓ AS, no income/AS trend, the greater the need and desire for travel then the greater the AS, living in outer suburbs↑ your AS.
Ory, D. T. & Mokhtarian, P. L. (Sub: 4/03/04; Acc: 7/09/04)	North San Francisco, Concord and Pleasant Hill	14 page self administered questionnaire	Not stated	1358 commuting residents	When is getting there half the fun?	Paper studies the relevance of the desire for travel itself rather than assuming that it is a derived desire. Uses data from 3 San Francisco Bay Area suburbs.	Traveller attitudes and personality are important factors, more important than objective travel amounts. Studies objective mobility (actual travel), perception of travel amount (subjective mobility) and relative desired mobility (how much more or less travel is desired). Identifies differences between long and short trips – travel seen as a sign of freedom, wanting to show off your vehicle etc

Peddie, B. & Somerville, C. (No date included: 28th Australasian Transport Research Forum)	Victoria, Australia	Studies TravelSmart School Travel Planning Project. Surveys and focus groups. Travel plans introduced after surveys and focus group data analysed	2003	34 school from metro Melbourne, regional and rural Victoria. Approx 17,000 students plus parents	Can travel to school behaviour change? Can real and perceived barriers be removed?	Main barriers: distance from home to school, dangerous roads, convenience of car, safety and time	Travel by car dominates school journeys. Student travel behaviour can be modified esp. if school authorities play a central part in the process.
Perkins, A. (World Transport Policy & Practice, Vol. 8, No. 4, 2002)	Adelaide (Dulwich-Rose Park) and South Perth, Australia.	Two TDM approaches tested; Travel Blending in Adelaide and IndiMark in South Perth. TB involves 7-day travel diary; IndiMark involves marketing strategies.	Adelaide – 2000 (prior to Olympics); South Perth – 1999?	Adelaide – 350 households for Travel Blending via Transport SA, workplace, two other firms and a high school; IndiMark – South Perth pop of 35,000 but piloted on 400 households.	Can travel demand management (TDM) measures reduce the amount of travel by private motor vehicles?	Two different programmes analysed; one based on marketing and the other on information sharing. Both aim for achievable travel goals	Improved information to travellers produced 14% reduction in car useage. No infrastructure or service improvements were included.
Plaut, P. O. (Transportation Research Part D 10 (2005) 347 – 356)	USA – national	2001 American Housing Survey (AHS).	2001	2001 survey is USA wide. Covers 106,000 housing units (70% OO and 30% rental). Detailed commuting info from 60,000 individuals. 35,000 used car, 3243 – non-motorized commuters inc 1627 home-workers, 1369 walkers and 247 cyclists.	What variables influence non-motorised journey to work? Studies the use of non-motorised travel-to-work methods	Perhaps at too early a stage in understanding identity and characteristics of non-motorised commuters.	Higher incomes and more expensive housing lead to greater likelihood of working at home but lower propensity to walk or use bicycle. College education increases non-motorised useage. Car ownership, race, gender, locational issues all affect modal choice
Polk, M. (Transportation Research Part D 8 (2003) 75 – 95)	Sweden - nationwide	Postal questionnaire – random sample to 2000 residents aged between 18 and 80	1996	1180 respondents equalling a 61% response rate after 3 follow-up letters	Does gender play a part in determining travel behaviour? Specifically are women more adaptable to a more sustainable transport system than men?	Women appear more willing to reduce their use of car than men, more positive towards reducing environmental impact of travel mode, and are more positive towards ecological issues.	Yes. Based on various determinants it does appear that woman are judged to have more potential for an ecologically sustainable transportation system in Sweden than men.

