



The Social and Distributional Impacts of Transport: A Literature Review

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Abstract

Despite the widely acknowledged significance of the social impacts of transport in political and public life and their distributional effects across various segments of society, this issue has received less policy attention relative to economic and environmental impacts. The aim of this working paper is to synthesise and critically evaluate the currently disparate literatures pertaining to the social impacts and equity of transport, transport disadvantage as it pertains to different social groups, and the wider interactions between transport poverty and social exclusion. It summarises what is known about these issues at the present time, identifies gaps in the knowledge base and draws attention to opportunities for further research. The working paper is designed to contribute to a wider scoping study of this topic, which has been funded by the Economic and Social Research Council of Great Britain. Further information about the study can be found at <http://www.tsu.ox.ac.uk/research/uktrcse/>.

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People must be told that a car is a sign of importance, the first rung on the ladder of social position.

(Le Corbusier, 2000 / [1954] p. 53)

Introduction

The social impacts of transport and their distributional effects across various segments of society have traditionally been viewed as secondary or even tertiary concerns relative to economic and environmental impacts. Recognising the relative lack of academic and policy attention in this area and the tendency for research findings to be fragmented across a number different disciplines, this TSU working paper synthesises and critically evaluates the currently disparate literatures regarding the social and distributional impacts of transport, transport disadvantage for particular social groups, and wider interactions with transport poverty and social exclusion. It summarises what is known about these issues at the present time, identifies gaps in the knowledge base, reflects on some of the patterns evident in the literature and highlights opportunities for further research, thus serving as a resource for other researchers investigating this important area of study.

Scope of the Review

Whilst not a systematic review, the approach to reviewing the literature for this working paper was informed by traditional methods in the social sciences and began with a broad search of terms and indexes as detailed in Appendix A. Given the context for our review, we concentrated our search on recent literature (2000 – 2011), English language texts, and a combination of academic studies, policy documents and practitioner reports. Whilst research findings from developing countries were included as relevant, the main focus of our search emphasised the UK context and other developed countries. Informal consultations with experts in academia and policy were also conducted to help guide the scope of our review. Summaries of journals, authors and subject areas reviewed are provided in Appendices B, C, and D, respectively.

Paper Structure

This working paper comprises six sections. Section Two outlines some important conceptual, methodological and legislative considerations regarding the social impacts of transport and their distributional effects across various segments of society. This is followed by reviews of the evidence regarding social impacts and their distributional effects. The fourth and fifth sections outline the relationship between social impacts and transport disadvantage, and wider considerations, such as social networks and social isolation and independence. This precedes the final section, in which concluding remarks and suggestions for further research are provided.

Understanding the Social and Distributional Impacts of Transport: Conceptual, Methodological and Legislative Considerations

There is something of a paradox regarding the social and distributional impacts of transport. Despite a long trajectory within planning scholarship (see, for example, Appleyard, 1981; Appleyard and Lintell, 1972; Banister and Hall, 1981; De Boer, 1986), and their widely acknowledged significance in political and public life (Geurs *et al.*, 2009), these issues remain under-examined relative to economic and environmental impacts and are more commonly viewed as secondary or even tertiary concerns (Burdge, 1987; Schiefelbusch, 2010). This can be seen as problematic for at least three separate yet necessarily interrelated reasons, as illustrated in Figure 1 and elaborated below.

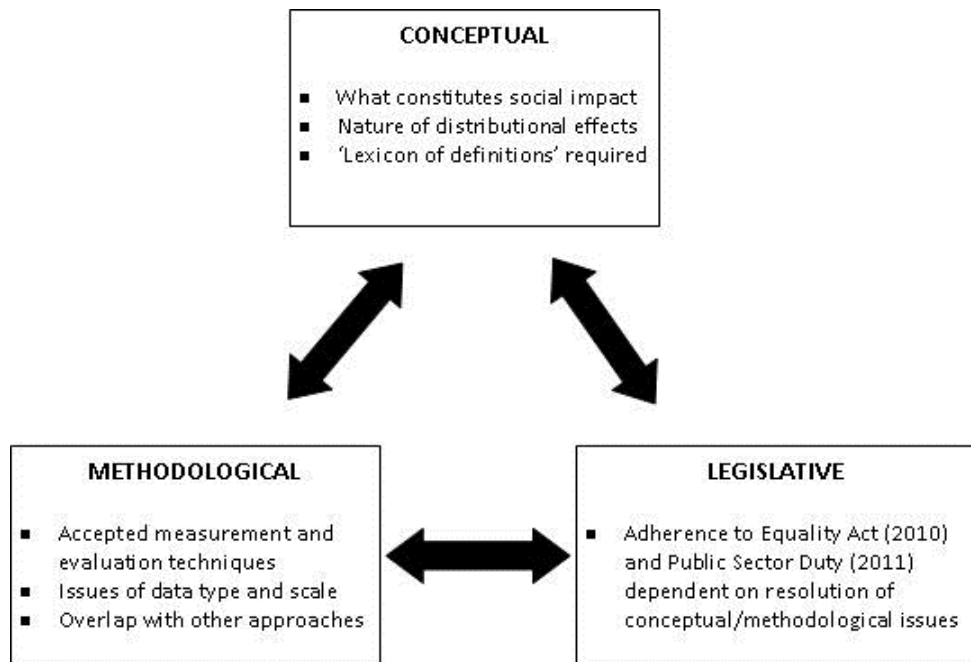


Figure 1: Key Considerations of the Social and Distributional Impacts of Transport

Firstly, there remains considerable ambiguity surrounding what constitutes a social and/or equity impact and distributional effect and this has generated a range of conceptual issues and misunderstandings. The need to develop a 'lexicon of definitions' has consequently been recognised as an important priority by participants of the project workshops¹, in order to ensure a greater degree of clarity and consistency within academic and policy literature.

Secondly, and related to this first consideration, is that a similar set of issues has arisen regarding appropriate ways of measuring and evaluating social impacts. These include such considerations as: the utility of qualitative and quantitative methods; analysis at the macro or individual level; and overlap with other approaches to assessing economic and health impacts associated with transport.

Lastly, and particular to the UK context, the Equality Act (2010) and the Public Sector Duty (2011) are new forms of equality legislation that affect all public bodies, including those that deliver transport services and devise transport policy. The ability of transport and related authorities in the UK to adhere to this legislation would therefore be enhanced as these first two issues are resolved.

¹ Project Policy Briefing Note 1, p. 4 http://www.tsu.ox.ac.uk/research/uktrcse/UKTRC-policy_briefing_note1.pdf

Conceptual Considerations and Definitions

Social Impacts

The first set of considerations is largely conceptual and pertains to the ambiguity surrounding the definition of what constitutes a social and/or equity impact. As Geurs *et al.* (2009, p.71) observe, the task of defining social impacts is not an easy one, and there remain a number of diverse, overlapping and sometimes competing, examples in this regard. The perceived relative importance of these impacts has also been noted to vary quite widely within the literature (Forkenbrock *et al.*, 2001, p. 3). Some of the earlier attempts at defining social impacts, for example, were based exclusively on *adverse* impacts (see Burge, 1987; FHWA, 1982 in Sinha and Labi, 2007), and whilst this has changed there remains something of an emphasis on the negative impacts of transport in contemporary definitions (e.g. SEU, 2002), as we elaborate later on in this working paper.

Geurs *et al.* (2009, p.71) provide what is, arguably, the most comprehensive definition and categorization of the social impacts of transport at the present time. Social impacts are defined here as:

...changes in transport sources² that (might) positively or negatively influence the preferences, well-being, behaviour or perception of individuals, groups, social categories and society in general (in the future).

As these scholars argue, this definition implies some overlap with the economic and environmental impacts of transport, but is necessarily broad so as to avoid omitting impacts that might be considered social *and* economic or environmental from their analyses. Thus emissions from vehicles, typically considered an environmental impact, are categorised as a social impact within this typology as a result of their affect on human beings (p.71).

The overlap as identified by Geurs *et al.* (2009) has been recognised by other scholars in the field and highlights a tension within the literature between the need for social impacts to be recognised as distinct from environmental and economic impacts, and

² Within this definition, 'transport sources' are described by Geurs *et al.* (2009) as: 'a movement and/or (potential) presence of vehicles using infrastructure or merely the presence of infrastructure itself' (p.71).

their observed ‘conflation’ with these other aspects of transport (e.g. Parkhurst and Shergold, 2009; see also pp. 7-8 this working paper). Indeed, some studies reviewed for this paper appear to make little distinction between economic and social impacts, for example, and they evaluate the latter purely in monetary terms (see, for example, Preston and Wall, 2008).

As detailed by source and degree of human need in Table 1, Geurs *et al.* (2009, p.75) provide a comprehensive categorization³ of the social impacts of transport. To this we have added two broader categorizations: social impacts derived from the provision of transport (e.g. infrastructure, vehicles, facilities and activities); and impacts derived from the user experience (e.g. the experience of travelling and being in traffic).

Table 1: Social impacts by type, source and levels of human need

Source	Theme	Sub-theme	Impact
Provider-based	Presence of Infrastructure	Structurally	Visual quality
		Temporarily (construction)	Historical/cultural resources Severance/social cohesion Noise nuisance Barriers and diversions Uncertainty of construction Forced relocation
	Presence of parked vehicles		Visual quality Use of space
	Presence of transport facilities, services and activities (accessibility) (incl. cost and temporal dimension)	Transport facilities	Availability and physical access
		Land use/delivery/opportunity	Level of service provided Transportation choice/option values Cultural diversity Access to spatially distributed services and activities
User-based	Traffic (movement of vehicles)	Safety	Accidents Averting behaviour Safety perceptions

³ This categorization informed the development of search terms as set out in Appendix A.

Source	Theme	Sub-theme	Impact
		Environment	Public safety (dangerous cargo) Noise levels, nuisance Soil, air and water quality
	Travel (movement of people)		Intrinsic value, journey quality Physical fitness (active travel) Security

(Adapted from: Geurs *et al.*, (2009, p.75)

Distributional Effects

A similar set of issues can be observed with respect to defining what constitutes a distributional effect. At its heart, the term is used to refer to the different ways in which the social impacts of transport affect various groups within society (see Atkins, 2010, p.1). As Sinha and Labi (2007, p. 427) describe, these effects can have a distance or geographical component, in that impacts such as noise can vary in severity as one moves away from the transport project area (see also Atkins, 2010, p.1), and a temporal component. Moreover, as Geurs *et al.* (2009, p.85) observe, distributional effects can be cumulative, as in the combined effect of traffic noise and pollution levels on disadvantaged populations.

The definitions described above necessarily imply that distributional effects arise from *all* social impacts of transport, and yet the majority of the literature that focuses explicitly on this element of transport (e.g. whereby the authors use this phrase specifically within their titles or key words), is generally concerned with road and congestion pricing schemes (see, for example, Bureau and Glachant, 2008; Graham *et al.*, 2009; Levinson, 2010; Santos and Rojey, 2004; Schweitzer and Taylor, 2008; West, 2002), and carbon or environmental taxes (see Bureau, 2011; Santos and Catchesides, 2005, and others). A smaller subset of this literature examines the distributional effects of public transport infrastructure or policies (see Bureau and Glachant, 2011; Nuwarsoo *et al.*, 2009). As will be demonstrated in the next section of this working paper, however, the distributional effects of transport extend far beyond these issues and are in fact related to the full range of social equity impacts as summarised in Table 1.

Methodological Considerations

A second set of considerations pertains to the ability to measure and evaluate the social equity impacts of transport. As Forkenbrock *et al.* (2001, p.81) observe: “it is clear that the profession is better equipped to assess economic effects than social effects”. Whilst a number of scholars have elaborated as to the range of methods utilised for the assessment of social impacts (e.g. Burdge, 1987; Forkenbrock *et al.*, 2001; Sinha and Labi, 2007), there is no standardized set of methods at the present time and as Sinha and Labi (2007) have observed, the process is a ‘relatively inexact science’ (p. 427). Part of the reason for this, as illustrated in Appendix C, is that the knowledge base is currently fragmented across numerous disciplines, including: spatial planning; human geography; social policy and sociology; public health; engineering; and of course, transportation; each with their own dominant approaches and methodologies. Accordingly, key issues highlighted in this section include: the use of qualitative versus quantitative methods; the validity of particular methods; overlap with other approaches; the need to consider temporal impacts; and the need to expand the concept of distributional effects.

