



Faculty of the
Built Environment

Literature Review - The Treatment of Social and Distributional Impacts in Appraisal and Evaluation

Final Report

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FOREWORD

The objectives of this research programme are to enhance the Departments' understanding of the impact of transport provision, schemes, and policy on different social groups and areas, and the extent to which impacts are disproportionate for different groups and areas. This report presents the findings from the first of three stages conducted during the first phase of this research programme. This stage set out to gain a better understanding of the range of social and distributional impacts arising from transport schemes. The second phase was commissioned in September 2008, and will rigorously test the feasibility of these proposals.

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Executive Summary

Purpose

1. This literature review has been undertaken as part of a project for the Department for Transport (DfT) examining the current evaluation of Social and Distributional Impacts (SDIs) in transport scheme appraisal and evaluation. SDIs are the 'social' effects on individuals and communities arising from transport schemes - for example changes affecting an individual's mobility, or a community's ability to access services such as healthcare. They are distinct from the economic and environmental consequences of a transport intervention, although there is overlap between the categories. They may be the result of physical change, for example in local pollution levels, or as a response to changed opportunities to access services, facilities, or social networks. Impacts can also be seen to be 'distributed', as different groups in society may potentially be affected in different ways, and to a greater or lesser extent.
2. The Literature Review contributes to the first stage of the project, gaining a better understanding of the range of SDIs arising from transport schemes. To achieve this, the review has searched for and then considered literature on SDIs when related to transport. Wherever possible, empirical evidence of the impacts was drawn on.
3. The overall project has three objectives, which are:
 - *To understand how to better take social and distributional impacts into account in the development of transport scheme design and appraisal;*
 - *To examine how evidence from social research can best be integrated into appraisal so that it is given appropriate weight in decision-making; and*
 - *To identify the implications that any proposed approach(es) for better taking social and distributional impacts into account in appraisal may have for subsequent post-implementation transport scheme evaluation.*This review is expected to contribute directly to the first of these, and may provide some input for the responses to the second and third.
4. In line with the project brief, the review has considered social and distributional impacts without seeking to subdivide the evidence into those specific categories in the presentation. Neither has it attempted to categorise it according to specifically social or economic definitions of the term 'distributional' impacts.

Methodology

5. The methodology adopted was a simplified version of the rapid evidence assessment procedures, focussing primarily on the identification of relevant research from keyword searches in electronic databases. This was augmented by a request for material currently 'in publication' from academics and further experience-led gap-filling.
6. The keyword-relevant sources were initially checked for topic relevance, and then underwent an evaluation to see if they contained evidence of social and distributional impacts. This resulted in approximately 140 topic-relevant sources being identified, of which nearly 40 have been included in the review as relevant.
7. The review's primary evidence presentation is organised around the New Approach To Appraisal (NATA) framework objectives in order to maximise 'read across' to Stages 2 and 3 of this project. However this has not prevented evidence of SDIs outside of this framework from being included. The review process was conscious that material might be found which did not easily 'fit' the NATA classification, but

where this is the case it has still been included in the report, and identified as such.

Evidence in Respect of the Environment Objective

8. Most evidence under this objective relates to exposure to noise and gaseous emissions, with some consideration of landscape, townscape and physical fitness issues.
9. Noise: There is wide acceptance that transport is a major source of ambient noise in the environment today, and that negative impacts from it are experienced at both the personal and community level. In general, the social and distributional impacts arise from differential exposure by groups of different age and spatial location. Specific health issues have been identified for children, for example physiological evidence linking detrimental blood pressure and hormone level changes to noise exposure, and also indications of children suffering problems with cognitive ability as a result of noise. At the community level, studies have identified a relationship between traffic levels and disturbance caused by noise. This disturbance is seen to impact on physical and social activity levels on and around streets. Evidence has also been found for some spatial re-distribution of noise following transport development, in this instance relating to urban bypasses, where noise and disturbance has been transferred from urban to rural communities. Noise also has the ability to become a barrier, and thus has a role to play in severance.
10. Air Quality: Transport is now the most important source of airborne pollutants in this country, and links with health problems are well understood. There is still some uncertainty about the effects of long-term exposure to air pollution and health effects. Direct social and distributional impacts can be identified for groups defined by medical vulnerability and age, but also indirect relationships with income and ethnicity. As in the case of noise pollution, there is a spatial element to exposure, with more affordable housing and housing located close to employment opportunities often being found in areas with higher levels of air pollution. A further finding here is that the groups with the highest level of exposure - most of it transport-derived - often benefit least from the high levels of mobility brought by private cars.
11. Landscape/Townscape: Rural areas are likely to be subject to negative impacts on the landscape from transport schemes. Mitigation measures may help in some circumstances, but these often take time, for example waiting for planting to mature. One particular area of concern seems to be impacts on 'tranquillity' as noise may be a particularly intrusive element of a new scheme, and one which it is not possible to remedy. In respect of townscape, there appears to be more opportunity to improve areas around transport development and produce social benefits, as found in London on the route of the Jubilee Line Extension. Communities may benefit from an enhanced sense of place following from a high-quality redevelopment, and it can also create opportunities for more physical and social activity.
12. Physical Fitness: Evidence for this sub-objective exists partly in association with other sub-objectives (such as noise and severance). However, specific medical evidence also implies that SDIs can relate to age, since older people are the group that benefits most from increasing activity levels by walking more (and conversely then suffers most if walking levels are suppressed by external factors). More generally, however, more potential to enhance physical fitness effectively is seen to lie in encouraging cycling, which indicates that groups for whom cycling is out of reach might be disadvantaged. Evidence is also found for an unintended side effect

of improved public transport, in that it may reduce the amount of walking and cycling undertaken.

13. Gaps relating to the Environment objective include:

- The understanding of impacts created by the full range of modes, as most of the current evidence refers to road schemes.
- More information about impacts on property values of environmental effects from transport schemes. It seems likely that evidence exists relating to downward pressure on values created by the proximity of major schemes, but this did not emerge in the review.

Evidence in Respect of the Economy Objective

14. Travel Costs: Taking a historical perspective, an overall SDI is identified for low income groups because there has been a rise in public transport costs since 1985 and because low-income households spend a much higher proportion of household budget on transport than wealthier households. Moreover, attempts have been made to link low levels of observed mobility to ability to pay, arguing that it is lack of money which suppresses demand, not free choice. One specific group identified in the literature is young people, who are likely to have low incomes, even though they may come from relatively wealthy households. This may inhibit the journeys they can make, including those journeys that are particularly important to them such as travel to access education and training opportunities.

15. Regeneration: One set of evidence here is provided by the various light rail monitoring studies, covering systems in Tyne-and-Wear, Greater Manchester, Sheffield and Croydon, where the schemes had been justified partly on the regeneration benefits that might be delivered. Potentially, different groups might benefit differentially from such schemes, depending on the appropriateness of the travel opportunity and level of disadvantage prior to implementation. In practice, however, the evidence that light rail directly contributes to regeneration objectives is weak, and therefore any evidence about SDIs then arising must also be weak. However, there was some evidence that city centres might benefit more than inner city and suburban areas, which might imply that disadvantaged groups in inner city locations might not be obvious beneficiaries. An indirect finding of the light rail studies was that road schemes were more likely to be direct contributors to regeneration objectives being achieved than light rail, but no SDIs were reported. Further evidence is found in London, with the Jubilee Line Extension, where the conclusion is that regeneration has occurred, with positive SDIs for the communities along the route. However, it is noted that economic activity has probably been re-distributed in London, implying other areas may have suffered negative impacts.

16. Property Values: Evidence here relates to the potential for the direct or indirect effects of transport schemes to initiate mechanisms such as 'gentrification', which then enhance property values, creating benefits for property owners, possibly at the expense of property renters. There is also an SDI debate around Land Value Taxation, with the strongest evidence relating to the Jubilee Line Extension, via primary research with estate agents. Here, the key argument is that provision of the infrastructure by the state has resulted in transfers to land owners which should have in part been recovered by taxation.

17. Gaps relating to the Economic objective include:

- There seems to be a general presumption in the literature that increases in land and property values are 'good', with weak recognition that there may be loser groups amongst people who do not own properties. Evidence is needed on the effects of transport schemes on specific groups in the property market.

Evidence in Respect of the Safety Objective

18. As might be expected given that many premature deaths and injuries each year occur in relation to the transport system, there is an extensive literature on relative incidence of casualties. There is a more select literature relating to personal security.
19. Collision risk: High-profile SDIs relate to transport mode and age, with pedestrians, cyclists and motorcyclists being vulnerable mode-based groups and the young and old being vulnerable age groups. More subtle evidence relating to SDIs includes the finding that safety schemes around new roads relating to walking may be ineffective if they are insufficiently attractive by virtue of their design, thereby creating less safe conditions for pedestrians than might have been achieved with the new scheme (or than might have existed prior to the new road construction). Ethnicity also emerged as a factor in explaining incidence of collisions in more than one study. One of these, based in Birmingham, identified a statistically significant excess of injuries amongst "Asian children" over other ethnic groups, due to the higher likelihood of them playing amongst parked cars. Further evidence relates to SDIs amongst children according to socio-economic group and presence of a lone mother¹ or two parents in the household, with the casualty rate for the latter being half that of the former. Fear of being involved in an accident can be a factor in suppressing travel, with cyclists and children being two specifically identified groups.
20. Personal security: The main effect established in the literature is that particular groups can be deterred from making trips or making trips by a specific mode, due to their actual or perceived vulnerability. These issues become even more important if travel needs to be undertaken at night, or involves city-centre transport systems (perceived to be factors that increase the risk). Vulnerable groups include the young, the old, women and ethnic minorities. These vulnerable groups are also argued to be particularly disadvantaged by increases in car use costs (assuming they have access to one), where public transport is seen to be a particularly unacceptable alternative, for cultural reasons.
21. One interesting finding in this category was that the introduction of a new transport scheme, in this case the London Congestion Charge, had led some residents in neighbourhoods immediately outside the charging zone to feel that their 'sense of safety' had deteriorated.
22. Gaps relating to the Safety objective include:
 - There appears to be little research available into how the 'fear' of accidents may suppress travel by modes such as walking and cycling.

Evidence in Respect of the Accessibility Objective

23. A range of evidence is considered relating to personal mobility, the needs of communities, and also in terms of specific urban and rural accessibility issues and severance. Some specific points about the difficulty of effectively appraising accessibility needs are also identified, such as the fact that demand is often 'hidden' until new services are actually provided.
24. Rural Effects: Access to health care, education and employment emerge as the key rural concerns, with children, older persons and housewives² and women in general

¹ The studies refer specifically to single or lone mothers, not single or lone parents.

² This 1983 study *is* gender-specific in using this term.

identified as vulnerable groups. Positive examples of accessibility being enhanced through the use of public transport applications were reviewed, confirming the importance of buses in particular in addressing some needs.

25. Urban Effects: Evidence here comes mainly from light rail schemes, which found significant increases in mobility for particular groups, which could be interpreted as increasing accessibility and reducing deprivation. Specific evidence related to a higher rate of job creation and significantly reduced journey times in Croydon and an increased rate of travel by older persons where a new rail system replaced an old one in Manchester (although the rate of use by mobility impaired travellers did not change). However, studies of other rail systems - in Glasgow and the Jubilee Line - showed a low level of benefits experienced by long-standing residents of the areas served, suggesting their needs may not have been fully considered in appraisal. In relation to road transport in urban areas, one study considered potential SDIs arising from a possible future road pricing implementation. In this case, public transport users and ethnic minorities *perceived* themselves to be potential losers. This is not borne out by findings from a study of the Congestion Charge in London, which found little change in access for residents inside and outside the charging zone, with the exception of 'social gatherings', which were perceived to be widely reduced.
26. Severance: Although a widely recognised concept, there is evidence that many appraisal and evaluation studies in the past did not include this consideration. There is a debate as to how far communities 'recover' from severance, and adapt to the new circumstances, and how far the effects have health as well as quality of life impacts. Similarly, there is a debate as to how far severance is experienced as a physical or psychological barrier, and whether barriers are always negative since they can also provide 'definition' to communities.
27. Gaps relating to the Accessibility objective include:
 - Identifying or predicting psychological barriers in respect of severance, and the extent to which segregation mechanisms are perceived rather than physically experienced.
 - The mental health effects of changes in transport infrastructure.

Evidence in Respect of the Integration Objective

28. The light rail studies are important sources of evidence for this objective, as they often contained an underlying assumption that very close integration and coordination of public transport services was desirable. The proposed benefits, as illustrated in the study on the Tyne and Wear Metro, are twofold. First, that access to the system from other public transport networks (such as buses) would extend the benefits of the service to a wider community and, second, it would do away with unnecessary competition for passengers between rail and bus over the same routes. There is, however, recognition that where this requires additional interchanges, this may not be welcomed by all, as there is a time and effort penalty to changing modes.
29. One specific linkage with other areas of policy concerns urban rail and the guiding of development. There is some evidence from the Jubilee Line that the density of new development is greater along the line. In Sheffield transport investment more generally has been seen as important in opening up major derelict industrial sites to new development, with the implication that SDIs would be reduced by creating job opportunities for people in nearby housing areas which were formerly dependent on the iron and steel industries.

30. Some indications are found that transport development is considered to be complementary to other Government policies. However it is also highlighted in one report that there are actually conflicts between some Government policy goals, specifically environment and transport and economy in the example found, which prevent comprehensive integration.
31. Gaps relating to the Integration objective include:
 - An evidence gap - or at least a gap in the transport policy literature - exists around the extent to which increasing density generates or reduces SDIs.

Evidence Outside the NATA Framework

32. Population Migration: Evidence was seen in both Croydon and London for inward migration of people into areas now being served by new transport infrastructure (light rail and underground respectively). This was stronger in London where the migration was seen to change the character of some areas, and also led to changes in the services and facilities available.
33. Wider economic factors: In respect of some transport schemes, it was apparent that wider economic circumstances were likely to be instrumental in the level of SDIs that were affecting communities. For example, transport developments undertaken at the time of the economic depression in the early 1990s were perhaps unable to deliver on the benefits promised as quickly as it had been predicted that they would deliver.