Polk, M. (Journal of Transport Geography 12 (2004) 185 – 195)	Sweden – nationwide	Postal questionnaire – random sample to 2000 residents aged between 18 and 80. In fact only 1943 were sent out.	1996	1180 respondents equalling a 61% response rate after 3 follow-up letters	What influence does gender have on daily car use and willingness to reduce that car use?	Clear message that gender MUST be considered as a factor in attitudinal research on car use.	Conclusion isn't as strong as previous paper but suggests that men and woman have different travel patterns. Most research doesn't include a gender variable as a significant determinant of travel behaviour. Suggests that future research MUST include gender variable
Pucher, J. (Journal of the American Planning Association, 54(4): 509 – 520, Autumn 1988)	12 countries including USA, Canada, West Germany, Switzerland, France, Sweden, Netherlands, Belgium, Italy, Austria, UK, Denmark	Studies modal split to describe travel behaviour and examines public policy inc transportation policy (subsidy and taxation), and non-transport policy inc land use controls and housing programmes.	Varies from 1978 to 1987	Uses national travel data from 12 countries but number of respondents for primary data collection is not stated.	Are differences in travel behaviour due to differences in public policies?	Large differences in travel behaviour even among countries with similar standards of living, technology, industrialisation and urban morphology.	Yes, esp. public policy geared towards car support and highway construction. Public policy increases the importance of the majority's prefer4nces by forcing the minority to adopt their preferences. PP magnifies any differences between countries based on variation of individual preferences.
Richardson, A. J., Davis, M. B. & Harbutt, P. L. (No date included: 28th Australasian Transport Research Forum)	Darebin Council – north-eastern suburbs of Melbourne inc Alphington, Fairfield, Northcote, Thornbury and Preston	North-eastern suburbs travel survey (NESTS). Self-completion questionnaires supported by face-to-face interviews and telephone interviews. Four main parts inc household form, person form, vehicle form and 1 day travel diary	Before survey – March 2004. After survey – March 2005.	30, 000 households contacted for before survey in March 2004, (1347 households responded) After survey contacted the 1347 households responding to before-survey.	Project aimed to achieve a 10% reduction in car trips and kms; and to raise awareness of travel behaviour change	Project used IndiMark technique, a marketing tool.	VKT (?) decreased by 7% but no corresponding increase in public or non-motorised transport use. Non TravelSmart households increased their car use and decreased public transport useage. Info provided on TravelSmart does appear to reduce car use and increase PT use

Rietveld, P. & Daniel, V. (Sub: 5/01/04; Acc: 27/05/04)	Focuses on Netherlands but inc some discussion on EU 15 countries, Canada and USA. Focus on Dutch cities inc Amsterdam, Rotterdam, Maastricht, Wageningen etc	'Part of the data originates from ordinary statistical sources' – unstated; Main dataset from Dutch Cyclists Union (Fietsersbond)	Dutch data predominantly produced in 2000. Vague about data methodology in general	15 Dutch municipalities surveyed. No further detail given	Do municipal policies in the Netherlands influence bicycle use for journeys under 7.5 kms?	Wide variation in bike use throughout EU members. Acknowledges that a variety of variables need to considered including travel time, safety, risk of bike theft, physical comfort, cost and personal security	Partially – esp. in respect to costs. Results show two ways to increase bike use; reducing cost of cycling and increasing cost of other travel modes. Physical aspects of area, travel time, accidents and cultural tradition are significant variables.
Rodríguez, D. A. & Joo, J. (Transportation Research Part D 9 (2004) 151 – 173)	University of Carolina, Chapel Hill	Random sample of commuters stratified by employment status; postal questionnaire inc 7 day travel diary; other unspecified databases used measuring local physical environment	1997	395 students and 728 staff at University of North Carolina, Chapel Hill – 16% response rate for students and 29.1% for staff	Do the physical attributes of an area influence travel mode choice, esp. for pedestrians and cyclists?	Paper addresses the relationship between travel mode and attributes of local physical environment such as slope, residential density, presence of walking and cycle paths	Four variables make significant marginal contributions to travel mode choice inc sloping terrain and sidewalk availability increase ped. and cycle use. Housing density does not seem a significant variable. Employment densities at destination are significant
Rose, G. & Ampt, E. (Transportation Research Part D 6 (2001) 95 – 110)	Sydney and Adelaide, Australia	4 kits used including letter of intro; info booklets, one-week travel diary x 2, summary of analysis. Sydney acted as a pilot study	Sydney – 1996; Adelaide – unstated but either 1996 or 1997	Sydney – 46 individuals representing 27 vehicles from 13 households; Adelaide – random sample from 4 gov depts inc Dept of Transport, Dept of Env and Nat Resources, Dept of Housing and Urban Dev, and Passenger Transport Board – 96 households	Paper outlines new approach to reducing car use to address environmental concerns using Travel Blending technique.	Travel diary results are used to show travel patterns and emissions from cars. Second diary after 4 weeks to show shift in travel patterns	10% ↓ in car kms with a slightly higher↓ in car driver trips and total hours in car. Paper warns to interpret results cautiously – doesn't indicate why.