Quantitative versus Qualitative Methods

The dominance of quantitative methods over qualitative approaches is one that is apparent within the transport sector more generally (Schiefelbusch, 2010), but is also an issue with regards to evaluating social impacts in particular. Writing on the visual impacts of roads and traffic, for example, Wright and Curtis (2002, p. 145) assert that these are: “less tangible aspects that cannot be expressed in quantitative terms”. Scholarly work in this area emphasises the use of focus groups and in-depth interviews, often integrating visual materials to help guide participant discussion (e.g. Bayley *et al.*, 2004). This approach is in contrast to assessments of other social impacts of transport, such as noise exposure and accidents, which rely on quantitative methods.

Validity of Particular Methods

There are related debates regarding the utility of particular methods for evaluating social impacts. Some scholars have noted the popularity and promising nature of neighbourhood surveys in the evaluation of the social effects of transportation projects. For example, Forkenbrock *et al.* (2001, p.20) find:

These surveys enable planners to deduce the qualities or attributes of neighbourhoods valued by residents; they can then take care to consider these attributes when formulating transportation system changes and mitigating negative impacts resulting from them.

Whilst observed as a common technique in evaluating a range of social impacts, neighbourhood surveys were recognised as particularly useful for issues pertaining to community cohesion and forced relocation. For other scholars, however, surveys are viewed as only being useful in identifying a limited range of social impacts, such as trip diversion and delay, and road safety (e.g. James *et al.*, 2005, p.8).

Overlap with Other Approaches

One of the major themes observed within the literature is the overlap between social and other impacts associated with transport, such as environmental, health and economic (Parkhurst and Shergold, 2009, p. 14). This conceptual overlap has led to a further set of considerations regarding methodological approaches. The area of Health Impact Assessment (HIA), for example, has emerged as its own unique approach in relation to transport infrastructure and policies (e.g. Gorman *et al.*, 2003; McCarthy *et al.*, 2010; Mindell *et al.*, 2004; Thomson *et al.*, 2008) and within spatial planning more generally (Forsyth *et al.*, 2010). And yet as Forsyth *et al.*, (2010) observe (see esp. pp.238-239), there are multiple variations of this approach in practice and there are some concerns that HIAs may simply be ‘repackaging’ social impact and other forms of assessment in a ‘health wrapping’ (p.241).

Other approaches to assessing the social impacts of transport schemes have focused on the monetary valuation of these effects (e.g. Monzón and Guerrero, 2004; Preston and Wall, 2008). Here, social impacts are considered to be a ‘social cost’, and assessed not unlike other monetary costs associated with transport projects.

Inclusion of Temporal Impacts

As Geurs *et al.*, (2009, p.71) highlight, there is an important temporal dimension to the social impacts of transport. Yet very few studies reviewed for this working paper considered this element in their approaches. One exception to this was the growing body of literature that examines parental influences on children and their subsequent views on car-based travel, as they become drivers of the future (see Kopnina, 2011,

and others). Forkenbrock *et al.*, (2001, p.20), recognise the opportunities that exist for developing methodologies to predict the social impacts of transport, rather than analyses that document existing or past impacts, which tend to dominate the literature.

Expanding the Concept of Distributional Effects

There are two methodological implications arising from the somewhat narrow conceptualisation of transport's distributive effects mentioned previously in this working paper. In terms of the particular methodological approach to this review, search terms necessarily had to be modified to include the specific social impacts as listed in Table 1; the classification of the literature in this way involved a more rigorous, and arguably more subjective, approach to coding. From a wider methodological perspective, however, is the lack of recognition within the literature of these outcomes as legitimate distributional effects. Further work in this area is therefore required to help 'frame' or disseminate these issues in this way, so that they might be analysed as such and receive the attention they deserve in policy and practice.

Legislative Considerations

Unique to the United Kingdom in their specifics but more generally relevant conceptually, a final set of considerations pertains to the legislative implications associated with the social impacts of transport as a consequence of the Equality Act (2010) and the Public Sector Equality Duty (2011). These are two forms of equality legislation that were developed under the New Labour Government and have been now been ratified by the New Coalition Government, the latter of which applies to all public bodies and authorities, including those that are responsible for delivering transport services and devising transport policy, The Public Sector Duty replaces three older forms of equality legislation (gender, race and disability) and has been extended to include: age, sexual orientation, faith/religion, pregnancy and maternity, and gender reassignment (Government Equalities Office, 2011). Whilst a provision for a socio-economic duty was included in the original Act (Part 1) as developed by New Labour, the decision to scrap this aspect of the legislation was made by the Coalition Government in November 2010, in favour of other policies that are perceived to address this issue more effectively.

Public bodies are required to respond to this Duty not only in terms of their employment practices, but also in the development of policy and delivery of services. Of interest to scholars and policy makers in transportation is that the legislation also applies to a number of transport-related public authorities, including: county, district, and parish councils; Transport for London (TfL); The Common Council of the City of London in its capacity as a local authority or port health authority; and many related others (see Schedule 19: <http://www.legislation.gov.uk/ukpga/2010/15/schedule/19>). Part 12 of the Act focuses exclusively on disabled persons and transport, and outlines accessibility regulations⁴ for taxis, public service vehicles, and rail vehicles (see Chapters 1, 2, and 3, respectively).

These new forms of equality legislation, and arguably the recent changes made to them in the current political climate, are reflective of the ethical dimension inherent to transport policy as it relates to social exclusion (see, for example, Lucas, 2010 for an overview and alternative approaches). As Van Wee and Lucas (forthcoming) observe, the normative idea of policy with respect to equity and fairness in transport is that a minimum level of opportunity to participate in activities (e.g. work, education, health services, etc.) should be made available for all persons, regardless of whether or not they have access to cars or hold driver's licences, and irrespective of such factors as household income, gender, age, ethnicity or disability (e.g. Social Exclusion Unit, 2003). As an important element of social exclusion is that it is 'beyond the control of excluded persons' to reduce or eliminate barriers to inclusion, 'policy interventions are necessary to change either their personal circumstances or the conditions that surround them' (Lucas, 2010). This can be viewed as further indicative of the aim of public policy more broadly, namely to improve citizens' welfare and protect the most vulnerable individuals within society (e.g. Hill, 1996).

Whilst the ability of public authorities to effectively respond to this legislation is both influenced by, and indicative of, the normative approaches within government, we would also recommend that this is very much related to the conceptual and methodological issues outlined earlier in this section. Previous research on the implementation of the Gender Equality Duty (2007), for example, one of the

⁴ Of importance to note is that these stipulations refer largely to the design of vehicles and do not make reference to other considerations, such as timing of the service provided or extent of the overall network. See also, for example, Schedule 20 of the Act with regards to rail vehicle accessibility compliance.

precursors to the Public Sector Duty, revealed that many local authorities lacked the awareness, training and experience to adequately respond to this legislation in their practices (see Burgess, 2008; 2009). The resolution of these other issues could therefore provide greater clarity for public authorities and greatly assist them in responding to the current Duty.

Evidence of the Social Impacts and Distributional Effects of Transport

With these conceptual and definitional issues in mind and drawing on the typology set out Table 1, this section reviews the evidence of the social impacts of transport and their distribution effects within the available literatures. The section is structured on an ‘impact-by-impact’ basis, and is primarily ordered from the most commonly to the least studied issue based on our literature search (Appendix D), although we have also grouped them by theme to some extent.

However, it is vital to note at this point that the regularity with which a given impact is studied and/or appears within the transport and associated literatures does not denote either the level or extent of its impact or the degree of its distributional inequities across different vulnerable social groups within society. We further recognise that whilst many of the themes identified in this section are similar to those found in the environmental literatures, these are often presented with a view towards overall impact levels, as opposed to more detailed discussions of how they are distributed and impact differentially upon various segments of society (see also pp. 8 & 11 this paper). We attempt to identify each of these issues to a certain extent within the summaries of the individual themes and also return to them more generally in the final conclusions section of the paper.

Casualties and Injuries

Casualties and injuries were probably the most commonly cited form of transport-related social impact discovered in the literature we reviewed. As indicated in our summary of publications (see Appendix C), this type of impact is increasingly being framed as a public health issue and widely regarded as an ‘epidemic’ (e.g. Anbarci *et al.*, 2009; Dahl, 2004). The World Health Organization (WHO), for example, recognises road traffic injury as part of the global burden of disease, and predicts that by the year 2020 it will rank third amongst leading causes of disability adjusted life

years (DALYs) lost (see Peden *et al.*, 2004, p. 5); an overall increase in rank from ninth in 1990. As a consequence, this issue has received notably more attention by scholars in public health departments, than those in the social sciences *per se* (though see Short and Pinet-Peralta, 2010 for a notable exception).

The distributional effects of road traffic casualties and injuries, particularly with respect to lower-income groups and neighbourhoods, are well documented within the literature (see Cutler and Malone, 2005; Short and Pinet-Peralta, 2010; White *et al.*, 2000). As Short and Pinet-Peralta (2010, p.49) observe: ‘accidents are not random across the population’; instead, they are intimately connected with disadvantage at individual, neighbourhood and global levels. As these scholars argue:

‘Accidents’ reflect and reinforce social differences: they are less accidents and more manifestations of wider and deeper inequalities in society that reflect the relative power of a vehicle-dominated as opposed to a pedestrian-dominated culture (Short and Pinet-Peralta, 2010, p. 56)

Factor *et al.* (2010, pp.1412-1413) identify five main social groups that are more likely to be involved in traffic casualties and injuries: men; young people (esp. 15-29 year olds); visible minority groups; people with lower levels of educational attainment; and people from lower socio-economic backgrounds. To this we would add, however, the longstanding and now burgeoning literature on the vulnerability of children from low-income households in traffic accidents and fatalities (as distinct from young adults) (see, for example, Edwards *et al.*, 2006; Laflamme *et al.*, 2009; White *et al.*, 2000); and further recognise that the distribution of traffic related injuries and fatalities is highly variable at a global level, with many scholars documenting their rise in the developing world and subsequent decline in developed or ‘high-income’ countries (see Kopits and Cropper, 2005 and 2008; Naci *et al.*, 2009; Peden *et al.*, 2004, and others).

It is important to recognise the intersectionality of these patterns, as those observed by Factor *et al.* (2010) and others for accidents more generally are also prevalent within the various social groups in particular. In their review of child pedestrian fatalities in the Province of British Columbia, for example, Desapriya *et al.* (2011) document an over-representation of males, Aboriginal children, and children from low income

families. In addition, children in the lowest socioeconomic status (SES) bracket in Canada are four times more at risk of pedestrian death than children in the highest SES bracket (Desapriya *et al.*, 2011, p. i7); and in the UK are five times more at risk (Graham *et al.*, 2005).

It is also instructive to note that the majority of the literature in this area is focused on road traffic accidents⁵, though there is variable interest in accidents derived from other modes of transport, such as light rail, streetcars and trams (e.g. Currie and Reynolds, 2010), aeroplanes (e.g. Bazargan and Guzhva, 2011), and within the shipping industry (e.g. Tzannatos, 2010), though many of the evaluations of these other modes tend to be concerned with occupational accidents.

Noise Levels and Nuisance

Noise and nuisance related issues derived from transport are another well-studied set of social impacts. As Payer (2007) observes, heightened public sensitivity to noise arose in many European cities during the latter half of the nineteenth century, and was derived in large part from the significant increases in traffic associated with urban industrialization. The influx of horse-drawn carts, pedestrians and cyclists, streetcars, railroads and automobiles to industrialising cities was a notable contributor in this regard (pp.776-778), and the side effects of urban noise were being treated by medical health departments as an important health issue by the 1880s, in particular for their association with ‘nervous behaviour’ (p.779). Payer (2007, p. 780) attests:

Without doubt, noise was assigned a special position among urban nuisances for physiological reasons. Many argued that unlike other sensory organs, the ears could not be sealed and were therefore unprotected against all sorts of penetrating noises.