Further Analysis of Evidence against Overall Project Objectives

34. An analysis of the various documents included in this review indicated very different levels of representation in the evidence for different social groups. Most studies concentrated on predetermined social groups in terms of expected impacts. Of these, many referred to 'younger' and 'older' people but there were also social groups described by dimensions other than age. Some groups expected to be considered were not seen in the material found for review. The analysis has also enabled an understanding of which social groups actually did experience the impacts.
35. There is a temporal dimension to SDIs, particularly in relation to major infrastructure schemes. In some cases the authors reviewed acknowledge themselves that their findings related to specific time periods only. There are significant methodological challenges to longer-term evaluations, although some road studies did cover periods of up to 30 years.
36. Specific possible limitations to appraisal and evaluation observed during the review relate to spatial boundary. As the traffic effects of road schemes, for example, may be very widespread, so too potentially are the SDIs. Specifically in the case of bypasses, in some cases SDI assessment has focussed on the bypassed community, but ignored the communities alongside the new road.
37. None of the studies reviewed were empirical tests of appraisal or evaluation. However, a number of comments across the literature reviewed suggested additions to, or amendments of, assessment and appraisal methods. These recommendations have been collated, and are found in Section 4.3 of this study.

Implications for Evaluation and Appraisal Frameworks

38. Some of the material reviewed has contained suggestions for improvements to the appraisal process. This material may provide input for the later stages of this project.
39. Environment: Several authors have proposed methodologies and tools for plotting, and even costing, environmental factors and vulnerable groups. It is also proposed that Health Impact Assessment (HIA) has a role to play in transport appraisal.
40. Economy: Observations were made that the current economic elements needed to be adapted to consider wider spatial areas, as well as providing greater depth of investigation. An argument was made for the consideration of 'Land Values' as part of any scheme appraisal.
41. Accessibility: Better integration with other appraisal methodologies across government was one suggestion, and an acceptance that there were no 'simple' ways of measuring accessibility was another. Again there were specific new tools and models promoted, as well as some specific measures which would help understand severance.
42. Integration: Better understanding of potential land use change and any resultant impacts on transport infrastructure were proposed in one study. Another contained a comprehensive set of suggestions for linking transport appraisal with appraisal processes in other government departments, and a way of creating 'common' indicators.
43. Another proposal, outside of the current NATA categories, was the use of 'Equity Audits'. The review also identified that there has been research undertaken in the US on the subject of SDIs, and measurement of them in transport appraisal for some time. Some suggestions are also identified from this literature.

Discussion of what overall review implies for Appraisal

44. Transport schemes generate a wide range of effects, and these can have consequences of both positive and negative SDIs. The NATA appraisal process appears to respond well to the breadth of issues that need to be considered; although there may be debates about the weighting that different issues are given. However, it is apparent from the range of suggestions made in the material reviewed that there is scope to amend and add to the current appraisal process in order to make it more responsive to SDIs. Some of these suggestions reflect concerns about specific issues, but others offer opportunities to achieve more consistency and integration with other appraisal processes in government. What is apparent from the review is that there are no calls to replace NATA at present, but certainly encouragement to learn lessons from the information we already have from appraisal and assessment.

Conclusions

45. Evidence exists about a number of SDIs, although within this there are clear areas of strength relating to age group (young, old), transport mode (road and urban rail investment), and appraisal objective (some types of environmental impact, safety, and accessibility).

46. Extensive empirical research was undertaken in the UK in the 1970s, particularly considering rural public transport needs, and there is a strong tradition of assessing SDIs in the United States. There is a greater tendency in contemporary studies to focus on theoretical, hypothetical analysis of possible outcomes of new types of transport scheme, such as road pricing.
47. In terms of the approach of methodologies to appraising and evaluating SDIs, there are limitations identified in respect of the length of time the appraisals cover and the breadth of appraisal boundaries.

1 Introduction

1.1 Purpose of Review

This Literature Review was produced for the Department for Transport (DfT), as a contribution to Stage 1 of a research project considering the treatment of Social and Distributional Impacts (SDI) in Transport Scheme Appraisal and Evaluation. The overall project is being jointly undertaken by Atkins, British Market Research Bureau (BMRB) and the Centre for Transport & Society (CTS) at the University of the West of England, Bristol. CTS has conducted the literature review.

The primary aim of the review was to provide a better understanding of the social research evidence that currently exists. The specification for the work provided by the DfT states that it will be a "*brief review*", and that it will "*need to review and draw together findings from the key sources of social research evidence on the social and distributional impacts of transport schemes*". These latter terms are defined in the DfT Project specification for this review as:

"The impacts on people's mobility and travel behaviour that are attributable to the introduction of a scheme. Impacts are wide ranging and can include things like trip suppression (i.e. someone not making a trip), changes to travel patterns (including change in mode, time of day, route etc), reduced access to jobs and key services (e.g. education, healthcare and quality food shops) and social participation, and improvements in local air quality and noise levels. The impacts of transport schemes are likely to affect different population groups in different ways and, therefore, this must be recognised in any assessment of impacts. There is some overlap between social, economic and environmental impacts, because economic and environmental impacts can have social consequences and vice versa".

Distributional impacts are further defined thus in the project brief:

"a term used by economists to describe the distribution of the costs or benefits of interventions across different groups in society" (HM Treasury Green book, 2006); this includes assessing impacts within economic appraisals of interventions. It is comparable to the social scientific concept of 'social impacts' and for the purpose of this study will be considered to have the same meaning as the social scientific understanding. Hence, we are not primarily concerned with identifying evidence about actual quantified costs/benefits in this review, although any such information will be included where relevant."

The review was intended to contribute a 'base' for the following stages of the project, but may also provide some direct response to Objective 1 in the DfT brief ('*To understand how to better take social and distributional impacts into account in the development of transport scheme design and appraisal*'). Some evidence may also help address Objectives 2 and 3 in the brief, which are "*To examine how evidence from social research can best be integrated into appraisal so that it is given appropriate weight in decision-making;*" and "*To identify the implications that any proposed approach(es) for better taking social and distributional impacts into account in appraisal may have for subsequent post-implementation transport scheme evaluation.*"

The review primarily focussed on 'empirical' evidence, with a specific goal to try to identify any 'evidence gaps' that were present, whether related to a type of transport scheme, impact or group. Where particularly relevant or pertinent, theoretical research was introduced when appropriate. Finally, the review attempted to concentrate primarily

on UK research material, although particularly relevant international studies have been included.

1.2 Origins of Concern over Social and Distributional Impacts of Transport Schemes.

The Project Specification for this review suggests that the key piece of UK literature in respect of this topic is the Social Exclusion Unit (SEU) report 'Making the Connections: Transport and Social Exclusion' (2003). This illustrated how transport allows people to access services and facilities such as employment, education, health, leisure and good quality food as well as enabling social interaction. It also investigated how a range of factors might encourage, or deter people from using transport, and thereby help ameliorate or contribute towards their social exclusion. These factors could include availability, accessibility and affordability of transport, concerns for personal safety (including road safety and crime/fear of crime), poor travel information and low travel horizons or aspirations.

Although 'Making the Connections' encapsulates much of the current understanding of the topic, some themes can be traced back to earlier research, and there are other elements of the interactions between society and transport that also generate social and distributional impacts. One such issue is (community) severance. This concept was first explored in the US in the late 1960s and early 1970s in San Francisco³. Research was carried out into the behaviour of residents in streets affected by heavy volumes of traffic, allowing researchers to understand how they were affected by transport. It is now defined by the SEU as "*the cumulative impact of psychological and physical barriers to movement and social participation, created by the transport infrastructure*" (SEU 2003).

Another concept that developed in the early 1970s was (personal) accessibility, introduced at a conference in 1970⁴. This has developed to become a key measure of whether or not people in communities can reach the services and facilities they need, and how well transport infrastructure is working. It has also become an important element in Local Transport Planning through the process of 'Accessibility Planning', and 'Accessibility Audits'.

Other transport related issues that have SDIs include noise and air quality. These issues have also been recognised for many years, with an extensive review of the potential affects published by the Royal Commission on Environmental Pollution (RCEP) in the 1990s (RCEP 1995). This clearly stated that: emissions from road vehicles are the major source of outdoor exposure to air pollution, noise in the environment is recognised as a health hazard by the World Health Organisation (WHO), and heavy road traffic diminishes the 'quality of life'. How these types of SDI might affect different groups in the community to a greater or lesser extent as a result of their social class has also been noted for some time. For example, it was highlighted in the 'Black Report'⁵, a review of national health trends and issues over the first thirty five years of the National Health Service, first published in 1980.

One final area that also underpins the consideration of SDIs is related to the concepts of environmental and social justice. The concept is broadly attempting to ensure that adverse environmental impacts from human activity (in this instance transport), do not fall disproportionately on minority, or disadvantaged sections of society. These terms perhaps have a greater resonance in US literature on this subject, where the concepts first

³ Appleyard D & Lintell M (1972). Journal of the American Institute of Planners.

⁴ Jones P. (1975) Accessibility, Mobility and travel need: Some problems of definition and measurement. Paper for IBG Transport Geography Study Group Conference. Birmingham, in Moseley (1977)

⁵ Townsend P, Davidson N & Whitehead M (1988). The Black Report and the Health Divide, Penguin. London

developed in Civil Rights legislation in the 1960s, and have now become enshrined in US law, with particular statutes relating to transport assessment⁶.

1.3 Document Structure

Section 2 provides a brief outline of the methodology employed in undertaking the review. Section 3 considers the evidence identified, organised around the New Approach to Appraisal (NATA) objectives and sub-objectives. Section 4 then provides further analysis of the evidence according to specific research questions raised by the project objectives. Finally, Section 5 will conclude by summarising the evidence gaps and other key findings, and make recommendations for Stages 2 and 3 of this project.

⁶ Executive Order 12898 on Environmental Justice. (1994), and specifically for transport, ‘The Intermodal Surface Transportation and Efficiency Act’ (1991) and ‘Transportation Equity Act for the 21st Century’ (1998).

2 Summary of Methodology

2.1 Selection of material

Please note this review was undertaken in September 2007. The review has carried out a search for existing readily-identifiable evidence on the SDIs of transport schemes that were:

- available in academic journals, books and other papers in physical libraries or in electronic libraries accessed through proprietary databases of abstracts to which UWE, Bristol subscribes⁷;
- on institutions' websites, accessed via public-domain search engines, notably Google;
- and supported by experience-guided searching, drawing on the expertise of the research team and wider consultations, for example with the Universities Transport Studies Group (UTSG).

A search strategy was developed which facilitated the identification of as many studies as possible, in order to address as fully as possible the research area in the time available. Relevant items were identified using criteria for assessment of quality.

The identification of evidence was based on the principle that research quality and relevance were more important for inclusion than disciplinary orientation or particular methodological approach.

2.2 Review processes

Searches for relevant literature were carried out against a number of electronic Databases, and the results captured. The search results were coded with respect to their level of relevance for inclusion in the study⁸.

It was considered important throughout the review that evidence was valid and reliable. Consideration was also given to the quality of the methodology, and the degree to which it was relevant.

The evidence identified is presented in Section 3. Where Harvard referencing is used the item was a primary source obtained and evaluated in full and the bibliographic details were included in the list at the end of the review. Some evidence was extracted as a secondary source, summarised in one of the primary sources, but was not - for resource or availability reasons - obtained as an independent document. Such items are identified as footnoted references.

⁷ In line with the Magenta Book recommendations, resources will not be dedicated to "hand searching of journals and textbooks, or searches of the grey literature (unpublished studies of work in progress)" (pp. 18-19).

⁸ Full details are available in a separate working note.

3 Evidence Classified by Current Appraisal and Evaluation Objectives

This section of the Literature Review considers the evidence acquired on SDIs which follow from the implementation of transport schemes and initiatives. The evidence has been categorised, and presented in a format which mirrors that of Objectives and Sub-objectives in the New Approach to Transport Appraisal (NATA) process. For example, where there is evidence that noise from transport schemes has produced an SDI then this has been related to the Environment Objective. It is intended that by using the NATA framework as a mechanism for categorising the issues it will make it easier for later stages of the research to consider the evidence from this review in relation to the current appraisal process, and any proposed changes. One further point to note is that the review will not seek to summarise knowledge about the nature of *overall* impacts from transport systems in general, but will endeavour to highlight social and distributional consequences arising from those impacts.

Further, it should be emphasised that the review starts from the evidence base, and not from the NATA sub-objectives. Hence, the evidence will be 'fitted on' to the objectives and it is likely there will be an imbalance between the amounts of evidence across the sub-objectives, with a relatively large amount for some and little or none for others.

3.1 Environment

The majority of material considered against this NATA category has reviewed evidence relating to noise pollution and air quality. Although there was also limited consideration of Townscape, Landscape and Physical Fitness, there was little evidence for the other Environment Sub-Objectives⁹.

3.1.1 Noise

The SDI arising from this environmental impact broadly fall into two categories: health effects on individuals, and secondly the disturbance and severance impacts on wider communities. Both have social and distributional components.

The Royal Commission on Environmental Pollution (RCEP) laid out the range and extent of environmental problems arising from transport in their 18th Report, 'Transport and the Environment' (RCEP 1995). This report states that transport noise is likely to be "*the most pervasive source of noise in the environment*" (p46), and examines various health-related impacts of noise. This view of transport noise is echoed in a comprehensive report on transport and health in the context of transport in London (Watkiss *et al*, 2000). The source begins its discussion on the health effects of noise by expressing the view that "*noise is a major nuisance and is widely recognised as a dis-benefit affecting daily life*" (page ix), and that "*transport is a major source of ambient noise levels and therefore may have important health impacts*" (p49).

Individual Health Impacts

The Watkiss report (*ibid.*) does not present any new empirical evidence, but it does investigate the finding of four substantial reviews of existing evidence in order to draw its own conclusions. The authors conclude that it is accepted that in general the levels of noise associated with transport are likely to have limited direct effects on individual health. Although it did find an emerging health concern in a World Health Organisation

⁹ The remaining sub-objectives are: greenhouse gases; heritage of historic resources; biodiversity; water environment and journey ambience.

(WHO)¹⁰ review of current evidence on noise and health. This found that exposure to environmental noise leads to detrimental changes in blood pressure and stress hormone levels in children who are exposed to it on a regular basis.

Another impact of noise which is mentioned in the Watkiss report (*ibid.*) as a possible health issue is sleep disturbance. The conclusion drawn here was that there was sufficient evidence to suggest that noise led to changes in sleep patterns, such as prolonging the time needed to fall asleep and to return to sleep after being awoken, as well as causing a shift from deeper sleep to shallower sleep. However, it was acknowledged that the significance of these effects on long term health was not fully understood, for example the 1999 DETR¹¹ review considered that "*the clinical or social significance of increments in sleep disturbance are still unclear*" (p53). Some studies also suggested that individuals tend to 'habituate' with (or adapt to) an increased number of sound exposures per night over time, and thus sleep disturbance impacts are reduced.