Ryley, T. (Journal of Transport Geography xxx (2005) xxx – xxx)	Edinburgh, Scotland	Used data from Scottish Household Survey. SHS surveys 15,000 private households pa.	1999 and 2000	Data from 2910 households accessed	Does stage of life cycle affect individual travel behaviour?	Project employed cluster analysis to split Edinburgh households into 10 distinct population segments	Yes. Households with children have distinct travel behaviour characteristics esp. car dependency, own but not use bikes and favour bike trips for leisure only. Key life stages are gaining employment, having children and retiring. Students, unemployed and part-timers without kids are most likely to use non-motorised travel modes. Retirees and high-earners without kids are least likely to use them. Biking and walking most linked to high-density accommodation.
Schlich, R. & Axhausen, K. W. (Transportation 30: 13 – 36, 2003)	Karlsruhe and Halle/Salle, West Germany	6-week travel diary; sampling method unstated	1999	361; 52,273 trips recorded on 14,360 person days	How repetitious is travel behaviour?	Different methods of recording travel behaviour were used in project including trip-based methods rather than time budgets.	Method of recording travel is critical. Variability is most marked if using trip-based methods rather than methods based on time budgets. Similarity declines if methods allow complexity of travel behaviour to be recorded. A minimum two week diary is required to clearly identify travel variability. Strong similarities do appear though. Travel behaviour is most stable on work-days

Schwanen, T., Dieleman, F. M. & Dijst, M. (Journal of Transport Geography 9 (2001) 173 – 186)	Netherlands – metropolitan/urban regions only	Used data from Dutch National Travel Survey 1998 only; 1-day travel diary	1998	Used sub-set of data involving head of household and their partner only. 82.3% of all complete individual records included.	How do monocentric and polycentric urban structures affect modal choice and travel distances for different travel purposes in the Netherlands?	Four kinds of urban centres studied; one monocentric and the other three being variations on the polycentric form.	No absolutely clear message but structure of urban regions does affect travel behaviour. Deconc. of urban land use encourages driving and discourages public transport, cycling and walking. Relocating jobs and houses to suburbs means less commuting in some regions and longer in others. Longer commuting might be due to strong spatial planning policies in Neth.
Schwanen, T. & Mokhtarian, P. L. (Journal of Transport Geography 13 (2005) 83 – 99)	San Francisco Bay Area, California, USA inc North San Francisco, Concord and Pleasant Hill	14 page Postal questionnaire using random household sample. One adult per household asked to complete survey.	May 1998	8000 households with 2000 questionnaires returned, of which 1358 respondents used in this analysis	What extent does commute mode choice differ by residential neighbourhood and by neighbourhood type dissonance (ie difference between actual and preferred neighbourhood)	Paper addresses the question of can conditioning and the environment of the neighbourhood influence the commute mode?	Neighbourhood dissonance is significant and associated with commute mode choice. Dissonant urban residents are more likely to commute by private vehicle than consonant urbanites who cycle, walk and use public transport more. Neighbourhood itself determines commute mode to some extent. Environment conditioning will influence commute mode.
Schwanen, T. & Mokhtarian, P. L. (Transportation Research Part D 10 (2005) 127 – 151)	As above	As above	May 1998	As above	Can living in the 'wrong' neighbourhood influence your travel mode choice?	Paper tries to determine if attitudes towards land use rather than the actual land use characteristics themselves can influence travel behaviour.	As above – research suggests that neighbourhood mismatch can be important and should be included in future research on travel behaviour.

