

# **Distributional Impact Appraisal in WebTAG: Evidence Review and User Engagement**

Report for Department for Transport

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# Table of contents

<b>Chapter</b>	<b>Pages</b>
<b>1. Introduction</b>	<b>5</b>
1.1. Background	5
1.2. Project Objectives	5
1.3. Report Structure	5
<b>2. Approach to the Evidence Review</b>	<b>6</b>
2.1. Overview	6
2.2. Approach to Rapid Evidence Review	6
2.3. Approach to User Engagement	7
<b>3. Overall DI Appraisal of Transport Schemes</b>	<b>8</b>
3.1. Introduction	8
3.2. Rapid Evidence Review	8
3.3. User Engagement	11
<b>4. Relevance of Social Groups</b>	<b>16</b>
4.1. Introduction	16
4.2. Rapid Evidence Review	16
4.3. User Engagement	18
<b>5. Air Quality and Noise</b>	<b>21</b>
5.1. Rapid Evidence Review	21
5.2. User Engagement	23
<b>6. User Benefit &amp; Personal Affordability</b>	<b>25</b>
6.1. Rapid Evidence Review	25
6.2. User Engagement	27
<b>7. Accidents</b>	<b>30</b>
7.1. Rapid Evidence Review	30
7.2. User Engagement	31
<b>8. Accessibility, Security &amp; Severance</b>	<b>33</b>
8.1. Introduction	33
8.2. Rapid Evidence Review	33
8.3. User Engagement	37
<b>9. Other indicators</b>	<b>40</b>
9.1. Introduction	40
9.2. Rapid Evidence Review	40
9.3. Assessing Equality and Equity in Transport	41
9.4. User Engagement	42
<b>10. Summary and recommendations</b>	<b>43</b>
10.1. General Approach to DI Appraisals	43
10.2. Air Quality & Noise Indicators	44
10.3. User Benefits & Personal Affordability	44
10.4. Accidents	44
10.5. Accessibility, Security & Severance	45
<b>Appendices</b>	<b>46</b>
Appendix A – Search Terms	47
Appendix B – References	49
Appendix C – Robustness and relevance of the identified literature	54
Appendix D – Pro-formas and Report Summaries (see excel)	59

## Tables

Table 2-1	Reviewed Evidence	6
Table 2-2	User Engagement Sampling Framework	7
Table 4-1	Factors and associated degree of difficulty travel attributes	18

# 1. Introduction

## 1.1. Background

In 2011, the Department for Transport (DfT) introduced Social and Distributional Impact appraisals (now known as DIs) within its Transport Analysis Guidance, WebTAG<sup>1</sup>. The guidance was derived in part from research started in 2007 and reported in 2009<sup>2</sup>, which identified eight DI indicators - Air Quality, Noise, Severance, Accessibility, Personal Security, User Benefits, Personal Affordability and Accidents. These indicators were selected from a long list of potential indicators and prioritised on the basis of strength of evidence gathered as part of the 2007 literature review, their deliverability and proportionality within the existing WebTAG process.

DI appraisals have been applied to a number of transport schemes over the past three years and DfT have welcomed feedback from users on the process and guidance. In January 2014 DfT released revised **WebTAG A4.1 Social Impacts and A4.2 Distributional Impacts** which provided a streamlined, more user-friendly document. DfT recognised research has continued in this field and wished to ensure appraisals remain relevant, effective and 'fit for purpose'. As such, it commissioned a review of the evidence base for DI appraisals and engagement with users of the guidance.

## 1.2. Project Objectives

The objectives of the project are to:

- Update the WebTAG DI evidence base;
- Consult DI appraisal guidance users; and
- Where appropriate, incorporate evidence and user feedback into the WebTAG DI module.

## 1.3. Report Structure

The report follows the structure presented below:

- Chapter 2: Approach to the Evidence Review - presents the approach to the rapid evidence review and user engagement;
- Chapter 3: Overall DI Appraisal of Transport Schemes - focuses on the research evidence and user comments relating to the overall DI appraisal of transport schemes;
- Chapter 4: Relevance of Social Groups - presents the summary of evidence review on a range of social groups;
- Chapter 5: Air Quality & Noise - presents findings from the research evidence and user engagement on the Noise and Air Quality Indicators;
- Chapter 6: User Benefits & Personal Affordability - reflects the evidence review on User Benefits and Affordability Indicators;
- Chapter 7: Accidents - presents findings from the research evidence and user engagement on the Accident Indicator;
- Chapter 8: Accessibility, Security & Severance - presents the overview of evidence on Accessibility, Security and Severance Indicators;
- Chapter 9: Other Indicators - outlines the summary of evidence on other indicators; and
- Chapter 10: Summary and Recommendations - presents a series of recommendations to WebTAG.

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<sup>1</sup> <https://www.gov.uk/transport-analysis-guidance-webtag>

<sup>2</sup> Shergold, I. and Parkhurst, G. (2009) Literature Review - The Treatment of Social and Distributional Impacts in Appraisal and Evaluation. UWE. Available online

## 2. Approach to the Evidence Review

### 2.1. Overview

The evidence review consisted of two equally important tasks. Firstly, the Rapid Evidence Review (RER) involved the collation and syntheses of peer-reviewed research on the social impacts of transport and consideration of the implications for the distributional aspect of appraisal. Secondly, detailed feedback on the current DI guidance from a core user group of transport professionals who regularly undertake Social and Distributional Impact appraisals (DIs). The combination of these two evidence bases enabled a discussion around potential changes and noted a series of recommendations as presented in the final chapter.

### 2.2. Approach to Rapid Evidence Review

At the beginning of the rapid evidence review (RER), an initial list of search terms were prepared, reviewed and approved (see Appendix A). The search was performed on peer reviewed papers and reports, publications and relevant studies available online. The search focused on the following websites:

- ScienceDirect;
- Scholar.google.com;
- websites of leading UK universities, including: UWE, Oxford, Leeds;
- online library resources of University of Amsterdam (Netherlands);
- European Transport Conference website;
- DfT website;
- most relevant legal acts such as Equality Act (2010) and the Public Sector; and
- Equality Duty (2011).

After an initial screening of the relevance of various papers and publications, based on the given abstracts, the RER list was revised and a final list of publications produced (see Appendix B). The list of publications includes papers and reports covering the eight DI indicators and other indicators as well as publications in broader scope covering overall appraisal and various social impacts. In total, some 61 peer reviewed papers and 23 wider publications and reports were reviewed. More than half of those reviewed were UK based studies, with the remaining publications focusing on key areas of relevance: - Netherlands (overall appraisal, air quality, measuring accessibility), Sweden (accidents), Australia (equity, ethnic groups, and accessibility), Malaysia (personal security) and USA (accessibility, personal security). The findings from each review are provided in Appendix C (initial review) and Appendix D (full review).

**Table 2-1 Reviewed Evidence**

Indicator	Number of relevant and reviewed papers per indicator
User Benefits	7
Noise	4
Air Quality	11
Accidents	6
Security	6
Severance	1
Accessibility	20
Personal Affordability or Financial Impacts	10
Other indicators	11
Cross cutting papers	9
<b>Total number of peer reviewed papers</b>	<b>61*</b>
<b>Total number of reports &amp; other publications</b>	<b>23</b>
<b>% complete in total</b>	<b>100.00%</b>

\* In some cases 1 paper is relevant to more than 1 indicator

## 2.3. Approach to User Engagement

The project required detailed feedback on DI guidance from a core user group of transport professionals. Twelve external stakeholders were interviewed as well as two members of Atkins staff. To achieve a broad range of views and opinions, a sample framework was developed to consider a range of scheme typologies, indicators appraised and DI appraiser as shown in Table 2.2.

The approach to engagement followed a series of depth interviews completed either face to face or over the phone and each interview covered at least three different indicators as shown in Table 2.2. Each interview followed a piloted discussion guide covering a number of questions including:

- Summary of their involvement in DI appraisals to date - brief exploration of their general views/experiences;
- How did they go about the appraisal - sources of information, models they adopted and why;
- Any problems/barriers and how were these managed;
- What sorts of evidence or research did they need/would have liked to have used;
- How did they view the guidance; and
- Views on how the guidance can be improved or other indicators to be considered.

It is important to note that most of the users' comments and suggestions are based on their experience of using the 'old' WebTAG guidance. WebTAG Unit 3.17 Social and Distributional Impacts Unit was in use until January 2014 and was replaced by a streamlined version which separated Social Impacts (Unit 4.1) and Distributional Impacts (Unit 4.2). The vast majority of interviewees, whilst aware of the changes in the guidance had not used it at the time of interview. However, the current guidance is not significantly different from the previous version, with the changes largely limited to presentation. When comments or suggestions referred to the current guidance, it is specifically mentioned in the evidence review.

**Table 2-2 User Engagement Sampling Framework**

Scheme Type	Air Quality	Noise	Severance	Accessibility	Security	Accidents	User Benefits	Affordability
Rail (Station)	✓	✓		✓	✓			
Rail (New Line)		✓	✓	✓		✓	✓	✓
Integrated Packages	✓		✓				✓	
LSTF	✓		✓				✓	
LSTF		✓		✓	✓			✓
Highway (Existing)		✓				✓		✓
Highway (New Road)	✓		✓				✓	
P&R and Maintenance			✓	✓		✓		
Bus Rapid Transit	✓					✓	✓	
Bus Interchange		✓		✓	✓			

## 3. Overall DI Appraisal of Transport Schemes

### 3.1. Introduction

This chapter covers a broader scope in response to evidence reviewed on the overall transport appraisal process and approaches followed. Many of the users also provided comments and suggestions that go beyond the appraisal of specific DI indicators but rather refer to the overall transport appraisal as well as guidance.

### 3.2. Rapid Evidence Review

Findings from the review include the need for broader approaches in transport appraisal, presents suggestions for new approaches to transport appraisal and future research areas.

#### 3.2.1. Need for broader approaches in transport appraisal

Bakker et al. (2010) conclude that transport planning is not primarily an engineering activity, but a multi-faceted rational investigation and organisation of scarce space. They state that this calls for a more integrated perspective on transport planning. Consequently, there is a need and scope for new, broader-based approaches that are able to include a wide variety of different types of impacts. Bakker et al. (2010) also state that there is a need to further develop currently available methodological processes, saying that interactive decision-aid methods would be one direction, while GIS-based assessment might provide new departures for operational research in the transport field. According to Hamersma, M. et al. (2014), the overall assessment should look into wider neighbourhood factors as they are at least equally important as highway-related factors.

#### 3.2.2. New approaches to transport appraisal and further research

The latest literature provides various suggestions on how transport appraisal could be improved and what directions further research should focus on.

##### **Disaggregation of impacts is currently undertaken for different social groups**

Delbosc, A. and Currie, G. (2011a) suggest that the assessment of disaggregation benefits should not only look at the different social groups (percentiles) but also the geographical areas. Transport disadvantage should be carefully addressed in regional areas where alternatives to private transport are scarce. Well-scoped, targeted transport solutions such as demand-responsive transit, local and long distance buses, subsidised taxis or shuttle buses will not only increase mobility but may also increase the quality of life of service users. According to Atkins (2010), there are points of overlap between social, economic and environmental impacts, because economic and environmental impacts can have social consequences and vice versa.

##### **Measuring environmental quality**

AEA (2011) study suggests 'green-space' as another environmental quality in addition to noise and air pollution. In a highly built-up environment in an area where road-space is dominant, 'green-space' can be very important to the overall quality of life. Residing in a location with no parkland can have negative impact on quality of life.

##### **New approaches to transport appraisal**

Caulfield, B. et al. (2013) present the Data Envelopment Analysis (DEA) as a tool to identify the most efficient solution for the city centre-airport route and to establish the reasons for inefficiency. It is concluded that DEA can be used as a complementary tool to Cost Benefit Analysis (CBA) and Multi-Criteria Analysis (MCA). However, it does not provide a replacement to these methods.

Carse (2010) developed the transport quality of life model (TQoL) as an alternative transport appraisal technique. The TQoL model is redefined to produce an accurate appraisal tool that can identify differences in journey experience. Factor analysis on the data from both Glasgow and Manchester confirmed that the TQoL model should be based on five factors: access and availability; sustainable transit; environment; personal safety and transport costs. By evaluating



transport from the passenger's viewpoint, the TQoL model can help validate existing techniques to make transport appraisal more co-ordinated and comprehensive. Carse (2010) suggests that the model could be used in addition to the existing techniques to enable the policy makers and practitioners make a better informed judgement decisions. Affordability was recognised as one of the most significant aspects of transport quality of life.

#### **New dimensions of appraisal**

Parkhurst and Shergold (2009) highlighted that the 'temporal dimension' should be taken into consideration in DIs, particularly in relation to major infrastructure schemes. They stated that in some cases other authors state that their findings related to specific time periods only. This dimension was not highlighted in the more recent studies reviewed within this project. Furthermore, Parkhurst and Shergold (2009) state that, in terms of the approach of methodologies to appraising and evaluating DIs, there are limitations identified in respect of the length of time the appraisals cover and the breadth of appraisal boundaries.

Tajima, R. and Fischer, T.B. (2013) aim to provide evidence to the question - is the integration of different instruments achieving its aim in supporting sustainable decision making, focusing on strategic environmental assessment (SEA), inclusive sustainability appraisal (SA) and other impact assessments (IAs) currently used in English spatial planning.

### **3.2.3. Evidence Gaps**

Parkhurst and Shergold (2009) identified a number of gaps with respect to five key appraisal policy objectives, these include:

#### **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.

#### **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.

#### **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.

#### **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.

#### **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 DIs.

An additional area highlighted that the author thought should be taken into consideration was the temporal dimension to DIs particularly in relation to major infrastructure schemes. Both Parkhurst and Shergold (2009) as well as Jones, P. and Lucas, K. (2012) argue that distributional impacts may take three forms:

- Spatial (e.g. varying locational distribution of air pollution).
- Temporal (e.g. varying noise levels by time of day).
- Socio-demographic (e.g. differential impacts by age, income group or gender).

Currently, DI appraisal looks into spatial and socio-demographic impacts and does not assess the temporal form (e.g. varying noise levels by time of day). The data and findings available in some cases are related to specific time periods only. There are significant methodological challenges for longer-term evaluations, although some road studies did cover periods of up to 30 years.

Parkhurst and Shergold (2009) point out that there are limitations identified in respect of the length of time the appraisals cover and the breadth of appraisal boundaries in terms of the approach of methodologies to appraising and evaluating DIs.