Whilst noise is often regarded as a nuisance associated with contemporary urban living (Schade, 2003), the issue is also widely recognised as a significant public health burden, particularly for its association with sleep deprivation, cognitive impairment (in children), high blood pressure, cardiovascular disease, and fatal heart

⁵ By way of example, a preliminary search within the ISI Web of Knowledge Database for the years 2000 to 2011 revealed the following number of articles under the topics ‘accidents’ AND: ‘shipping’ (104); ‘trains’ (79); ‘airplanes’ (31); ‘streetcars’ (2); and ‘trams’ (3). A search for ‘traffic’ and ‘accidents’ revealed 15,048 articles for the same time period, with 107 having been published during 2011 alone.

attacks (see Berry, 2008a; BMA, 2009; WHO, 2011, and others). Traffic-related noise annoyance is also correlated more broadly with lower health-related quality of life (HrQoL) (Dratva *et al.*, 2010). The World Health Organization (WHO) attributes traffic-related noise to the annual loss of 1 million ‘healthy years’ of life through ill health, disability, and early death; a statistic that applies to western countries of the WHO European Region alone (WHO, 2011). As Fhyri and Aasvang (2010) assert, the main contributor of environmental noise is road traffic (p.4935), and whilst many of the studies in this area consider the effects of car-based travel, a growing body of literature considers noise exposure as derived from other modes of travel (see, for example, Dinno *et al.*, 2011; Neitzel *et al.*, 2009; Gershon *et al.*, 2006; Stansfeld *et al.*, 2005; and others); as well as other elements in the urban ‘soundscape’ (e.g. Adams *et al.*, 2006).

The distributional effects of traffic-related noise exposure are well documented within the transport literature. Dinno *et al.*, (2011, p. 11), for example, recognise that long-term noise exposure from rapid transit makes vulnerable those segments of society that the system principally serves; thus, school-age children, elderly people and people of low-income would necessarily be more vulnerable to these negative impacts. Dratva *et al.*’s (2010) research on road traffic-related noise exposure revealed that women reported significantly higher levels of noise annoyance and thus lower health-related quality of life than men. Children have also been recognised as particularly vulnerable to the negative health effects associated with traffic noise (especially aircraft noise), as exposure has been associated with cognitive impairment and issues with reading comprehension (see Clark *et al.*, 2006; Matheson *et al.*, 2010; Stansfeld *et al.*, 2005, and others), and the impact of aircraft noise is viewed as more significant than road traffic noise (Haines *et al.*, 2003).

Despite the wealth of studies that consider the impact of traffic noise on residents, Adams *et al.* (2006, p.2386) observe that it is visual aesthetics not acoustic properties that dominate in urban planning policy and guidance. The importance of this issue within the UK, however, has arisen in the form of the *Noise Policy Statement for England* (NPSE) (2010), which recognises the adverse health and quality of life impacts associated with noise exposure (but does not elaborate as to the distributional effects associated with this type of impact); and the Mayor of London’s (2004) *Ambient Noise Strategy*, a much more rigorous document that acknowledges the

inequalities regarding noise exposure, such as for children and other disadvantaged groups (p.9).

Air Pollution/Air Quality

Although less studied within the social science literatures on transport, traffic-related air pollution is another important social impact with often, severe adverse health impacts on the population, such as asthma, cardiovascular and respiratory diseases, and reduced life expectancy (BMA, 2009, p.14). In addition to the widely recognised health impacts, traffic-related air pollution can also adversely affect the quality of life in urban areas and can further damage the image, reputation and economic performance of cities (Mingardo, 2008, pp. 268-269). As road transport is recognised as the largest contributor of emissions within the transport sector (Mingardo, 2008, p. 268), many of the studies in this area necessarily focus on road traffic-related air pollution.

Although there are numerous studies on the air quality impacts of traffic generally, Schweitzer and Zhou (2010) present one of the few studies found in the literature that specifically examines the distributional effects of air quality and pollution. In their analysis of ozone and particulate matter exposure in 80 metropolitan areas in America, these scholars discovered that neighbourhoods with high proportions of low-income, Asian and African American households exhibited higher exposure rates. Poverty was also found to be a strong predictor of exposure to ozone and fine particulates for those individuals aged 65 and older (pp.367-368). In comparing compact and sprawling regions, Schweitzer and Zhou (2010) also found that exposures to ozone and fine particulates were higher in the former at the neighbourhood-level.

Not unlike other social impacts identified in this working paper, the majority of empirical studies found in the literature focus their analyses on air pollution emitted from road traffic (though see Haynes and Savage, 2007, for an investigation of the health impacts of particulates derived from transport infrastructure construction at Kings Cross; and Zurbier *et al.*, 2010, for an examination of traffic-related air pollution exposure for commuters using buses, cars and cycle routes). As we have argued elsewhere, further research in this area would thus benefit from examination of a greater range of modes.

Accessibility

Reduced accessibility to essential services has become an increasingly important emergent area of research over the last ten years, particularly within the transport geography and transport policy fields. Although a fluid and highly-contested concept, accessibility is broadly defined as:

[T]he extent to which land-use and transport systems enable (groups of) individuals to reach activities or destinations by means of a (combination of) transport mode(s).

(Geurs and van Wee, 2004, p. 128)

Four main components of accessibility are identified within this literature: i) a physical component (availability and physical access to transport facilities); ii) the level of service provided by the system (in terms of travel time, cost, and comfort); iii) the spatial distribution of transport services and activities and their spatial and temporal constraints (including the option value of preserving accessibility to public transport, irrespective of use); and iv) cultural diversity (Geurs *et al.*, 2009, pp.76-7).

i) Availability and Physical Access to Transport Facilities

The physical component of accessibility, most notably the availability and physical access to transport facilities, is arguably the most commonly cited and influential in the literature (e.g Farrington, 2007; Preston and Rajé, 2007; SEU, 2003). For Farrington (2007, p. 320), accessibility became widely accepted as a transport policy goal within the UK Government largely due to the Social Exclusion Unit's (2003) seminal report *Making the Connections*, which recognised transport as a social policy issue and specifically established the linkages between lack of access to transport and the exclusion of members of society from important life-chances. The role of transport in enabling people to participate in various activities, such as employment and learning opportunities, and to make use of local services, such as healthcare, food shops, and recreational and leisure facilities, received particular attention within this Report (SEU, 2003). Lack of access to transport facilities is not the only element of accessibility as defined here; writing on the needs of disabled individuals, for example, Casas (2007, p.463) recognises that difficulties are defined in terms of:

[M]obility, which can be related to deficiencies in the transport system or to a particular impairment affecting access level.

The distributional effects of the physical component of accessibility are well documented in the literature. Specific groups identified by the SEU in this regard include: teenagers, the elderly, job seekers, and people living in rural areas. Dobbs (2005 and 2007) reveals how poor access to public transport in north east England has posed problems for women in accessing employment opportunities; the car is viewed as crucial in enabling women to participate in the labour market. The availability and physical access to public transport in rural areas (and resultant car dependency) have also been recognised as important issues for the elderly (Dwyer and Hardill, 2011; Park *et al.*, 2010); women (Noack, 2011); young people (SEU, 2003); and rural residents more generally (SEU, 2003).

ii) Level of service (time, cost, comfort)

The timetabling and operating hours of public transport services, what Cass *et al.* (2005, p.551) refer to as the *temporal dimension* of accessibility, form an important area within this literature (see also Currie and Loader, 2009; Loader and Stanley, 2009; SEU, 2003). The operating hours of transport systems have been criticised for adversely affecting the ability of socially disadvantaged groups to access such important services as: before-and-after school activities, health care facilities, supermarkets and food shops, employment opportunities (SEU, 2003), and higher education (Kenyon, 2010). Extending the operating hours of transport systems could therefore be an important element in reducing social exclusion.

The benefits of extending the operating hours of public transport, however, are only realised within certain scheduling parameters and minimum service levels. In their evaluation of the patronage impacts of improvements to bus service levels in Melbourne, for example, Loader and Stanley (2009) discovered that for bus use to be improved, the minimum level of service that public transit routes must offer is a seven day a week model with half-hourly (or better) service (p.114).

The distributional effects of level of service are generally underexplored in the literature. Loader and Stanley (2009), for example, focus much of their analysis on aggregate changes in bus patronage following service expansion, as opposed to how

particular segments of society responded to these changes *per se*. Structured interviews with new bus users following the expansion of services did reveal, however, that new evening users were principally young people, under 30 years of age (p.112). Further research into this area would thus benefit from greater attention to these distributional effects.

The cost of public transport services has also been cited as an important dimension of accessibility (Geurs *et al.*, 2009, p. 76), as this has been documented as a factor in transport-related social exclusion (PTEG, 2010; SEU, 2003). The role of concessionary bus fares for the elderly and people with mobility issues forms an important part of this literature (see Rye and Carreno, 2008; Rye and Mykura, 2009; Rye and Scotney, 2004). As Rye and Scotney (2004) elaborate (pp.133-134), these schemes were introduced as a New Labour initiative following their election in 1997.

The benefits of these schemes, however, are debated within the literature. In their estimates of demand for concessionary bus schemes for the elderly over a 15-year period, for example, Rye and Scotney (2004) assert that increases in ridership will be attained over the short-to-medium term, but that this will be tempered over the longer-term due to the ‘dampening effect’ caused by subsequent increases in car ownership by the eligible age group. Rye and Carreno (2008) also recognise the limited utility of concessionary schemes for many elderly people, for whom barriers other than cost contribute to their social exclusion. These scholars further suggest that bus operators in Scotland and Wales are being over-reimbursed for these schemes, leading to larger questions about their utility from a policy perspective.

iii) Transportation Choice/Option Values

Transport facilities offer people choice of travel mode and route throughout the day. Many scholars identify ‘option values’ as another important social impact of transport, defined as:

‘People’s willingness to pay for the continued availability of a transport facility, to preserve the option of using this facility in the future’ (p.76). A common example is the willingness of car owners to have access to public transport facilities for those situations in which car access or use is compromised (Geurs *et al.*, 2006, p.614).

Option values are further recognised as most likely having a role when transport modes or infrastructures are either significantly diminished or improved (Geurs *et al.*, 2009, p.77). The concept is well-known and applied within environmental economics, but has recently been extended into the field of transportation (Laird *et al.*, 2009).

Many of the empirical studies in this area attempt to measure transport option values by mode (e.g. Geurs *et al.*, 2006; Roson, 2001), yet as Laird *et al.* (2009, p.178) observe, this field 'is far from developed' and the small sample sizes of the studies reviewed by these scholars make it difficult to have reliable willingness-to-pay (WTP) values. In addition, the distributional effects of option values in these studies disaggregate participants on the basis of their use of mode (e.g. regular train users versus possible users); aspects such as age, race or gender do not feature in these analyses. Given the relatively few studies in this field, and their applicability in transport appraisal guidance (Dft, 2003; 2007), this is an important area for further research.

iv) Cultural Diversity

The potential impact on cultural diversity, notably the benefits to Third-World countries derived from new transport facilities that support large-scale tourism, is another element cited by Geurs *et al.* (2009, p. 77). As Khadaroo and Seetanah (2008, p. 832) observe, the majority of tourists are inhabitants of developed countries who are used to modern transport infrastructure, and so deficiencies in this infrastructure can adversely affect the ability of developing countries to attract visitors. Our review of the literature within the time period of interest revealed a limited number of studies considering the role of transport and mobility with respect to tourism in developing countries (e.g. Khadaroo and Seetanah, 2007, 2008), as well as in the EU (Albalate and Bel, 2010; Bel, 2009). We would concur with Khadaroo and Seetanah (2008, p. 832), who acknowledge that the literature on the role of transport infrastructure on tourism is 'scarce', and further recognise that the social impacts of transport-related tourism are even more so. The studies that we did uncover, for example, are necessarily focused on the broad role of transport infrastructure in tourism (e.g. Bel, 2009; Khadaroo and Seetanah, 2007, 2008), and how the existing supply of transport infrastructure is (or is not) enhanced to accommodate an influx of tourists (e.g. Albalate and Bel, 2010). This theme in

general would thus be an important area for further research, as would the distributional effects associated with transport facilities and large-scale tourism.