A further issue arising from transport noise is its potential to impact on the educational performance of children. In reviewing existing evidence on the impacts of noise, the Watkiss *et al.* (*ibid.*) report determined that there is sufficient evidence to conclude that in children, "*environmental noise impairs a number of cognitive and motivational parameters*" (p54). It again drew on findings from the 1999 DETR review, which concluded that "*there was sufficient evidence for detrimental effects on performance in school children as a result of noise exposure*" (p54). A second review by the World Health Organisation (WHO)¹² also confirmed that exposure to occupational noise '*impairs cognitive task performance*'. Although there seemed to be consensus on the effects on children, none of the material reviewed by Watkiss (*ibid.*) found conclusive evidence that environmental noise caused similar problems with adults.

Community Impacts

Both the RCEP and the Watkiss report also illustrate that there are other, wider, impacts on society that transport noise contributes to. The first of these is the effect on communities, and community activity. The RCEP report draws on evidence first developed by Appleyard in San Francisco in the 1970s (Appleyard, 1981), that concluded that traffic noise was an element contributing to 'disturbance' in communities. This study found that increasing volumes of traffic would mean streets were less likely to be used, leading to reduced social contact on them. This community disturbance, in the form of traffic noise, fumes and vibration would be felt not only on the street itself, but also in front gardens, and even rooms facing on to the street. The RCEP agree with this evidence and go on to propose that noise could be a 'significant impact' from traffic, particularly if levels prevented conversation. The authors also conclude that noise could be contributing to wider social impacts although no further specific evidence was presented in the report. Examples of these impacts include children no longer playing on streets or walking unaccompanied to school, and an increased risk of crime as a result of a lack of people on a street.

Disturbance caused by roads was also an issue considered by Egan, Petticrew, Ogilvie & Hamilton (2003) in an attempt to systematically review studies and evaluations of new road schemes. In this review, thirty-two individual reports, covering almost one hundred and fifty road schemes from around the world from the 1970s to 1990s were considered. The conclusion from this evidence was that new major urban road schemes would increase

¹⁰ WHO (1999). Guidelines for Community Noise. Edited by Birgitta Bergland, Thomas Lindvall and Dietrich Schwela. World Health Organisation, 1999.

¹¹ DETR (1999). *Health Effect Based Noise Assessment Methods: A Review and Feasibility Study*. A review by the National Physical Laboratory and the Institute of Sound and Vibration Research for the Noise and Nuisance Policy Unit.

¹² WHO (1999). Guidelines for Community Noise. Edited by Birgitta Bergland, Thomas Lindvall and Dietrich Schwela. World Health Organisation, 1999.

disturbance in communities (from factors such as noise, vibration, fumes and 'dirt'), and in one instance increased levels of disturbance were still being detected three years after opening (*ibid*). The one exception to this finding was in the situation where a by-pass was being constructed. In this case it was reported that disturbance was being reduced in areas now being bypassed, both along the main roads in the towns being bypassed, and similarly on secondary roads in the area as well.

What was also observed was that the disturbance was being experienced in rural areas surrounding new bypasses. The Egan review noted that often the study of a new road scheme was not actually investigating and / or appraising this 'displacement' effect. For those studies that did, increases in noise disturbance of up to 79% were quoted. In their review of thirteen recent road schemes in the UK, Matson, Taylor, Sloman and Elliot (2006) conclude that noise measurement is generally not considered outside of a narrow zone close to the road itself. Citing two of the case studies in their report, the M65 near Blackburn and the Newbury bypass, they state that "*noise has a major impact on the rural character of the countryside*" (p43).

Taking the impact of noise and disturbance further, it can also be seen as a potential contributing factor in community severance. The possible contributions of noise were highlighted in a case study of the effects of a ring-road around a small town (James, Millington & Tomlinson, 2005). Residents of the neighbouring community found the level of noise emanating from the road was sufficient for it to be perceived as both a physical and psychological barrier. This impact was found to be potentially greater at night because the road was relatively free of traffic, and some motorists took the opportunity to drive faster (and thus create more noise).

In the instances where disturbance from a road scheme had been investigated, some evidence was found for adaptation to it through changed behaviour or attitudes, or through physical measures such as new barriers. However, the evidence was seen to be inconsistent in the studies on by-passes, and for new roads the evidence found to support the process was only qualitative (Egan *et al* 2003).

Note: The details of any specific research, methodologies or field trials that may have been carried out for the DETR and WHO reports is not known. Watkiss *et al.* themselves state that they have not had time to consider the underlying evidence, but instead have "*focused on a number of major reviews on this subject that have been published over the last five years*" (p 50).

3.1.2. Air quality / pollution

Once again, the SDIs arising from these environmental effects of transport fall into two categories, health effects on individuals, and resultant impacts on wider communities. As with noise, there are social and distributional components to the impacts.

Health Impacts on Individuals

The RCEP 18th Report (*ibid.*) highlights the range and levels of airborne pollutants evident in the UK. It states that transport is now the most important source for most of them, and road transport is responsible for almost all of the transport emissions. Watkiss (*ibid.*) confirms that there are still issues with transport emissions and health. They point out that events such as the London smog in the 1950s have illustrated the link between high-levels of pollution and increases in health problems. In their review, they have identified more recent evidence of smaller increases in adverse health effects at typical levels of urban air pollution. The report draws this conclusion from a number of studies undertaken in the 1990s, designed to isolate only air pollution related factors. These studies suggest that longer-term exposure to ambient particles does have health implications. These include respiratory problems, possible exacerbation of asthma, and even premature mortality. The strongest evidence exists for pollutants such as particulates (PM₁₀), Sulphur dioxide (SO₂)

and ozone and the “relationships are widely accepted as causal” (p132). The report also highlights growing concern over long-term exposure and health, which it is feared may have greater impacts than the acute effects already mentioned. Overall, the report concludes that transport is a major source of these atmospheric pollutants in urban areas and can be assumed to be producing both short-term and long-term health effects.

Impacts on Groups and Communities

Accepting that health issues are connected with transport, and particularly road transport in urban areas, a number of studies have attempted to quantify whether the effects of these issues are felt disproportionately by different groups in society. In one study of an urban motorway in the US the authors proved that it was possible to identify minority and low-income groups, and model the environmental impacts of transport on them (Forkenbrock & Schweitzer, 1999). The process also allowed them to gain an understanding of the distributional effects of such impacts. Watkiss (*ibid.*) found in their review of the then current UK¹³ and European¹⁴ evidence in respect of air pollution, that disproportional effects have been identified on what they described as ‘vulnerable groups’. They also consider that the relationship between poverty and air pollution is important.

Other studies have also considered links with specific social groups. Brainard, Jones, Bateman & Lovett (2002) explored exposure to two traffic pollutants in Birmingham (UK) in relation to poverty, but more specifically looking at whether there were links between exposure and groups determined by age and ethnicity. Although they did not find a “significant” relationship between age and exposure to transport-related pollutants, they did find a “striking” relationship for pollution with ethnicity and poverty. In their view, a disproportionate level of pollution was being borne by ethnic minorities in Birmingham, primarily as a result of the physical location of their communities and the higher levels of traffic pollution they were being exposed to in those areas. The study also found a similar association between poverty and exposure. Overall, the highest levels of pollutant emissions in Birmingham were recorded for populations with the highest proportions of minority ethnic groups, and of impoverished residents. After further statistical analysis of citywide data by the authors, it was determined that the two conditions were independent of each other although it has also been shown that ethnic groups tend to live in more impoverished areas in the city.

A recent study, in Christchurch, New Zealand (Kingham, Pearce & Zawar-Reza, 2007), has also investigated whether there is a social impact in respect of differential rates of exposure to transport-related air pollution. Using a pollution model for Christchurch, and socio-demographic data from the NZ census, the researchers carried out a detailed mapping exercise to understand exposure rates. Where this particular study differed from others, such as Brainard above, was that the Christchurch model also included local weather and wind pattern information, to enable a more accurate determination of where pollutants were going. The study concluded that there was evidence that exposure to traffic-related pollution is highest amongst low-income groups, recording the worst level of pollution in the neighbourhoods with the lowest levels of household income. There was not only a ‘social gradient’ in pollution exposure, but also variations in exposure across different ethnic groups, areas with higher populations of Maori, Pacific Islanders and Asians generally having higher levels. They also made the point that not only are inhabitants of deprived areas exposed to more transport pollution, but that they also have lower levels of car ownership; considered to be the key source of the pollution. This led the authors to conclude that there were clear social justice issues related to traffic-related air pollution exposure.

¹³ COMEAP (1998). Quantification of the Effects of Air Pollution on Health in the UK. Committee on the Medical Effects of Air Pollutants. DoH. London, The Stationary Office,

¹⁴ EC (2000). Externalities of Energy (ExternE). The final report of the ExternE Core/Transport Project. European Commission, Directorate-General XII. Science, Research and Development. Brussels.

Both Brainard and Kingham explored possible reasons for their results, and conclude that the primary reason may be spatial. Inner-city districts and areas near major transport infrastructure may be less desirable, and offer more affordable housing and easier access to employment for deprived communities. In the UK, these have traditionally also been areas where ethnic minorities have initially found accommodation, although Brainard also points out that there is also a factor of communities concentrating in some of these areas for social and perhaps cultural reasons.

3.1.3. Landscape

Changes to the landscape as a result of a transport scheme could affect both rural residents and the rural economy, through the creation of new impacts and transferring them from more urban areas. For example negative impacts on the landscape have the potential to cause problems for rural industries such as leisure and tourism industries. One report which considered landscape was that produced by Matson *et al.* (2006). This report investigated the landscape impacts of three case study road schemes (A34, M65 and A27/A22). Their finding was that in all three case study areas there was a permanent deterioration in landscape quality. These issues were experienced primarily in rural areas, including an Area of Outstanding Natural Beauty (AONB). Specific problems included light pollution and also secondary effects such as fly-tipping from a new viaduct built for the M65. The report also noted that development generated by the road could have as much impact as the road itself, citing the new industrial parks alongside the M65 as an example. The report considers what effect these impacts may have on the rural environment, concluding that the "*lighting of roundabouts and the increase in noise experienced in the countryside around these roads combines to erode the tranquillity and rural feel of these areas*" (p5), and that the impacts can also reduce the "*remoteness and wildness of a landscape*" (p43).

There is also a consultant's report available for the Newbury bypass development (A34); one of the roads used as a case study above (Atkins 2006). This report considers the development five years after it opened, and in reviewing the landscape impacts of the road, comes to a similar conclusion: "*the overall impact of the Bypass on the local landscape character and quality is deemed to be adverse, especially for areas within the AONB and SSSIs. The tranquillity of the area has been affected adversely, as has the pattern of the landscape*" (p 7-13).

3.1.4. Townscape

One source that formally considered the Townscape Sub-objective, was the impacts report for the Jubilee Line Extension (JLE) to the London Underground (Lane, Powell, Evers, Paris, Lucas & Jones. 2004), although there was little consideration of any social impacts that might flow from it. However, there are impacts that could be drawn from the information provided in the report.

The first of these is that during the construction phase, and subsequent operation of the JLE, a number of areas of contaminated land have been used. Material from these areas has also been used in construction. It could be argued that a social benefit has accrued to the neighbourhoods and communities where these contaminated areas were located, providing environmental and possibly health benefits, although this was not explicitly discussed or investigated in the JLE report.

Other factors that were considered in the JLE Impacts study (*ibid.*) were community perceptions of their neighbourhood before and after the construction of the line. People who lived in areas along the route of the line were polled for their views on issues such as personal safety, and 'sense of place'. The responses received on safety suggested that this did not improve after the JLE was constructed. However, in respect of the latter question the results were in general higher after the JLE was built and operating, which in the view

of the report's authors indicated a positive impact as a result of the new transport infrastructure.

A further JLE investigation into townscape quality involved a 'before and after' study by consultants, the results of which are incorporated in the main summary report. This determined that there had been no negative impacts, and that the development of new stations had contributed to public and private sector improvements in surrounding areas. In Stratford, the consultants reported that the station demonstrated a 'design quality' and 'concern for public space' that could be seen as a 'landmark' for subsequent redevelopment, and they noted that since the JLE was developed there had actually been a significant upgrading of the surrounding area. It is possible that some of these consequences could be interpreted as gentrification, and there is a link here with land values, which are discussed later in Economic evidence. However, there are also neighbourhoods and communities that achieve positive benefits purely from the introduction of an improved townscape.

Related evidence of the impacts of improved 'streetscapes' was found at a smaller scale in the evaluation of the Southville Home Zone in Bristol (Sherwin, Parkhurst & Chatterjee, 2006). This development included various landscaping and traffic management measures aimed at both reducing the speed of traffic in the Zone, and improving the environment for alternative modes of access such as walking and cycling. This found positive improvements in social activity on the streets involved, but also identified some tentative evidence of a house price premium resulting from the provision of the enhanced streetscapes. Based on discussions with four local estate agents the evaluation found that a property premium of around £5,000 might exist for dwellings located in the Home Zone, over similar ones in the same area, but just outside the Zone. Hence an effect - both social and distributional - results in public investment in a scheme primarily to reduce the impacts of traffic results in additional benefits for landlords and owner occupiers, whilst tenants may face slightly higher rents.

The 'five-year on' review of the Newbury bypass (Atkins 2006) also found a positive impact from that road scheme under the Townscape category. In this instance it related to the fact that the main road through the town centre was now pedestrianised, and closed to traffic at certain times of the day, creating a better environment for shoppers, and for walking in the town centre.

3.1.5. Physical Fitness

The Watkiss (*ibid.*) study also considered the links between physical fitness and transport. As part of their study, they reviewed relevant material on physical activity and health from an electronic database of medical literature¹⁵. Their conclusion was that the evidence supported the position that physical activity has significant health benefits, for example in reducing the incidence of physical health problems such as coronary heart disease, diabetes and obesity, and mental health problems such as depression. The report suggested that two groups particularly at risk from having insufficient exercise were the elderly, and children (with implications for health problems such as obesity).