Scott, D. M. & Kanaroglou, P. S. (Sub: 4/12/2000; Acc: 5/09/01)	Greater Toronto Area, Canada	Postal questionnaire plus one-day travel diary	February – March 1987	738 households (sub-sample of much larger survey of 1948 households (1986 Transportation Tomorrow Survey))	Does the type of household structure play some part in influencing non-work, out-of-home activity episodes for household heads?	Paper produces a model for the daily number of non-work out-of-home activity episodes for household heads. Includes various types of households – couple with non-worker; couple with one-worker, and couple with two workers.	Little prior research in this area. Appears to be first research that includes activity setting and interactions between household heads. Interactions vary between households indicating that decision-making and household dynamics also varies by household type. Trad gender roles only appear to persist in couple, one-worker households. Value to travel behaviour (?)
Shailes, A., Senior, M. L. & Andrew, B. P. (Journal of Transport Geography 9 (2001) 49 – 60)	Cornwall, England	Face-to-face interviews conducted at four tourist locations in Cornwall inc two medium sized camping and caravan sites, an inland ferry crossing and a large north coast beach	Summer 1997?- date not clearly stated	232 tourists interviewed with 200 valid responses – tourists travelling to Cornwall from elsewhere in UK	How do tourists adjust their travel behaviour in response to congestion? Destination was Cornwall	Research concentrates solely on tourist travel behaviour unlike previous studies which concentrated on urban or commuting travel behaviour	54% of respondents took action to avoid congestion mainly through trip timing rather than route avoidance. Factors felt to be important included distance to destination, number of previous trips, and inclusion of caravan. Three variables were most importance for congestion-avoidance – higher vehicle occupancy, higher number of previous visits to area and prioritising congestion avoidance in pre-tip planning.
Sohn, J. (Journal of Transport Geography 13 (2005) 306 – 317)	Seoul Metropolitan Region, South Korea (which includes Metro Seoul, Metro Inchon and Kyungki Province	Data used from commuting survey using commuting origin-destination data	1987, 1990 and 1995	Not stated	How well do commuting patterns reflect the corresponding urban spatial structure?	Research used an adjusted gravity model in the Seoul Metro Region and urban density functions estimated	Partly – distribution of employment is consistent between spatial structure projected from commuting patterns and urban density functions. Distribution of employed residents is less clear and needs to be interpreted with caution.

Soltani, A. & Primerano, F. (No date included: 28th Australasian Transport Research Forum)	Adelaide suburbs inc Norwood, Unley, Para Hills, Golden Grove, South Australia	Used data from Metropolitan Adelaide Household Travel Survey (MAHTS99) inc 2 day travel diary. Face-to-face interview	1999	MAHTS99 uses 9000 randomly selected households. 1842 trip records used in this paper	Do pedestrian-orientated urban environments with high density, mixed land use and high quality urban design reduce mobility and car use and hence increase market share of more sustainable modes of transport?	Study reviewed various research papers as well as using Adelaide data	Yes – although authors warn of limited range of suburbs used in this study. Low-density, single use, large-area zoning usually found in suburban areas limits ability to walk or cycle for daily transportation. Local networks, proximity to shopping places encourages choice of sustainable travel modes. Suburban development away from major activity centres ↑ private car use and ↓ the use of other modes.
Srinivasan, S. (Sub: February 2001; Acc: January 2002)	Boston Metropolitan Area, USA	Random sample stratified based on Transit Analysis Zones (TAZ), auto ownership levels and people per household. I weekday travel diary and other landuse datasets.	1991	3854 households, inc 9281 persons making 39, 373 trips during one weekday.	Do neighbourhood characteristics affect mode choice on the work and non-work tour? Which ones affect travel mode choice?	Included 50 variables such as land use, network and accessibility-related characteristics. Used GIS to model data. Measures inc. population density, jobs-housing ratio, land-use balance and mix etc	Yes – this was marked in work travel choice. Car was the overwhelming mode of choice for both work (64.5%) and non-work trips (70.6%). Transit (bus) used for 12 % for work and 8 - 11% of non-work trips. Walking used for 12% of work and 14% for non-work trips. Varies if multi-mode journeys made.
Srinivasan, S. & Rogers, P. (Journal of Transport Geography 13 (2005) 265 – 274)	Two suburbs of Chennai, India – Srinivasapuram and Kannagi Nagar	Stratified random sample from 500 households using trip diary. 1 day trip diary?	Not stated but estimated to be some time between 2000 - 2003	70 households inc 146 adults (over 16 years) making 427 trips.	What variables affect mode choice and trip frequency in Chennai?	Little research has been undertaken on travel behaviour in developing countries and India in particular. Mode choice is limited to walking and cycling predominantly and employment location is highly concentrated in city centre.	Differences in accessibility strongly affect travel behaviour with residents in the central areas more likely to use non-motorised modes of travel (walking and bike) than the peripherally located residents. Location of employment should be considered in the planning of new housing for low-income households