Personal Safety and Security

Feelings of personal security and safety can also be associated with perceptions of reduced accessibility, although the literature often deals with these issues in isolation from each other. This is particularly important in terms of accessing public transport, as the presence and fear of crime affects the decision to use public transport (Cozens *et al.*, 2004; Loukaitou-Sideris *et al.*, 2002; Smith, 2008; Yavuz and Welch, 2010). As Liggett *et al.* (2003) observe, the construction of a new public transport link can also heighten fears that crime will be increased in station neighbourhoods (e.g. from lower to higher income areas, though their research found no evidence of this in practice).

The issues surrounding safety and security also relate to another social impact of transport, the aversion of particular forms of travel behaviour (see section below). As Cozens *et al.* (2004) assert, the perception of risk from crime at public transport stations has a negative effect on patronage levels, and so an important part of successful modal shift would necessarily involve addressing concerns about crime.

As Loukaitou-Sideris and Fink (2009) describe, there are important gender differences to the perception of fear and personal safety on public transport stations, with women more likely to limit or alter their travel behaviour based on their fears and concerns as passengers (see also Smith, 2008). Yavuz and Welch (2010, pp. 2495-2498) outline five key issues in this regard: adequate lighting and visibility at transport stops and stations; the appearance of trains and stations (e.g. cleanliness); reliability of service; the presence of CCTV cameras versus police officers (with women preferring the latter); and previous experience with crime. These scholars also identify a number of other socioeconomic factors as being important, with older men and women; people with disabilities; people of low income; and visible minority groups more likely to be fearful of crime at transport stations (p.2498).

As at 1998 in the UK, the Department for Transport (DfT) implemented the Secure Stations Scheme, an accreditation process applicable to all rail and underground stations policed by the British Transport Police (BTP). Station design is one of four

main accreditation criteria⁶ (which includes Crime Prevention through Environmental Design (CPTED) as well as security systems), as is station management, the collection of crime statistics, and surveys of users to demonstrate that passengers feel secure (DfT website, 2006). As Cozens *et al.* (2004, p. 27) observe, however, there are no empirical studies that measure whether design (CPTED) measures implemented at railway stations are effective in reducing crime. Moreover, as Wigan and Clarke (2006) elaborate, transport surveillance systems, which are one of the preferred mechanisms used to help address concerns about personal and public safety, generate a whole other range of social impacts. These include: the implicit presumption that people are to be denied anonymity; the lack of balance between human rights and security concerns; and a number of control issues that can emerge with respect to abuse of surveillance systems, data holdings and security; ‘function creep’, and a lack of credible audits of the systems in place (pp. 399-400).

Aversion Behaviours

Related to fears for personal safety are aversion behaviours, which refers to certain social groups modifying their own or others travel behaviours due to such concerns as personal safety (e.g. ‘stranger danger’) or risk of traffic accidents (Geurs *et al.*, 2009, p. 77). One of the major trends observed in travel behaviour modification over the last few decades, for example, is the unwillingness to let children play outside or to walk and cycle, and a subsequent reliance on parental chauffeuring, particularly for the journey to school (see, for example, Buliung *et al.*, 2009; Carver *et al.*, 2008; Fyhri *et al.*, 2011; Lucas, 2006; Malone, 2007; Mitchell *et al.*, 2007; Scottish Executive, 2003; Whitzman *et al.*, 2010, and others). As Mattsson (2002) reveals in her research in Sweden, the loss of independence associated with increased chauffeuring is not confined to urban areas, and is a significant issue for rural children as well.

These scholars have also highlighted the contradictions inherent in the motivations of many parents. As Fyhri *et al.* (2011, p.8) observe:

Traffic danger as a reason is a paradox, since most of the local traffic around the schools is often generated by the parents themselves. By taking their children by car, other parents may

⁶<http://www.dft.gov.uk/pgr/crime/sss/securestationsscheme?page=2#a1003>

feel obliged to do the same to avoid the risk of their children of being involved in traffic accidents by letting them walk or cycle.

There are important health implications arising from this form of behaviour modification, as a decline in active travel is viewed as a contributing factor in rising rates of child obesity. Further health implications are derived from the increasing polarisation of children in low-income families, who are still more likely to play outside near busy roads and walk to school and so are more vulnerable to accidents (see accidents above), and those in middle and upper-income families, who have greater access to motorcars and so are more likely to be 'protected' from accidents as passengers. As Malone (2007) observes, the decrease in children's independent mobility has resulted in what she refers to as the 'bubble-wrap generation', and is a response that largely appeases the anxieties of middle class parents.

The unwillingness to let children be outside and participate in active forms of travel also has important temporal implications. As Kopnina (2011) observes in her research with young children in the Netherlands, the amount of time that children spend in cars is having an influence on their attitudes towards them, and will ultimately lead to a new generation of adults who are completely socialised into car use and ownership, as 'drivers of the future' (p.2). As revealed in a research study for the Scottish Executive (2003), parents are the largest influence on the travel behaviour of many children, and this influence can even outweigh any awareness children may have from educational programmes about the benefits of sustainable travel. As confirmed in its report (p.62):

Children might have positive attitudes towards sustainable travel, but if their parents are not signed up to the same agenda children will experience conflicts between their attitudes and what they can actually do individually. Any pro-environmental attitudes which once were strong may be lost as new habits take hold.

Thus, the travel behaviour modification evident now in relation to young children will have long-term health and sustainability implications for the next generation of drivers (and transport planners).

As we have argued in the case of other social impacts it is important to recognise the intersectionality of various aspects of identity (e.g. age, gender, race, class) when understanding how behaviour aversion is distributed amongst children as a group. As indicated previously, the distributional effects of this social impact vary by class, with middle class children more likely to be part of the ‘bubble wrap generation’ than children living in lower income households (Malone, 2007). Mode choice for the journey to school also varies by ethnicity of the child, with Caucasian children less likely to be walked to school and more likely to be driven to school than children from other ethnic groups (Yarlagada and Srinivasan, 2008). As indicated earlier, geography can have an influence on the distributional effect of behaviour aversion, with Mattsson’s (2002) research in Sweden confirming that rural children have less independent mobility than those living in a mid-size town.

There is also an important gender and inter-generational component to this type of behaviour aversion, in relation to the adults responsible for chauffeuring children. As Greed (2008) observes, it is principally mothers who drive their children to and from school and to other extracurricular activities. As Dowling (2000) reveals, the car is central to the experience of being a ‘good mother’ and enabling children to have access to these activities.

Public Safety (Dangerous Cargo)

Whilst on the subject of transport safety, it is worth noting that Schweitzer (2006) is one of the few researchers to focus explicitly on the social impacts of road-based transport of hazardous materials (hazmat) for residents of poor and minority neighbourhoods. As she observes, other themes that predominate in the literature include the nature and causes of incidents; and modelling risk-minimizing routes (p.410). Schweitzer (2006) argues that people of colour and low-income individuals are more at risk of exposure to hazardous materials spills due to their greater likelihood of residing near a hazmat route; and/or near industrial land uses, including the shipment’s origin or destination (p. 409). Based on spill frequency data in Southern California, Schweitzer’s (2006, pp.417-418) analysis reveals that transport-related spills tend to cluster around shipment origins (including intermodal facilities and transfer points), and a raised incidence of spills is evident within two kilometres of intermodal facilities.

The distributional effects of public safety in relation to the transport of hazardous materials have also been assessed by Schweitzer (2006, p. 420), who concludes that Latino residents in Los Angeles are disproportionately affected as a community group. As she observes, this finding is related to wider settlement patterns across the Los Angeles metropolitan region, such as suburbanization or 'white flight', which intersect with race:

[B]ecause white metro residents are so spread across space (and others are less so), many white residents have the opportunity to live far from the nuisance which communities of color, much more densely settled, do not have to the same degree.

(Schweitzer, 2006, p.420)

The distributional effects of public safety in relation to shipping hazardous waste have also been evaluated at a global level. Sonak *et al.*, (2008), for example, recognise the inequity inherent in the export of end-of-life vessels, many of which are loaded with hazardous waste, to developing countries for ship-breaking. These scholars note that countries such as India and Bangladesh, who are favoured destinations for ship-breaking, not only lack the regulatory and physical infrastructures to process toxic waste in an environmentally appropriate manner, they do not have the public health infrastructure in place to address resultant health impacts associated with handling toxic waste. Given the significance of this issue and the dearth of literature that recognises the social impacts of hazardous materials' transport, we would suggest that this is an important area for further research.

Community Severance

Community or social severance is widely recognised as another important social impact associated with transport (Geurs *et al.*, 2009, p.71). Whilst the development of the concept has evolved considerably over time since its initial definition in the 1920s (Guo *et al.*, 2001, cited in James *et al.*, 2005), James *et al.*, (2005, p. 24) define severance as:

[T]he existence of a real or perceived barrier to people's movement through an area that is created by the transport infrastructure (such as roads or railways) or traffic.

Whilst physical severance is arguably the most commonly recognised in the literature (e.g. Rajé, 2004a and 2004b), James *et al.* (2005, p.6) emphasise that there are important psychological and social dimensions⁷ associated with this form of social impact. These include: fears of accidents and feelings of intimidation associated with busy roads, which may ultimately prevent people from accessing certain facilities (SEU, 2002, p. 14); and the lower quality of life associated with the loss of social interaction amongst neighbours (particularly children), resulting from concerns about busy roads (SEU, 2002, p.15), respectively. Rajé (2004a, p.269) further recognises the health dimension associated with severance, which includes such aspects as reduced access to facilities and services for disabled people, and reduced social support derived from lack of interaction cited previously.

An important distinction is also made between *primary severance* (e.g. caused by the initial barrier itself), and *secondary severance*; an additional barrier derived from the lack of adequate, accessible and operational mitigation measures (James *et al.*, 2005, pp.7 and 8). Examples of this latter form of severance include: poorly designed mitigation measures (such as crossings); poor maintenance leading to such physical barriers as those formed by flooding or icy areas; and the neglect or lack of maintenance of an area leading to such problems as graffiti or rubbish, ultimately deterring pedestrians through fear of crime (James *et al.*, 2005, p.61).

Whilst a number of articles discovered in our literature review made reference to severance as an important social impact, there were comparatively fewer studies that focused on this issue explicitly, and those that made little or no reference to its distributional effects. In their qualitative research with local authority practitioners, James *et al.* (2005, pp.61-61) cite five main social groups who are most adversely affected by severance: individuals without cars; those with restricted mobility (e.g. wheelchair users, older people, people pushing prams and buggies); school children; and individuals who are not reached through the usual methods of consultation, such as elderly people and carers of young children). Rajé (2004a, p. 271) also highlights students and women of low-income as other members of society who are potentially more affected by community severance as derived from increases in bus fares. There

⁷ As these scholars elaborate, psychological and physical dimensions of severance pertain to barriers towards individuals, whilst social severance pertains to barriers towards communities as a whole (James *et al.*, 2005, pp.21-22).

remain, however, few empirical studies on this aspect of transport and so opportunities exist to extend this literature considerably.

Forced Relocation

Geurs *et al.* (2009, p.76) identify forced residential relocation as a social impact associated with the construction phase of transport infrastructure. As Hwang *et al.* (2011, pp. 76-78) elaborate, there are a number of important social, economic and health implications for residents who have been forced to relocate due to development projects. These include: being able to socially adapt to a new place of residence and 'host society' (p.77); dealing with the act of moving itself, for those longstanding residents who may have never moved previously (p.77); securing a post-migration livelihood and gainful employment (p.77); and mental and physical health impacts arising from such aspects as reduced social networks and social support systems (p.78).

Our review of the literature did not uncover many studies that focus on residential relocation as a result of transport construction projects *per se*, as those that consider forced relocation are typically focused on neighbourhood renewal and relocation schemes more generally (e.g. Kleinhans and Van der Laan Bouma-Doff, 2008), sporting events (see Porter *et al.*, 2009), or other types of construction projects, such as dams (e.g. Hwang *et al.*, 2011). Two studies that we did locate during the time period of interest are focused on transport-related resettlement processes in developing countries (Ndezi, 2009; Patel *et al.*, 2002). As Betts (2009, p.9) observes, it is in the developing world where the majority of Development Induced Displacement and Resettlement (DIDR) takes place.