The report goes on to propose that walking and cycling, as modes of transport, are a means of achieving this level of physical activity, and they believe that across the population as a whole the best potential health gains are to be made by increasing activity levels in one specific group, the elderly. However, they then point out some transport-related issues that may deter these groups from pursuing such options. Firstly, this aspiration may actually be compromised by an unintended side-effect of improvements in public transport provision. This point was considered particularly for London, where it was

¹⁵ Medline (an electronic bibliography that includes all papers published in a selection of the world's medical journals since 1966)

thought possible that low or free fares and improved public transport services may actually encourage journeys by the elderly that could have been walked. Secondly, walking and cycling may be impacted by levels of noise and air pollution, and specifically by fear of accidents (see Section 3.3 below)

Gaps:

- The focus of the material on environmental impacts is on road transport, not other modes, such as rail. Although the database searches revealed a theoretical paper that looked at valuing noise from rail infrastructure, no empirical material specifically covering social impacts of that mode of transport were identified.
- Egan *et al.* (2003) highlighted gaps in the road studies they reviewed, specifically the effect of new roads on respiratory health, mental health and physical activity.
- Further evidence is needed, or needs to be identified, to help understand whether the concerns raised in the Watkiss report on factors which may suppress levels of cycling and walking are well-founded. For example, are people dissuaded from these modes by levels of pollution and/or the risk of accidents?

3.2 Economy

3.2.1. Transport Economic Efficiency - Consumers (Costs of travel)

The costs of travel may have a significant impact on the amount of travel, and the mode used. As highlighted in the Social Exclusion Unit (SEU) report on transport and exclusion (SEU, 2003), the cost of transport was identified as one of the five barriers to people accessing services that they need such as healthcare and employment. This report highlighted that bus fares had risen by nearly a third over the period from 1985-2003, and that motoring costs for those households in the lower income quartile which did have a car accounted for 24% of their weekly expenditure. This level of expenditure had been identified several years earlier by Lucas, Grosvenor & Simpson (2001), who had investigated the costs by reviewing household expenditure data¹⁶ related to transport. In respect of public transport spending, Hine and Mitchell (2003) found in their studies that "*relative to other income groups, people in lower income groups can pay more for their public transport in terms of their income*", when accessing the same goods and services as those with higher incomes (p78). The study also found little evidence of those on low-incomes taking advantage of Season Tickets, or paying reduced fares.

The cost of travel can also act as a barrier to the amount of travel undertaken, and the distance travelled. In a study on transport and exclusion (Lucas & Tyler, 2001) it was found that those in the lowest income quartile travel only a third of the distance travelled by those in the highest quartile¹⁷, and that this suggested that economically disadvantaged people are travelling less because they are constrained financially. Evidence of this can also be seen in London in respect of the Congestion Charge. Although a majority of the people living in the Congestion Charging Zone are finding the charge affordable (MORI 2004), about 25% are having problems, particularly low-income households. This is seen as less of an issue outside the Zone, even though people in those areas do not benefit from the same substantial discount offered to Zone residents. It is worth noting though, that there has been a significant fall in car use in these Inner-London areas (immediately outside the Zone), with potential health and accessibility benefits for those communities.

Another group that have been identified as being potentially restricted in their transport solutions by cost are young people. Taylor *et al.* (2007) reviewed attitudes and opinions of young people in respect of transport. Their work noted that the transport choices of young people reflected several factors, including the costs and benefits associated with

¹⁶ Office for National Statistics (ONS). Family Expenditure Survey 1998-99

¹⁷ National Travel Survey 1998/99

particular services. Cost was considered to be a major barrier to car ownership for young people, and the cost and availability of local transport affected whether some young people took up education or training opportunities, as well as affecting the options they chose. Consequently, some young people took up less attractive or relevant opportunities because they were closer to home, and would lead to lower transport costs.

3.2.2. Wider Economic Benefits

Regeneration

Several of the studies included in this review have examined the relationship between specific transport interventions and economic and social regeneration of an area(s). However, the evidence is conflicting on the contribution of transport schemes to regeneration, with some studies finding no clear link and others finding some positive impacts.

A review of the Tyne and Wear Metro concluded that the scheme had helped to reinforce the status of Newcastle city-centre, primarily by helping to overcome the lack of parking provision in that part of the city (Robinson & Stokes, 1987). Benefits were felt particularly by the retail sector, but the Metro was also seen as an aid to 'retaining' office space in the city-centre. However, the authors concluded that the Metro had failed to achieve other regeneration goals. The report also provided evidence based on interviews with representatives of the property sector that, although proximity to the Metro would be mentioned in property marketing, it was not an important factor in attracting new industry or commerce to the overall area, or in inner city regeneration in particular. Non transport and road infrastructure were considered to be more important factors. In a review of the effects of transport investment on the economy of the inner city, Grieco (1994) concludes that there can only be a "*limited impact of transport on land use in a mature city*", and "*transport investment in a mature city makes no contribution to general metropolitan growth goals*" (p 3). Citing a review of evidence relating to rapid transit systems in England and Germany¹⁸, Grieco (*ibid.*) claims that there is no clear link between such transport investment and economic growth or development. From this finding it can be inferred that intended or unintended SDIs may be unlikely to result.

A later study of the introduction of the South Yorkshire Supertram in and around Sheffield (Lawless 1999) also considered regeneration. Part of the rationale for the introduction of this particular light-rail scheme had been to promote economic renewal in the Sheffield area, particularly in support of those suffering from the decline in the traditional industries in the area. The study compared the Supertram and a number of new roads which were intended to facilitate the regeneration, and concluded that the roads had had some impact, but the tram itself had little effect, at least in the short-run. This study also found that lack of integration between the bodies responsible for regeneration and the 'transport providers' may have prevented some of the potential positive social and economic benefits of the system from being achieved.

The extensive review of the impacts of the JLE in London also considered regeneration (Lane *et al.* 2004). It was of the opinion that there was evidence that regeneration had been facilitated by the new line, and that the type and density of development had been made possible by increased accessibility and confidence among developers provided by the JLE. It cited, as examples of change, the transformation of some secondary commercial areas into thriving business and residential districts, indicating how areas which had been predominantly vacant land, short-term industrial leases or poorly maintained local social housing had undergone a massive transformation, now with better maintenance and major retail and leisure facilities. There was also evidence in the report, from a number of property consultants, for increased demand for office space from high-tech, media and cultural industries, with implications for employment creation. There are now proposals

¹⁸ Hall P & Hass-Klau C (1986). Can rail save the city? UITP Revue, Vol 35, No3

for other major regeneration schemes along the route of the JLE, both commercial and residential, again with potential positive benefits for the residents of the corridor.

In terms of wider economic benefits, the economic activity study undertaken for the JLE Summary Report (Lane *et al.* 2004) concluded that the JLE had “probably not added materially to the total volume of economic activity in the London region”, but had “directed economic activity to areas needing regeneration and has, as a consequence, taken some of the pressure off more established areas” (p 146).

Land Value / House Prices

Increases in land value and house prices are identified by many reviews of transport interventions as indicators of positive change as a result of increased accessibility¹⁹. For example, land values were considered in the study of rail improvements carried out in Glasgow in the late 1970s (Gentleman, Mitchell, Walmsley & Wicks, 1981). In this instance they were seen as positive indicators of social as well as economic benefit. Robinson and Stokes (1987) reviewed evidence²⁰ that houses within 200 metres of Metro stations in Newcastle rose in value by 1.7% more than those 1.5-3 km from stations over the period two months before and two months after opening. They noted that the increase began “a few months” (p9) prior to the line opening and persisted for a year after opening. However, whilst the small uplift in property values may have benefited landlords and house owners, it could also have generated negative impacts on tenants through higher rents, and on the supply of housing available for rent.

Both the official study of the JLE (Lane *et al.*, 2004) and an independent opinion expressed by Riley (2001) consider increases in land values for areas around the new line. In the Riley book the argument is made that taxpayers have paid for the construction of the line, but the economic benefits have gone to land owners who have seen property prices rise, and rents increase substantially around stations. This study also makes the case for assessing land value, and taxing the ‘windfall’ gains through a Land Value Tax. If this approach had been followed, then increases in land values around the JLE would have allowed the project to have been paid for by (relatively low level) taxes on rental income and property sales. In the official JLE report (*ibid.*) qualitative evidence in the form of opinions obtained from estate agents who specialise within the JLE Corridor area suggests that residential property values have risen relatively quickly in most of the corridor and particularly in the area south of the River Thames.

Gaps:

- No consideration appears to be given in any of the studies mentioned above as to whether there may be negative social impacts from rising land and property prices. For example, consideration is not given to whether the existing population would be able to afford to buy homes in the area if prices rise, and whether this may cause potential tensions between existing residents and people who may migrate to the area, or in the case of deprived areas, between public and private sector redevelopment interests and local residents. It could also lead to pressure on Local Authorities in respect of releasing land for development. Given the high profile of such conflicts in the case of schemes such as the London Docklands redevelopment, this lacuna within transport scheme appraisal is a surprising one.

¹⁹ NB the increases in value considered earlier under Townscape were identified as resulting from perceived increases in aesthetic value, rather than accessibility.

²⁰ Pickett, M & Perrett, K (1984). The Effect of the Tyne and Wear Metro on Residential Property Values. TRRL Report SR 825. TRRL, Crowthorne.

3.3 Safety

As for the environmental issues such as noise and air quality discussed earlier, there are SDIs affecting particular social groups, and also particular spatially defined communities. The implications of Safety cover not only accidents, but also safety whilst using transport. At a community level, there are the costs associated with accidents as well as wider impacts on community cohesion and community severance caused not just by actual safety issues, but also perceived ones.

3.3.1. Accidents

This section of the review is focussed primarily on how accident rates change as a result of new transport interventions, or how those accident rates differ across groups in society. The primary focus of the evidence reviewed is road accidents (see also 'Gaps' below), but it is evident that different types of roads have different levels of risk associated with them. It is also apparent, that there are different levels of risk associated with different groups, for example those defined by age, ethnic background, social class or type of road user.

In the extensive review of road scheme studies carried out by Egan *et al.* (2003), covering almost one hundred and fifty different roads, the authors found it possible to determine a number of effects on accident rates. These were that 'out-of-town bypasses' decrease injuries on main roads through or around towns, 'new major urban roads' have statistically insignificant effects on injury incidence and 'new major roads' between towns decrease injuries. The one caveat applied to the results was that there seemed to be a lack of information in the studies as to accident rates on secondary routes following the introduction of new roads such as by-passes. Even where new schemes have included mitigation measures to provide a safer environment for users, particularly cyclists and pedestrians, these options may not actually be used as intended, leading to safety issues. In a case study involving a ring-road around a country town (James, 2005) it was observed that pedestrians still undertook dangerous road crossings on the new road, even though a 'safer' route had been provided near (but not actually on) the pedestrian 'desire line'.

There was also a spatial factor in the study of accident rates in Birmingham carried out by Lawson & Edwards (1991). They made use of fatality statistics (covering multiple years), police and health service data, and interviews with victims and drivers to map geographic aspects of the data and the relevance of ethnicity. Their study of accidents in the city found significant differences in rates across different neighbourhoods. They found a greater concentration of accidents in what they termed 'priority areas'. These were described as those needing regeneration, or showing deprivation. Whilst their study determined that there was no significant overall difference in accident rates for ethnic minorities, they did find a statistical difference in the rates for Asian children (aged 0-19). The rates for these children were double that of non-Asian children, including those of other ethnic minorities. One aspect that was deemed to be significant in respect of the level of accidents for Asian children was the influence of parking: there was a much higher incidence of Asian children being injured whilst emerging from between parked vehicles. This is perhaps particularly topical, as increased parking of cars in inner-city areas outside of congestion charge cordons is identified as a potential issue with the introduction of these schemes (Rajé 2003).

Other studies have found similar results. In a review of current literature on road accidents and children in disadvantaged areas carried out for the Scottish Executive (White, Raeside & Barker, 2000) significant differences in child pedestrian injury rates based on ethnicity

were found. One of the specific studies quoted in the review²¹ found that ethnic origin came through as an important accident indicator especially for 'non-white' children aged less than 11 years old.

Watkiss *et al* (2000) also found evidence of what they termed 'disproportionate' distribution of accidents amongst groups of road users. In their review of existing data they found links between social class and accident rates, and identified children as being amongst the particularly vulnerable groups - accounting for 30% of pedestrian casualties in London in 1997. Children also illustrated a very sharp 'social gradient' for both incidence of injury, and mortality from road accidents, with those in the lowest social class experiencing four times as many overall road accident deaths, and five times as many pedestrian deaths as the highest²². One possible reason put forward was that children in low-income families will spend more time walking or cycling as they have less access to other modes of transport. There was also a link between the type of road user and accident rates. For example, the relative risk of serious injury or death by distance and by journey for pedestrians, cyclists and motor-cyclists is much higher than for car drivers and passengers. This is illustrated by the fact that although the number of walkers involved in collisions is less than the number of car occupants, more than half of the accident fatalities in London in 1998 were pedestrians.

The specific issue of child accidents was also explored in depth by White *et al.* (2000). In their conclusion they make the point that on the basis of the available evidence it appears that children from disadvantaged areas are exposed to greater levels of accident risk and that, specifically, the risk of death for child pedestrians is highly class related. Evidence was found that the risk of pedestrian injury for the children of lone mothers²³ was over 50% higher than for other social groups²⁴.

Christie (1995a, reported in White *et al.*, 2000), in research at the individual and household level, also states that the risk of death for child pedestrians is highly class related. With reference to fatalities from road accidents, it is found that children in the lowest socio-economic group are over four times more likely to be killed as pedestrians than their counterparts in the highest socio-economic group.

White (*ibid.*) also proposes some possible reasons for the difference in risk. These include lack of access to a car for journeys to and from school, and lack of alternative modes of transport, exposing children to more hazardous journeys on foot. Lack of access to a car is associated with a doubling of the risk of injury as a pedestrian. Another aspect cited as a potential reason is less safe access to supervised and/or safe play areas for those children in disadvantaged areas.

One final consideration is whether concern about being involved in an accident may actually suppress travel, or discourage people from selecting modes other than the car. Watkiss *et al.* (2000) noted how the fear of traffic accidents amongst groups such as cyclists and children may reduce their willingness to use these modes. However, they also highlighted that there was currently a lack of research available to quantify any such effect.

²¹ Christie, N., (1995a). *The high risk child pedestrian: socio-economic and environmental factors in their accidents*. Transport Research Laboratory, Project Report 117.