Steg, L. (Sub: 27/02/04; Acc: 16/07/04)	Study 1 - Groningen and Rotterdam, Netherlands; Study 2 – commuters in and around Rotterdam, Netherlands	Study 1 – individual questionnaires administered in a group setting; Study 2 – car use for commuting in rush hours, questionnaire based on TPB	Study 1 - 1997; Study 2 - 1999	185 respondents all owning a valid driving licence in Groningen & Rotterdam. Second study involved 113 commuters in Rotterdam	What are the motives for using the car in urban centres in the Netherlands?	Study investigated instrumental, symbolic and affective motives for using the car? ie. Studied feelings of power, superiority, arousal etc as reasons for driving. Uses psychological models to analyse car use.	Policy makers need to incorporate instrumental, symbolic and affective variables when studying car use. People more often commute by car if they judge its symbolic and affective functions more favourable particularly in the younger age and lower income groups. Some gender difference in symbolic variables but not all.
Stone, G., Giles-Corti, B., McBride, S. & Jackson, B. (World Transport Policy & Practice Vol. 9, No. 3, 2003)	Bunbury, Western Australia	Focus groups using semi-structured, non-directive, facilitation discussion techniques. Audio-taped.	March – November 1999	14 focus groups comprising 87 participants aged 18 - 59	Paper investigated perceptions of active and alternative forms of transport to the motor car as one way of increasing incidental physical activity.	Paper combines research on physical activity and travel behaviour. Almost more of a paper on physical activity than travel behaviour.	Transport mode choice determined by: time, distance, purpose of trip, safety. Social perceptions of transport, and features within natural and built environment. Public transport travel determined by control, convenience and choice. Numerous barriers, real and perceived prevent public transport use.
Timmermans, H., van der Waerden, P., Alves, M., Polak, J., Ellis, S., Harvey, A. S., Kurose, S. & Zandee, R. (Journal of Transport Geography 11 (2003) 37 – 46)	Portland (USA), Midlands (UK), Fukuoka (Japan), metro areas (Canada), Hendrik-Ido-Ambacht & Zwijndrecht (south Rotterdam)(Netherlands)	Portland – activity diary; Fukuoka – travel diary; Metro Canada – activity diary; Midlands UK – travel diary; south Rotterdam, Netherlands – activity diary	Portland – 1994; Fukuoka – 1993; metro Canada – 1992; midlands UK – 1994; south Rotterdam - 1997	Portland – 4451 HHs, inc 10,048 respondents; Fukuoka – 32,333 HHs inc 78,487 res; metro Canada – 6050 res; midlands UK – 3-5 HHs inc 466 res; south Rotterdam – 554 HHS inc 1040 res	Does travel behaviour reflect the properties of the urban structure and the transportation network? Do travel patterns reflect their own regularities? Can different patterns be observed across different space-time settings? Are common patterns independent from such contexts?	Research paper is a review of various international travel behaviour papers. Not primary data analysis. Original data collected from different time-periods and different methodologies. Need to be cautious drawing any conclusions.	Travel patterns seem to be largely independent from spatial setting. Within a society, psychological principles seem more important in shaping activities than the specific characteristics of the urban form and the transport system.