A paper by Markovich and Lucas (2010) presented a literature review which highlighted that the importance of the social and distributional impacts of transport has historically been underestimated. This is likely because:

- the issues cut across a number of different disciplines, are thus conceptualised differently and treated separately and there are a number of institutional barriers to be overcome before they are more widely disseminated within policy environments;
- these impacts are not all readily quantifiable in the way that environmental and economic impacts are, thus making them more difficult to assess and be integrated into transport policy; and
- they have generally been assigned low priority, and the lack of financial and political will observed more generally within the context of socially inclusive transport projects in the UK can be expected to continue in light of the current political and economic climates of many countries.

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

- Largely comprise negative impacts, with the majority reflecting disbenefits (either implicitly or explicitly), as opposed to benefits per se (with access to spatially distributed services and activities being one notable exception);
- Tend to negatively and consistently affect the most socially excluded members of society, not only within the context of injuries and casualties (following Short and Pinet-Peralta's (2010) observation that there are 'no accidents'), but for the full range of impacts.
- Operate at a range of scales, from the individual/household level, to that of the neighbourhood, community and national level; and
- Are not mutually exclusive, as most of the impacts described in this working paper intersect with other transport-related effects.

Markovich and Lucas (2010) highlighted the following key points following the literature review:

- Greater attention paid to the full range of impacts;
- More emphasis on the full range of distributional effects for each impact;
- Expanding the range and type of modes studied;
- Greater emphasis on the longer-term temporal implications of transport related social impacts;
- Addressing the oversight into cognitive issues and personal skills; and
- Capacities in relation to network capital.

Finally, based on an extensive review of the contemporary literature, Jones, P. and Lucas, K. (2012) aim to clarify key concepts and definitions around the notion of social impacts, and to give them an identity distinct from economic and environmental impacts and from existing notions of 'distributional issues'. The paper identifies a discussion in the literature about the risks of overlaps and ambiguity around categorisation and distinction between social, environmental, economic and distributional impacts. According to the authors it would be more useful to define impacts and then recognise that each potentially has an economic, environmental and a social dimension – all of which, in turn, might have distributional consequences.

### **3.2.4. Directions for Future Research**

The review of literature identified evidence gaps as discussed in the previous section and areas for further research as presented in the following section.

Geurs, K. et al. (2009) present a theoretical framework describing the relationships between determinants of social impacts of transport and it also provides a definition and categorization of those impacts.

- The distinction between social, ecological and mainly economic impacts is often opaque, and questions of mutual exclusivity remain. Regardless of whether these examples are called social impacts or something else, they should be identified in policy appraisal.
- There are, for example, difficulties in translating theoretical concepts from social sciences to measurable indicators and empirical evidence, and difficulties and uncertainties when translating transport changes into health impacts through specific relationships. This leads to the first major direction for further research, which is to conduct research to improve the methodological soundness of social impact assessments. Key issues are the definition of indicators and how to assess them in a specific context, and the harmonization of the valuation of social impacts.
- A third major direction of research worth pursuing is examination of the relative importance of all indicators of social impacts for different types of projects and plans; the question being: which indicators are the most important for which appraisals?
- The fourth direction of research is to improve the potential role of social impacts in decision-making. Cost Benefit Analysis is not well placed to address the distribution of costs and benefits or to assess decisions in terms of justice and acceptability. Cost Benefit Analysis guidance suggests that when the total amount of utility is maximized, its distribution is of less relevance. Alternative approaches to justice are documented in the literature, which would allow testing the robustness of decisions in terms of justice, and aiding the assessment of acceptability of transport policies (MCA).

Lucas, K. (2012) suggests that metrics are needed to establish the minimum level and standards of public transport which are necessary for social inclusion given certain distances, densities, levels of services, etc. and local targets set to achieve these within given time frames. To achieve this goal, social inclusion also has to be an explicitly stated outcome within service contracts with public transport operators. The accessibility planning (in its broadest sense) of public transport which is necessary to meet the travel needs of socially excluded people must be highly integrated with socially responsible land use, housing, health, education and welfare policies and programmes. Similarly, large transport infrastructure projects need to be more transparent in their ex ante analyses to consider their long-term social equity effects on local populations and communities. Finally, Lucas, K. (2012) concludes that transport and access has a fundamental role to play in this transition and so understanding the processes, actions and decisions which lead to transport-related exclusion should be a key focus of future transport policy research.

### 3.2.5. Comparing UK transport appraisal with other countries

Geurs, K. et al. (2009) argue that social impacts of transport investments can take on many forms and their levels of importance may vary widely, in project appraisal. According to Geurs et al. (2009), UK transport appraisal guidance (WebTAG) includes a much broader spectrum of social impacts than the Dutch appraisal guidance (OEI), but it does not cover the full range of potential social impacts as identified in the literature. A number of potentially relevant social impacts are not sufficiently dealt with in the guidance, particularly temporary impacts of transport investments, health impacts and social cohesion effects. The distinction between social, ecological and mainly economic impacts is often opaque, and questions on mutual exclusivity remain. Further research is needed in this domain.

Gühnemann et al. (2013) compared the Transport Appraisal Practices in Europe. Along with the Netherlands and Scandinavia, the UK has been a leader in transport appraisal practice. UK has a strong tradition of doing cost-benefit analysis of transport sector projects. It has Guidance Manuals which constitute a clearly defined framework for appraisal which is to be followed at all stages including consultation, public inquiry and decision. The framework populated with measures and values of the impacts are based on evidence generated from research studies. The policy intention is that the results from the appraisal framework should have a significant influence on the case for investment and on prioritisation within programmes.

## 3.3. User Engagement

This section considers comments and feedback made by the core users on the overall appraisal process and includes discussions around the purpose of DI appraisals, their role in influencing

decisions, and the importance of considering DI indicators early in the scheme development process. Additionally, the interviewees provided comments on the structure, proportionality of the DI appraisal guidance and links with other impact assessments.

### **3.3.1. The purpose of DI appraisal and its role in influencing decisions**

The majority of users (interviewees) expressed doubts on the DI appraisals role in influencing decisions on the scheme within the appraisal process in comparison with the economic and value for money appraisals. They felt the Benefit Cost Ratio (BCR) is more widely acknowledged and accepted as a key determinant of transport appraisals, consequently ensuring that scheme promoters and analysts are engaged in the DI process remains a challenge.

A small number of users highlighted the need for more engagement/feedback with the DfT on the process and appraisal outputs. Feedback on the appraisal submissions would reinforce good practice and encourage 'buy in' to the process by promoters. It is important to note that many users also stated that when advice was sought from the DfT, support was available and early engagement enabled good progression of the scheme DI appraisals.

A few users suggested the appraisal Guidance should outline how the appraisal should inform the scheme design and determine a suitable level of accountability of scheme promoters for improving the scheme at the end of the appraisal process. This may determine the level of detail of the assessment and the presentation of outputs.

### **3.3.2. Importance of DI appraisal early in the scheme development process**

The majority of interviewees indicated the importance of considering the DI appraisal early on in the process (Screening), which enables the process to run more smoothly. As described by one user, this Screening enables a 'stage-gate' type process; so that the appraisal approach is clarified and agreed before setting off on detailed work. However, in some cases schemes can be largely defined and designed by the time the DI appraisal is completed, which limits opportunities to influence the scheme design or operation. According to one user, the DI appraisal is either done retrospectively or at the very end as an 'after thought' for many scheme promoters.

Users suggested that particularly for Highway Agency (HA) schemes, where modelling is required at a fairly early stage, some coarse modelling and DI analysis on selected indicators could be done at the same time to give an indication of the level of impact and time/detail required later in the process. For more strategic local authority led schemes, the data is not always available at an early stage; hence the DI analysis is undertaken on proxy data for the screening step and updated when detailed data is available.

### **3.3.3. Old Guidance vs. new Guidance**

Although the majority of users interviewed had not used the revised guidance, they had reviewed the documents and felt the DI guidance looked more approachable for those new to DI appraisals. Many users found the new three-step process to be an improvement. It was considered to be more streamlined, less difficult to follow and comes across as less onerous. Additionally, the revised guidance made the process seem more proportionate. It was also suggested by several users that that the proportionality of appraisal often comes with experience of the appraisers.

Several users felt the new approach integrated well with other appraisal processes and it was easier to understand the links between the standard appraisal and DI. A further reduction of the number of steps to just 2 steps – i) screen and ii) appraisal was suggested by one.

A couple of users mentioned limited discussion around the role of ongoing evaluation and monitoring of DI impacts and this could perhaps be made clearer in future guidance. Some users suggested that some aspects of the screening process could be merged together more and felt the guidance worked better together, rather than having it split into SIs and DIs. If they remain separated it might be helpful to have an explanation of the relationship between the two.

### **3.3.4. Relevance of the existing eight indicators**

The majority of users agreed that overall the indicators currently appraised seem appropriate; however, their relevance is scheme dependant. The users felt that the screening proforma enables the scoping out of indicators of little or no relevance to the individual scheme.

### 3.3.5. Appraisal Inputs and Outputs

Several users felt the appraisal inputs can pose some challenges and a certain amount of realism / pragmatism needs to be applied in terms of data inputs to the appraisal process. The focus should be on making use of existing, available data sources and minimising the need for more bespoke data or primary research. The appraisal inputs are heavily reliant on Census data, which brings the issue of out-dated information, especially as some recent appraisals have been based on 2001 Census data. Also the use of Census data does not take into account future developments which may impact on the distribution of vulnerable groups.

One user stated that the appraisal inputs are dependent on the size of the scheme, as for smaller schemes the level of accuracy can be an issue due to the Output Areas not being geographically small enough to demonstrate distributional changes across the scheme. In some instances the use of other data presented at postcode level (e.g. MOSAIC data) is necessary to get a more accurate impact on the population within the affected scheme area. The other extreme also exists where the area impacted is too wide.

Several users mentioned the need to consider the context of the modelling outputs which feed a number of the DI Indicators and understand the implications for the analysis. A small number of others mentioned the need for a sense check on the inputs and outputs raising issue with the fact that there will always be limitations on data, and the appraisal process needs to be viewed with this in mind. In depth knowledge of the local areas by the DI practitioner is valuable in terms of being clear on what the limitations of the appraisal are and how to interpret it.

Many users recognised that over time they had developed efficient, standardised ways in undertaking a DI appraisal. This has aided the process, but concern was raised that changes to the Guidance may pose a risk as they may miss the new changes made.

The main issues raised by users relating to the appraisal outputs included the underlying quality of the data, robustness of the appraisal and the appropriateness of identifying these caveats in the qualitative comments box within the Appraisal Summary Table. Other suggestions were made around using a RAG status type approach based on data reliability and possibly weighting the different DI impacts in relation to scheme objectives.

The DI matrix in the new Guidance is considered to be an improvement; however, it implies that each row is to the same magnitude of impact (e.g. two crosses on one row might be 'balanced out' by two ticks on another). Several users felt the matrix provides no concept of scale and questioned whether it is really possible to disconnect distribution from magnitude. For example the scale of impacts on some rows is equal to millions of pounds (User Benefits) and the scale on another row can be just over 20 people, this may be seen as misleading.

The key issue that should be considered is how to offset these disparities. Some users suggested introduction of a certain trigger / threshold related to adverse distribution of impacts suggested in the guidance. The Guidance could help to set thresholds or 'red flags' to help understand which impacts to focus on in such instances. Such an approach would make it clear what has been identified as a problem and the appraiser/scheme promoter could then act to ensure mitigation or that an opportunity to have a positive impact on a vulnerable group is not missed.

In terms of the presentation and structuring of the outputs, a number of users suggested that maps are an essential output for some indicators and the guidance should refer more to the use of maps/GIS to help work through the DI appraisal process. Additionally some users felt the guidance on how to structure the report and present the findings would be appreciated. It would be helpful to have clear outputs defined for each step.

### 3.3.6. Relevance of guidance to the different scheme types

DI appraisal guidance generally translates well across various scheme types. According to over half of the interviewed users; it will never be able to cover every single circumstance and should not be trying to do so. However, several users suggested that there could be a greater recognition in the guidance of how it applies to different scheme types. There is a risk that taking different approaches by different practitioners may result in different outcomes.

For projects of strategic importance in particular, one user felt it is challenging to adopt an appropriate approach focus following DI guidance. Schemes of strategic importance can affect the whole region or country as well as having very local impacts. Accessibility, affordability and user benefits are considered strategic, whereas noise, air quality, severance, security and accidents are considered to have more local impacts. There is no specific guidance for strategic schemes on whether the distributional impacts should be considered at a local, regional or national level. However it was recognised that the current DI guidance should not be necessarily changed to fit all types of schemes including those of strategic importance as these do not happen very often.

Feedback from one user suggests that typically, larger (non-strategic) projects tend to be more straight forward as there is more data available and there is usually a transport model. However, area wide packages (e.g. LSTF) present the most difficulty and clearer guidance for these scheme types would be beneficial. Another user felt that public transport schemes did not always fit entirely within the guidance; however they were not seeking separate guidance as there should be opportunities to use a practitioner's professional judgement and adapt it to the need of a specific scheme.

Many users suggested that provision of best practice examples for different types of schemes would be a useful addition to the guidance.

### **3.3.7. Links to other assessments - Environmental Impact Assessment (EIA) and Equality Impact Assessment (EqIA)**

A number of interviewees highlighted similarities between the requirements for an EIA and EqIA and the DI appraisal process and suggested whether integrating such requirements in terms of data sets could be possible.

### **3.3.8. Proportionality of appraisal**

In general it was considered that the DI guidance allows for proportionality, which is critical for identifying the information required for decision makers. The practitioners felt that whilst it was important to follow the guidance it should enable them to discontinue the appraisal if the expected impacts are very small.

As a number of methods are used in the appraisal of various indicators, the general feeling from users was that DfT were content if scheme promoters had provided evidence to demonstrate that reasonable effort was made to consider the various impacts. It was felt that proportionally was possible, however early engagement with DfT was considered key if it looked like they were unlikely to follow the guidance to the letter.

One user commented that a pragmatic approach should consider the value (return) on time / cost involved in undertaking more detailed or more comprehensive analysis of indicators and the issue of proportionality should be considered as to whether it ultimately has a material impact or influence on the scheme.

### **3.3.9. Summary**

Although the majority of users recognised the importance of assessing social and distributional impacts of a transport scheme, they expressed concerns on the value of the appraisal in comparison with the Value for Money assessment and the ability for influencing the scheme design.