²² MacGibbon, B. (1999) Inequalities in health related to transport. In: Gordon, D., Shaw, M., Dorling, D. and Davey Smith, G., (Eds.) *Inequalities in health: the evidence*, pp. 185-195, Bristol: Policy Press, and McCarthy, M. (1999) Transport and health. In: Marmot, M. and Wilkinson, R.G., (Eds.) *Social determinants of health*, pp. 132-154. Oxford: OUP

²³ This study specifically considered 'lone mothers' as opposed to 'lone parents' in its investigations.

²⁴ Findings reported by White *et al.*, from Judge, K., and Benzeval, M., (1993) Health inequalities: new concerns about the children of single mothers. *British Medical Journal*, 306, 677-680.

3.3.2. Personal Security

Personal safety is seen as an issue for users of public transport. This particular concern was amongst those explored by a series of focus groups identifying issues related to a potential congestion charging scheme in Bristol (Rajé 2003). In this instance the groups were considering a possible shift to public transport in response to the increased costs of using a car. The study highlighted the perception of, as well as experiences of, personal safety problems on public transport. These included not only crime and violence on public transport and whilst getting to it, but also weather-related problems. Specific issues raised by the focus groups included factors such as the design of the transport system, which led to passengers having to walk across a city centre at night to reach a transport interchange, and the lack of staff on the system to provide a sense of security - particularly at night. One consequence of this level of concern may be suppression of travel, particularly affecting vulnerable groups such as women, young people, older persons and ethnic minorities. Evidence from these focus groups indicates that if car-based travel became more expensive, then these groups may stop making some journeys. By extension, cheaper car use costs may then increase trip rates by car.

Other studies have considered this issue for some specific social groups. For example, Knight, Dixon, Warrener & Webster (2007) cite the 'fear of crime' on public transport and safety concerns with using public transport as particular issues for older people. Taylor *et al.* (2007) identified personal safety as a key factor in young people's views about using public transport, particularly their fear of harassment or attack. Personal safety was also a key issue for the women surveyed by Dobbs (2007), who noted a related issue that having personal confidence in using travel options and making journeys was also very important.

As well as the safety issues involved in using various modes of transport, the introduction of transport policies and schemes may also have a safety impact on a community. The MORI (2004) review of social impacts from the London Congestion Charge found that some 18% of inner-London residents (i.e. those living immediately outside the congestion charging zone) thought that the 'sense of safety' in their area had deteriorated since the introduction of the charge. Amongst issues identified by residents in these areas was the increase in 'strangers' in their community. It is worth noting though that a small section of the community (6%) disagreed with this view and felt that safety had actually improved in the neighbourhood.

Gaps:

- There appears to be little material considering accidents on modes of travel that are not based on roads, *i.e.* on the railways, for example.
- There seemed to be a lack of information in the road studies as to accident rates on secondary roads following the introduction of new roads such as by-passes.
- Similarly, more research is required into how much changes in the fear of accidents as a result of providing new 'fast mode' transport schemes may contribute to people choosing to walk or cycle or otherwise.

3.4 Accessibility

This section of the review contains evidence of SDIs related to transport in respect of individual access needs, as well as a consideration of evidence of transport's impact on communities - in particular in respect of (community) severance.

The SEU laid out clearly the issues surrounding accessibility and transport in '*Making the Connections*' (SEU, 2003). The case studies included in the document identified a range of groups who were disadvantaged in respect of their access to a range of services and facilities because of issues with transport. These groups included the young, the elderly

and the unemployed. Knight (2007) in a specific study of the transport needs of older people highlighted a number of areas where this group could have problems as a result of poor transport availability, such as attending GP or hospital appointments, or doing the weekly shopping. But aside from these physical needs, the study found that access to transport also had psychological impacts, giving a sense of independence, and a degree of freedom by enabling people to do what they want when they want. The report also concluded that it could aid physical and mental health, and encourage social networks. Although this study focussed on older people, these positive impacts could equally apply to other groups.

Another social group who have particular issues in respect of accessibility are the disabled. In a recent review of evidence relating to mobility across all groups, Smith *et al.* (2006) conclude that "*Access is a fundamental issue in realising disabled people's entitlement to achieve the same opportunities as non-disabled people*" (p62), but that their travel is limited by a lack of accessible services, and confidence that their journeys will be completed without problems. The report found evidence that disabled people had less access to a car, and were deterred from travelling by public transport by a range of issues which prevented (physical) access to services, and also by factors such as: difficulties with information provision, high costs, personal safety, uncertainty, lack of flexibility of services and attitudes of transport staff. The resulting lack of travel was then a 'barrier' to social inclusion, as disabled people found it more difficult to access education, employment, services such as health, and social networks.

Whichever social group is being considered, there are issues around how the problems of accessibility might be measured, and authors of some of the studies reviewed have commented on this aspect. In their study of accessibility issues in East Anglia in the 1970s, Moseley *et al.* (1977) noted that there needed to be an understanding of the 'norm' in terms of accessibility in order to determine a lack of it. They also stated that "*it is the non-users of transport that warrant attention, not the users*" (page xii). Rajé (2004) also found that there was a need for data which 'realistically reflected the daily experience of local residents', if issues such as accessibility and severance were to be dealt with effectively in planning and appraising new transport schemes.

In their investigation into methods of reviewing accessibility needs, Cass, Shove & Urry (2003) concluded that merely knowing the locations of communities and services, and mapping what transport services were available, would not be enough to understand what level of demand for access people actually had. This was confirmed by interviewing passengers on a newly-introduced demand responsive bus service in the North East of England. A similar conclusion was reached by Dobbs (2007). In this latter study it was household access to a car which was being used as a measure of accessibility. Nearly 90% of the women surveyed reported living in households with a car, but only 29% reported that they actually had full access to their own car or unrestricted access to the family car. This echoed the findings from the earlier studies carried out in Scotland by Hine and Mitchell (2003), which identified that men were more likely to have regular car access, whereas women were more likely to have no access at all.

Although there are issues with understanding levels of accessibility, there were a number of further studies identified and reviewed which have attempted to address the issue in connection with transport. In most instances there has been a specific focus on either rural or urban access problems, and the potential resulting SDIs, and these are now considered below.

3.4.1 Rural Accessibility

In the 'Rural Transport and Accessibility Research Project' conducted for the Department of the Environment (Moseley, Harman, Coles & Spencer 1977) an attempt was made to assess the impacts of the lack of access at that time in rural East Anglia. The study

focussed on 'car-less' households and identified the problem of rural inaccessibility as "*the inability or difficulty of car-less rural residents to gain access to the activities which are relevant to them*" (page xii). A particular area of concern for the communities studied was (lack of) access to healthcare.

Another rural study (Nutley, 1983) carried out in Wales considered whether accessibility had improved following a series of public transport interventions carried out from mid-1977 to the end of 1978 (The Rural Transport Experiment - RUTEX). These interventions included measures such as postbuses, extending use of school buses, and 'social car' schemes²⁵. Considering 'functions' and 'groups' in society in order to understand which specific sections of the population were restricted in their access to particular services and facilities, Nutley assessed data from the six areas of Wales in the experiment. The study identified problems for groups such as children, older people, and 'housewives'²⁶, but concluded that the experiments had undoubtedly increased the supply of public transport available. It was also noted that the greatest benefits were achieved by some of the groups and communities that suffered most from access problems.

Two other accessibility problem areas are access to education and employment. In a review of the travel needs of young people (Taylor *et al.* 2007), it was found that local transport provision in rural areas in particular would need to be improved if access to key services such as education and employment were to be widened. The young people who were interviewed, and took part in focus groups, considered this particularly important as the availability of good transport could affect their ability to successfully make the transition to adulthood. Similar problems were identified in an extensive study of women in north east England (Dobbs, 2007). Although respondents rarely referred to physical location as a factor constraining their mobility, even when they were living in fairly isolated rural areas, they were particularly critical of the way in which the current transport infrastructure restricted their employment opportunities.

3.4.2 Urban Accessibility

Studies have also been carried out into accessibility problems in urban areas, although in two of the studies discussed below there is some conflicting as well as mutually supportive evidence. Specifically, fears of a negative impact from a 'potential' congestion charging scheme which have not been fully borne out by evidence from the implementation in London.

Unforeseen effects of schemes such as Congestion Charging were highlighted by Rajé (2003). In this study in Bristol, concerns were raised by focus groups about the impacts of possible greater road congestion on public transport if car trips were displaced by the charge from the city centre into inner-city areas just outside the charging cordon. Another possible impact of the introduction of a congestion charge was the potential suppression of travel amongst some ethnic minority groups who said they were less likely to use public transport. There was a concern that the increased costs of motoring following charging would lead to reduced car travel, and thereby reduced access to services and facilities.

The study of the impacts of the Congestion Charge in London (MORI 2004), found little change in 'accessibility' to local shops, facilities and services amongst respondents in areas inside and outside of the Congestion Charging Zone. The one neighbourhood that did report a decrease in access was located immediately outside the charging cordon for the scheme. Confirming some of the findings of the Rajé study above, the residents here reported an increase in the number of cars parked in their area, and particularly of cars parked by

²⁵ Such schemes are generally now referred to as 'community transport schemes'.

²⁶ Nutley describes this term as meaning: "The economically inactive, comprising primarily the housewives, but including also students and the unemployed" (p 23).

'strangers'. It was suggested that these are people avoiding the charge by completing their journeys into the charging zone by foot or public transport.

Another impact noted by the MORI study (*ibid.*), was that 'social gatherings' within the Congestion Charging Zone were impacted. Some 43% of the respondents to the survey located within the zone believed that family and friends were finding it more difficult to visit now. The primary reasons cited for this reduction, which had been forecast, was the cost of the congestion charge, and an inability to park. Interestingly, the neighbourhood that reported the most problem with this issue is located immediately outside the Congestion Zone.

As discussed above in respect of rural accessibility, some transport interventions have the capacity to improve access, and thereby potentially create positive social impacts. A study of the Metrolink light rail scheme in Manchester (Law *et al.*, 1994) found that rail use had doubled following the introduction of the new service. It was noted though, that most passenger destinations were the same as for the users of the previous heavy-rail system and that the new service was encouraging people to change from using buses for the same journey. It is possible that savings in journey time over the equivalent journey by bus could be contributing to this change.

In a separate study of the Metrolink (Knowles, 1996), some other changes in patronage were recorded which could also be seen as improving access, and as positive SDIs. The first of these was an increase in travel by people aged over 60. Overall passenger numbers on the Metrolink two years after opening were 12.1 million, compared to 7.6 million on the preceding heavy-rail network along the same corridors²⁷. Within these totals, the percentage of older travellers increased from 8% to 13.5%, which Knowles argued was due to the level access to the tram cars and the more favourable concessionary fares arrangements (although no specific evidence to support the contribution of these two explanations is provided). It was also seen that the percentage share of mobility-impaired travellers (wheelchair users and people with walking difficulties) remained the same as for the previous service (resulting in an absolute but not proportional increase by this group). Given that the investment in level access to the trams had been conceived partly for this group, and at considerable extra public cost, this result is seen as disappointing.

Positive impacts have also been seen in access to employment, again in respect of light-rail schemes. This SDI is specifically highlighted in the review of the Croydon Tramlink²⁸. Here statistics show that the levels of unemployment in wards served by the new tram had fallen faster than in those wards not served by it. Unemployment was seen to fall by over 9% more in those wards served by the tram between 2000 and 2002, than those that were not.

Access to employment was also considered by the Transport for London report on the Croydon tram system (Thomas 2002). In a brief section on accessibility, the report points out that journey times to employment locations elsewhere in London have reduced - sometimes dramatically. They cite an example whereby a journey to Canary Wharf had reduced from around 90 to 26 minutes. This may mean greater access to employment opportunities than before. It could also mean that some inward migration to the area may occur as a way of avoiding the high costs of housing in other parts of London.

This kind of change has not always followed from a transport intervention intended to increase accessibility. Gentleman *et al.* (1981) in the Glasgow rail study found that

²⁷ Senior, M.L. (1994). The Transport Impacts of Metrolink: The evidence of secondary data. Metrolink Impact Study, Working Paper 17. Dept of Geography. University of Salford.

²⁸ "The Economic and Regeneration Impact of Tramlink". (2003). Colin Buchanan & Partners. Commissioned by South London Development Partnership. Excerpts published on the South London Development Partnership website. <http://www.southlondonpartnership.co.uk/home.aspx>

although improvements were intended to provide social benefits in terms of accessibility, the results showed a continuation of other barriers to travel for deprived communities (such as cost, for example). Thus, no real change in travel patterns was evidenced. It was suggested by Gentleman that an earlier consideration of accessibility in the planning process might have been more beneficial.

Similar issues were seen in London in respect of the JLE. Residents who had lived in the area for some years make relatively little use of the JLE, and their activity and travel patterns have remained largely unchanged (Lane *et al.*, 2004). This was particularly notable in connection with access to employment. There was a large increase in the number of jobs in the JLE corridor between 1998 and 2000 (when the JLE opened), but these new opportunities appear to have done little to reduce the historically high levels of unemployment among long-standing residents. Over this period there was no significant increase in the proportion of local residents in employment, and no increase in the proportion of these residents working locally. Several possible explanations for this were considered in the report. First, a mismatch between the skills of local residents, particularly those previously employed in the docks or industry, and the professional and clerical skills needed by new employers. Second, the potential increased competition for new jobs as a result of better access from other residential areas, and finally the possibility that some of the incoming businesses may have brought some of their existing employees with them.

Considering other forms of public transport, positive improvements have also been seen in accessibility to employment following bus interventions. Lucas & Tyler (2005) discuss the positive benefits seen in services in the UK, US and France. They find that even after taking into account the not-insignificant costs of developing a specific demand responsive service for one scheme, the benefits in quality of life for the individuals concerned, and the reduced welfare spending justify it. It was noted though that the improved transport was not the only element that would help those excluded from employment, and there may well be other social reasons why individuals may not actually make use of the transport when it was available.

3.4.3 Severance

The accessibility objective in NATA also covers the issue of severance, or 'community severance' as it is sometimes referred to, as a sub-objective. As was pointed out in Section 1.2, this concept has its origins in the work of Appleyard in the US in the early 1970s. When introducing a new transport scheme there is the possibility of creating negative SDIs on a community by increasing severance, but also the potential to address severance and generate positive SDIs.