Titheridge, H. & Hall, P. (Journal of Transport Geography 14 (2006) 60 – 75)	Greater South East England Region, UK –East corridor and North Corridor	Ward data taken from 1981 and 1991 Census of Population, bus and rail timetables	Data modelled for 1981 and 1991	Not stated	Will the population growth in the global mega-city region of south-east England have major impacts on commuting patterns? Incs growth of Ashford, Stansted, Cambridge etc and completing of Channel Tunnel link	Relationships between travel-to-work patterns and socio-economic and land-use characteristics examined	Creation of new growth centres may result in increased car use but is unlikely to result in longer journeys to work. Variety of other results inc high % of professionals use car and rail rather than walking, bus or cycle. Higher numbers of stations and location↑ use of rail. Bus travel highest in locations with a high level of rail service.
Vande Walle, S. & Steenberghen, T. (Transportation Research Part A 40 (2006) 151 – 162)	Belgium national study	2 day travel diary	1998 - 1999	7000 representing 21,000 trips	Does travel time influence travel mode choice?	Paper aims to gain a better understanding between time and space-related determinants which are an important factor in travel mode choice. Study focuses on public transport use only.	Partial yes, but some limitations of study. On trip level there is a clear relation between waiting and walking time and public transport use. The longer you wait and walk then the less likely you are to use PT. But study did not start point or destination, timing etc.
Zacharias, J. (International Planning Studies Vol. 10, No. 3-4, 323 – 340, August – November 2005)	Shanghai, China - Zhongyuan, Luwan, Kangjian, Pudong	Face-to-face questionnaire & travel diary (most recent trip & usual daily trips)	Not stated	1811 respondents	Can significant differences in the use of non-motor transport in different parts of Shanghai be attributed to features of the local environment such as road network characteristics and design? Do personal and household characteristics contribute to the variable use of foot and bike modes of travel?	Study used a GIS methodology to examine locational variables. Regression analysis used to determine importance of distance, age, income, trip purpose etc. Motor use if growing rapidly in Shanghai. 2000 new licences per month.	Yes – some locations are more attractive to non-motor vehicles than others accounting for 22% of variance in mode split. Block structure and road density are most important for all but public transport use. Sig differences in travel distance by mode and trip purpose. Age, income household composition and type of employment have minor impact in travel mode and distance for non-motor options.

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Zhang, J., Timmermans, H. J. P. & Borgers, A. (Sub: 11/06/01; Acc: 24/03/04)	South Rotterdam, Netherlands	Activity-travel diary (7 day?)- mentions weekday trips	Data originally collected for Albatross model - date not specified.	257 households	Research studies the allocation of tasks and influences in multiple person households on travel behaviour. What impact does it have?	Study used household-level model of activity demand rather than based on individuals. Household task allocation and time use model using multi-linear group utility function. Quantifies the relative impact of individual household members	On weekdays, in nearly half the households the husband mostly influences task allocation and time use. In 20% of households it is the wife with the remaining households split evenly between husband and wife. Travel time seems to be an important factor in increasing the model's accuracy.

Appendix 4: Literature Review Matrix – Reviews of the literature or Conceptual Models

Gärling, T. & Axhausen, K. W. (Transportation 30: 1 – 11, 2003)	International	Review of published papers	1975 – 2003	Review of 39 international papers	What is the role of habit in TB? what is habitual choice?, how should habitual TB be measured? How to model the learning process that makes travel choice habitual? How to break and replace car-use habits?	Paper is an introduction to a special issue on habitual travel choice in 'Transportation'	Review of papers rather than evidence based using primary data
Gärling, T., Eek, D., Loukopoulos, P., Fujii, S., Johansson-Stenman, O., Kitamura, R., Pendyala, R. & Vilhelmson, B. (Sub: 1/06/01; Acc: 1/12/01)	Not relevant	Development of conceptual model on impact of travel demand management on private car use	Paper initially delivered on 1 June 2001	Not relevant; conceptual model only	A conceptual framework studying the impact of travel demand management (TDM) on private car use	Uses goal setting theory to understand how travel is influenced by the impact various TDM measure shave on time, cost and convenience of travel options. (Nice conceptual framework diagram)	Discusses a variety of further research directions inc hoe do TDM measures influence attributes of trip chains in terms of cost, time and convenience, does the content of a goals influence the likelihood of its achievement etc