It was widely recognised that it is very important to consider the DI appraisal early on in scheme development process and engage with the DfT to agree a way forward/proportionate approach for the DI assessment.

Users felt the guidance was quite straight forward and well-structured and had the required level of detail, although some felt it would benefit from direction on the use of GIS within the appraisal process and best practice case studies. A number of interviewees had taken the guidance and developed their own standardised processes for the DI appraisal which enabled efficiencies in the process.

The indicators appraised at present seem appropriate; however, their relevance is scheme dependant and weighting the different DI impacts might be appropriate in relation to scheme objectives.

Users stated that a certain amount of realism / pragmatism needs to be applied in terms of data inputs to the appraisal process. The focus should be on making use of data sources that are freely available and minimising the need for more bespoke data or primary research.

The presentation of distributional impacts only (proportions) rather than absolute number of people impacted can often lead to misleading conclusions. A certain trigger / threshold related to adverse distribution of impacts could be suggested in the guidance to help understand which impacts to focus on in such instances.

## 4. Relevance of Social Groups

### 4.1. Introduction

The RER identified several sources of evidence that referred to different social groups in relation to different transport issues. Some evidence suggests that specific groups are more relevant for selected indicators than for others whilst other evidence suggests new classifications of social groups for transport appraisal.

Findings from the user engagement interviews also highlighted discussions around different social groups which are presented later in this chapter.

### 4.2. Rapid Evidence Review

The current Distributional Impact Appraisal considers the following social groups:

- Children (proportion of population aged <16);
- Young adults (proportion of population aged 16-25);
- Older people (proportion of population aged 70+);
- Proportion of population with a disability;
- Proportion of population of Black and Minority Ethnic (BME) origin;
- Proportion of households without access to a car; and
- Carers (proportion of households with dependent children).

#### 4.2.1. Key issues to be considered

The key issue to be considered when looking at various social groups is transport equity. There are two general categories of transport equity (after Delbosc, A. and Currie, G. 2011b): horizontal equity and vertical equity (Litman, 2007). Horizontal equity (fairness or egalitarianism) is concerned with providing equal resources to individuals or groups considered equal in ability. It avoids favouring one individual or group over another and services are provided equally regardless of need or ability. Vertical equity (social justice, environmental justice or social inclusion) is concerned with distributing resources between individuals of different abilities and needs. Vertical equity favours groups based on social class or specific needs in order to make up for overall societal inequalities. These two perspectives often conflict as prioritising one can come at the expense of the other (after Delbosc, A. and Currie, G. 2011b; Taylor et al., 2009; Sanchez et al., 2007; Litman, 2007).

The UK Government published 'Equality Act' (2010) which simplifies the current laws and puts them all together in one piece of legislation. It is a framework of protection against direct and indirect discrimination, harassment and victimisation in a number of areas, one of which is transport (others include services and public functions, work, education and associations). An authority to which this section applies must, when making decisions of a strategic nature about how to exercise its functions, have due regard to the desirability of exercising them in a way that is designed to reduce the inequalities of outcome which result from socio-economic disadvantage. The 2010 Single Equality Duty requires all public bodies to consider the impacts of their policies in relation to sexual orientation, faith/religion/pregnancy and maternity, and gender reassignment. Current data collection and modelling, however, do not address these forms of distributional issues.

Equity, on the other hand, refers to the distribution of impacts (benefits and costs) and whether that distribution is considered fair and appropriate (Litman, 2013). Transport planning decisions often have significant equity impacts, and equity concerns that often influence planning debates. Litman (2013) argues that there is no single way to evaluate transport equity; it is generally best to consider various perspectives and impacts. A planning process should reflect each community's concerns and priorities, so public involvement is important for equity analysis. More comprehensive equity analysis allows planners to better anticipate problems, incorporate equity objectives in planning (for example, it can help identify congestion reduction strategies that also improve mobility for non-drivers and help lower-income people), and it can help optimize planning decisions to maximize equity objectives.



### 4.2.2. Literature review

The literature reviewed considers the impacts of transport investments on various social groups. Special attention is given to older people as a specific social group that needs more attention when planning and appraising transport schemes (Ahern, A. and Hine, J., 2011, Delbosc, A. and Currie, G., 2011a, 2011b, 2011c, Li, H. et al., 2012). The UK society is ageing and older people will have a larger share in the population, therefore, the needs of this group and the impacts on public transport should be given more attention. Additionally, Jephcote, C. (2013) suggests that some ethnic groups are more likely to suffer from respiratory problems than others and are less likely to seek doctor's help than others. The publications on health impacts of transport focus on children (Jephcote, C., 2012). Li, H. Et al. (2012) on the other hand, looks into accidents and focuses on killed and seriously injured (KSI) rates for 17 to 24 year old drivers and those over 70 (the latter exhibit increasing KSI rates). Within the transport literature the influences of age, ethnic background and gender on perceptions of security have all been examined (Delbosc, A. and Currie, G., 2012).

According to Lucas, K. and Jones, P. (2012) the social impacts of transport can be significant, especially for already vulnerable population groups but these effects are currently poorly accounted for within transport policy appraisal. Some social groups are more adversely affected than others, especially children and young people, older people, lone parents, disabled people and ethnic minority populations. The report 'Social Development & Infrastructure', Making Transport Work for Women and Men – Tools for Task Teams (Nash, 2010) provides brief, relevant, and practical tools for World Bank task teams and their country counterparts to facilitate their work in addressing gender issues in transport policies and projects in developing countries. Hine (2009) suggests particular social groups and how they might be affected by different transport measures. Key points from this include:

- Women also experience exclusion in a number of ways as a result of poor public transport services.
- Disabled people are a group that also features in discussions surrounding the link between transport and social exclusion. They suffer because for a variety of reasons they find it difficult to access public services. These reasons include: low incomes, physical layout of infrastructure and design of vehicles, and location of stops.
- Poor transport access is an important barrier to employment opportunities. For young people in rural areas, transport is vital to holding down a job; public transport is often seen as unreliable with timetables that do not match up with work schedules. Cost and availability of childcare, lack of knowledge of the local job market, and an unwillingness to travel outside the locality can also be barriers to employment.
- Inadequately managed and structured public transport systems can be responsible for influencing perceptions of safety and fear. Perceptions of safety and fear can have significant effects on levels of personal mobility. Older people, women, and those from ethnic communities are more likely to fear crime while using public transport.

Group specific policy interventions need to be developed more fully for those identified as transport disadvantaged (low income, non-car, female, working) in order to increase their accessibility to goods and services (Kamruzzaman, Md. and Hine, J., 2013). According to Lucas, K. and Jones, P. (2012) the social impacts of transport can be significant, especially for already vulnerable population groups but these effects are currently poorly accounted for within transport policy appraisal. Transport 'goods and bads' are unevenly distributed across the population. Some social groups are more adversely affected than others, especially children and young people, older people, lone parents, disabled people and ethnic minority populations.

Currie, G. et al. (2010) identify four key types of transport disadvantage including, social exclusion and well being assessment:

1. Transit disadvantage,
2. Transport disadvantage,
3. Vulnerable/impaired,
4. Rely on others

The detailed characteristics of these groups are presented in Table 9-1. This paper updates results of an international study aimed at quantifying the links between transport disadvantage (TD), social

exclusion (SE) and well-being (WB) in Melbourne, Australia. The study extends knowledge associated with SE and transport by quantifying social and behavioural implications of lack of public and private transport and the nature of the social WB benefits associated with improving services. Overall results suggest that those without a car on the urban fringe adjust well with their circumstances by living close to activity centres. They demonstrate sustainable choices, trading off budgets and home location to balance mobility and accessibility. Poorer households with high car ownership value mobility and cheaper more remote fringe dwellings but demonstrate numerous strategies to reduce high car costs which are acknowledged as a significant burden.

The study suggests that 'vulnerable/impaired' groups should be of much greater concern for targeted policy than others due to poor scoring on social exclusion and well-being scales. Analysis has also suggested that transport disadvantage can relate to socially advantaged as well as socially disadvantaged groups through time poverty. Overall the fringe low income/car ownership analysis found those without a car were more vulnerable to social exclusion but only because of who they were (older, retired) than because of transport per se.

**Table 4-1 Factors and associated degree of difficulty travel attributes**

Transit disadvantage	Transport disadvantage	Vulnerable/impaired	Rely on others
<b>Access/Transport/Mobility</b>			
<ul style="list-style-type: none"> <li>• Outer/remote</li> <li>• Low Walkable</li> <li>• Low PT Supply</li> <li>• Average car ownership</li> <li>• Average PT use</li> <li>• Average no (longer trips)</li> </ul>	<ul style="list-style-type: none"> <li>• Outer/remote</li> <li>• Low Walkable</li> <li>• Low PT Supply</li> <li>• Average car ownership</li> <li>• High PT use</li> <li>• Average trips</li> </ul>	<ul style="list-style-type: none"> <li>• Outer/remote</li> <li>• Low Walkable</li> <li>• Low/Average PT Supply</li> <li>• Average car ownership</li> <li>• Low PT use</li> <li>• Fewer but longer trips</li> </ul>	<ul style="list-style-type: none"> <li>• Outer/remote</li> <li>• Moderate Walkable</li> <li>• Average PT Supply</li> <li>• Average car ownership</li> <li>• Low/Average PT use</li> <li>• More trips</li> </ul>
<b>Socio Economic</b>			
<ul style="list-style-type: none"> <li>• Average Income</li> <li>• Average HH occupancy</li> <li>• High employment</li> <li>• High Part-time employed</li> <li>• Poor Health, Low benefits</li> </ul>	<ul style="list-style-type: none"> <li>• Average Income</li> <li>• Higher HH occupancy</li> <li>• High young adult</li> <li>• High Part-time employed</li> <li>• Poor Health, Low benefits</li> </ul>	<ul style="list-style-type: none"> <li>• Low Income</li> <li>• Average HH occupancy</li> <li>• Older, Female, Retired</li> <li>• Low employment</li> <li>• Very Poor Health &amp; Pension, Disability, Healthcare</li> </ul>	<ul style="list-style-type: none"> <li>• Mid/Low Income</li> <li>• Average HH occupancy</li> <li>• Average Full/Part time employed</li> <li>• Slightly Poor Health &amp;</li> <li>• Disability, Healthcare</li> </ul>
<b>Self reported Difficulties</b>			
<ul style="list-style-type: none"> <li>• Lack of Time</li> <li>• Moderate Travel Difficulties</li> <li>• High Activity Barriers</li> <li>• High Fuel Price Impact</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of Time</li> <li>• High Travel Difficulties</li> <li>• Very High Activity Barriers</li> <li>• High Fuel Price Impact</li> </ul>	<ul style="list-style-type: none"> <li>• Low Travel Difficulties</li> <li>• Very High Activity Barriers</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of Time</li> <li>• Moderate Travel Difficulties</li> <li>• High Activity Barriers</li> <li>• Very High Fuel Price Impact</li> </ul>
<b>Other</b>			
High Housing regret	Very High Housing regret	High Housing regret	Moderate Housing regret
<b>Social Excluded</b>			
Low	Low	High	Some (Social Support)
<b>Well-Being</b>			
Average	Slight Low	Low	Low

Source: Currie, G. et al. (2010)

### 4.3. User Engagement

This section considers the overall comments made by users on social groups. These include more general comments as well as those more specific to different indicators.

Several users suggested that if a project is specifically focused upon benefits to certain groups, then there ought to be the greatest focus on these groups in the appraisal process rather than on

all groups. One of the interviewees questioned the benefit of looking at older people if the scheme is aiming to connect regional centres for employment and hence should be looking at working people or people looking for employment instead. There is a need to ensure that the focus of the scheme is not confused and the focus of the appraisal process is on the most relevant groups to that specific area and scheme.

One user suggested that the impacts on certain groups can also be based on what time the impact occurs. For example, if the noise occurs at night, the appraisal should focus on the areas where children live, if the noise occurs during the day, the appraiser should be concerned with where they go to school.

Another general point raised during the user engagement suggests that the use of census data for the social groups can be too far reaching for small schemes. One of the interviewees considered using MOSAIC data, however they felt that only census and IMD would be acceptable - (*note that the guidance encourages the use of more refined data sets such as MOSAIC*).

#### **4.3.1. Accidents**

One of the users pointed out that the HA SDI Guidance highlights the need to consider the statistical significance of changes when relating them to vulnerable groups. Thresholds are considered very helpful, although these can severely limit the number of links potentially looked at. It would be helpful to have a similar approach in WebTAG, although it is unclear whether the number of accidents on smaller schemes would ever meet the thresholds of statistical significance.

One of the interviewees questioned the 'proportionate level of the population' in view of the accidents indicator. They felt this term can be misleading as an output area could fall into the top 20% percentile but the area itself may only be just above average.

It was generally considered that no other groups should be added to the analysis of accidents as it is already considered to be quite an onerous indicator.

#### **4.3.2. Severance**

As pointed out by some users, it can be difficult to identify the vulnerable groups for severance as this may require detailed surveys. The social groups identified in WebTAG guidance are probably the most relevant, but it can depend upon whether the focus is on community severance or severance of specific routes.

#### **4.3.3. Additional social groups**

Several users pointed out that within the current DI appraisal for air quality, there is a focus on children and young people (as residents within the impacted area) but maybe consideration needs to be given to more transient users who may pass through the impacted area, e.g. cyclists (perhaps making regular trips) and visitors who could still be affected by changes in the air quality.

One of the interviewees suggested that there are more vulnerable groups that could/should be considered depending on the scheme and area. For example, these include BME<sup>3</sup> in particular south Asians for air quality, as there is evidence they are more susceptible to respiratory problems. One of the users suggested adding two social groups for assessing the accessibility indicator - jobseekers and lone parents and in general LGBT groups<sup>4</sup> should also be examined.

#### **4.3.4. Disabled**

Many interviewees suggested that the 'disabled' vulnerable group could be better defined and should encapsulate visual and mobility impairments for instance. One of the users pointed out that this may only be relevant if the project is specifically focusing on for example physical access. One of the users suggested splitting disability into various categories to focus the appraisal e.g. those with mobility and new footbridges for example.

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<sup>3</sup> Black and Minority Ethnic

<sup>4</sup> Lesbian, Gay, Bisexual, Transgender

#### **4.3.5. Older people**

Specific attention was given to older people as a social group. One of the users suggested that as air quality can be linked to heart attacks maybe older people should also be considered as a vulnerable group for this indicator. Another user suggested that this group should be defined differently than it is done at present. It should include people over 65s rather than over 70s as this covers all pensioners and bus pass eligibility.