Similar to other issues in this working paper, the distributional effects of forced relocation are under-explored within the literature. Patel *et al.*'s (2002) research on the resettlement of 60,000 residents to accommodate railway expansions and upgrades in Mumbai, for example, focus their analysis principally on the process of resettlement, not the characteristics of the residents undergoing relocation. These scholars do, however, recognised the particular disadvantages for women, who are more likely to rely on local employment opportunities and thus lose these as they relocate to more distant neighbourhoods; and children, as schools in the resettlement areas are not always able to accommodate the influx of new students (p.169). Aside

from emphasising the low-income nature of the people being resettled, there is little in the way of elaboration as to how this process affects particular groups. Nzedi's (2009) analysis of the resettlement of 36,000 inhabitants to accommodate the expansion of port-related facilities in Tanzania is similarly concerned more with process and wider implementation issues than the characteristics of the affected people. So whilst the issue of forced relocation more generally is one that we would identify as an opportunity for further research, its distributional effects are particularly so.

Uncertainty of Construction

Related to the issue of relocation is the uncertainty that residents face in light of the construction of transport infrastructure (Geurs *et al.*, 2009, p.76). Our review of the literature uncovered one study that focused explicitly on the role of uncertainty with regards to transport-infrastructure, and that is Marx's (2002) study of the impact of port facility expansion on local village residents in Doel, Belgium. His research design involved surveying 159 households (416 residents) regarding their decision to remain in the village under three different port expansion scenarios: an 'uncertainty scenario' (e.g. where residents knew the port would expand, but not to what extent); and two scenarios with varying degrees of 'hypothetical certainty' (e.g. where residents were told that only a planned dock would be constructed or that a dock with additional industrial facilities would be constructed, respectively).

Marx's (2002) research revealed that uncertainty has a significant impact on the decision to move for residents: only 35.8% of households were sure of staying in the village under the 'uncertainty scenario' (this compares with 44% of households being certain of leaving and a further 20.1% of households having doubts about remaining in the village). He further concluded that uncertainty would have a significant impact on the village as a whole: not only would it result in a loss of services and amenities for those residents who choose to remain, it would compromise the ability to attract new residents to the area, contributing to further social and economic decline. The distributional effects of uncertainty in relation to transport construction also emerged within this study. Marx's (2002) survey revealed that elderly residents living in single-person households were most likely to remain in the community, whilst younger residents and those in larger families were more likely to relocate.

Despite the importance of this issue and significance of these findings, we were unable to find any other studies that focused explicitly on the role of uncertainty associated with transportation projects. Accordingly, we could argue that this is an important opportunity for further research, particularly with respect to the distributional effects of uncertainty.

Visual Quality

A smaller subset of the literature as reviewed for this working paper investigates visual quality and aesthetics as a form of social impact, in terms of the presence of vehicles themselves and the presence of transport infrastructure more generally (Geurs *et al.*, 2009, p.75). As Taylor (2003, p. 1610) observes, the relative lack of attention to this area of study is remarkable, given the significance of the experience of motor vehicle traffic in modern urban life, and the ways in which urban form and the aesthetic character of cities have been radically transformed to accommodate car-based travel (pp.1612-1614). As Hess (2006) elaborates, for example, transport schemes were an important component of the City Beautiful planning movement in America. Two main themes are observed within this literature: vehicle aesthetics and their impact on the pedestrian environment (e.g. Bayley *et al.*, 2004; Wright and Curtis, 2002); and transport-related landscaping features (including signage and other forms of 'street furniture') and their impact on active travel (e.g. Humpel *et al.*, 2004) and safety (via accident rates) (Mok *et al.*, 2006).

As Wright and Curtis (2005) assert, the aesthetics of motorcars (e.g. paintwork, body shape, windscreens and headlights) are essential features in their popularity with drivers. And yet these scholars also recognise the adverse visual impact that vehicle aesthetics have on the landscape and the ways in which they dominate street frontages, particularly in suburban environments (p.13). Whilst there are few empirical studies available in this area for comparison, Bayley *et al.*'s (2004) research on the impact of vehicles on the pedestrian environment is instructive, in that it revealed that the size of motorcar has an adverse impact, with large vehicles with high roof-lines (such as SUVs), being notable in this regard. Agglomerations of vehicles, such as lines of stationary/parked vehicles and lines of moving traffic, were also found to be 'visually claustrophobic' to research participants (p. 449). Wright and Curtis (2002) similarly emphasise the size and design of vehicles in the contribution to a positive aesthetic environment for pedestrians, but further cite a number of other

transport related features that contribute to 'aesthetic degradation' (p. 146). These include: wide junctions that create 'no-go' areas for pedestrians; road markings (e.g. hatchings and coloured surfaces); and street furniture, such as street lamps and signage. These scholars argue that a more positive aesthetic environment for pedestrians would be achieved by: removing vehicular traffic from heavily pedestrian areas; reducing the size of street furniture and integrating it into the existing fabric; and more creative design of pedestrian environments (Wright and Curtis, 2002, p. 148). Similar findings were revealed in Mullan's (2003) research with 11-16 year olds in Wales, in which high levels of traffic and car parking were cited as factors negatively affecting young people's views of their local area as a good place to grow up.

Roadside landscaping has also been studied in relation to public safety via driving behaviour and accident rates. In their before-and-after study of ten sites in Texas, Mok *et al.* (2006) discovered that roadside landscaping treatments resulted in a significant decrease in crash rates at eight sites, and overall decreases in tree collisions were observed. These data were described, however, as 'very coarse' (p. 272) and it was recognised that further research was required before landscaping treatments could deliberately be employed as an accident mitigation strategy.

The safety impacts of particular roadside features, such as gateway monuments (e.g. freestanding roadside structures or signage), have also been studied. In their before and after study of crash data in relation to the construction of seven gateway monuments at five sites in California, for example, Ye *et al.*, (2011) found that monuments do not have a negative impact on traffic safety. Whilst these scholars recognised that their findings cannot be used as a basis for advocating gateway monuments as safety treatments (p. 300), they confirmed that these particular roadside features were not detrimental to safety; thus contradicting a common assumption made by traffic engineers that roadside landscaping generates traffic hazards (e.g. Wilde, 2009).

As noted previously, the literature pertaining to the aesthetics of transport (as a social impact) tends to be focused on motorcars and related environments. There are few studies that examine the aesthetic feature of other sorts of transport infrastructure (though see Kido's (2005) work on the aesthetics of train stations in Japan). There is also little examination of the distributional effects of these visual impacts. As a

consequence, further research into these areas is required in order for policy makers to better understand how the aesthetic aspects of vehicles, signage and street furniture affect various segments of society

Historical and Cultural Resources

An emphasis within the literature in this area is the effects of road and rail traffic-induced vibration on heritage buildings (e.g. Crispino and D'Apuzzo, 2001; Erkal *et al.*, 2010; and Kliukas *et al.*, 2008). As Kliukas *et al.* (2008, p. 324) observe:

Traffic-induced vibration does not represent, in general, an immediate hazard to buildings, but in time it can worsen the state of a building or even lead to its failure.

Given the aesthetic value of these structures, even cosmetic or minor damage to historic buildings from traffic-induced vibration is viewed as significant and affecting the quality of life in cities (Crispino and D'Apuzzo, 2001).

There is something of a tension observed within the literature in this regard. Certainly, transport's earlier impact on these resources was rather poor, with cities the world over having lost many of their architecturally significant buildings and historic neighbourhoods through the introduction of expressway schemes and related urban renewal initiatives following the Second World War (see, for example, Mohl, 2004, 2008; Rockwell, 2009; and others). At the other end of the spectrum, however, roads and road landscapes are increasingly being recognised as having cultural and historical significance themselves and therefore being listed and protected (Grazuleviciute-Vileniske and Matijosaitiene, 2010).

The studies cited above are typically focused on measurement and prediction techniques to better understand how vehicle size and type, distance to road or railway, and level and speed of traffic affect particular historic buildings; the wider distributional effects upon society are not considered. This is therefore one of a number of opportunities for further research, as we elaborate in the final section of this working paper.

Two main guidance documents within the UK recognise the importance of transport infrastructure on built and cultural heritage: the Highways Agency's (2007) guidance note for Historic Landscape Assessment (HLA); and the Department for Transport's (DfT, 2008) Design Manual for Roads and Bridges (Volume 11, Section 3, Part 2,

<http://www.dft.gov.uk/ha/standards/dmrb/vol11/section3.htm>). Both sets of guidance notes provide details for preliminary (scoping), simple and detailed assessment processes as part of their environmental assessment framework. Whilst these documents recognise the importance of built and cultural heritage to people who access and use such sites, there is no elaboration as to how various groups within society value or access heritage resources.

Physical Fitness

Thus far, we have focused on the types of social impacts which are predominantly associated with the dis-benefits of the transport system, but as Geurs *et al.* (2009) elaborate (see p. 6 this working paper), transport impacts can also have positive social effects. The issue of positive social impacts derived from the perceived health benefits associated with walking and cycling is one example of this within a relatively new, yet burgeoning literature, particularly with regards to the influence that the design of the built environment has on mode of travel (see, for example, Frank and Kavage, 2009; Handy *et al.*, 2002; and Saelens *et al.*, 2003 for some of these debates). Whilst the health benefits associated with an increase in physical activity are widely documented (e.g. BMA, 2009), there remain a number of unresolved issues as to whether the introduction of new transport infrastructure (e.g. Olgivie *et al.*, 2010), or other changes to the built environment (Coulson *et al.*, 2011), can reliably or predictably lead to an increase in active travel for residents.

Coulson *et al.*'s (2011) research on home zone⁸ remodelling in a neighbourhood in Bristol, for example, revealed that whilst residents felt that there were substantive aesthetic improvements to their area (p. 305), most focus group participants did not feel that their level of physical activity had increased as a result of this physical planning intervention (p. 306). The introduction of a cycle-walkway as part of this scheme also appeared to have little impact on the physical activity levels of research participants (p. 307). Similarly, Biddulph's (2010) monitoring of 14 recently completed home zone pilot projects in the UK reveals that residents did not spend more time in their streets following the remodelling, despite overwhelmingly citing aesthetic improvements to their neighbourhoods. Whilst neither study examined the distributional effects of these remodelling schemes, Biddulph (2010) and Coulson *et*

⁸ The term 'Home Zones' (or 'shared space') is used to refer to the UK version of the Dutch 'woonerf' concept, in which residential streets are redesigned and modified to enhance opportunities for pedestrian activity and reduce the dominance of motorcars (see Biddulph, 2010).

al., (2011) did recognise the advantages for children, as parents became more likely to let their children play outside.

Furthermore, not all scholars are in agreement as to whether a reliance on walking or cycling for transport offers only health *benefits*. Bostock (2001, pp.11-12), for example, in her research with single-mothers in the Midlands, recognises the disadvantages associated with walking:

[F]or some segments of the population, walking is compulsory and a source of both physical fatigue and psycho-social stress. At best, it could be said to have contradictory health effects for such groups: positive features include exercise while negative effects create fatigue and stress. At worst, walking may be health damaging.

Thus, the extent to which walking may provide health benefits or dis-benefits relates to the degree of choice of travel mode, with those individuals who walk or cycle for pleasure experiencing the former whilst those without alternatives experiencing the latter. As access to private transport is necessarily related to socioeconomic status, there are clear class dimensions to the health benefits of active travel. Bostock (2001, p.12) identifies three main negative health effects associated with compulsory active travel: psycho-social pressures associated with managing the demands of children whilst walking; physical fatigue as a result of long journeys; and limited access to health care and retail services, including hospitals and food shops. Her research thus is indicative of one of the major tensions observed within the literature, between sustainability (which ultimately seeks to secure modal shift and discourage car use) and social exclusion (which recognises the social and health benefits of car use).

Intrinsic Value/Journey Quality

Geurs *et al.* (2009, p. 78) also recognise the intrinsic value of travel and the enjoyment that people can experience from travel itself as a potential social benefit. The focus on the travel experience and travel for its own sake (what Cao *et al.* (2009) refer to as ‘autotelic’, or undirected travel), is a relatively new area of study and one that completely contradicts the traditional assumption within transport, namely that all travel is a derived demand (see, for example, Choo *et al.*, 2005; Ellaway *et al.*, 2003; Lois and López-Sáez, 2009; Mokhtarian and Salomon, 2001; Shiefelbusch, 2010; and

the 2005 special issue of *Transportation Research Part A* 39(2-3), for some of these studies). Cao *et al.* (2009, p. 234) distinguish between two types of ‘autotelic’ travel: unnecessary trips (where there is no particular destination in mind); and necessary trips with ‘unnecessary activities’, such as those where more distant destinations are visited and a longer-than-necessary journey is undertaken.