Both Rajé (2004) and James *et al.* (2005) consider how new road development can cause severance issues for communities. Rajé finds that the development of a roundabout and major urban roads constrains the mobility of the community affected, and consequently its ability to access services and facilities. This particular set of problems is compounded by poor and expensive public transport provision for the same area, and the fact that it is happening in a low-income neighbourhood. Physical, psychological and accessibility barriers are identified as being present along a ring-road in the case-study in the James *et al.* (2005) report. In the review of road schemes carried out by Egan *et al.* (2003), only one study out of the thirty-two reviewed considered severance. This found that a new road caused a 14% reduction in what it termed 'neighbourhood traversal', *i.e.*, crossing the neighbourhood or local area to access services and facilities. However, the study did find evidence that the community was beginning to adapt to the new circumstance by expanding the boundaries of what they perceived to be their neighbourhood. This expansion allowed people to access services and facilities further from their homes, but on their own side of the road.

The Watkiss *et al.* (2000) report attempted to gauge the health implications of severance. They concluded that severance was a plausible but unproven 'cause of inequalities in health'. They ascribed this to both the physical presence of traffic, and the risk of accidents presenting a barrier to a community which then limits or disrupts social networks and social contact. Studies indicate that social contact may be inversely proportional to the volume of traffic²⁹, and that social factors in turn may influence disease causation. The mechanisms they suggest of relevance here are firstly *stress* which increases susceptibility to disease, and secondly a *reduction in social support*, which is believed to reduce the ability of people to cope with illness. However, it is pointed out, that "*studies have not been done linking health with community severance or lack of social contacts or social support that are due to transport problems. Community severance thus remains a plausible but unproven cause of inequalities in health*" (p 112).

Another set of issues related to severance are to do with the impact that severance might have on the community as a whole: what has been termed social or 'community cohesion'. For example, in the case study of a ring-road described in James *et al.* (2005), members of the community were of the opinion that the ring road had become a 'psychological boundary' between them and other communities. They also felt that the road had contributed to a reduced 'sense of community', and that this was being further eroded as more people took to using their cars to make journeys that previously would have been undertaken on foot - thus reducing the potential for social interaction with other people during the journey.

The converse of this was that there were also instances of how improving access might also be of concern to existing residents. In a study into the impacts of the JLE, Gatersleben, Clark, Reeve & Uzzell (2007), found evidence of fears about possible impacts on communities along the line. For example, worry about negative impacts resulting from the neighbourhood becoming more 'accessible' and possibly more desirable to people in surrounding areas. These issues seemed particularly important for those people who saw strong *social boundaries* around their community. These boundaries are formed by the social groups in an area that people choose to interact with and are in addition to any spatial demarcation of a neighbourhood. They tend to exist mainly in peoples' heads³⁰. The authors considered that it is likely that these social boundaries are stronger for people who have lived in an area for a longer period of time.

It is also possible that by resolving accessibility and severance problems in one area or community that the problems are passed on to, or made worse in, other areas. This was a situation identified by Egan *et al.* (2003) in their review of road schemes. Out-of-town bypasses reduce disturbance and community severance in towns but actually increase them elsewhere.

Gaps:

- No evidence was identified that considered how to identify or predict psychological barriers in respect of severance.
- More needs to be known about the impacts of new transport infrastructure and schemes on access to healthcare.
- Consideration should be given to the mental health effects of changes in transport infrastructure, for example, with respect to annoyance, frustration and anxiety from delays and congestion, and from fear of accidents.

²⁹ Appleyard D & Lintell M (1972). *Journal of the American Institute of Planners*.

³⁰ Billig, M., & Churchman, A. (2003). Building walls of brick and breaching walls of separation. *Environment and Behavior*, 35(2), 227–249.

3.5 Integration

3.5.1. Transport Interchange

In considering literature for this review, integration has tended to feature in the studies of light-rail schemes reviewed, although it appears to be less evident in the reviews of road developments. It is assumed by most public transport schemes that integration with other modes of travel will be a positive outcome, both in terms of delivery of that specific service, but also in respect of wider accessibility goals, thereby creating beneficial SDIs. Improvements to transport interchange are also seen as a positive in the NATA appraisal process. Similarly, high quality interchange is generally regarded as desirable by surveys of the travelling public, but this does need to be placed in the context that direct services, not requiring interchange, are likely to be even more desirable, and there may be specific groups, such as the mobility impaired, for whom interchange is a particular deterrent to travel.

In Glasgow, both heavy rail and underground system improvements were introduced at the same time, with consideration given to how they would support each other (Gentleman *et al.*, 1981), a process aided perhaps by public ownership of the assets involved. As a result, it was possible to create effective interchanges between the systems, and achieve one of the goals of the redevelopment, providing the means for former inner-city residents displaced to outer suburbs to access employment and retailing in the city centre.

When the Manchester Metrolink system was first designed it was thought that bus and rail services would be integrated, and that free-parking would be provided at stations outside of the city centre in order to encourage patronage and reduce congestion (Law *et al.*, 1994). This again could have provided positive SDIs in the city centre, by potentially reducing the environmental effects of traffic and congestion, whilst at the same time improving accessibility. However, in this instance bus de-regulation, which allowed buses to run in competition with rail, and no restrictions on the supply of car parking in the city centre combined to undermine these possible benefits.

Similar situations occurred with the Sheffield and Newcastle light-rail schemes. Both provided opportunities for a more integrated public transport system. In both schemes the changes brought about by de-regulation in the bus and rail industries were seen to make this integration more difficult. Lawless (1999) for example, when considering Sheffield, found that the buses and light-rail scheme ended up competing with each other for passengers rather than supporting wider aims to reduce congestion and the impacts of road traffic.

In the JLE impacts report (Lane *et al.*, 2004), it is stated that the primary aim of the JLE was "to assist in the regeneration of areas of London including the Docklands, which were relatively deprived and underdeveloped" (p1). The existing transport links in the area were considered poor, and it was deemed beneficial to create interchanges with all the other public transport systems in the area. The study finds that there are now better connections between bus, DLR and Underground, and even an interchange with park-and-ride in Greenwich. However, the impacts study is critical of the integration with pedestrians and cyclists, particularly as at some stations this is how the majority of passengers arrive. It is suggested that whilst considerable care seems to have been taken to improve 'movement' within new stations, in particular for those in wheelchairs, the same consideration has not extended outside the station buildings.

The Atkins (2006) study of the Newbury by-pass also considered integration of the new scheme with other mode of transport. Here though, they found that no improvements to transport integration had been planned, or executed, since the new road was built. In particular the poor interchange between bus and rail had not been addressed. Neither had

the opportunity been taken to increase bus services in the town following the original decrease in traffic following the opening of the bypass.

3.5.2. Land Use Policy

In a number of the studies considered in this review, there is evidence that transport interventions are linked to broader planning objectives. In the case of the Sheffield Supertram and the concurrent road developments, there was a specific link to regeneration plans in the city, and redevelopment of former industrial areas (Lawless 1999). Similar links can be found in some of the other rail schemes reviewed.

The introduction of new transport facilities can also generate opportunities to progress other spatial planning objectives. Planning policy now encourages higher density residential development, and in London, there is evidence to suggest that the introduction of the JLE is helping that higher density to be achieved (Lane *et al.*, 2004). Increased awareness of the development potential amongst the local authorities along the line has allowed them to capitalise on these opportunities. There is now more proactive planning of how this potential could be realised, particularly in terms of high density and transport intensive uses. It is also likely that the JLE has enabled a 'critical mass' of new development in some areas, encouraging developers, and providing confidence for further development to take place.

3.5.3. Other Government Policies

Several of the studies considered have commented on integration with other government policies. Lane *et al.* (2004), for example, highlight how the JLE development is consistent with Government policies to encourage development in the Thames Gateway, and also to promote greater use of public transport in urban areas, with the resultant social and distributional benefits that those policies may generate. Other studies have illustrated how a transport scheme may actually be subject to competing government policy goals. The Atkins (2006) five-year review of the Newbury bypass is an example of this. Here it is found that the new road contributes to transport policy objectives but not environmental policy ones. It was contrary to policies on AONBs and Sites of Special Scientific Interest (SSSIs), but it did support policies to assist economic growth by reducing transport costs, remove through traffic from unsuitable roads and to enhance road safety. Each set of policies could create SDIs, some positive and some negative.

Other authors highlight areas where perhaps there should be greater integration of government policies in order to avoid some of the negative SDIs generated by transport schemes. For example, the study by Brainard *et al.* (2002) explores some of the reasons why minority communities are likely to be located in areas with lots of road traffic, uncovering a deeper linkage between transport, housing and community policies. In their specific study of the issues in Birmingham, the authors propose that the location of ethnic minority populations is partly the result of historical housing policies. For example, the City Council approach to inner-city slum clearance in the 1960s and 1970s is seen as one contributory factor. Other suggested causes include problems of racism, particularly in relation to the rented-housing sector, and the migration of more affluent (white) people to areas further out of the city. There is also seen to be a link with that fact that the housing in more polluted areas is less expensive³¹, making it more attractive to some ethnic families who are thought to be experiencing higher levels of poverty than their white counterparts³². Hine & Mitchell (2003) also link transport with housing policy, finding that

³¹ Oakes J M, Anderton D L, Anderson A B, 1996, A longitudinal analysis of environmental equity in communities with hazardous waste facilities. *Social Science Research* 25 125-148.

³² Rex J, Tomlinson S, 1979 *Colonial Immigrants in a British City* (Routledge, London).

lack of access to a car and lower income can geographically restrict peoples' housing choices.

3.6 Other Evidence outside NATA Objectives

Some evidence has come forward whilst reviewing material, which does not necessarily fit comfortably under one of the NATA Objectives. Two specific topics that fell into this category are discussed below.

3.6.1 Population migration

There is the potential for a transport intervention to have social impacts on a community through changes in population and demographic mix. The study of the Croydon Tramlink system (Thomas, 2002) identified increases in numbers of people using light rail as a mode of transport over and above the previous heavy rail network. Some of these people were identified as having moved to the area since the Tramlink had opened, potentially as a result of the accessibility benefits that it was perceived to provide.

The JLE study (Lane *et al.*, 2004) also highlighted migration of people into the corridor around the line. It was noted that, historically, a high proportion of migration in these neighbourhoods (as in other parts of London) was likely to be local. In data collected over the periods 1998/9 and 2000/1, it was found that migrants were more likely to have moved from further away in London, or from outside London. The study notes though that much of this inward migration seems to be 'temporary', with people planning to relocate again relatively shortly.

The migration identified by the JLE study also uncovered differences between the demographic classifications of the people moving to the area and existing populations. Incomers tended to be younger, white, in smaller households, with higher household incomes and in receipt of fewer benefits. People moving into new-build housing were significantly more likely to be employed, and in professional and management roles. The authors perceive that it is mainly the newcomers to the JLE rail corridor that have contributed to increasing property prices, and that have also changed the overall composition of the population and led to changes in the type of services and amenities being provided. The profile of the migrant population could also suggest that economic benefits from a scheme such as the JLE are more readily available to those people who are capable of, and willing to move.

3.6.2 Social and Economic factors impacting on Transport

There can be wider economic and social factors at play which will influence any impacts resulting from transport interventions. This was highlighted by Law (1994), who identified that the effects of the economic recession of the early 1990s were instrumental in the levels of patronage seen on the new Metrolink service in Manchester. It was also considered to have depressed land values along the Metrolink corridor, which may have dampened some commercial development, delaying or defraying expected regeneration activity. Lucas *et al.* (2001) in their study investigating transport and social exclusion also identify that many of the problems associated with poor transport and accessibility could actually be related to the broader economic and social climate. The focus group evidence collected by this study led the authors to conclude that it was unlikely that the then current central or local government transport policies would fully address the exclusion problems of disadvantaged groups.

4 Analysis of Evidence against Overall Project Objectives

4.1. Who is impacted, and how do those impacts differ for different groups?

Many of the studies considered by this review have identified specific groups who they feel may be impacted by SDI from transport schemes. Where these have been noted in the description of the study, for example in a methodology, then they have been mapped against the list set out in the earlier Review Protocol³³. A summary of which groups were identified is presented in Table 1 below (see Table 2 in Appendix A for a detailed breakdown of information by Author(s)). As a result, consideration can then be given to whether there appear to be any shortfalls.

Table 1. Social Groups identified in the evidence review (Section 3).

Social Group	No of Refs	Social Group	No of Refs
<i>Demographic groups</i>		<i>Economically defined groups</i>	
Different genders	8	People in education	2
Children and young people (under 25)	12	People in unpaid or voluntary work	0
Middle generational people (26 to 50)	1	People seeking work	2
Older people (over 50)	11	Part-time workers	0
Families (with dependent children aged 15 and under)	1	Key workers	0
<i>Groups defined by social and cultural factors</i>		<i>Groups defined through transport choices</i>	
ethnicity	9	Bus users	1
nationality	0	Car users	1
religious belief	0	Pedestrians	2
		Users of powered two-wheel vehicles	1
<i>Groups prone to exclusion on accessibility grounds</i>		<i>Other Groups referenced in evidence (using original terminology)</i>	
Disabled people	5	'Economically inactive Women'	1
Households without access to	4	Carers	1

³³ Shergold I & Parkhurst G (2007) Literature Review. The Treatment of Social and Distributional Impacts in Appraisal and Evaluation Review Protocol. Version 2, 1 July 2007. Centre for Transport & Society. University of the West of England, Bristol.

Social Group	No of Refs	Social Group	No of Refs
cars			
People unaware of travel opportunities	0	People not reached by the usual methods of public consultation	1
Low-income households	6	People with health problems	2
<i>Geographically defined groups</i>		'Elderly Housewives'	1
Rural	4	'People in work'	1
Suburban/peripheral estate	5	'Hidden deprived'	1
Urban core	7	People in Underground Railway Station Catchments (1k radius)	1
		Lone Parents	1

As can be seen in Table 1 above, the social groupings that were mentioned most frequently in the evidence were the 'age' related demographic groups. As well as the specific reports on older people and young people, groups such as children were highlighted in many studies and reviews of studies. The next most frequently discussed grouping was related to ethnicity, the evidence including specific investigations of links between both air quality and accidents and ethnic groups. The other groups which received wider mention were women, people on low incomes, inner-city residents, and the disabled. In respect of groups who were less well represented in studies, there was little explicit mention of groups defined by mode of transport, or those categorised by their occupational or economic status.