#### **4.3.6. Young male drivers / Young males**

A few users discussed young male drivers or young males as a social group. Firstly, it was noted that it can be difficult to get a hold of data for young male drivers with regards to accidents, and another user suggested that the accident section should be extended to young people up to the age of 30. On the other hand, another interviewee felt it was unclear in the purpose of looking into the 16-25 group for accidents, as it was felt that this was more of a driver behaviour risk group.

A few users also commented that in some locations young adults (especially when alone) can be a target of crime, such as around universities and this is currently not considered in the DI appraisal.

#### **4.3.7. Women**

Women are mentioned several times in the DI guidance; however women as a separate group are not defined effectively. Additionally, one of the interviewees suggested that the social group 'women' should be broken down further when assessing the security indicator. It might be that women of particular age or ethnicity may feel more vulnerable than others.

#### **4.3.8. Summary**

Many users suggested a focus on examining those social groups likely to be impacted on by individual schemes rather than considering all the groups for all schemes. This would enable a more detailed assessment on some key groups. Furthermore if a project is specifically focused upon benefits to certain groups, then there ought to be greater focus on these.

The impacts on certain groups should also be based on the timing of the impact occurrence, for examples noise impacts – day and/or night. The DI guidance could consider the statistical significance of changes when relating them to vulnerable groups.

Some specific groups should be added for specific indicators, i.e. old people and south Asian for air quality, young people up to age of 30 for accidents and job seekers and lone parents for accessibility. In addition it was felt that the granularity of 'disabled' and 'women' vulnerable groups could be improved and better defined.

## 5. Air Quality and Noise

### 5.1. Rapid Evidence Review

This section presents findings from the literature reviewed relevant to the air quality and noise indicators. The publications suggested new ways of assessing air quality and noise - physical boundaries and thresholds and discussed the need for considering the perception of air quality and noise nuisances.

Air quality was given significant attention in the relevant publications, compared with limited discussion around noise impacts. However it is noted that significant research on the noise indicator was published prior to 2007, addressed in the previous research. The most recent literature focuses around four key topics - new ways of assessing air quality and noise; setting a boundary for air quality assessment in relation to health impacts; considering the perception of air quality and noise nuisances; and the need for a holistic approach to assessment of external impacts of transport. These four areas are considered in further detail in the following sections.

#### 5.1.1. New ways of assessing air quality and noise

The most recent literature suggests that new ways to assess air quality impacts should be considered in the appraisal of externalities of transport investments. According to the AEA report (2011), there are three main air pollutants to the local environment which can have harmful effects on people's health, namely CO (Carbon Monoxide), NO<sub>2</sub> (Nitrogen Dioxide) and PM<sub>10</sub> (Particulate Matter (<10 µm)). It should be noted that local concentrations of PM<sub>10</sub> and NO<sub>2</sub> are often influenced by factors such as the mechanical characteristics of vehicles that frequent the local area. In addition, a Dutch based study by Keuken, M.P. et al. (2012) reported that Elemental Carbon is a sensitive indicator for the effect of exhaust emissions by road traffic and can be directly linked to people's health. Both studies were assessed as highly relevant and robust. The main air pollutants currently considered in DI appraisal do not include Carbon Monoxide or Elemental Carbon.

Additionally, Keuken, M.P. (2012) concluded that traffic management on the highway network is particularly effective in reducing the Elemental Carbon (EC). Keuken suggests that managed motorway schemes offer a higher potential for air quality improvement with respect to EC reduction when compared to a low emission zone.

Molinier et al., (2013) suggest a method for calculating external costs of noise in accordance with the Eurovignette Directive. The Eurovignette Directive allows EU Member States to levy infrastructure charges to compensate for the external costs of noise caused by heavy goods vehicles. The authors outline that the Directive does not provide specific values or guidelines for calculating these factors. Moreover, while the Directive only focuses on the charging of heavy goods vehicles for day and night, the authors extend the calculations to other vehicle classes and time periods (evenings). Molinier et al. suggest improved weighting factors both for vehicle classes and for times of the day. These factors are more disaggregated than in other studies and take into account the influence of vehicle class, speed and time of day.

Parkhurst and Shergold (2009) explain that a variety of statistical databases, GIS, air quality models and weather models have been used previously in order to reach conclusions. They conclude by stating that these methods provide ideas for enhancement of existing appraisal and evaluation processes, and they suggest that incorporating some form of impact distribution analysis into the appraisal process is an important addition.

#### 5.1.2. Physical boundary and emissions thresholds

Several papers discussed the setting of a distance boundary or an emission threshold for planning and construction of new transport infrastructure. Jephcote, C. (2012) established a threshold of 0.865 tonnes of PM<sub>10</sub> road transport related emissions for 53.72 cases of J00–99<sup>5</sup> children's hospital admissions per 1,000 persons each year in Leicester. Although this threshold is likely to be different in various places, the author concludes that all schemes contributing to the decrease

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<sup>5</sup> whose primary diagnosis was recorded under the WHO International Classification of Diseases (ICD) as 'Diseases of the respiratory system'

of PM<sub>10</sub> in the most deprived areas could be considered as a priority when compared to schemes that do not address this issue. This applies to transport schemes as well as other schemes. The study, however, has some limitations. Firstly, emissions were estimated based on modelled vehicle flows which do not account for the actual dispersion of vehicle pollutants. Secondly, it has been assumed that people are subject to the same level of emissions throughout the day to the levels observed around their homes which does not take into account that they change their location throughout the day and the level of exposure can differ per person.

Jephcote, C. (2013) suggests setting the distance boundary for planning of new dwellings, schools in particular. The outcomes of this study are in line with other studies (distance boundary 100-400m for elemental carbon or particulate matter mass concentration, 200-500m for NO<sub>2</sub>, 100-300m for ultrafine particle counts). The study does not, however, address the issue of those houses or buildings located for example 1 meter outside these boundaries and the rest of the impacted network. Despite the identified limitations, both studies were identified as highly relevant and robust.

Furthermore, Carse (2010) states that there are two types of air quality to be taken into consideration in air quality analysis, 'Global Air Quality' and 'Local Air Quality'. It was explained that global air quality affects quality of life at a wider level, taking into account the impact on climate change, as where local air quality affects 'transport quality of life', which has an impact on the health of an individual.

Additionally Jephcote, C. (2013) suggests that some ethnic groups are more likely to suffer from respiratory problems than others and are less likely to seek doctor's help than others. This suggests that, apart from the transport appraisal, there can be possible recommendations for health management.

### **5.1.3. Considering the perception of air quality and noise nuisances**

The current DI appraisal approach only examines observed levels of air quality and noise indicators. However, people can be affected differently by changes in the air quality and noise as a result of transport infrastructure schemes. Hammersma, M. et al. (2014) suggests consideration should be given to assessing both the impacts related to observed changes in air quality and noise but there should also be an attempt to assess the perceptions of these nuisances. For example, a 1dB change will be perceived differently by different people and also when and how this change occurs i.e. a continuous 1dB change during the day will be different to a 1dB intermittent change. The study was assessed as highly relevant and highly robust. The paper is based on a study in the Netherlands and it would be interesting to see whether similar satisfaction / dissatisfaction levels are applicable to the UK. It would also be interesting to see the outcomes for a control group not living close to a highway as the outcomes of the study might be applicable only to adjustment schemes for existing roads/highways rather than building new roads.

A study by Olowoporoku et al. (2011) explains that the risk of exposure to air pollution on public health, and its associated costs, is more significant than risks associated with passive smoking and vehicle transport accidents. However, they explain that, in reality, the public has less concern for air quality, in comparison to road safety or traffic congestion. Olowoporoku et al. (2012) also states that in practice, air quality is given a low priority compared with other shared priorities such as safety, accessibility and congestion. Furthermore, Olowoporoku et al. (2011) stresses that Environmental Health Officers and Transport Planners should work jointly to enable efficient assessment of air quality and successful management of traffic-related air quality in England.

### **5.1.4. Importance of air quality and noise assessment and need for a holistic approach**

Many peer reviewed papers and other publications underline the importance of air quality and noise assessment for transport infrastructure investments (Olowoporoku, D. Et al., 2012, AEA, 2011, Jephcote, C., 2012 and Hammersma, M. et al. 2014).

According to Olowoporoku, D. et al. (2012) a shift is needed from a local hotspot management approach to air pollution control to a more holistic management of vehicular emissions within a wider spatial administrative spectrum. This paper highlighted the policy disconnects between the process of diagnosing air pollution and its management. Although the focus of this paper is

different, it can be considered relevant to DI Appraisal. According to Jephcote, C. (2012, 2013) overall assessment should look to wider neighbourhood factors as they are at least as important as highway-related factors. Finally, a suggestion by Hammersma, M. et al. (2014) to give consideration to the perception of nuisance confirms the importance of a more holistic approach in the appraisal of transport externalities.

## 5.2. User Engagement

This section considers the overall comments made by users on air quality and noise indicators. Comments more specific to social groups are included in Chapter Four.

### 5.2.1. Air Quality

Most of the interviewees agreed that the process for assessing air quality was easy to follow and standardised. The guidance was felt to be relatively straight forward and well defined. Overall, this indicator is considered to be one of the key indicators in the DI appraisal as there is clear evidence on links to health and deprivation and the impacts of air quality are spatially defined. Additionally, air quality impacts can be experienced by those who may not use a car.

Whilst no main concerns were identified by users, several users felt an overlap with the environmental screening of an Environmental Impact Assessment (EIA) and felt these assessments could be integrated. One interviewee suggested it would be logical and more efficient to take the EIA a step further to consider distributional impacts for air quality changes, rather than have a separate process.

### 5.2.2. Noise

In principle, noise was considered as an important indicator that adds value to the appraisal and has a clear distributional impact as it is particularly important to schools and can impact on children's development. However, several points specific to noise were highlighted by the interviewees.

The current appraisal only examines the percentage change in traffic levels for the affected area. However, according to a number of interviewees, the absolute number change in traffic should also be examined as not considering this could skew the impacts of large percentage changes for smaller numbers. The use of thresholds was not mentioned by the users in this context.

The completion of the AST is regarded as a reasonably straight forward process based on the guidance and outputs produced, however the text interpretation is less easy in terms of what the changes for each group actually mean.

Finally, a few interviewees suggested that this indicator is intrinsically linked to other processes and they felt it could be better integrated with the environmental work. In the view of some users, it currently feels like an add-on which is *'just asking for people to go down the tick box culture'*. One of the users did not feel that the DI process added much to the assessment for Noise and did not think that the outputs would influence/change a design.

### 5.2.3. Air quality and noise common comments

In addition to the comments specific to either air quality or noise, there were a number of comments or suggestions that referred to both air quality and noise.

Firstly, a few users indicated that it would be useful to understand what magnitude/ level of noise and air quality may be a concern to individuals and communities. The DI appraisal guidance currently looks for changes in levels, however, it does not specify what levels should be regarded as a problem and the suggestion of a 'red flag' warning approach would resolve this issue.

Furthermore, a number of interviewees pointed out that it can be unclear when defining the impacted area, as it often relates to the Affected Road Network (ARN), however for larger strategic schemes this could be a very large area to assess. One of the interviewees suggested that these indicators might actually benefit from having an initial screening process of social groups to identify beforehand if there are any vulnerable groups in the location of the scheme who could be affected.

Additionally, one of the users felt that the data for assessing these indicators is often obtained from an environment team who had previously produced the data for the Environmental Statement, not with DI in mind. As a result, additional work is required to understand it and to translate to right format.

There is also some ambiguity around why income deprivation is used for assessing air quality and noise. At present, as poorer people often have poorer health, this could be exacerbated by the air and noise changes. Lower incomes mean these people will have less opportunity to move house if air quality and noise deteriorates significantly. As pointed out by one of the users, this is relevant across all indicators. If any of the indicators had a significant negative impact, people with lower incomes would not have as much chance of being able to move. However, this approach is applied for DI appraisal of air quality and noise only (*note this is an incorrect statement by the user as income deprivation is used for other indicators – User Benefits and Personal Affordability*).

One of the interviewees suggested that it would be beneficial to include the health indices of multiple deprivation and long term sick/ limiting illness in the appraisal of air quality and noise.

#### **5.2.4. Summary**

The current processes for assessing air quality and noise are viewed as fairly straight forward, well defined and easy to follow.

The impacts for both air quality and noise are rather local, therefore, especially larger schemes could benefit from an initial screening focused on identifying the most affected locations to focus detailed analysis on. It would be desirable to establish more detailed guidance on the air quality and noise levels that should be considered as a problem and create a 'red flag' approach for these two indicators.



## 6. User Benefit & Personal Affordability

### 6.1. Rapid Evidence Review

This section presents the outcomes of a rapid evidence review on user benefits and affordability indicators. The most recent publications with respect to user benefits and personal affordability focus on issues such as transport disadvantage, option values and non-user values, valuing active travel and health impacts, transport equity and social exclusion, and finally, the issue of well-being. The sections below provide a brief review of these relevant topics.

#### 6.1.1. Future of option values and non-use values

An option value can be defined as “the value that economic agents are willing to pay above and beyond their expected value of consuming the good, to have the option of consuming that good at some point in the future.” (After Johnson, D. et al. (2013): Laird et al., 2006). Non-use values are a value held by an individual unrelated to their own use or future use of a service, in contrast to option values. They can be divided into three main types: existence values, altruistic values and indirect user benefits (after Johnson, D. et al., 2013: Geurs et al., 2006). Considering rail provision, Johnson, D. et al. (2013) identified much lower option values for rural lines than previously found for more city commuter oriented services. This suggests that careful disaggregation of service types will be necessary if more quantitative valuation of these effects is to be introduced into appraisals. Option values and non-use values are relevant not just for public transport services but also for facilities such as rural post offices, where a case for subsidy will also exist. According to Johnson, D. et al. (2013) the location of a respondent combined with their use of the rail service can heavily influence the valuations of the service. For those respondents who live some distance from the station and are users the valuations are almost the same as those people who use the service and live close to the station. In stark contrast, those who do not use the service and live further from the station hold almost no value at all. The converse of this is that it is clear that non-users who live close to a station hold a value for the service, after disaggregation, of around 30% lower than for users of the service. This study provides further evidence on the relevance of option and non-use values for the appraisal of rail subsidy decisions. Option values already feature in the standard British approach to appraisal (Department for Transport, 2003), but their assessment is largely qualitative.