As Cao *et al.* (2009) further observe, not all autotelic trips are undertaken by car, in fact the literature on the physical fitness benefits of transport is categorised as autotelic walking and cycling (p.234), yet the car does feature within this type of travel (e.g. Handy *et al.*, 2005; Steg, 2005) and has thus been recognised within urban planning as a form of travel that should be reduced if transport problems are to be addressed (Handy, 2006, p.276). As Shiefelbusch (2010, p. 216) observes, however, there is a ‘modal imbalance’ with respect to the recognition of, and engagement with, the emotional experience of travel. As he elaborates:

[U]nlike transport planning, the car manufacturing industry has known and used the ‘emotional appeal’ of their products since their invention. Over time, car design and marketing has made ever greater use of the non-rational dimension of travel, with good results ... For public transport, the opposite development can be observed. Its character as a ‘collective’ service already leads to a different emotional profile and limits its possibilities to compete with the car ... This has without doubt affected its position negatively – in its perception among the citizens as well as professionals.

The distributional effects of the intrinsic value of travel have received less attention within the literature relative to other social impacts of transport, and so remain an opportunity for further research. Some of the studies reviewed for this working paper, however, suggest that certain segments of society are more likely to engage in undirected driving. For example, Cao *et al.* (2009, p.248) discovered that age, education, and number of children under 18 years of age are correlated with this type of travel. In addition, Steg’s (2005) research with car drivers in the Netherlands revealed that male and younger study participants exhibited symbolic and affective motives for car use, rather than intrinsic motivations. Similar findings regarding

gender and age have been confirmed by Ellaway *et al.*, (2003); and Lois and López-Sáez (2009), respectively.

Wider Social Considerations

The social and distributional effects elaborated in the previous section can be seen to relate to a number of wider social considerations, such as the development and maintenance of people's social networks and social capital, social isolation and independence in later life, and social exclusion. These are also issues which have seen greater recognition and coverage within the transport literatures over the last ten or so years, but interest in the potential role of transport in these social processes has not necessarily been reflected within the social sciences, with the exception of the 'new mobilities' literatures (Kaufmann *et al.*, 2004; Sheller and Urry, 2006; Urry, 2007; Ohnmacht *et al.*, 2009).

We now briefly touch upon some of the key literatures we have identified across these three broad themes, but with recognition that these aspects of the wider study will be explored in the workshop series that follows and will be more fully reported on at a later stage of the research programme.

Social networks and social capital

Much of the social networks literature has predominantly focused on the relationship of people's social networks and their social capital (material, financial, practical, cognitive, informational resources). The role of transport in terms of these social interactions is not well understood, mainly due to lack of appropriate data and methods, although this is changing (Axhausen, 2008). Recognising that a relevant portion of human travel is oriented towards interaction with others (Axhausen, 2005), a growing body of literature now explores the relationship between transport, social networks and social capital (e.g. Currie and Stanley, 2008; Carrasco *et al.*, 2008; Frei *et al.*, 2009).

In this context, the link between social exclusion, social networks, and social capital is starting to receive attention within the travel behaviour debates, recognising that social capital constitutes a key concept to encompass desirable social policy goals that may be associated with transport (Stanley and Vella-Brodrick, 2009). Urry (2002) for example, argues that full, active, and engaged members of society require social

capital within localities, and that their participation involves transportation and mobility. In a similar vein, Currie and Stanley (2008) argue that the role of transport in social capital has been overlooked, with a need for better understanding how transport acts to address social disadvantage through the provision of mobility. These authors further identify “plausible links” between transport and “positive” social interaction, such as the role of car dependence, spatial relations, co-presence, and well-being. At the same time, the literature still tends to focus mostly on theoretical developments (e.g., Doi *et al.* 2008), although a few studies (Hartell, 2008; Farber and Páez 2009) have started to empirically examine links between social capital and transport.

However, quantitative primary research measuring the role of travel in social exclusion and social capital remains scarce, both in terms of methods and empirical findings. In fact, authors such as Stanley and Vella-Brodick (2009) recognize that “little theoretical work has been undertaken on social capital and transport, apart from the recognition that it does play a role” (p.90), calling for more explicit measures around social capital and community, especially since social interaction in this context tends to be viewed “narrowly and specifically”. Then, although there are reasonable intuitions and expectations about the relevance of transport in people’s social exclusion, a broad scope for research to quantify and identify those links remains.

Social isolation and independence in later life

An additional set of social considerations is the relationship between mobility, social isolation and independence, particularly for older people. Over the last decade, there has been increasing interest in, and recognition of, the relationship between mobility and quality of life⁹ for the elderly (e.g. Banister and Bowling, 2004; Metz, 2000; Ziegler and Schwanen, 2011). As Schwanen and Ziegler (2011, p. 720) assert, mobility, wellbeing, and independence are: ‘intricately connected with each another in many ways, especially in later life’. As these scholars further observe (p.720):

[M]obility allows older people to engage in everyday activities outside the home that are meaningful and enhance wellbeing, whilst independent living gives older people

⁹ As Schwanen and Zeigler (2011, p.721) observe, a distinction between the terms ‘wellbeing’ and ‘quality of life’ is evident in the literature, however we would concur with these scholars that the terms are ‘more or less interchangeable’.

control over the times and places in which activities are carried out.

Access to a car, for example, has been correlated with improved perceptions of quality of life for the elderly, and greater participation in social activities (Banister and Bowling, 2004, pp. 109-110). Loss of mobility, such as derived from age-related disability or the inability to continue driving a car safely, is thus viewed as significantly diminishing wellbeing for the elderly (Metz, 2000, p. 149). Loss of mobility can also contribute to the social isolation and exclusion of the elderly, particularly in rural areas, where as Dwyer and Hardill (2011, pp. 246-247) observe, isolation is less visible than in more urban areas in part because of older people's reluctance to acknowledge their experience with exclusion, and partly because the lower population densities in rural areas makes the collective experience with exclusion appear less significant.

Research in the area of transport and wellbeing recognises that mobility is a multidimensional concept that includes not only movement in physical space, but psychological space (Zeigler and Schwanen, 2011). Thus Zeigler and Schwanen (2011) suggest that driving cessation, which commonly results in fewer out-of-home activities for many elderly people, will not only compromise physical mobility, but adversely affect such fundamental psychological elements as life-satisfaction, happiness, and sense of self. Just as the concept of mobility needs to be expanded to include this psychological dimension (Zeigler and Schwanen, 2011), we would suggest that the social impacts of transport could benefit from a more nuanced understanding of what constitutes mobility. We recognise, for example, that the social impacts as summarised in Table 1 are largely based on a conventional understanding of mobility that emphasises movement in physical space.

Social exclusion

In the late 1990s and early 2000s, debates within the transport literatures moved away from discussions of transport inequalities *per se* towards the broader consequences associated with the inability to access or participate in key life activities, such as employment opportunities, education and training, health care, food shops and leisure and cultural activities (e.g. Church and Frost, 1999; TRaC, 2000; Hine and Mitchell, 2001; Lucas *et al.*, 2001). In 2003, the Social Exclusion Unit Report formally

identified lack of transport as a contributing factor in the social exclusion of already disadvantaged and vulnerable population groups, and this sparked a raft of UK-based studies exploring different aspects of this issue for different disadvantaged segments of the population and in particular geographical contexts (e.g. Hodgson and Turner, 2003; Kenyon *et al.*, 2003; Rajé, 2004b; McDonagh, 2006; Preston and Rajé, 2007; Mackett *et al.*, 2008; Jones and Wixey, 2008; Bristow *et al.*, 2008; Lucas *et al.*, 2008; Wright *et al.*, 2009). These studies have helped to demonstrate the highly context- and person-specific nature of the phenomenon, confirm that not all socially excluded people are necessarily transport disadvantaged, and reveal that being transport disadvantaged does not always result in social exclusion.

There has also been steadily growing international research interest in this area. In mainland Europe, for example, Schonfelder and Axhausen (2004) analysed the activity spaces of different income populations in two German cities; Cebollada (2009) mapped accessibility and social exclusion in Barcelona 2009; Priya and Uteng (2009) examined differential access to driving licences by Norwegian migrants; and Priya Uteng (2009) considered the self-imposed exclusionary boundaries of ethnic women.

In North America, the related *environmental justice* perspective has also long served to offer similar analyses of the social impacts of transport disadvantage on low-income individuals and communities (e.g. Cervero, 2004). More recently, McCray (2009) considered perceptions of safety in relation to modal use in relation to exclusion from activities in Quebec; and Paez *et al.* (2009) undertook an extensive study for the Canadian Directorate of Social Policy and Research to explore the exclusion of older people, lone parents and low-income households from key activities in three Canadian cities. Elsewhere, Australian researchers have also pioneered research in this area, considering the accessibility needs of different social groups in Sydney (e.g. Hurni, 2006; Batellino, 2009) and Melbourne (e.g. Currie *et al.*, 2010; Currie and Delbosc, 2010), as well as considering the role of public transport in meeting these needs (e.g. Loader and Stanley, 2009). Rose *et al.* (2009) have also researched the issue of transport and social exclusion in the context of New Zealand cities.

The authors have extensively reviewed this material elsewhere (Lucas, 2004; Lucas, 2006; Lucas, 2010), and as such we do not wish to duplicate this effort here. We

believe that the main contribution of these literatures has been to: a) establish transport and mobility, or rather the lack of it, as a *social policy* problem, b) differentiate between constraints which predominantly rest with the affected *individuals* and the *system of provision*, and c) ‘give voice’ to the lived experiences of affected groups and individuals. As Currie and Delbosc (2010) note and has also been commented on in workshops for this study¹⁰, one possible research deficiency in this area has been its inability to sufficiently quantify the extent and severity of the relationship between transport disadvantage and associated social exclusion or to adequately identify ways of assigning monetary values to social benefits which accrue from policy interventions to reduce these negative impacts.

Conclusions

The importance of the social and distributional impacts of transport has historically been underestimated. As we have illustrated in this working paper, this is likely because: a) the issues cut across a number of different disciplines, are thus conceptualized differently and treated separately and there are a number of institutional barriers to be overcome before they are more widely disseminated within policy environments; b) these impacts are not all readily quantifiable in the way that environmental and economic impacts are, thus making them more difficult to assess and be integrated into transport policy; and c) they have generally been assigned low priority, and the lack of financial and political will observed more generally within the context of socially inclusive transport projects in the UK (e.g. Lucas, 2006) can be expected to continue in light of the current political and economic climates of many countries.

And yet it is precisely because of these challenges that the treatment of the social and distributional impacts of transport needs to change. Certainly, a number of important insights gained from this review suggest that they:

- **largely comprise negative impacts**, with the majority reflecting *disbenefits* (either implicitly or explicitly), as opposed to benefits *per se* (with access to spatially distributed services and activities being one notable exception);
- **tend to negatively and consistently affect the most socially excluded members of society**, not only within the context of injuries and casualties (e.g.

¹⁰ See Policy Briefing Note 1 http://www.tsu.ox.ac.uk/research/uktrcse/UKTRC-policy_briefing_note1.pdf

following Short and Pinet-Peralta's (2010) observation that there are 'no accidents'), but for the full range of impacts identified in Table 1;

- **operate at a range of scales**, from the individual/household level, to that of the neighbourhood, community and national level; and
- **are not mutually exclusive**, as most of the impacts described in this working paper intersect with other transport-related effects.