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Larson, P. D. & Poist, R. F. (Transportation Journal; Fall 2004; 43, 4)	Analysis of mail surveys in transport and logistics research mainly in Transportation Journal	Review of all papers in Transportation Journal between 1992 – 2003 using mail surveys	1992 - 2003	106,300 questionnaires mailed in the papers reviewed.	How to improve the response rates for postal questionnaires?	Recognition that response rates have been ↓ since 1992. Uses analysis of all papers in Transportation Journal from 1992 – 2003 to provide a content analysis of surveys and methodology.	Paper includes a series of guidelines to improve response rates: send well-designed questionnaires inc stamped addressed envelope, avoid overt government sponsorship, include a deadline for return and avoid sensitive information, caution in using monetary incentives, care needed for follow-up mailings.
Marchetti, C. (Technological Forecasting and Social Change 47, 75 – 88 (1994))	International	Review of research and research papers	Examples from 1800 onwards	Includes research papers and research projects	What are the anthropological factors which influence travel behaviour?	Paper puts together a list of basic instincts that drive and contain TB, showing how they mesh with technological progress and economic constraints. Based on review of journal papers.	Looks at international case-studies so a variety of factors involved. Difficult to summarise due to above. Different cultures and political systems have different perceptions of time and space. What is acceptable for walking in one country would be unacceptable in another.
Mokhtarian, P. L. & Chen, C. (Sub: 1/07/02; Acc: 23/12/03)	Analysis of 28 research papers on travel time and travel time budget	Review of papers	Papers published from 1972 – 1999 based on travel studies from 1955 - 1988	Varies from not stated to 450,680 households	Are travel time expenditures constant?	Paper summarises and analyses 28 papers on travel time and money expenditure.	No, TT are not constant except at the most aggregate level. TT expenditure is strongly related to individual and HH factors – income, gender, employment status, car ownership, activities at destination and characteristics of residential areas – density, spatial structure and level of service. Underlying mechanisms are not understood.

Næss, P. (Sub: June 2003; Acc: January 2004)	Europe	Review of papers and transport studies	Variable – 1976 onwards	Not stated	Do urban structural variables influence inhabitant's amount of travel regardless of city size?	Reviews a number of empirical studies from Norway and Denmark	Yes. Strongest factor is location of residence from city centre on travel distance, modal split and energy use. Closer to downtown area then the shorter the travel distance and more likely to travel on foot. Local high pop densities imply shorter travel distances and↑ walking, cycling and↓ car use. High road capacity encourages commuters to travel by car.
Michon, J. A. in Polak, J. B. & van der Kamp, J. B. (Eds) (No date included, 1980 ?)	Review of modelling approaches – transnational	Review of following TD analytical methods/variables: life-style variables, disaggregate modelling, psychological approaches, reinforcement, stable behavioural variables, attitude surveys, behavioural decision analysis	?	?	When social values change does travel-demand and travel-demand forecasting also change?	Paper looks at variables that influence travel demand. In particular psychological processes are examined as well as social and attitudinal processes.	Difficult paper to condense. Essentially author states that psychology can aid travel demand analysis at different levels but to a limited extent. Psychology should aid and guide travel demand analysis.
Salomon, I. & Mokhtarian, P. L. (Sub: 14/05/97; Acc: 30/10/97)	Review of international transport case-studies and strategies	Review of a number of papers and strategies. Lacking clear detail over methodology	Papers range from 1978 to 1997	Not always stated. One Jerusalem study sampled 474 adults in 1977 but no other studies described in detail	Do humans have an intrinsic desire for 'excess travel'? Does density make a difference? Is there a demand for higher density landuse patterns?	Paper studies the inclination for 'excess' travel. People do not always want to reduce travel time, they may be travelling for the sake of travelling or for multiple purposes. Excess travel is 'travel that exceeds what could be a minimum satisfying level'.	Much research fails to acknowledge that travel is caused by multiple purposes. Public policies may ↑ car dependency through low operating costs, mortgage interest deductions encouraging low density housing, various fringe and tax benefits. Public policies may cancel each other out. Need to identify socio-economic and life-style characteristics.