Other terms that arose in evidence tended to reflect either the age of the study, for example references to 'housewives' from the 1970s, or the particular area of concern of the author(s) of the study. One particular grouping which is found in this list which may be worthy of increased consideration is that of 'people with health problems'. This is likely to be an area of increasing concern in respect of transport schemes as a result of the ageing population in the UK, and concerns over levels of illnesses such as obesity.

It is noted that the differences in coverage of the various social groups could either be coincidental or systematic. If it is systematic then that could reflect the fact that certain groups are particularly affected by transport schemes, so researchers have been more concerned with them, or because there is a high intrinsic level of interest in those groups, so they generally have a high profile in social research output. It is not possible to resolve which of these explanations is more important on the basis of the present literature review, but one possible implication is that some groups which are relatively affected by transport schemes have been under-researched. This may suggest a particular research effort in the future, in order to understand how important each group is for inclusive appraisal, which groups are well covered and which gaps should be filled by future research, including Stages 2 and 3 of the current project.

4.1.1. Groups identified as being impacted in the evidence

Many of the studies considered in this literature review have identified the social groups which they thought were likely to be affected by impacts from transport schemes (as discussed above). However, in some instances the findings of the studies may have highlighted groups they believed had been impacted, or most impacted. These may have been the same groups determined at the outset of the study, or others that came to light during the course of any investigation. Where groups have been explicitly mentioned, then this information is listed below:

Children / Young people:

- The fear/risk of vulnerable groups such as children to traffic accidents was highlighted as important (Watkiss *et al.*, 2000).
- Noise was noted as a particular issue for school children (Watkiss, *ibid*).
- Links were revealed between mode of transport, accident rates and vulnerable groups, particularly children (Watkiss, *ibid*).
- Young pedestrians (aged under 9) of Asian origin were over-represented in road accidents by a factor of two (Lawson, 1991).
- Beneficial impacts were identified for children and students of higher / further education (Lucas & Tyler, 2005).
- 'Young people' are found to "*have much in common with other age groups*". It was also concluded that transport could have both positive and negative impacts on young people's access to services and facilities (Taylor *et al.*, 2007).

Older People:

- The elderly were considered to be one group specifically impacted by social exclusion as a result of transport issues, (as well as others such as the disabled). Elderly people are likely to have to spend more time travelling as a result of having less access to cars and more need to rely on buses (Hine & Mitchell, 2003).
- In respect of positive health impacts from travel/transport initiatives, then the greatest 'benefits' were seen to be gained by increasing activity levels in elderly, sedentary or obese individuals through walking and cycling (Watkiss *et al.*, 2000).

Women

- In respect of exclusion, 'women' are noted to be less likely to have access to a car - and therefore would be more reliant on lifts. Women are also more likely to have to use buses, and therefore spend more time travelling than those with access to a car (Hine & Mitchell, 2003).

Low income / Deprived Groups:

- In examining the relationship between air quality and poverty, this New Zealand study found "*a clear gradient from quintile 1 (least deprived) to 5 (most deprived) with those living in the most deprived areas having the highest levels of pollution*". (Kingham *et al.*, 2007).
- The risk of death for child pedestrians is highly class related, and injuries to children from socio-economically disadvantaged families tend to be of greater severity. It is also seen that Children from single parent households have higher pedestrian injury rates

than children from 2-parent families, as much as 50% higher in some instances (White *et al.*, 2000).

- Positive impacts were reported by 'high-income households without cars', and negative impacts by 'low-income households who drive in the congestion zone' (MORI, 2004).
- This report concluded that disproportional effects from activity related to transport had been identified on vulnerable groups. The relationship between income / poverty and air pollution was highlighted as important (Watkiss *et al.*, 2000).
- People on low incomes are likely to have to spend more time travelling as a result of having to use buses etc. (Hine & Mitchell, 2003).
- Links were also discovered between mode of transport, accident rates and social class. (Watkiss *et al.*, 2000).

Ethnic Groups:

- Young pedestrians (aged under 9) of Asian origin are found to be over-represented in road accidents by a factor of two, although ethnic minorities in general were not over-represented (Lawson, 1991).
- The study also found a significant difference in child pedestrian injury rates based on ethnicity, particularly for younger 'non-white' children (White *et al.*, 2000).
- In respect of pollution and ethnicity in this NZ study, the authors found "*There is a clear gradient from quintile 1 (lowest proportion European) to quintile 5 (highest proportion European). For Maori, Pacific Islanders and Asians the pattern is less clear although pollution levels are generally higher in census areas with increased proportions of those populations*" (Kingham *et al.*, 2007).

Motor Cyclists / Cyclists / Walkers:

- The report highlights the fear/risk of vulnerable groups such as cyclists to traffic accidents. In respect of accidents, pedestrians, cyclists and motor-cyclists are identified as groups most at risk (Watkiss *et al.*, 2000).

Rural Communities:

- Rural communities were likely to be affected by road schemes, but not necessarily assessed (Egan *et al.*, 2003).

People with health problems:

- People accessing healthcare were seen as a potential at risk group. The impacts of transport could change their behaviour, for example restricting their access to facilities and services. The authors felt that this group could be disproportionately affected. (Bonsall & Kelly, 2005).
- People with health problems were considered to be one group specifically impacted by exclusion as a result of transport issues (Hine & Mitchell, 2003).

Others:

- Lucas & Tyler (2005): Found positive social impacts for those accessing employment through the transport improvement schemes they studied.

4.1.2. Consideration of Timescales

The influence of the timing of the research study is also discussed in a number of the documents reviewed. It is evident that some studies have been undertaken very soon after a new transport intervention has occurred, and in some cases the authors have reflected that they may be too early to capture all the impacts of the scheme. There may also be instances where different impacts may be felt at different stages of a transport project, or at different points in its life. Whilst most of the rail studies occurred soon after implementation, at least some of the road scheme studies have reviewed a project over a number of years. Where there has been some consideration of time in a study, then this is summarised below.

It was acknowledged by a number of studies that some impacts would take time to be felt. In the work on the Glasgow rail and underground system, for example, Gentleman *et al.* (1981) identified that some of the economic regeneration benefits, and resultant social benefits, of that set of schemes could take time to come through. In that particular instance the timeframe was presumed to be 'many years'. A similar opinion was formed by Law *et al.* (1994) when considering the Manchester Metrolink scheme. Here the authors were also considering the impacts of the wider economic recession during the implementation period of the initial Metrolink lines. Their conclusion was that, as a result, localised economic impacts from those interventions would only be felt over a longer term. The survey in Sheffield by Lawless (1999) considered change over a four year period, and did manage to find emerging benefits, although changes didn't appear to be on a particularly large scale. No significant impacts were detected over the shorter term.

In respect of roads, Egan *et al.* (2003) quantified the timescales being applied to the schemes they were reviewing. For example, they found that studies of by-passes generally ranged from a few months to a couple of years. Post-construction studies, some only qualitative, ran for longer time periods, up to five or even seven years. But there was also material considering 'disturbance' over a 30 year period in one instance. Matson *et al.* (2006) also used five-year review material in their case studies.

4.2 Considerations for Developing a Scheme Typology

Whilst considering SDIs arising from transport and transport interventions, it has been possible to see some themes emerging about types of transport scheme and related effects. Where this has suggested specific links between some particular element (mode, spatial context *etc.*) and set of impacts then this is discussed below. As this may help inform a 'typology' of schemes, impacts and assessment, then there are suggestions of what may be appropriate as potential criteria for appraising that type of scheme.

4.2.1 Road

One particular theme which has emerged in the reviews of road schemes is the need to consider all communities likely to be impacted by SDIs from a project, and to consider these communities across a wide enough range of scales. This is illustrated in the Egan *et al.* (2003) review. Here, a common thread was the consideration of levels of 'disturbance' caused by each scheme. Enough commonality of approach was seen to enable the authors to draw out broader conclusions about this impact. The failing with many of the studies considered though was that 'displacement' impacts did not seem to be reviewed in many instances. For example, although the effects of disturbance on towns being bypassed was measured before and after a scheme was implemented, this was often not then applied to rural communities where the bypass was built.

Similar concerns arose from the studies by James *et al.* (2005) and Rajé (2004), which saw road developments³⁴ contribute to problems of accessibility and community severance. In the case studies in these reports, the introduction of new transport infrastructure was seen to have impacts on the neighbouring community. No indication was given as to whether these impacts were assessed before the changes were implemented, but even if they were there could still have potentially been a wider conflict with goals for other communities and transport users. For example, improvements in air quality, reduced disturbance and severance elsewhere, and improved accessibility for a wider community. As a result, it is apparent that severance and accessibility issues need to be considered at all scales when developments of this nature are being considered.

4.2.2 Rail

The rail studies examined in this review have in general concerned themselves with positive impacts along the corridor that the line(s) run through, although the study on Glasgow (Gentleman *et al.*, 1981), and the JLE study (Lane *et al.*, 2004) also gave some consideration to the wider impact on their respective cities. The primary area of focus in most of the work is economic, particularly evidence of regeneration and employment creation. The other commonplace element in the various rail studies has been some investigation into travel patterns, patronage levels, and any modal shift exhibited by passengers.

4.2.3 Bus

The bus studies considered have primarily been located in rural areas, and from Nutley (1983) onwards, the focus of study has been on any improvements the new service might make to access provision for those without cars. The geographic scale of assessment of impacts of these schemes is normally relatively small-scale.

4.2.4 Congestion Charging and Demand Management

The other area of transport scheme seen in the evidence is focussed on demand management techniques, primarily road pricing schemes (both hypothetical and real), and the workplace parking scheme at Birmingham University. In both the Rajé (2003) and Mori (2004) studies on congestion charging, the issue that seems to be of most concern is the impact of charges on the level of travel of vulnerable groups, particularly those on low incomes. Less consideration appears to be given to other appraisal issues.

4.3 Implications for Evaluation and Appraisal Frameworks

Some of the material considered by this review has made proposals as to how the assessment and evaluation of transport schemes might be extended, or enhanced, to become more effective in respect of social and distributional impacts. These suggestions are discussed below, categorised against the NATA Objectives (where possible).

This material is intended to provide input into later stages of this project, by giving an indication of where opportunities could exist to improve on the existing processes.

4.3.1 Environment

Much of the evidence considered in Section 3 focussed on health impacts, particularly those related to air quality. Several studies were considered that investigated air quality and exposure levels in particular groups, for example Forkenbrock *et al.* (1999), Brainard *et al.* (2002), and Kingham *et al.* (2007). Each developed a spatial methodology for

³⁴ In the case of James *et al.*, the ring-road was already in place prior to the study.

plotting where air quality issues might be found, and the groups likely to be affected in those locations. A variety of statistical databases, geographical information systems (GIS), air quality models, and weather models (Kingham), were used in order to reach conclusions. These studies may provide ideas for enhancement of existing appraisal and evaluation processes, and would also suggest that incorporating some form of impact distribution analysis into the appraisal process would be an important addition.

In Spain, Monzon & Guerrero (2004) have proposed taking this a stage further and have developed a methodology for 'costing' the health impacts of air pollution from various modes of transport in monetary terms. Their method takes into account costs associated with losses in working time, mortality and human suffering. The authors also consider that the methodology has the ability to cost the impacts of Greenhouse Gases (GHGs).

The Watkiss *et al.* (2000) report was specifically aiming to evaluate the 'direct relationships' between transport and health in London, and consider whether it was possible to then quantify them in a Health Impact Assessment (HIA). Importantly, this study took a view of 'health' to mean not just 'medical effects', but also a wider view of health as a state of physical, mental and social well-being. The conclusion was that an HIA could be used alongside traditional transport appraisal to provide a better understanding of the health consequences of transport. It was suggested that by doing so it may be possible to help improve the health aspects of transport schemes, minimising negative health effects and maximising positive health effects. The authors did make clear though that they thought the HIA process should not be used as an alternative to existing appraisal for setting transport policy, as it only considers a sub-sector of the wider criteria involved. They also highlighted some specific issues in respect of air quality, noting that there was still some debate about specific levels of exposure and related health impacts.

4.3.2 Safety

No suggestions made in material reviewed.

4.3.3 Economy

Suggestions were made by several authors about the need to gain a better understanding of some of the wider economic benefits, and dis-benefits, of any specific transport scheme. Considering impacts that are felt beyond any specific corridor related to the new transport development, and also those economic effects that may occur over time, as a result of the development. For example, in the Grieco (1994) study of transport investment in the inner-city, it was recommended that 'before and after' studies were undertaken to properly understand the impacts of a scheme. In particular it was thought that this should:

- explore where new commerce near transport infrastructure has come from, and if it had moved, what the effect on its previous location was and
- identify where users of new facilities near new transport infrastructure came from - to test if other businesses in less accessible areas had lost custom to them.

These questions had a specific focus on economic development moving away from inner-city areas, but Matson *et al.* (2006) were also concerned with these wider impacts. In their review of road schemes it was suggested that although the appraisal process may include forecasts of other benefits such as 'job creation', it did not evaluate widely enough to take account of jobs lost elsewhere as a result of the introduction of the scheme.

Lane *et al.* (2004) made suggestions in relation to land value. They felt that it was a particularly important issue for the appraisal process to consider, and that change in land and property values should be included as a benefit. The authors suggest that, traditionally, these increases have been put to one side, to avoid what was perceived to be the 'double-counting' of a positive impact, the rationale being that the increase in land

values resulting from a new transport scheme is due to better transport accessibility, which is already captured as 'travel time savings' in NATA. This report suggests there are good reasons not to adopt this approach, and instead include land value in appraisal. Several reasons are given:-

1. Only part of any increase in values is likely to be directly attributable to an increase in accessibility. After a (short) period of operation of any new transport scheme any further uplift in value is likely to be due to 'multiplier effects' from the enhanced attractiveness of an area. These longer-term effects would not have been captured in any estimates of travel time savings.
2. Increases in property prices and land values will have distributional effects. For example, forcing some less well-off tenants to move to more affordable locations. In addition, those who gain financially from price increases may be different from those who benefit from time savings.
3. Changing land and property values are also important in understanding regeneration processes. They indicate what the market demand is for an area, and give an indication of how 'commercially' attractive redevelopment will be. Prices will also give an indication of what density any new development is likely to achieve.

4.3.4 Accessibility

The issue of measuring accessibility came up in a number of studies. For example, Jones and Lucas (2000) compared the approach used to measure accessibility in appraisal processes in a number of different areas of government policy, including transport. They found issues with the approach adopted by NATA, and scope to represent social exclusion issues in a manner more consistent with the appraisal processes used by the (former) SEU. They proposed a number of enhancements and changes in order to improve the situation, some of which are discussed below - see 'Other Government Policies' in 4.3.5 Integration.