#### 6.1.2. Valuing active travel and impacts on health

There are numerous transport schemes that promote active travel and sustainable transport; however, the relation between transport and health is still difficult to assess. Hodgson, S. et al. (2012) develop an integrated conceptual framework of the many links between transport and health (after Lucas, K., Jones, P., 2012). Milne, E.M.G., 2012 (after Lucas, K., Jones, P., 2012) confirms that the loss of opportunities for casual physical activity in our society, as a result of growing car ownership and use, has increased the likelihood of weight gain in children, and substitute activities (TV, computer games) tend to exacerbate the problem. Although it is possible to encourage people to achieve better health outcomes through transport solutions, to succeed policy needs to go much further than the current ‘persuasion tactics’ and must address fundamental issues of infrastructure and service provision. Similarly, estimated health benefits from active transport modes are a significant portion of the quantifiable benefits (after Mulley, C. et al., 2013: Queensland Department of Transport and Main Roads, 2011). While these improved health benefits (and reduced health costs) are often a primary factor behind an individual's decision either to walk or to cycle, research is also required to further understand the negative health costs associated with other mode choices which reduce physical activity. For example, recent research in the United States has drawn the correlation between obesity and heart disease and increased use and reliance on car travel, based on the sedentary nature of car travel (Frank, Andresen, & Schmid, 2004). This research showed that each additional hour spent in a car per day was associated with a 6% increase in the likelihood of obesity, while each additional hour spent walking per day was associated with a 4% decrease in the chance of obesity. While there is a direct cost to the individual, there is also an external cost to society through the increased health care burden placed upon society.

Furthermore, it has been stated (Preston and Rajé, 2006) that, if transport costs (and times) were to be reduced, it would increase physical mobility (and accessibility). This is particularly important

for people who cannot afford to drive vehicles but live in vehicle-dependent communities, which can be a leading causation of social exclusion (Shi, Zhou, 2012).

Davis, A. (2010)<sup>6</sup> suggests that almost all of the studies identified report economic benefits of walking and cycling interventions which are highly significant. The median result for all data identified is 13:1 and for UK data alone the median figure is higher, at 19:1.

At present, valuing active travel and impacts on health can be done by using the WHO/Europe Health Economic Assessment Tool (HEAT)<sup>7</sup>. The tool is designed to conduct an economic assessment of the health benefits of walking or cycling by estimating the value of reduced mortality that results from specified amounts of walking or cycling.

### 6.1.3. Assessing transport equity and social exclusion

The topics of transport equity and social exclusion are widely represented in the latest literature. There are, however, a number of different approaches to these topics. The literature suggests that transport equity and social exclusion are not well researched.

Welch and Mishra (2013) explain that while it may be desirable in some planning situations to provide more benefits to those that pay more, or to ensure that certain economic groups have access to a transit service, it is important to measure how equitable the distribution of public transport service is to all households, irrespective of income. There are two general categories of transport equity (after Delbosc, A. and Currie, G. 2011b): horizontal equity and vertical equity (Litman, 2007). Horizontal equity (fairness or egalitarianism) is concerned with providing equal resources to individuals or groups considered equal in ability. It avoids favouring one individual or group over another and services are provided equally regardless of need or ability. Vertical equity (social justice, environmental justice or social inclusion) is concerned with distributing resources between individuals of different abilities and needs. Vertical equity favours groups based on social class or specific needs in order to make up for overall societal inequalities. These two perspectives often conflict as prioritising one can come at the expense of the other (after Delbosc, A. and Currie, G. 2011b: Taylor et al., 2009; Sanchez et al., 2007; Litman, 2007). Delbosc, A. and Currie, G. 2011b suggest a new way of measuring transport equity by using Lorenz curves and Gini Coefficient. This method provides a single value assessing horizontal equity across the entire transit system.

According to Stanley, J. and Lucas, K. (2008) the concept of social exclusion in a transport context is very important in transport appraisal. Shi, J. and Zhou, N. (2012) aim to develop a method for quantitative evaluation of transport investment considering efficiency and equity. However, further research is needed to make the model more precise and more practicable. In terms of personal affordability, this research highlights how people on different incomes are impacted differently by public transport. Public transport services are a vital component in both the social inclusion of individuals and the vitality and vibrancy of low-income neighbourhoods (Lucas, K. et al., 2009). Smaller initiatives offering individuals travel training and advice and help with their travel costs are also an important factor for encouraging socially excluded people to use public transport more. Additionally, for some areas, the withdrawal of these services could result in a disbenefit.

Preston, J. and Rajé, F. (2007) briefly reviewed the rise of the social exclusion policy paradigm. The paper stresses that although income deprivation can contribute to social exclusion it is not always the cause of social exclusion. According to Preston, J. (2009), two main issues have emerged with respect to social exclusion concept, including identifying the concept and the difficulties in operationalising the concept. Social exclusion can be used as an approach used to quantify the health and wellbeing benefits of the social contacts engendered by transport (reference to WebTAG). Lucas, K. and Jones, P. (2012) suggest that the social impacts of transport can be significant, especially for already vulnerable population groups but these effects are currently poorly accounted for within transport policy appraisal. Additionally, transport benefits and disbenefits are unevenly distributed across the population; the wealthiest in society tend to gain the most benefits from the transport system, whilst the poorest suffer its worst effects. According to Stanley, J. et al (2011) social exclusion could be assessed as a consequence of accessibility.

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<sup>6</sup> Davis, A. Value for Money: An Economic Assessment of Investment in Walking and Cycling, March 2010, Government Office for the South West, Department of Health, available online

<sup>7</sup> See <http://heatwalkingcycling.org/>

Lucas, K. and Jones, P. (2012) argue that some social groups are more adversely affected than others, especially children and young people, older people, lone parents, disabled people and ethnic minority populations. Additionally, there is strong research evidence that these uneven outcomes reduce people's ability to fully participate in society and can lead to their social exclusion but this is often difficult to measure and quantify.

It was also highlighted by Stanley and Lucas (2008) that there is an association between the availability of public transport, the lack of walking access and the additional financial hardships experienced by low- income households who are 'forced' to own two or more cars. This is due to the lack of adequate transport provisions meaning the only viable means of transport is to get your own vehicle. This theory challenges the commonly held assumption that the greatest disadvantages are felt by those who do not have a private vehicle. Stanley and Lucas (2008) state that these low-income households with two cars made less trips and travelled shorter distances than the average household with two or more cars living in the same geographical area.

Lucas et al. (2008) reports that transport can act as a barrier and is 'a significant contributory factor' in the exclusion of many low income groups and communities.

#### **6.1.4. Increasing importance of well-being**

One of the most recent and highly relevant topics is the importance of well-being in the transport appraisal. Stanley, J. and Lucas, K. (2008) identified well-being as one of the very important concepts that require further attention in transport appraisal. According to Delbosc, A., Currie, G. (2011c), social exclusion has a greater impact on well-being than transport disadvantage alone. Two components of social exclusion had much larger influences on well-being than the others: unemployment and social support. Different types of transport disadvantage appear to have similar effects on well-being, although the largest effect size was felt by those who have to rely on others for transport. Therefore, policies that increase overall mobility (such as mass transit or congestion reducing initiatives) may not increase psychological well-being (although they may serve other important policy goals). However, the study shows potential for assessing transport schemes and measures from a wider well-being perspective. Preston, J. (2009) argues that transport policy may only be a secondary tool to reducing social exclusion, with policies concerning employment, income, housing, social care, health and education of greater primary importance, although the intermediate goods status of transport means that it has impacts on many of these primary factors. Additionally, it states that social exclusion is an approach that can quantify the health and well-being benefits of the social contacts engendered by transport. Jones, P. and Lucas, K. (2012) point out that there is a wider interest in developing social measures of well-being and the measures of well-being have been added recently to government funded national surveys.

## **6.2. User Engagement**

This section includes the overall comments made by the interviewees specifically on the user benefits and affordability DI indicators. Comments on social groups are included in Chapter 4.

### **6.2.1. User Benefits**

This indicator was considered by most of the users to be one of the most important indicators if not the most important one. The guidance for this indicator was viewed as relatively straight forward and well defined. Users agreed that it seems logical to take the economic appraisal a step further and examine the distribution of benefits and disbenefits. Whilst the majority of interviewees were happy with the content of the guidance a few users had the following comments.

Firstly, one of the interviewees suggested that the guidance could be better related to traffic model development in WebTAG, to ensure that the requirements for DI appraisals are considered at the outset of model development. Significant GIS work is sometimes needed to match the model and census area zones and this can be challenging to someone who is not experienced. Furthermore the time consuming nature of aggregating data to ensure that it aligns with model zones was also identified as an issue. For example in the case of a Bus Rapid Transit schemes where the intention is that passengers are picked up at either end of the line, passengers can originate from a wider area, and a proper consideration of the impacts would require looking at feeder services which is a much more complicated analysis than just looking at the scheme area.

Users of a scheme can be diffused and it is difficult to forecast what type of person will use/benefit from (not always same thing) a new scheme. Additionally, detailed public transport impacts are often not provided from the model (treated as aggregate benefits for all users), although this may be possible to derive from the model outputs (TUBA).

One of the users indicated that the guidance requires a proportion of the overall scheme benefits to be isolated for the purposes of the DI appraisal. It was not entirely clear why and could be misleading. It was felt that benefits need to be proportioned by household, which would require address point data which is not free to use. This process can be complex and different practitioners are likely to approach it in different ways (e.g more detailed or coarser) and this may result in inconsistency in the appraisal outputs.

Other users felt the impacted area is typically based upon the simulation area of the traffic model; however for regional/national schemes the proportion of benefits captured for the DI appraisal may be small compared to the overall total. Furthermore localised variations in demographics may not be accounted for based on the aggregation of model zones and in relation to income deprivation data, a wealthy area might be located next to a deprived area, but this distinction is likely to be masked in the LSOA data, which would categorise the whole area the same.

Several users commented on the fact that some scheme objectives may appear to be contrary to the DI objectives, for example a public transport scheme which disproportionately benefits high income groups is not necessarily a DI issue as it could mean the scheme is encouraging a modal shift from car use to public transport.

### **6.2.2. Personal Affordability**

Similar comments to those received on User Benefits above were also made for the Personal Affordability indicator. Users felt the variations within each LSOA for income deprivation would be lost within the appraisal and hence not as robust as analysis undertaken at a postcode level – though it was recognised that this data is not readily available.

One of the users indicated that thresholds could be used for vehicle operating cost changes. For example small changes may not be noticeable (like small journey time changes), therefore by adding thresholds such as only looking at increases over a 10% or 20% change (assuming for example a minimum of 5 seconds) could be examined.

It was concluded by several users that the assessment and presentation of the affordability indicator requires a level of GIS analysis. The indicator could benefit from presenting the key areas in the form of a map in the DI report. This would help illustrate the problem areas and to see whether they are close enough to the actual scheme to enable/allow the promoter to perhaps try to influence/change the impacts.

The treatment of strategic schemes or routes of strategic importance could be further tailored in the DI guidance. One of the users highlighted their concerns that some of the strategic routes have large numbers of vehicles travelling long distances and just passing through the scheme area. As a result, the impacts may not be distinguishable for some users. For more local traffic, even a small change in the affordability may make a big difference. On the other hand, an interviewee indicated that although strategic schemes are in general designed to be affordable, it is difficult to establish what can be done before the full mitigated version of the scheme is known. The DI analysis is required early on in the process to understand the impacts, however, the mitigation measures are not yet known at this stage as they have not been designed yet.

Some interviewees commented that the DI analysis should not only look into the distribution of the impacts but should also consider the scale of the impacts. In the case of strategic schemes in particular, the scale of impacts could be millions of pounds or millions of people while on the other end of the scale we look into an impact on an individual school. Relevant questions for the appraisal of strategic schemes are for example: How do you offset these? How do you combine impacts across the country? How do you compare them? One way of doing this is to split the assessment into those which are strategic and those which are local assessments. In general, affordability is considered to be of strategic importance.

### 6.2.3. Summary

According to a number of users the appraisal process for user benefits and affordability is relatively straight forward and well defined, enabling a standard approach, however, there is not a great deal of scope for proportionality (e.g. if a model is not available).

The recommended process in the guidance requires a proportion of the overall scheme benefits to be isolated for the purposes of the DI appraisal, which could be misleading as these benefits could be small in comparison to the overall benefits.

A better understanding of the purpose of DI appraisals is required to enable DI analysts to substantiate schemes that appear to be disproportionate, for example a public transport scheme with the objective of encouraging modal shift may demonstrate a disproportionate spread of benefits amongst high income groups, which is required to encourage such mode shift.

For schemes where change in vehicle operating costs is available and TUBA models are available, the assessment is rather straight forward. However the process would benefit from some thresholds for vehicle operating cost changes to avoid over - analysis on small impacts.

The use of GIS to undertake analysis and present findings is vital for both user benefits and affordability indicators and enables the DI analyst to illustrate problem areas which may be mitigated through the scheme development and design.

## 7. Accidents

### 7.1. Rapid Evidence Review

This section presents the most recent and relevant papers for the accidents appraisal and the key conclusions from these papers. These focus on the ways of reducing accidents including introduction of engineering measures or linking accident location and casualty residence. Additionally, overall comments on the accidents appraisal identified in the literature review are presented below.

#### 7.1.1. Reducing accidents - Engineering measures, accident location and casualty residence

A reduction of accidents can be a direct result of the new transport schemes; however, the decrease of accidents can also be a result of other measures. Given sufficient information regarding both accident locations and where casualties come from, it may be possible to adopt a strategy that uses this information to optimise casualty reductions (Goh, K.C.K. et al., 2014, Green, J. et al., 2011). Also, support should be given to engineering measures that modify the physical and traffic environments where accidents occur, and wider social policy measures in the places where the casualties live (Green, J. et al., 2011).

Additionally, an important determinant in assessing the likelihood of accidents is the age of traffic participants. According to Li, H. et al. (2012) involvement of older men and women in serious road traffic accidents show that they have lower killed and seriously injured (KSI) rates than 17 to 24 year old drivers. However, those aged over 70 years exhibit a trend of increasing KSI rates. Analysis of casualty rates of drivers by type of junction, manoeuvre and environmental conditions found that some gender-age groups are overrepresented in certain accident types, including higher serious accidents rates for men, and over representation of older women when driving in poor conditions and turning right and negotiating roundabouts, crossroads and T, Y and staggered junctions. Improvements in engineering design and driver training are suggested together with the need for a greater understanding of the transport system needs of old and very old people. Goh, K.C.K. et al., 2014 supports this thesis by suggesting that consideration should be given to bus priority measures as they reduce the number of accidents.