Author	Location	Research/Method	Dates	Hypothesis	Question	Findings	Conclusions
Stern, E. & Richardson, H. W. (Sub: 6/10/04; Acc: 12/08/04) This date doesn't make sense – probably submitted in 2003	Europe and North America	Review of international research and papers from Europe and North America	1960 - 2004	Not stated	Paper proposes that most travel behaviour models lack a cognitive explanatory mechanism explaining the individual's choice process.	Includes a survey of recent papers on travel behaviour particularly human cognitive mechanisms. Proposes an extension of Decision Field Theory for new research agenda.	Wide variety of suggestions rather than conclusions. Effects of socio-demographic and personality attributes on travel behaviour are similar. Need to make distinctions between planned, habitual and impulsive travel using Attitude Theory models. Travel behaviour needs to be better understood to design effective transportation policies.
van Exel, N. J. A. & Rietveld, P. (Sub: 1/02/01; Acc: 1/06/01)	New York City, Los Angeles, Pittsburgh, Knoxville, Leeds, The Hague, Rotterdam, Orange County, Ile-de-France, The Netherlands, London, Norway	Reviewed 13 studies of public transport strikes	1966 – 2000. NYC (1966), LA (1974 & 2000), Pittsburgh (1976), Knoxville (1977), Leeds (1978), The Hague (1981), Rotterdam (1981), OC (1981 & 1986), Ile-de-France (1995), Netherlands (1995), London (1996), Norway (1998)	Not stated	What impacts do public transport strikes have on travel mode behaviour and use?	Paper reviews papers describing 13 studies of strikes in the public sector. Discusses impact of these strikes on short-term and long-term travel patterns.	Mostly affects people with no transport alternatives in the short-run whose departure and arrival times are inflexible. 10 – 20% of trips are cancelled if strike occurs. Most travellers switch to car ↑ road congestion. Longer-term leads to 0.3 – 2.5% ↓ in public transport market share. Effects can be temporary or permanent depending on type of strike and policy response.
van Wee, B. (Journal of Transport Geography 10 (2002) 259 – 271)	The Netherlands	Variety of datasets and papers reviewed	Variable – 1991 datasets, papers from 1988 - 2001	Not applicable – review of papers predominantly	Does land use affect travel behaviour? If it does, then should land-use policies be partly based in expected or assumed transport impacts?	Variety of datasets used for this research paper. Suggestions are 'speculative' in nature. Nice conceptual model included on page 260.	Yes, overall level of travel may be reduced by land-use planning and a modal switch from car to public transport achieved. However, future land-use plans and transport plans should accommodate a wide range of factors not just car reduction outcomes. Including congestion, road safety, env. impacts, preferences of households and firms etc.

| Wang, J. Y. T., Yang, H. & Lindsey, R.

(Sub: 10/09/03; Acc: 6/10/03) | Theoretical model | Theoretical model of travel within a linear city | Not applicable but paper submitted in 2003 | Not applicable | What is the optimal location for a park-and-ride facility in a linear city? What is the best pricing model for such a facility? Is it possible to maximise profit and minimise social costs? | Various assumptions used in this paper such as uniform population distribution which clearly isn't the case. Deterministic mode choice framework used for this study. | Yes – study shows it is possible to achieve a 'win-win' situation and achieve profit maximisation and social cost minimisation. But limitations to model probably need to be relaxed which would provide a more realistic model. |