Cass *et al.* (2003) also identified problems with existing appraisal techniques for transport initiatives, after reviewing new workplace parking and demand responsive transport (DRT) schemes. Their findings at Birmingham University (which had introduced a workplace parking scheme where previously free parking was the norm) were that there was a lack of any simple common response. The impacts varied from person to person, depending on that person's current travelling arrangements and on their perceptions of valid alternatives. This has implications for predicting impacts of such schemes in assessment. The second desktop study and series of interviews carried out on DRT services identified that there is a 'significant gap' between identifying accessibility by looking at the number of buses passing bus stops, and population densities, and the 'hidden demand' uncovered by actually talking to users on the bus.

Other authors have proposed new tools for assessing the access and exclusion potential of new transport schemes. One such suggestion has been put forward by Bonsall and Kelly (2005). Their study used a new methodology, 'Popgen-T'³⁵, to understand the possible impacts of various types of congestion pricing schemes on the city of Leeds. Although there is no charging scheme as yet, their method was able to propose which social groups might be adversely-impacted by various configurations of such a system. Groups considered to be at risk included: those on low income, the disabled, lone-parents, the over 60s, females, and ethnic minorities.

³⁵ The Popgen-T methodology is a set of processes which 'generates' traveller characteristics, and then determines which individuals in an area might be expected to be impacted by any given travel policy. Its primary source of data is 'small-area-statistics' from the National Household Census, and it uses a standard 'traffic assignment' tool as part of the analysis of impacts. For more details of the methodology see Kelly, C. and Bonsall P.W. (2002). The Popgen-T Methodology. ITS Working Paper 569, University of Leeds, Leeds.

The issue of assessing severance was also considered directly in the Department for Transport / TRL report on Community Severance (James *et al.*, 2005). This document proposed a number of measures which would allow the assessment process to deal with the issue more effectively. These included consideration of:

1. Potential increased car use by a community in order to minimise the physical, or psychological, barriers created by new transport infrastructure (leading to less social interaction on the street and thereby reduced community cohesion).
2. How community severance effects might change between day and night (*e.g.* congestion in the day and high traffic speeds and noise at night).
3. How secondary community severance might occur through problems with a mitigation measure, for example, their inaccessibility or unacceptability.
4. Whether a wider range of social groups than those currently identified as being most vulnerable to the effects of community severance needs to be investigated.

Rajé (2004) also considered what might help avoid a transport initiative from negatively impacting on community cohesion, suggesting that in order to properly evaluate a scheme, there needed to be data available which realistically reflected the “daily experience of local residents” in terms of their current access.

4.3.5 Integration

Matson *et al.* (2006) suggest that when a new road is being constructed, there should not be an assumption of no change in land use. Instead, there should be consideration given to what impact the road might have in stimulating out-of-town or rural development, as this could be counter to national and local land-use policy. They also point out that although the appraisal process seems to recognise that roads may be required to serve developments, it fails to take account of what the development will mean for the future functioning of the road, *e.g.* considering whether it will cause it to be congested.

Jones and Lucas (2000) looked at issues of integrating transport schemes with other areas of Government policy, finding inconsistencies between the various appraisal approaches used. They concluded that transport appraisal was currently excluding some important aspects of transport impact (*e.g.* resource depletion) and had been developed in such a way as to make it difficult to link with many of the other policy sectors. They suggested a number of principles that could be adopted to improve this situation:

1. The Department for Transport should provide a basic set of measures and indicators that depict transport provision, the main impacts on the performance of the transport system and the travel (dis)benefits to users. These could then be used in other department’s appraisal processes.
2. The same principle should be applied to all other indicators. With the most appropriate department providing those for the area which they are responsible for. These would then be incorporated by other departments into their own appraisals.
3. The categories of criteria or objectives in an appraisal should be ‘readily attributable’ to a given department or policy initiative (*i.e.* health, environment, education, employment, housing, crime *etc.*).
4. Indicators should be delivered in a hierarchical or nested format, so that any particular topic can be covered in greater or lesser detail, as appropriate, but within a common structure.
5. All appraisals should support a common core set of disaggregations, by user type and stakeholder group.
6. Finally, there should be an agreed set of procedures for presenting a financial assessment of any scheme.

4.3.6 Other

A number of other suggestions have been made in relation to the appraisal process, which do not necessarily sit within the NATA framework above.

Matson (2006) in the review of recent UK road schemes comments that the appraisal process “fails to consider the road scheme against other, fully developed, alternative measures”. As an example, a scenario is proposed in which an alternative to dualling a rural single-carriageway road for road-safety improvements could be lower speed limits and traffic calming in the villages concerned. The result would still be the improvement in safety required, but at a fraction of the cost.

Several studies consider the concept of ‘equity audits’. Rajé (2003, 2004) for example, suggests that these would allow consideration of scheme impacts on different social groups. The author recommends that the audit should consist of a checklist that would be carried out at various stages in the scheme’s lifecycle, before and after construction, and that it should take account of all groups in society (groups defined by gender, ethnicity, age, disability, unemployment, low-income). Lucas *et al.* (2001) also recommends that local authorities evaluate the ‘social equity’ implications of their transport plans. However, it is noted that the range of issues encountered will make resolution highly complex.

As a result of specific legislation (see section 1.2 above), there has been extensive consideration of SDIs of transport schemes in the USA in recent years. The US Transport Research Board (TRB) has commissioned a specific study of appraisal methods for SDIs. This report (Forkenbrock, Benschof & Weisbrod 2001) and a subsequent guidebook³⁶ for planners provide a number of suggestions for the assessment of transportation projects, as follows:

- 1) Neighbourhood survey: The TRB report believes that this could be one of the most promising approaches for estimating the social effects of transportation projects. The surveys would enable planners to understand the qualities or attributes of a neighbourhood valued by its residents. These qualities can then be considered when determining changes to transport infrastructure, and ensuring that negative impacts are mitigated.
- 2) Methods, tools, and techniques that may be useful and appropriate for estimating social effects should be adapted from other, non-transport, areas: The TRB report cites reasonably direct applicability for studies of neighbourhood cohesion, pedestrian safety, accessibility to people or places, and housing relocation as examples.
- 3) The report also considers that there are assessment tools available which would allow planners to measure the concept of ‘liveability’ in a neighbourhood.
- 4) In respect of distributional impacts, the authors comment that they believe there are enough readily available GIS software, pollution and noise models, travel analysis models, and various liveability indicators to enable competent evaluations of distributive effects.

4.3.7 Discussion of what overall review implies for appraisal

What is apparent from the evidence reviewed is that transport developments have the potential to create a very wide range of effects, most of which can be expected to create some form of SDI. It is also apparent that the relationships between transport and SDIs are not simple. In general, the material reviewed has not expressly identified SDIs that follow from the problems they discuss, but they do reflect wider concerns about transport. They also present a wide range of evidence of ‘negative impacts’ of transport schemes

³⁶ Forkenbrock D J & Weisbrod G E. (2001) Guidebook for assessing the social and economic effects of transportation projects. NCHRP Report 456. Transportation Research Board National Research Council, Washington DC, USA.

(particularly roads), and reflect a greater desire to better understand the likely impacts of any particular scheme. As a result, it is apparent that any appraisal process for transport development will need to reflect this wide range of issues and impacts, as it can be argued NATA does. Whilst there may be plenty of debate and discussion as to the weight that particular issues are accorded in the NATA process, it does at least appear in the main to address most of the impacts that it needs to. What is not clear is the robustness of the methods used to measure social and distributional impacts.

The suggestions for amendments and additions to the appraisal process detailed above illustrate the desire of a number of authors to incorporate impacts across a wider range (spatial and social / distributional). There are also some specific additions proposed which would capture information particularly relevant to particular negative impacts, such as the use of the HIA to capture health impacts. The suggestions made for achieving a better understanding of the wider economic benefits of a scheme offer opportunities to consider impacts across a broader spatial area than that immediately affected by the transport development. The proposals for better integration with other types of appraisal, and with other arms of government look particularly promising, offering the potential for much more consistency of approach. It is also apparent that the appraisal process and subsequent reviews create a wealth of material which is relevant to future schemes. Sometimes it seems difficult to access some of this information, which could and should allow lessons to be learnt and applied.

Perhaps the most important finding for the current appraisal process from the material reviewed is that none of them have suggested it is entirely 'unfit for purpose'. There are studies published before NATA that were recommending something that looked like it, and none of those produced since its introduction have suggested replacement rather than revision.

5 Conclusions

5.1 Summary of Extent of Evidence and Gaps

The evidence base has a broad scope and reach. It was generally of good quality, although there were some instances where longer timescales for the study could have helped confirm whether or not impacts were evident, and where 'before' data was not available for a study. In both instances, the quality of the resultant evidence could have been improved. There were also potentially issues with the currency of some of the studies, particularly those from the 1970s, although the quality of the original research is not at question.

The limitations of the evidence base are perhaps characterised as areas of thin coverage rather than major gaps, with areas of relative strength relating to the Objectives of Safety and Accessibility and parts of the Environment Objective, with weaker coverage to date of the Economic and Integration Objectives.

In terms of social groups and issues studied, there has been a natural focus on potentially dis-beneficial SDIs and on vulnerable groups, particularly the old and the young, whilst the involvement of the health sector has added important capacity to the transport sector, for example in the form of high quality epidemiological analyses of noise and air pollution.

In the transport sector itself, many studies relate to road schemes, particularly on topics such as severance and pollution. Evidence on urban rail schemes is also strong, due in the UK at least to the need to run detailed, well-funded monitoring studies to test the appropriateness of investing millions - even billions - of pounds of public money in specific schemes. Nonetheless the material on SDIs has had to be carefully selected from data focussing on the primary objective of evaluating overall patronage and economic outcomes rather than social and distributional outcomes.

In considering the broad needs of future appraisal requirements, a need for more information focussing on travel needs and preferences as opposed to established travel behaviour is identified, due to the 'masking' of needs by the suppression of trip making due to SDIs. The spatial and temporal dimensions also need greater consideration, to avoid transferring dis-benefits across space, failing to fully account for both positive and negative outcomes at a wide enough boundary of appraisal, and to ensure long-term implications are understood alongside short-term.

5.2 Other key findings

Although the review has not produced evidence about exactly how practitioners apply NATA (in part as the remit was to focus on evidence), the impression given by the written record is of an activity which sometimes lack coordination, and which is applied in a variety of ways. It is generally not the subject of major, coordinated research programmes comparable to the research initiatives around environmental problems such as climate change or economic problems such as road pricing. A comment made by Egan (2003) is striking: *"despite an extensive literature search, most of the studies [identified] were not found in electronic databases. This suggests that systematic reviews of non-clinical topics in the area of transportation may need to rely more on hand searching etc."*.

To some extent, the same experience was identified in the current review, with several of the most important sources (including Egan's work itself) not being identified through systematic searching but via an emailed appeal to the academic research community.

Another finding in respect of the review process was that an important seam of comprehensive empirical studies date from the 1970s, such as those by Moseley and Nutley, although these studies are now 30 or more years old. The more contemporary literature tends towards being more theoretical and to focus on high profile topics such as road pricing.

Studies from the United States were also important on some topics, offering a more advanced level of evidence and debate than available in UK sources.

To conclude, the review identifies evidence and arguments supporting the case for some revisions to NATA procedures, but no suggestions that the philosophy of the appraisal framework is fundamentally flawed and in need of replacement.

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Appendix A - Social groups identified in evidence

Table 2 Groups considered and/or investigated in Literature Review Documents

Groups Listed in Protocol	Moseley	James	Rajé (2003)	Hine	Brainard	Nutley	Lucas (2001)	Cass	Dobbs	Gatersleben	Grieco	Kingham	Knight	Law	Lane	Lawson	Lucas & Tyler	MORI	Raje (2004)	SEU	Taylor et al	Watkiss et al	White et al	Bonsall & Kelly
Demographic groups																								
Different genders				X					X	X								X		X	X	X		X
Children and young people (under 25)	X	X	X		X	X	X	X								X		X			X	X	X	
Middle generational people (aged 26 to 50)																		X						
Older people (over 50)	X	X	X	X	X		X	X					X					X				X		X
Families (with dependent children aged 15 and under)		X																						
Groups defined by social and cultural factors such as:																								
ethnicity			X		X		X					X				X		X		X	X			X
nationality																								
religious belief																								
Groups prone to social exclusion on accessibility grounds																								
Disabled people		X					X													X		X		X
Households without access to cars		X																		X	X		X	
People unaware of travel opportunities																								
Low-income households							X			X		X								X			X	X

Groups Listed in Protocol	Moseley	James	Raje (2003)	Hine	Brainard	Nutley	Lucas (2001)	Cass	Dobbs	Gatersleben	Grieco	Kingham	Knight	Law	Lane	Lawson	Lucas & Tyler	MORI	Raje (2004)	SEU	Taylor et al	Watkiss et al	White et al	Bonsall & Kelly
Geographically defined groups (usually in cross section with the demographic /accessibility / economic dimensions)																					X			
Rural	X						X													X	X			
Suburban/peripheral estate												X							X	X	X	X		
Urban core											X	X				X		X		X	X	X		
Economically or occupationally -defined groups. Using Socio-economic Classification occupation classes																								
People in education																				X	X			
People in unpaid or voluntary work																								
People seeking work																	X			X				
Part-time workers																								
Key workers																								
Groups defined through their transport choices																								
Bus users																							X	
Car users																							X	
Pedestrians															X								X	
Cycle users															X								X	
Users of powered two-wheel vehicles																							X	

Groups Listed in Protocol	Moseley	James	Raje (2003)	Hine	Brainard	Nutley	Lucas (2001)	Cass	Dobbs	Gatersleben	Grieco	Kingham	Knight	Law	Lane	Lawson	Lucas & Tyler	MORI	Raje (2004)	SEU	Taylor et al	Watkiss et al	White et al	Bonsall & Kelly
Other groups defined in Literature (original terminology taken from the relevant study)																								
'Economically inactive Women'	x																							
Carers		x																						
People who aren't reached by the usual methods of public consultation																								
People with health problems				x																				x
'Elderly Housewives'						x																		
People in work						x																		
'Hidden deprived' (in pockets of affluence)							x																	
People in Underground Railway Station Catchments (1k radius)															x									
Lone Parents																								x