#### 7.1.2. Overall safety appraisal

Gühnemann et al. (2013) suggested potential changes to how accident data is assessed. The Department commissioned a study in 2010 to evaluate the existing methods and values applied to casualties and accidents. The phase 1 report is available from NERA (2011). HSE (2007) focused on 'dread risk' – whether certain ways of dying are worse than others and whether this should result in a different value being applied. Wolff and Shepley (2009) evaluated the use of the value of life and health for the Intergovernmental Group on Value of Life and Health. Finally, DEFRA (2010a) published guidance providing updated health costs for fine particles PM<sub>2.5</sub>, which recommends further work to improve the methodology for the valuation of air pollution health impacts. Wee van, B. et al. (2014) discuss the indicators (outcomes) that express road transport safety effects from an ethical perspective. Based on a review of policy documents and Cost Benefit Analyses (CBAs), it was concluded that safety levels are generally expressed in terms of fatalities or (seriously) injured people, either in absolute numbers or on a per capita or per kilometre basis. One can debate whether these indicators express safety well enough.

According to Wee et al (2014) there are some areas of the accident analysis that are overlooked. They state that when analysing accidents, future changes in the risks should be taken into account, primarily because in most countries the accident rate is decreasing and consequently travelling overall is becoming less risky. Wee et al (2014) also suggest an additional criteria to be considered when undertaking a CBA, based on accidents. They propose that the effects of accidents on property damage should also be considered, as this is neglected in almost all CBAs. Since property damage makes up a substantial part of the social costs of road crashes (up to about 50% in countries like Germany and France), this may lead to an underestimation of the road safety benefits.

Furthermore, Parkhurst and Shergold (2009) identify another gap in the evaluation of safety, which they state as being the 'fear' of accidents. They report that there is little research into how the 'fear' of accidents may suppress travel by modes such as walking and cycling.

With regards to the social groups affected by accidents, AEA (2011) found that the predominant social groups more vulnerable to road accidents include: younger people; low income groups; minority ethnic groups/high density housing and non-car users. According to Norman (2013), fatalities, injuries and disabilities arising from road accidents can worsen household poverty. The costs of prolonged medical care, funeral costs, or the loss of income due to disability are all costly.

One of the main problems highlighted in the literature concerned national road accident data. As stated by Wee et al (2014) not all injury accidents are reported to, and recorded by police. Underreporting of accidents varies force to force and country to country; in Germany, The Netherlands and France, it is thought that the underreporting of traffic fatalities varies from 5% to 12% while in Italy, underreporting of traffic fatalities is estimated to be at the level of 26%. Wee et al (2014) also report that there are further discrepancies between the level of injury and whether it is classed as slight or serious.

## 7.2. User Engagement

This section includes an overview of suggestions and comments made during the user engagement interviews. Any comments specific to the social groups on accidents are included in Chapter 4.

According to most of the interviewees, 'accidents' is considered to be a valuable indicator, particularly as it allows additional consideration of the people who might be affected by a scheme rather than just a change in accident numbers. However, its 'usefulness' can be scheme-specific. Due to small numbers of fatal accidents, there is a question whether there is sufficient detail to draw robust conclusions.

According to one interviewee who used the tailored Highways Agency (HA) Guidance, this states that all schemes have an impact on accidents and therefore a full appraisal is undertaken enabling a good standardised methodology to be developed. This is to ensure that small numbers do not lead to over analysis. However, they felt that the accident indicator is rarely assessed for the DI appraisal of HA schemes as the safety impacts of schemes usually do not have impacts on the local road network and therefore little benefit can be gained from considering the local social groups. Another user felt that the absolute change in traffic should be considered as well as the 5% threshold change as suggested in the HA Guidance.

One user stated that the current guidance does not provide a proportionate approach and felt it is at the judgement of the DI analyst and their 'common sense approach' as to what is appraised.

Several users stated various challenges with the data requirements. Firstly, data on public transport network accidents in particular is hard to get while data for highway schemes is easier to obtain, i.e. STATS19 data. Secondly, some users pointed out that it is often difficult to achieve data that is statistical significance. Thirdly the affected area boundary is identified from modelling outputs which could cover a wide area; hence practitioners often have to use a pragmatic approach to the area defined using local knowledge.

Similar to other indicator discussions, issues relating to the different approaches required for appraising strategic schemes and more local schemes was highlighted for the accident indicator and mentioned the focus on the old and young populations may not be appropriate in all scheme cases.

According to WebTAG guidance accidents on the railway (e.g. trespassing and suicides) should be taken into account. However, as pointed out by one of the users, schemes do not necessarily cause these types of accidents. These accidents cannot be predicted and they are difficult to mitigate.

### **7.2.1. Summary**

'Accidents' is considered to be a valuable indicator, particularly as it allows additional consideration of the people who might be affected rather than just a change in accident numbers.

The full appraisal process is not proportionate and hence it is down to the judgement of the DI analyst as to what is appraised and what is scoped out of the DI appraisal.

Issues were raised regarding the ability to obtain statistical significant results. The HA Guidance enables provides a standardised approach for HA schemes which was welcomed by some users.



## 8. Accessibility, Security & Severance

### 8.1. Introduction

Three indicators, Accessibility, Security and Severance, have been presented in one chapter due to two observations made during the rapid evidence review. Firstly, there are possible overlaps between accessibility and severance and by some, severance is considered to be limited accessibility. In many cases, authors of different publications use these two terms interchangeably. Secondly, security is often referred to in the context of accessibility are these are considered to be closely linked.

### 8.2. Rapid Evidence Review

This section includes a summary of rapid evidence review on three indicators – accessibility, security and severance. Firstly, the most recent and relevant publications are listed. Secondly, personal security is discussed. Furthermore, the assessment methods for accessibility are extensively discussed. Then, accessibility is discussed with special consideration given to quality of life of social groups, elderly people in particular, access to essential services and finally, the role connectivity plays for accessibility.

#### 8.2.1. Personal security

In the literature, the term personal safety is often used instead of the term personal security. Following the international standards and definitions used in aviation industry, the term 'safety' is referred to with respect to unintentional acts while the term 'security' refers to intentional acts. Therefore, to ensure consistency, the term personal security is used in the paragraphs below.

Personal security is often viewed in relation to accessibility and severance. Several studies have looked into the issue of personal security (Delbosc, A. and Currie, G., 2012, Kim, S. et al., 2007) and personal security of women (Sham, R. et al., 2012, 2013). There is some disagreement in the literature over the degree of negative influences which personal security concerns can have on transit ridership (after Delbosc, A. and Currie, G., 2012: Booz Allen Hamilton, 2007). Within the transport literature, the influences of age, ethnic background and gender on perceptions of security have all been examined. However, the broader criminology literature highlights the importance of wider neighbourhood and psychological characteristics on feelings of security (after Delbosc, A. and Currie, G., 2012: e.g. Pantazis, 2000).

According to Delbosc, A. and Currie, G. (2012), it is worth considering community perceptions of security in a broader context than solely concentrating on public transport. The most unexpected finding according to the authors was that gender and age did not have a direct influence on feelings of security on public transport. In the literature, not all studies find a significant relationship between feelings of personal security and age (Morse and Benjamin, 1997; Ferraro and La Grange, 1992; Ross and Jang, 2000). It was also concluded that the direct effect of living in a better neighbourhood resulted in lower feelings of security on public transport (people did not necessarily consider security issues when living in nicer areas and therefore felt less secure when on public transport). Kim, S. et al. (2007) recognise the importance of light and proximity of parking facilities next to Light Rail Transit (LRT) stations to enhance passenger perceived feelings of security. This is important for transit planning, demand modelling, and transit-oriented development.

Furthermore, people's perception of their own personal security can be considered in addition to actual personal security. Parkhurst and Shergold (2009) suggest that the psychological barriers in respect of severance should be identified or predicted, to fully address the impact of exclusion. Additionally, they state that the extent to which segregation mechanisms are perceived rather than physically experienced should be assessed.

#### 8.2.2. Assessing accessibility

Accessibility is an indicator which tends to go hand in hand with many of the other indicators, specifically severance and personal security. Accessibility and severance are terms that have been used interchangeably throughout many papers and reports. Gühnemann et al. (2013) consider four sub-objectives underneath accessibility: option values, severance, access to the transport system

and personal affordability. It confirms that accessibility is highly cross-cutting with other indicators and that a comprehensive approach is needed in order to assess it.

The most recent literature identifies a number of possible approaches to assessing accessibility (Geurs et al., 2010, Hamersma, M. et al., 2014, Karou, S. and Hull, A., 2014, Koopmans, C. et al., 2013, Langford, M. et al., 2012). Lucas and Markovich (2011, p. 233) suggest that “*accessibility measures have come to be widely accepted as integral to the transport and social exclusion toolkit*”, and previous research has shown the benefits of multi-disciplinary approaches in identifying transit ‘rich’ and ‘poor’ areas using measures of transport service quality and potential associations with other aspects of socio-economic disadvantage (Currie et al., 2009), (after Langford, M. et al., 2012).

Geurs et al. (2010) suggest using Lorenz curves and Gini Coefficient to assess public transport equity. This is a new method that provides a single value assessing horizontal equity across the entire transit system. The logsum accessibility measure can be concluded to provide an elegant and convenient solution to measure the full direct accessibility benefits from land-use and/or transport policies, when a travel-demand model (using discrete choice models) is available that already produces logsums. The logsum measure accounts for changes in (generalised) transport costs, destination utility and trip production, and is thus capable of providing the accessibility benefits from changes in the distribution of activities, due to transport or land-use policies. In standard accessibility evaluation with the rule-of-half method, the accessibility disbenefits from land-use changes are not measured and would need to be measured in the land-use system (e.g. using property values or land rents). In practice, it is quite difficult to identify and measure these benefits within the land-use system, especially in regulated land markets and housing markets. Additional applications, however, will be necessary to firmly establish the added value of the logsum accessibility method in transport-project appraisal. For some cases, the use of the rule-of-half method as a complementary analysis tool along with the logsum method has been suggested, as it would ensure consistency and add to the scheme-impact analysis. In the Netherlands, it is not uncommon to use quite simple and aggregate rule-of-half measurements in transport infrastructure appraisal. This obviously has the advantage of the ease of calculation and interpretation, but does not result in accurate user benefit computations.

Spatial Network Analysis of Public Transport Accessibility (SNAPTA) which is a GIS-based accessibility model has been developed by Karou, S. and Hull, A. (2014) to measure the accessibility by public transport to different urban services and activities. It shows the potential for assessing accessibility. The model responds to several limitations in other existing accessibility models in planning practice. It offers an alternative and practical tool to help planners and decision makers in examining the strengths and weaknesses of land use – transport integration. SNAPTA has been applied to a pilot study in Edinburgh city to identify the contribution of the infrastructure improvements of the tram system and Edinburgh South Suburban Railway (ESSR) to improved accessibility by public transport to six types of activity opportunities. This paper offers a potential for a good practice / example on how to assess accessibility as an impact of selected transport schemes. This approach is relatively easy to use and is easy to interpret. It does not, however, try to answer all of the aspects of accessibility and, therefore, could be challenged in terms of its key principles. If developed for the specific sites/schemes, it could provide useful information for the scheme appraisal.

Koopmans, C. et al. (2013) suggest that a generalised transport costs indicator can be used for measuring accessibility for policy making. It incorporates financial costs, travel times, and reliability of travel times. It calculates the average costs per kilometre of trips disaggregated by transport mode, trip purpose, trip distance, region and time-of-day. It provides a sound method for assessing the non-conventional transport policy measures.

Modified Floating Catchment Analysis techniques provide a powerful tool for investigating intra-urban variations in accessibility to public transport opportunities and allow their comparison with the socio-economic characteristics of census output areas (Langford, M. et al., 2012). The main research question posed here concerns a comparison of the distribution of access to transport opportunities in relation to spatial patterns of social disadvantage and geo-demographic area classifications, both based on UK 2001 Census data, across the city of Cardiff, Wales.

Preston and Rajé (2006) suggest that examining the inter-relationships between accessibility and mobility is more rewarding than examining either in isolation. They define these terms: accessibility

is the ease of reaching, and mobility is the ease of moving. Preston and Rajé (2006) also suggest that transport-related social exclusion is not always a socially and spatially concentrated process; consequently they suggest a matrix of area accessibility, area mobility and individual mobility as a possible way for helping to identify concentrated and scattered manifestations of social exclusion and inclusion.

Research has suggested (Musselwhite et al, 2011, Parkhurst and Shergold, 2010 and 2012, and Cooper et al 2009) that rural populations should also be taken into consideration when evaluating accessibility. Parkhurst and Shergold (2012) state that, along with older people, rural dwellers are associated with a higher risk of social exclusion. They also stated that some of the most vulnerable people were those who currently have car-oriented lifestyles and living in car dependent areas, who would be most at risk of exclusion if the car became less or unavailable.

Shi and Zhou (2012) suggest a new model for measuring equity impacts; this includes separating the social groups according to the net benefit caused by highway infrastructure: including road users, roadside residents, and local government, and the project contractor. Separating the road users and roadside residents would provide the ability to observe the division between who the scheme benefits and who suffers as a result.

Finally, accessibility was also reviewed from the point of view of capturing land value. Medda, F. (2012) concluded that for the successful implementation of a land value capture finance programme to take place, we must always consider the context (the urban area and the transport mode) in addition to the economic relationship between the life cycle of the transport system, its profitability and the property market.

### **8.2.3. Accessibility and quality of life of social groups, elderly people in particular**

According to Preston, J. and Rajé, F. (2007), social exclusion could be assessed as a consequence of accessibility. The paper suggests ways of ensuring all the social groups are included in accessibility analysis.

Several studies identify older people as a specific social group that needs more attention when planning and appraising transport schemes (Ahern, A. and Hine, J., 2011, Delbosc, A., Currie, G., 2011a, 2011b, 2011c, Shergold, I., Parkhurst, G., 2010, 2012, Shergold, I. et al., 2012). The UK society is ageing and older people will have a larger share in the population. Therefore, the needs of this group and the impacts on public transport should be given more attention (Shergold, I. and Parkhurst, G., 2010, Li, H. et al., 2012). The growing size of this group means that their behaviour will be important to the outcomes of any sustainable mobility policy. The issue is particularly relevant for older people living in the rural areas.