The complexity of these impacts is thus becoming increasingly clear, and the ability of policy makers to engage with these issues successfully is necessarily dependent upon further research. Key opportunities that we would recognize include:

- **Greater attention paid to the full range of impacts**, such as visual quality and aesthetics, uncertainty of construction, forced relocation (in a contemporary context and in the developed world), historical and cultural resources, cultural diversity, and journey quality;
- **More emphasis on the full range of distributional effects for each impact** (e.g. beyond road pricing schemes and environmental taxes and particularly for those under-examined issues cited above);
- **Expanding the range and type of modes studied**, to enable a more comprehensive understanding of the impacts associated with modes other than motorcars and vehicular traffic, which tend to dominate in this literature;
- **Greater emphasis on the longer-term temporal implications of transport-related social impacts**, to enable a more comprehensive understanding of the issues beyond immediate or short-term impacts (the literature on children's attitudes towards car-based travel and the implications for 'drivers of the future' (see Kohn, 2011) is instructive in this regard); and
- **Addressing the glaring oversight into cognitive issues and personal skills and capacities in relation to network capital.** Socially disadvantaged individuals have been found to often struggle to understand the complexities of the public transport system, particularly within large cities, and may lack the necessary literacy and numeracy and ICT skills to access information about transport services (Lucas *et al.*, 2001; Morris, 2004; Fontanes *et al.*, 2006). Schwanen and Lucas (2011) also note the evidence to suggest that the early cognitive experiences of children may affect the way in which they perceive their future transport choices and serve to instil in them positive or negative *social learning* about travel which remain with them into later life (Sheller, 2004), generating longer-term implications as cited above.

It is becoming increasingly apparent that the policy implications associated with the social and distributional impacts of transport are critical to the future treatment of transport-related social exclusion. Whilst we have already highlighted the linkages between these impacts and wider considerations (pp.36-40), we further suggest that they relate to broader debates about the *transport disadvantage* of different social groups. Not unlike many concepts within the literature on transport and social exclusion, the notion of transport disadvantage is multidimensional (Delbosc and Currie, 2011, p.171) and one that has been elaborated and refined over the years. As Currie *et al.* (2010, p.288) observe, the concept used to refer exclusively to those individuals who do not have access to a car, and are hence overly reliant upon public transport, or neighbourhoods with poor access to public transport (Delbosc and Currie, 2011, p. 171); although as Denmark (1998, p. 231) highlights, transport disadvantaged people may also have difficulties using the public transport system. Examples of those groups within society that have traditionally been described as transport disadvantaged (or ‘transit captive’) include: women (e.g. Hamilton and Jenkins, 2000); the elderly, low income households and young people (e.g. Dodson *et al.*, 2007b); and people with physical impairments and disabilities (e.g. Casas, 2007).

As Currie *et al.* (2010, p.288) elaborate however, the concept has since expanded to include low-income households typically living in peripheral/fringe neighbourhoods who experience ‘forced car ownership’ and the resultant ‘transport poverty’ associated with the high costs of private transport, particularly in light of rising fuel prices (e.g. Dodson and Sipe, 2007). Recent research in Melbourne, for example, suggests that the proportion of low-income households on the urban fringe who have experienced enforced car ownership and transport poverty is greater than the proportion without cars (Currie and Senbergs, 2007).

The evolution of this concept reveals in part how increased access to private transport generates costs as well as benefits for low income and other marginalized groups within society. The social and distributional impacts of transport as detailed in this working paper can thus be viewed as additional elements of transport disadvantage, and we would suggest that further elaborations of this concept would benefit from including these elements. It is apparent that the distributional effects tend to be most pronounced for, and overlap with, those groups cited above. This is perhaps the paradox of transport for marginalized groups within society: they are more likely to

experience disadvantage as a result of lack of access to transport (both public and private); yet when access increases at an individual level (such as in the case of car ownership), or at an aggregate level (such as when low income communities are in close proximity to transport facilities), they are also disproportionately more likely to experience disadvantage.

Recognition of and engagement with this paradox can help policy makers move towards more equitable transport networks and plans. Yet, it is only through better understanding of the complex and nuanced nature of the social and distributional impacts of transport that these wider equity objectives will be achieved. Not unlike, perhaps, the opportunity presented by the introduction of accessibility planning in the previous decade (e.g. Lucas, 2006), whereby academics, practitioners, policy makers, and consultants collaborated ‘to pioneer a programme of research to make evident the links between transport and social exclusion’ (p. 808) and ultimately influenced a generation of central and local government decision making, a focus on the social and distributional impacts of transport presents another important opportunity to ‘ensure a more socially just system of transport spending and delivery’ (p. 807) in this decade and beyond.

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Appendix A: Databases Searched and Terms Used

Databases	Search Terms
Geobase	Accessibility and transport
Google Scholar	accidents and aviation
IBSS: International Bibliography of the Social Sciences	accidents and shipping
ISI Web of Knowledge	Accidents children
Refworks/Pubmed	Ageing, transport, social exclusion
Social Sciences Abstracts	cars aesthetics
Summon (multiple database search engine)	children transport
Web of Science	community severance
	disabled transport
	Distributional effects and transport
	Distributional impacts and transport
	Forced relocation
	Gender and transport
	gender transport
	health and transport
	health impacts transport
	heritage buildings traffic
	heritage buildings traffic vibration
	Older people and transport
	Option value and transport
	public transport level of service accessibility
	social impacts transport
	traffic accidents
	traffic aesthetics
	Traffic fatalities
	transit crime
	transport accessibility
	transport accidents

Databases	Search Terms
	Transport accidents rail transport aesthetics Transport aesthetics rail Transport air quality Transport and accessibility transport and air quality health impacts Transport and fear of crime Transport and forced migration transport and health transport and noise nuisance transport cultural diversity Transport forced relocation Transport hazardous waste Transport noise children Transport physical activity Transport and social exclusion Transport and wellbeing/well-being Women and transport

Appendix B: Journals Reviewed

Journal	No. of Records	Journal	No. of Records
Accident Analysis and Prevention	3	Evaluation and Program Planning	2
Advanced Materials Research	1	Gender, Place, and Culture	1
Advances in Nursing Science	1	Gender, Work and Organization	1
Ageing & Society	4	Generations	1
American Journal of Epidemiology	1	Geoforum	2
American Journal of Preventative Medicine	2	Geographical Analysis	1
American Journal of Public Health	1	Health & Place	4
Annals of Behavioural Medicine	2	Health and Social Care in the Community	1
Annals of Tourism Research	1	Housing Studies	1
BMC Public Health	2	Injury Prevention	2
British Medical Journal	1	Innovation	2
Built Environment	4	Int Environ Agreements	1
Canadian Journal of Economics	1	Int'l Journal of Behavioral Nutrition & Physical Activity	1
Canadian Journal of Transportation	1	Int'l Journal of Environmental Research and Public Health	1
Cities	1	International Journal of Sustainable Transportation	2
Ecological Economics	1	International Social Science Journal	1
Energy Economics	1	Journal of Ageing	1
Environment and Behavior	1	Journal of Applied Gerontology	1
Environment and Planning A	5	Journal of Environmental Psychology	1
Environment and Planning B	2	Journal of Epidemiology and Community Health	2
Environment and Urbanization	2	Journal of Maps	1
Environment International	1	Journal of Mental Health Promotion	1
Environmental Education and Research	1	Journal of Navigation	1
Environmental Health Perspectives	2	Journal of Physical Activity	1
Environmental Impact Assessment Review	1	Journal of Planning Education and Research	2
Environmental Monitoring & Assessment	1	Journal of Planning Literature	1
European Journal of Public Health	1	Journal of Policy History	1

Journal	No. of Records	Journal	No. of Records
Journal of Public Economics	1	Quality in Ageing and Older Adults	1
Journal of Public Transportation	2	Quality of Life Research	1
Journal of Social Policy	2	Research in Transportation Economics	3
Journal of Sound and Vibration	1	Risk Analysis	1
Journal of the American Planning Association	5	Science of the Total Environment	2
Journal of the Eastern Asia Society for Transportation Studies	1	Security Journal	1
Journal of Transport and Land Use	1	Social Indicators Research	2
Journal of Transport Economics and Policy (JTEP)	2	Social Science and Medicine	5
Journal of Transport Geography	18	Sociologia Ruralis	1
Journal of Urban Health	3	Sociological Review	1
Journal of Urban History	3	Space and Polity	2
Journal of Urban Planning and Development	1	The Gerontologist	1
Lancet	1	Tijdschrift voor economische en sociale geografie	1
Landscape and Urban Planning	1	Time and Society	1
Landscape Research	1	Tourism Management	3
Local Environment	1	Transport	1
Mobilities	3	Transport Policy	23
Noise & Health	4	Transport Reviews	4
People, Place & Policy Online	1	Transportation	6
Planning Practice and Research	1	Transportation Research Board	1
Planning Theory	1	Transportation Research Part A: Policy and Practice	8
Planning Theory & Practice	1	Transportation Research Part B: Methodological	1
Preventative Medicine	1	Transportation Research Part D: Transport and Environment	3
Proceedings of the ICE Municipal Engineer	3	Transportation Research Part F-Traffic Psychology & Behaviour	3
Professional Geographer	1	Transportation Research Record	6
Progress in Human Geography	1	Urban Affairs Review	1
Prometheus	1	Urban Geography	1
Public Health	1	Urban History Review	1
Public Works Management & Policy	1	Urban Policy and Research	2

Journal	No. of Records	Journal	No. of Records
Urban Studies	10		
WIT Transactions on the Built Environment	1		
International Journal of Urban and Regional Research	1		
New Zealand Journal of Social Sciences	1		
Theory, Culture & Society	1		
Sociology	1		
Grand Total	248		

Appendix C: Authors Reviewed

Theme/Author	No. of Records	Author	No. of Records
<i>Children and Mobility</i>			
Whitzman <i>et al.</i> (2010)	1	Hine (2009)	1
<i>Disabled People and Transport</i>			
Alfred and Woodcock (2008)	1	Disabled Persons Transport Advisory Committee (2002)	1
Anon. (undated)	1	Farber and Páez (2010)	1
Battellino (2009)	1	Penfold <i>et al.</i> (2008)	1
Clarke <i>et al.</i> (2009)	1	Schmocker <i>et al.</i> (2008)	1
<i>Distributional Effects</i>			
Anderson (2010)	1	Levinson (2010)	1
Bonsall and Kelly (2005)	1	Santos and Catchesides (2005)	1
Bureau (2011)	1	Santos and Rojey (2004)	1
Bureau and Glachant (2008)	1	Schweitzer and Taylor (2008)	1
Bureau and Glachant (2011)	1	Welsh <i>et al.</i> (2006)	1
Graham <i>et al.</i> (2009)	1	West (2002)	1
Kalinowska and Steininger (2009)	1		
<i>Ethnicity and Transport</i>			
Rajé (2004c)	1		
<i>Gender and Transport</i>			
Burgess (2008)	1	Hanson (2010)	1
Burgess (2009)	1	Law (1999)	1
Dobbs (2005)	1	Noack (2011)	1
Dobbs (2007)	1	Priya Uteng (2009)	1
Dowling (2000)	1	Siren and Hakamies-Blomqvist (2006)	1

Theme/Author	No. of Records	Author	No. of Records
Greed (2008)	1	Turner and Grieco (2000)	1
Hamilton and Jenkins (2000)	1		
<i>Health Impact Assessment</i>			
Forsyth <i>et al.</i> (2010)	1		
<i>Homelessness and Transport</i>			
Nichols and Cázares (2011)	1		
<i>Mobilities</i>			
Kaufmann <i>et al.</i> (2004)	1	Urry (2002)	1
Sheller and Urry (2006)	1	Urry (2007)	1
<i>Mobility and Wellbeing</i>			
Schwanen and Zeigler (2011)	1	Zeigler and Schwanen (2011)	1
<i>Older People and Social Exclusion</i>			
Dwyer and Hardill (2011)	1	Social Exclusion Unit (2006)	1
<i>Older People and Transport</i>			
Banister and Bowling (2004)	1	Risser <i>et al.</i> (2010)	1
Davey (2007)	1	Rosenbloom (2009)	1
Dobbs and Strain (2008)	1	Rosenbloom (2010)	1
Dunbar <i>et al.</i> (2004)	1	Shergold and Parkhurst (2010)	1
Gilhooly <i>et al.</i> (2002)	1	Su and Bell (2009)	1
Metz (2000)	1	Windle and Burholt (2003)	1
Park <i>et al.</i> (2010)	1		