According to Shergold, I. and Parkhurst, G. (2012) rural dwelling and older age are both being associated with a higher risk of social exclusion, with accessibility identified as having an important facilitating role. The car-dependent nature of travel overall means there is a rising risk of mobility-related exclusion in rural areas, particularly amongst the most elderly people. According to Shergold, I. and Parkhurst, G., 2010 there is a link between the level of accessibility and the level of health for an individual. For example, it is suggested that, in more rural locations, people are more likely to suffer worse from diseases such as cancer and diabetes due to avoided travel to healthcare services. This theory is supported by Lucas et al (2008) who stated that transport can act as a barrier and result in failed health appointments and associated delays in medical intervention.

Community activity is a key contributor to quality of life for many older people (Shergold, I. et al., 2012). Mobility, though, is central to such activity, and thus a conceptual link is proposed between 'mobility capital' and wider community sustainability. More modes than just car transport should be considered when looking at accessibility for the elderly.

According to Ahern, A. and Hine, J. (2011), older women are less likely to drive and to own a car and so are seriously impacted by loss of a spouse in terms of their unmet travel needs. However, older men also experience difficulties; the alternatives that are available (such as community transport schemes) to provide trips and services are seen to be more attractive to women. In addition, the car-dependent lifestyles of men throughout their adult lives seem to make them less prepared for life without a car than older women. Increasing car dependency has also made it more

difficult for older people and especially older men, to adjust to life without a car. At the same time, transport disadvantage should be carefully addressed in regional areas where alternatives to private transport are scarce (Delbosc, A. and Currie, G., 2011a). Well-scoped, targeted transport solutions such as demand-responsive transit, local and long distance buses, subsidised taxis or shuttle buses will not only increase mobility but may also increase the quality of life of service users.

Greater consideration could be given to how public and community transport in rural areas can be used to bring about less reliance on the car in all age groups (Ahern, A. and Hine, J., 2011). Also, if adequate transport services are provided for all residents of rural areas, there may be less need to create specialised services with low demand. Varying accessibility affects all the social groups differently. The elderly, in particular, were highlighted as a social group who would experience exclusion if public transport connectivity was not adequate (Shi, J., Zhou, N., 2012).

The cross-sectional ELSA analysis done by Jivraj S. et al. (2012) shows that the prevalence of social detachment was stable in the population aged 52 and above during the period 2002–03 to 2010–11. In 2010–11, almost one-in-five older adults were detached from three or more domains of social detachment and almost half were detached from civic participation and leisure activities. However, only one-in-twenty older adults were detached from social networks. Differences were observed between women and men, women were more likely to be detached from leisure activities than men, but less likely to be detached from civic participation, cultural engagement and social networks. Differences were also observed between elderly people aged 50–79 and 80 and above, as well as between elderly people with different marital status, economic status, education level. Access to private or public transport is associated with social detachment. According to Jivraj S. et al. (2012), older adults with limited access to transport were more likely to be detached from civic participation, leisure activities and cultural engagement. Wealth was considered to be the most consistent driver of movement into social detachment across domains. Poorer older adults are more likely to move into social detachment than those who are richer, with the exception of the social networks domain.

#### **8.2.4. Accessibility and essential services**

In the United Kingdom, social exclusion and transport has largely been linked through the concept of accessibility planning, viewed as the ability to get to essential services: education, employment, health and others, and to food shops, as well as to sporting, leisure and cultural activities (Stanley, J. and Lucas, K., 2008). According to Smith, N. et al. (2012), there is a possibility of weighting the accessibility by the importance of the location you are trying to access. The research did not aim to measure transport disadvantage but it effectively did set such a measure. By identifying households' minimum transport requirements as part of the wider project, it implies a threshold between what constitutes adequate and inadequate resources – where 'adequacy' is understood in terms of to which services and opportunities households need to have sufficient access to. For example, a supermarket and local GP may be more important to access than the local sports facilities for some people while for others it can be the other way around. In line with the above literature, according to Norman (2013), increased mobility can improve the uptake and quality of health and education services, particularly in rural or isolated areas. Reliable and affordable transport services also facilitate access to markets and basic services.

#### **8.2.5. Accessibility and connectivity challenges**

Connectivity plays a crucial role in accessibility. Some papers aim to identify the accessibility and connectivity challenges that are particularly associated with the rural context (after Lucas P34: Velaga et al., 2012). The demand responsive transport in conjunction with new information technologies is considered to be an important possible solution to address the mobility needs of rural communities. In order to implement such solutions, there is a need for technical adaptation, increased transport and technology provision and supporting policies. As well as increasing access to facilities, transport access can improve livelihood prospects (Norman, for DfT, 2013). Transport directly benefits many poor people through employment in the sector.

Lucas and Power (2010) state that severance can be experienced as a result of changes to transport infrastructure, traffic, noise and air pollution. They explain that these can all act to sever or exclude individuals and local communities from activities and have been demonstrated as powerful barriers to travel. This in turn can have the consequence of longer journey times, higher travel costs and abandoned trips.

## 8.3. User Engagement

This section focuses on the comments of DI appraisal guidance users with respect to accessibility, severance and security indicators. Any comments specific to the social groups are included in Chapter 4.

### 8.3.1. Accessibility

As expressed by several users, accessibility is a good, relevant indicator but it can often overlap with severance and personal security appraisals resulting in some ambiguity.

One of the users pointed out that the appraisal requirements for accessibility can often seem a bit excessive and there is no set approach adopted. The feeling was that the DI appraisal guidance was more suited to one type of scheme, over a fairly small area. It was suggested that the guidance does not really offer any advice on how to deal with a package of measures or area wide strategy.

Additionally, it was pointed out that it is difficult to define what accessibility is for a strategic project and one of the users defined their own approach - 'access to a town centre' was applied in this instance and was developed through discussions with the DfT.

Several users agreed that accessibility is an indicator for which the WebTAG guidance is more complex. As a result, they adopt their own approaches which included using the information from User Benefits as a proxy for accessibility. This method allows for looking at the change in spatial distribution of user benefits, overlaid onto Indices of Multiple Deprivation areas and gives an idea of accessibility (more network accessibility than physical accessibility) impact.

One user suggested that the assessment of accessibility is quite difficult for schemes improving an existing public transport route rather than stopping something / introducing a new route.

Defining the impacted area can be rather vague and ambiguous and depends on the nature of the scheme in the view of one of the users. For example, if there are interchange-type improvements which may improve combined bus-rail journey times, it is unclear whether the impacted area needs to extend out to incorporate the rail services.

One user felt the appraisal process needed to be caveated when looking at the benefits in relation to the actual number of people affected. For example a station can have a very good accessibility as a result of a scheme, however, there may be very few people in the area and as a result the number of people who benefit the scheme would be very small. Also, they felt the guidance defines good/adequate accessibility as access to an hourly bus service; however, there is no reference to where the bus was going, or the needs of the people using it. Additionally, the timings of the buses would be an important factor to consider. For example an hourly bus which gets to an employment site at 09:10 would not be very useful.

One of the users suggested that the Disability Discrimination Act process ensures that a lot of physical accessibility issues are covered during the scheme design and for the accessibility indicator to add real value, focus groups would be needed.

Several comments were made on the use of accessibility planning software to undertake the appraisal and others used GIS tooling linked to transport modelling outputs.

### 8.3.2. Severance

In general, this indicator is difficult to assess, but important regardless. This indicator tends to require a more ad-hoc approach tailored to the specific scheme. According to a few interviewees, the approach to assess this indicator can depend heavily on the scheme to a greater degree than other indicators (e.g. noise / air quality / user benefits).

Severance is considered by one user to not to be particularly relevant to strategic schemes and it is more relevant to inner city schemes. For strategic schemes, it is unclear how to consider which of the localised impacts that may affect dozens of people are worth considering for a scheme that benefits millions of people. In order to be proportionate, for LSTF studies, the focus might be just on the major severance issues while others could be ignored. There is a risk that if the guidance

tries to suggest how to do severance proportionately it provides a 'get out clause' which allows people not to consider it.

Additionally, the approach to assessment of severance is typically based upon changes in traffic flows from the transport model and identification of PROWs potentially impacted. Several users suggested that data for this indicator can be an issue, especially data on desire lines or for the number of people using routes is not always available, although recognised that this can be dealt with through site visits/count surveys.

### 8.3.3. Security

In general this indicator is considered to be proportionate, but scheme relevant. As pointed out by some users, security is perhaps of less relevance than other indicators. It tends to be considered as a matter of course anyway in scheme design, particularly, for instance, a public transport scheme in the design of waiting facilities etc. New schemes in particular, should adhere to good standards already, and be planned to take into account security from the outset. It would therefore be very relevant in scheme design and for upgrading an existing scheme.

For public transport operators this is a built in requirement to be considered, particularly in terms of personal security for women, evenings, out of hours staffing, etc. It is generally considered to be more of an operational requirement while DI appraisal does not add much extra according to some interviewees. Additionally, one of the users stated that for security the existing guidance refers to 'what was' scenario while for new schemes there is no scenario that can be compared to which makes the appraisal challenging.

Some users felt this indicator is predominantly subjective and questioned the use of existing data as it would be difficult to standardise the approach, and data requirements are only relevant if the scheme is likely to have a significant impact on security. If relevant to the scheme, crime prevention would usually be consulted as part of the scheme design/development and therefore should this be covered in the appraisal process.

The guidance suggests that research should be carried out on security, however undertaking a literature search first would be quite time consuming, hence it would be useful to provide a list of relevant documents and/or journals. To overcome these challenges, one of the users uses a common sense approach to completing the Appraisal Summary Table, rather than cross checking with the guidance each time.

During the user engagement it was mentioned that this indicator can also depend very much on whether we look at the current users or future potential users of a specific scheme. This indicator can also be easily undermined due to a one-off incident. For example when a crime happens at a specific station, people are likely to use it less. According to one of the interviewees, this indicator refers more to the perception of security rather than actual security. It was pointed out that it is very difficult to measure someone's' feelings.

Again for this indicator, it is difficult to consider which of the localised impacts that may affect dozens of people are worth considering for strategic schemes. In principle, new schemes are designed to the highest levels of security but it is difficult to make an assessment of this indicator.

For public entities in particular, this indicator is of relevance. Public bodies cannot 'fall back' on DDA requirements to pick up issues. In theory, any change in security will be an improvement through the design process; however, the DI process ensures the public bodies engage in a dialogue with the community. The DI appraisal provides a record to show different vulnerable groups have been considered and the impacts have been mitigated though the scheme. Public authorities may use focus groups for selected schemes to ensure that wider concerns, including security, are picked up.

### 8.3.4. Summary

Accessibility, security and severance are relevant indicators but they can all overlap each other which results in some ambiguity. Both accessibility and severance are indicators for which the WebTAG guidance is more complex and as a result, the interviewees adopted their own assessment approaches.

For accessibility, defining the impacted area can be rather vague and ambiguous and depends on the nature of the scheme. One needs to be careful when looking at the benefits of this indicator in relation to the actual number of people affected. Good/adequate accessibility regarded as access to an hourly bus service, however it does not specify to where the bus goes, its timings, or the needs of the people using it. The DDA process ensures that a lot of physical accessibility issues are covered anyway and for accessibility as a DI indicator to really add value, focus groups would be needed. Accessibility should be measured in a comparable way through the use of accessibility planning software or bespoke GIS tools.

Severance is difficult to assess, but important regardless. This indicator tends to require a more ad-hoc approach tailored to the specific scheme. The approach to assess this indicator can depend heavily on the scheme and it is more so than other indicators. Data on desire lines or for the number of people using routes is not always available and it is often dealt with through site visits. There is a risk that if the guidance tries to suggest how to do severance proportionately it provides a 'get out clause' which allows people not to consider it.

Security is perhaps of less relevance than other indicators. It was felt that security tends to be considered as a matter of course anyway in scheme design, particularly, for instance, a public transport schemes or schemes of strategic importance. It is questionable whether sufficient data sources exist as the indicator assessment is predominantly a subjective assessment. This indicator would be very difficult to standardise. The guidance suggests that research should be carried on security, however undertaking a literature search first would be quite time consuming. It could be useful to provide a list of relevant documents and/or journals. This indicator refers more to the perception of security rather than actual security and it is very difficult to measure someone's feelings. For public entities in particular, this indicator is of relevance. In theory any change will be an improvement through the design process.

## 9. Other indicators

### 9.1. Introduction

There are various other indicators that were identified in the reviewed literature. It is important, however, to ensure that the DI Appraisal is proportionate to the task in hand (Atkins, 2010). Therefore, the WebTAG focuses on the most important indicators. Other indicators identified previously in the DI research include Landscape and Townscape, Physical Fitness, Population Migration, Wider economic benefits, Integration, Aversion Behaviour, Forced Relocation, Intrinsic Value/Journey Quality, and Wider social impacts. There are also points of overlap between social, economic and environmental impacts, because economic and environmental impacts can have social consequences and vice versa (Atkins, 2010).

### 9.2. Rapid Evidence Review

The rapid evidence review on other indicators was done alongside the evidence review for the core eight indicators and no specific search terms were used for other indicators. The review showed that wider economic impacts, integration, wider social impacts and assessing equality and equity played an important role in the most recent research.

#### 9.2.1. Wider economic impacts

Transport Project Appraisal is often done with the use of cost benefit analysis (CBA) and it is a widely recognised and applied method. A more recent and more controversial development concerns the inclusion of “wider economic impacts” in appraisal. The wider impacts include effects on productivity, agglomeration, competition and labour markets. While some of these effects are not very clearly defined and there may be overlap between them, it is widely accepted that the effects are real and sometimes potentially important. There is less agreement, however, on what this means for the practice of appraisal (OECD, 2011).