Theme/Author	No. of Records	Author	No. of Records
<i>Social Impacts - Accessibility</i>			
(blank)	1	Geurs <i>et al.</i> (2010)	1
Casas (2007)	1	Hine (2004)	1
Cass <i>et al.</i> (2005)	1	Johnson <i>et al.</i> (2011)	1
Caubel (2006)	1	Kenyon (2010)	1
Chang (2003)	1	Khadaroo and Seetanah (2007)	1
Church and Marston (2003)	1	Khadaroo and Seetanah (2008)	1
Currie and Loader (2009)	1	Laird <i>et al.</i> (2009)	1
Department for Transport (2003)	1	Loader and Stanley (2009)	1
Department for Transport (2004)	1	MacDonald and Grieco (2006)	1
Department for Transport (2006)	1	Mackett <i>et al.</i> (2008)	1
Department for Transport (2007)	1	Martin <i>et al.</i> (2008)	1
Department for Transport (2010)	1	Nuworsoo <i>et al.</i> (2009)	1
DHC and the University of Westminster (2003)	1	Páez <i>et al.</i> (2010)	1
DHC and the University of Westminster (2004)	1	Preston and Rajé (2007)	1
Drew and Rowe (2010)	1	PTEG (2010)	1
EPSRC Project (undated)	1	Roson (2001)	1
Farrington (2007)	1	Rye and Mykura (2009)	1
Geurs and van Wee (2004)	1	Rye and Scotney (2004)	1
Geurs <i>et al.</i> (2006)	1	Schwanen and de Jong (2008)	1
Geurs <i>et al.</i> (2006)	1	Titheridge <i>et al.</i> (2009)	1
<i>Social Impacts - Accidents</i>			
Anbarci <i>et al.</i> (2009)	1	Jones <i>et al.</i> (2008)	1
Bazargan and Guzhva (2011)	1	Kopits and Cropper (2005)	1
Currie and Reynolds (2010)	1	Kopits and Cropper (2008)	1
Cutler and Malone (2005)	1	Laflamme <i>et al.</i> (2009)	1
Dahl (2004)	1	Naci <i>et al.</i> (2009)	1
Desapriya <i>et al.</i> (2011)	1	Peden <i>et al.</i> , (2004)	1

Theme/Author	No. of Records	Author	No. of Records
Edwards <i>et al.</i> (2006)	1	Short and Pinet-Peralta (2010)	1
Factor <i>et al.</i> (2010)	1	Tzannatos (2010)	1
Hasselberg and Laflamme (2005)	1	White <i>et al.</i> (2000)	1
<i>Social Impacts – Active Travel (Women)</i>			
Cleland <i>et al.</i> (2010)	1		
<i>Social Impacts – Aesthetics/Visual Quality</i>			
Bayley <i>et al.</i> (2004)	1	Taylor (2003)	1
Bayley <i>et al.</i> (2005)	1	Timms and Tight (2010)	1
Cerin <i>et al.</i> (2009)	1	Wright and Curtis (2002)	1
Hess (2006)	1	Wright and Curtis (2005)	1
Humpnell <i>et al.</i> (2004)	1	Ye <i>et al.</i> (2011)	1
Kido (2005)	1	Wilde (2009)	1
<i>Social Impacts – Air Quality</i>			
Forkenbrock and Schweitzer (1999)	1	Schweitzer and Zhou (2010)	1
Mingardo (2008)	1	Zuurbier <i>et al.</i> (2010)	1
<i>Social Impacts – Behaviour Aversion (children in cars)</i>			
Barker (2003)	1	Malone (2007)	1
Buliung <i>et al.</i> (2009)	1	Mattsson (2002)	1
Carver <i>et al.</i> (2008)	1	Scottish Executive (2003)	1
Kopnina (2011)	1	Yarlagadda and Srinivasan (2009)	1
<i>Social Impacts – Benefits</i>			
Lucas <i>et al.</i> (2008)	1		

Theme/Author	No. of Records	Author	No. of Records
<i>Social Impacts – Community Severance</i>			
Bjørnskau (2005)	1	Rajé (2004a)	1
Bradbury <i>et al.</i> (2007)	1	Rajé (2004b)	1
James <i>et al.</i> (2005)	1	Tomlinson and James (2005)	1
<i>Social Impacts – Concepts and Methods</i>			
Brocker <i>et al.</i> (2010)	1	Dodson <i>et al.</i> (2007)	1
Dodson <i>et al.</i> (2006)	1		
<i>Social Impacts – Conflict with Environmental Impacts</i>			
Root (1999)	1		
<i>Social Impacts – Dangerous Cargo</i>			
Schweitzer (2006)	1	Sonak <i>et al.</i> (2008)	1
<i>Social Impacts – Distributional effects</i>			
Christie <i>et al.</i> (2011)	1	van Hegel <i>et al.</i> (1999)	1
Sustainable Development Commission (2011)	1		
<i>Social Impacts – Economic</i>			
Preston and Wall (2008)	1		
<i>Social Impacts – Forced Relocation</i>			
Betts (2009)	1	Ndezi (2009)	1
Hwang <i>et al.</i> (2011)	1	Patel <i>et al.</i> (2002)	1
Kleinhans and Van der Laan Bouma-Doff (2008)	1	Porter <i>et al.</i> (2010)	1
<i>Social Impacts – Fuel Prices</i>			
Dodson and Sipe (2007)	1		

Theme/Author	No. of Records	Author	No. of Records
<i>Social Impacts – General</i>			
Atkins (2010)	1	Lucas <i>et al.</i> (2007)	1
Currie and Delbosc (2010)	1	Mitchell <i>et al.</i> (2007)	1
Currie and Delbosc (2011)	1	Parkhurst and Shergold (2009)	1
Delbosc and Currie (2011)	1	Sinha and Labi (2007)	1
Forkenbrock <i>et al.</i> (2001)	1	Stokols and Novaco (1981)	1
Gatersleben <i>et al.</i> (2007)	1	Thomopoulos <i>et al.</i> (2009)	1
Geurs <i>et al.</i> (2009)	1	Wright <i>et al.</i> (2009)	1
Golub and Kelley (2010)	1		
<i>Social Impacts – Health Impacts</i>			
Black and Black (2009)	1	Nicolopoulou-Stamati and Howard (2005)	1
British Medical Association (2009)	1	Ogilvie <i>et al.</i> (2006)	1
Frank and Kavage (2009)	1	Ogilvie <i>et al.</i> (2010a)	1
Gorman <i>et al.</i> (2003)	1	Ogilvie <i>et al.</i> (2010b)	1
Handy <i>et al.</i> (2002)	1	Saelens <i>et al.</i> (2003)	1
Haynes and Savage (2007)	1	Samimi <i>et al.</i> (2010)	1
McCarthy <i>et al.</i> (2010)	1	Thomson <i>et al.</i> (2008)	1
Mindell <i>et al.</i> (2004)	1	Wilkinson <i>et al.</i> (2011)	1
Monzón and Guerrero (2004)	1	Zimmerman (2005)	1
Morrison <i>et al.</i> (2004)	1		
<i>Social Impacts – Historical/Cultural Resources</i>			
Crispino and D'Apuzzo (2001)	1	Kliukas <i>et al.</i> (2008)	1
Department for Transport (2008)	1	Mohl (2004)	1
Erkal <i>et al.</i> (2010)	1	Mohl (2008)	1
Grazuleviciute-Vileniske and Matijosaitiene (2010)	1	Rockwell (2009)	1
Highways Agency (2007)	1		

Theme/Author	No. of Records	Author	No. of Records
<i>Social Impacts – Intrinsic Value</i>			
Cao <i>et al.</i> (2009)	1	Lois and López-Sáez (2009)	1
Choo <i>et al.</i> (2005)	1	Mokhtarian and Salomon (2001)	1
Ellaway <i>et al.</i> (2003)	1	Mokhtarian <i>et al.</i> (2001)	1
Handy (2005)	1	Schiefelbusch (2010)	1
Handy (2006)	1	Steg (2005)	1
<i>Social Impacts – Noise and Transport</i>			
Adams <i>et al.</i> (2006)	1	Greater London Authority (2004)	1
Berry (2008a)	1	Haines <i>et al.</i> (2003)	1
Berry (2008b)	1	Matheson <i>et al.</i> (2010)	1
Brainard <i>et al.</i> (2004)	1	Mayor of London (2004)	1
Bronzaft (2010)	1	Neitzel <i>et al.</i> (2009)	1
Clark <i>et al.</i> (2006)	1	Payer (2007)	1
Department for Environment, Food and Rural Affairs (2010)	1	Schade (2003)	1
Dinno <i>et al.</i> (2011)	1	Schreckenber <i>et al.</i> (2010)	1
Dratva <i>et al.</i> (2010)	1	Stansfeld <i>et al.</i> (2005)	1
Fyhri and Aasvang (2010)	1	World Health Organization (2011a)	1
Fyhri and Klæboe (2009)	1	World Health Organization (2011b)	1
<i>Social Impacts – Physical Activity</i>			
Biddulph (2010)	1	Coulson <i>et al.</i> (2011)	1
Bostock (2001)	1	Fyhri <i>et al.</i> (2011)	1
Boyce (2010)	1		
<i>Social Impacts – Road Pricing Schemes</i>			
Barham and May (2009)	1		

Theme/Author	No. of Records	Author	No. of Records
<i>Social Impacts – Safety/Security/Fear of Crime</i>			
Cozens <i>et al.</i> (2004)	1	Moore (2011)	1
Dickerson <i>et al.</i> (2007)	1	Mullan (2003)	1
Gershon <i>et al.</i> (2005)	1	Rosenbloom and Herbel (2009)	1
Liggett <i>et al.</i> (2003)	1	Smith (2008)	1
Loukaitou-Sideris and Fink (2009)	1	Wigan and Clarke (2006)	1
Loukaitou-Sideris <i>et al.</i> (2002)	1	Yavuz and Welch (2010)	1
<i>Social Impacts – Transport and Tourism</i>			
Albalate and Bel (2010)	1	Bel (2009)	1
<i>Social Impacts – Uncertainty of Construction</i>			
Marx (2002)	1		
<i>Social Impacts – Visual Quality</i>			
Mok <i>et al.</i> (2006)	1		
<i>Social Isolation</i>			
Cattan and Ingold (2003)	1		
<i>Transport and Cognitive Issues</i>			
Morris (2004)	1		
<i>Transport and Social Capital</i>			
Currie and Stanley (2008)	1	Hartell (2008)	1
Farber and Páez (2009)	1		

Theme/Author	No. of Records	Author	No. of Records
<i>Transport and Social Exclusion</i>			
Bristow <i>et al.</i> (2008)	1	Lucas (2010)	1
Casas <i>et al.</i> (2009)	1	Lucas (2011)	1
Cellobada (2009)	1	Lucas <i>et al.</i> (2001)	1
Church <i>et al.</i> (2000)	1	McDonagh (2006)	1
Currie (2010)	1	Morency <i>et al.</i> (2011)	1
Currie <i>et al.</i> (2007)	1	Ohnmacht <i>et al.</i> (2009)	1
Denmark (1998)	1	Páez <i>et al.</i> (2009)	1
Fontanes <i>et al.</i> (2006)	1	Preston and Hine (2000)	1
Hine (2007)	1	Rajé (2003)	1
Hine and Mitchell (2003)	1	Rose <i>et al.</i> (2009)	1
Hodgson and Turner (2003)	1	Rye and Carreno (2008)	1
Hurni (2006)	1	Schonfelder and Axhausen (2004)	1
Johnson <i>et al.</i> (2010)	1	Social Exclusion Unit (2003)	1
Jones and Wixey (2008)	1	Spinney <i>et al.</i> (2009)	1
Kenyon <i>et al.</i> (2003)	1	Stanley and Vella-Broderick (2009)	1
Lucas (2004)	1	Stanley <i>et al.</i> (2011)	1
Lucas (2006)	1	van Wee and Lucas (forthcoming)	1
<i>Transport and Social Networks</i>			
Axhausen (2005)	1	Frei <i>et al.</i> (2009)	1
Axhausen (2008)	1		
<i>Transport and Travel Behaviours</i>			
Dodson <i>et al.</i> (2010)	1	Schwanen and Lucas (2011)	1
Lucas <i>et al.</i> (2011)	1	Sheller (2004)	1

Theme/Author	No. of Records	Author	No. of Records
<i>Transport Disadvantage</i>			
Bayliss (2009)	1	Currie and Senbergs (2007)	1
Blumenberg (2004)	1	Currie <i>et al.</i> (2010)	1
Bromley et al. (2007)	1		
<i>Young People and Transport</i>			
De Witte <i>et al.</i> (2006)	1		