Since the publication of the previous literature review, there were a few publications on the possible methods for evaluation of wider economic impacts of transport. These include Integrated Transportation Land Use Models<sup>8</sup> (This paper presents the wider economic benefit methodology, describes the South and West Yorkshire Strategic Model, and reports on the results obtained), empirical estimates of the elasticity of productivity with respect to effective density<sup>9</sup> (The approach combines the behavioural richness of an integrated transport and location choice modelling system (TRESIS) and its outputs to a spatial computable general equilibrium model (SGEM), which uses data at a more aggregate level to compute the additional impacts of transport infrastructure change on the wider economy). A project in New Zealand<sup>10</sup> examined the latest research and evidence to derive values for the key parameters of the wider economic impacts calculation methodology for impacts relating to: imperfect competition benefits, increased competition benefits, labour supply benefits, job relocation benefits. The paper derives New Zealand-based values of key parameters on imperfect competition benefits, increased competition benefits, labour supply benefits and job relocation benefits. The methodology and the key parameters are then applied to a transport project to demonstrate how the wider economic impacts can be quantified. Evaluation by Marsden, G. and Thanos, S (2008)<sup>11</sup> shows the value of understanding the relationships between the

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<sup>8</sup> For details see Feldman, O., Nicoll, J., Simmonds, D., Sinclair, C., Skinner, A., 2008, Integrated Transportation Land Use Models for Calculations of Wider Economic Benefit in Transport Schemes, Transportation Research Record: Journal of the Transportation Research Board, Volume 2076 / 2008 Travel Demand 2008

<sup>9</sup> For details see Hensher, D., Truong, T.P., Mulley, C., Ellison, R., Assessing the wider economy impacts of transport infrastructure investment with an illustrative application to the North-West Rail Link project in Sydney, Australia, Journal of Transport Geography, Volume 24, September 2012, Pages 292-30

<sup>10</sup> For details see SDG, Kernohan, D., Rognlien, L., Wider economic impacts of transport investments in New Zealand September 2011, <http://www.nzta.govt.nz/resources/research/reports/448/docs/448.pdf>

<sup>11</sup> Marsden, G; Thanos, S; (2008) Measuring wider economic benefits of transport: A case study in good practice for indicator. DISTILLATE Research programme , available at <http://www.distillate.ac.uk/outputs/DeliverableC2v6.0.pdf>



intermediate transport outcomes that can be measured (e.g. generalised cost) and the end outcomes that these are expected to influence (e.g. productivity). In this instance the evidence base for the relationship between transport and productivity is still comparatively new and what is available suggests that most local transport initiatives will have very limited impact on productivity. According to the authors, further understanding will need to be developed, probably through major scheme development examples, before the added value of monitoring any related indicators could be assured.

### 9.2.2. Integration and wider social impacts

Ahern, A. and Hine, J. (2012) look into the issues of integration and wider social impacts. The paper describes the challenges faced by older people in rural Ireland when trying to make trips. The paper outlines transport policy in both Northern Ireland and the Republic of Ireland and describes the activity patterns of older trip makers and the modes they use. It also discusses some of the contrasts between challenges faced by older men and older women. Lucas, K. et al (2009) conclude that public transport services are a vital component in both the social inclusion of individuals and the vitality and vibrancy of low-income neighbourhoods. Smaller initiatives offering an individual's travel training and advice and help with their travel costs are also important for encouraging socially excluded people to use public transport more. According to Lucas, K. and Jones, P. (2012) the social impacts of transport can be significant, especially for already vulnerable population groups but that these effects are currently poorly accounted for within transport policy appraisal. Some social groups are more adversely affected than others, especially children and young people, older people, lone parents, disabled people and ethnic minority populations. Additionally, strong research evidence suggests that these uneven outcomes reduce people's ability to fully participate in society and can lead to their social exclusion but this is often difficult to measure and quantify. Lucas, K. and Jones, P. (2012) argue that there is need to develop better ways to communicate the social consequences of 'transport poverty' to national and local decision makers within and outside the transport delivery arena.

Additionally AEA (2011) gives an additional indicator (in addition to noise and air) quality of environmental quality which they have termed 'Greenspace'. It was stated that although this may not appear to be a major contributor to TQoL (transport quality of life), if you live in an area where road-space is dominant then it can be important. It is specific to the environmental problem because residing in a location with no parkland can have negative impact on your quality of life.

### 9.3. Assessing Equality and Equity in Transport

Both equality and equity have received quite a lot of attention in the latest publications. The UK government has recently published the 'Equality Act' (2010) which simplifies the current laws and puts them all together in one piece of legislation. It is a framework of protection against direct and indirect discrimination, harassment and victimisation in a number of areas, one of which is transport (others include services and public functions, work, education and associations). An authority to which this section applies must, when making decisions of a strategic nature about how to exercise its functions, have due regard to the desirability of exercising them in a way that is designed to reduce the inequalities of outcome which result from socio-economic disadvantage. It should also be noted that the Equality and Human Rights Commission is in the process of drafting new guidance for service users about transport and travel. The guidance will explain how the Equality Act 2010 applies to you if you are using transport or travel services as a member of the public. The guidance will make clear where the Equality Act contains specific provisions for transport and travel or makes exceptions to the law that may apply to transport or travel situations.

Equity, on the other hand, refers to the distribution of impacts (benefits and costs) and whether that distribution is considered fair and appropriate (Litman, 2013). Transport planning decisions often have significant equity impacts, and equity concerns that often influence planning debates. Litman (2013) argues that there is no single way to evaluate transport equity; it is generally best to consider various perspectives and impacts. A planning process should reflect each community's concerns and priorities, so public involvement is important for equity analysis. More comprehensive equity analysis allows planners to better anticipate problems, incorporate equity objectives in planning (for example, it can help identify congestion reduction strategies that also improve mobility for non-drivers and help lower-income people), and it can help optimize planning decisions to maximize equity objectives. According to Lucas and Power (2010) specific issues around which social impacts and equity are important in policy making include:

- Walking – its role as the ‘mode of the poor’, against its scope for improving sociability – the issues surrounding fear of walking alone.
- Cycling – younger cyclists being the ‘same market’ as new car drivers: the social connotations of cycling.
- Links between transport and health – fitness and obesity, walking and cycling, pollution, contribution to delivering on other agendas.
- Child poverty – although not specifically a transport issue, it has a transport dimension.
- Social networks – very little research being done in transport.
- Links between transport and social cohesion need to be considered in decision making. Currently missing and not quantified.
- Links between transport and gentrification – in urban and rural areas – currently missed out in most decision making.
- Reducing the need to travel/promoting alternatives to travel: what are the implications of this priority?
- Links between localism and the centre, and questions over what the role of the centre is.
- International transport – inequities in access to international travel and its impacts.
- Less choice in housing, schools and jobs. But with jobs becoming more flexible would there be more travel? How would the compromises between commuting times/schools/journeys/distance travelled be played out?
- Changing partnerships with the demise of the Regional level what will become national or more local?

Finally, Jones, P. and Lucas, K. (2012) point out that the 2010 Single Equality Duty requires all public bodies to consider the impacts of their policies in relation to sexual orientation, faith, religion, pregnancy and maternity, and gender reassignment. Current data collection and modelling, however, do not address these forms of distributional assessment.

## 9.4. User Engagement

This section includes comments on other indicators expressed by the users of DI appraisal guidance. Any comments made on the social groups in view of other indicators are included in Chapter 4.

The majority of users felt that the eight indicators currently used in the DI appraisal seem appropriate overall. Generally, the value of appraising each indicator depends on the nature of the scheme type and location, and its specific objectives.

One of the users suggested that perhaps the impact of the general environment on non-motorised users could be included in the DI appraisal. For example a quiet tree-lined street is nicer to walk along than a busy dual carriageway, even with a footpath provision. This could be looked at over and above accessibility type allowances but would probably only be feasible for a qualitative assessment. None of the remaining interviewees suggested adding any new indicators.

## 10. Summary and recommendations

This chapter summarises the key findings of the review, and includes **recommendations in bold**. Recommendations are based on the outcomes of the literature review, user engagement, as well as two internal workshops conducted during the project. The recommendations focus on the current and future DI Appraisal in WebTAG for all eight indicators.

### 10.1. General Approach to DI Appraisals

#### **DfT to continue to encourage good practice in DI appraisals and 'buy in' from scheme promoters**

Markovich and Lucas (2010) stated that the importance of DI appraisals has historically been underestimated as a result of impacts traversing several different disciplines, impacts not being readily quantifiable in a similar way to economic and environmental aspects and the belief that the DI appraisal has a lower priority in comparison with economic and financial drivers in the appraisal process (Olowoporuku et al. 2012). Whilst social impacts cannot be easily quantified at this moment in time this is an area for potential future development and opportunities to undertake research in valuing the determinants of DIs should be sought where appropriate. This research could consider both assessing impacts in specific contexts and also the 'harmonisation' of valuing such impacts.

Nearly all the users perceived that DI appraisals were given lower priority in comparison with other elements of the appraisal process such as the economic and environmental appraisals and it is felt DfT can play a role in encouraging good practice in DI appraisals and reinforcing 'buy in' from promoters through detailed feedback on submissions and identifying next steps to resolve any disproportionate impacts. Furthermore any updated guidance should include an outline to such next steps and how the appraisal informs the scheme development and ongoing design.

#### **Stipulate in any updated guidance the need to review distributional impacts early on in the process**

Users expressed a desire to encourage scheme promoters to consider social and distributional impacts early in the scheme development process (Stage 1 - option development) and reported in the Appraisal Specification Report. Early consideration will enable the acknowledgement of likely impacts and outline the likely appraisal requirements, which will feed into the modelling development, engagement with communities and stakeholders such as public transport operators.

#### **Redevelop the DI matrix to aid a more nuanced understanding of the appraisal findings**

Whilst users felt the DI Matrix presents a clear structure to presenting the appraisal outputs, the guidance provides limited advice on the scale/magnitude of impacts and how these disparities can be offset through mitigation. The DI Matrix should be reviewed to seek opportunities to contextualise the appraisal outputs.

#### **Consider including greater detail on the application of guidance to different scheme types**

The DI guidance was felt by users to translate well across various scheme types; however several users suggested there could be greater recognition of how it applies to different scheme types, through worked examples or good practice. Comments were also raised concerning the different approaches for strategic transport schemes and those more localised, with the current guidance being more appropriate to the more localised schemes.

#### **Consider the proportionality of assessing the impacts on social groups for different schemes**

The consideration of social and distributional impacts across different social groups is supported; however several users questioned whether the appraisal should focus effort on those groups significantly impacted by the scheme and not all groups for every scheme. Future guidance should consider how it informs the DI analyst on scoping out certain groups if it is felt appropriate to do so. For example a scheme looking to improve accessibility to regional employment centres may not wish to examine the impacts for older people or younger people but focus more on those of working age and those seeking employment.

### **Research the inclusion of additional social groups and disaggregated disability types in DI appraisal**

Several users identified additional social groups to be considered as part of the DI appraisal which include South Asians and older people for air quality and job seekers, non-car households and NEETs for accessibility. In addition some felt older people should be classified as 65yrs and not 70yrs (based on free concessionary travel) and 'young male drivers' category in accidents should be removed as this relates to driver behaviours. The categorisation of 'disabled' also needs further investigation for future guidance, with a desire to separate physical disability from sensory and learning difficulties.

## **10.2. Air Quality & Noise Indicators**

A number of research papers (AEA 2011 & Keuken 2012) identified different local air pollutants to those already examined as part of the DI appraisal, namely Elementary Carbon and Carbon Monoxide - both affecting people's health. However, neither pollutant is currently assessed in WebTAG or DMRB<sup>12</sup>, hence to remain proportionate it is not recommended to consider these different pollutants within a DI appraisal.

The Eurovignette Directive allows EU Member states to levy infrastructure charges to compensate for the external costs of noise related to heavy goods vehicles. Whilst this is not relevant to the DI appraisal per se it is worth considering as part of either an Environmental Impact Appraisal (EIA) or Health Impact Appraisal for the construction phase of new transport infrastructure.

Several users identified possibilities to improve the integration between the DI appraisal processes and the EIA process. It is recognised that these are two separate processes covering slightly different requirements. However scheme promoters should seek opportunities to share datasets between both assessments.

## **10.3. User Benefits & Personal Affordability**

### **Explore the use of input into the HA 'Appropriate Modelling Sifting Tool'**

Refinement of transport modelling processes was raised by a number of users in terms of ensuring the DI appraisal captures the full extent of traffic re-assignment before analysing the impacts and scoping out areas for more detailed assessment. We understand that the Highways Agency (HA) is in the process of commissioning a project to further refine and develop the 'Appropriate Modelling Sifting Tool'. The tool aims to determine the most appropriate level of modelling detail for an individual project, based on scheme-specific issues. This commission provides an opportunity to work closely with the HA to ensure that social and distributional considerations are identified in this early stage and taken into account when building/designing the transport model.

### **Distinguish between highway and public transport user benefits and re-emphasise in guidance**

Although transport user benefits appraisal (TUBA) outputs can be examined for highway and public transport users separately, the DI analyst will often aggregate these benefits for all users to undertake one assessment across all users. Future guidance should reiterate the need to examine these users separately and an update to the process and reporting should be completed.

## **10.4. Accidents**

### **Consider an in-depth review of accident guidance, including learning from HA and potential to develop a more streamlined approach**

Users described the DI appraisal process for the accident indicator as onerous and resource intensive, hence the approach needs to be streamlined and standardised, if appropriate. Areas for future consideration include examining thresholds for statistically significant accident data and

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<sup>12</sup> Volume 11 of the Design Manual for Roads and Bridges, Section 3, Part 1, Air Quality (DMRB 11.3.1).

traffic flow changes, obtaining network data on public transport accidents and the identification of the impacted area.

## 10.5. Accessibility, Security & Severance

### **Examine approaches for improving the screening/scoping stage for accessibility**

The current DI appraisal for the accessibility indicator can be onerous if undertaken for all different journey purposes and to different destination sets. However it is the decision of the DI analyst to determine the priority for such analysis in line with the scheme objectives and hence we do not suggest the approach gets streamlined in terms of only looking at accessibility to for example a town centre. Future guidance could include approaches to improve the screening/scoping stage of the DI appraisal for example examining connectivity levels using a minimum service frequency.

However the guidance could be updated to provide more support to DI analysts in reference to different approaches for different scheme types and modelling capabilities such as a package of public transport measures, a new bus/rail interchange, use of accessibility planning software or a bespoke GIS tool.

### **Consider removal of the personal security indicator and the physical accessibility element of the accessibility indicator as they are often 'designed out' during scheme development**

The other element of the accessibility indicator examined the physical accessibility of the scheme, for example low floor access. However users felt these aspects of accessibility are covered during the operational assessment of the scheme through an equality impact assessment and design process and hence should not be part of the DI appraisal. This could be further investigated to demonstrate if any added value is captured for the appraisal if undertaken as part of the DI appraisal.

In general the personal security indicator is considered to be proportionate, and predominantly subjective. As pointed out by some users, security is perhaps of less relevance than other indicators as it tends to be considered as a matter of course during the scheme design phase and hence recommended this is removed from any future DI guidance.

# Appendices

## Appendix A – Search Terms

No	Search terms
1	social impacts of transport
2	distribution of social impacts of transport across the population
3	methodology for assessment of social impacts of transport
4	distributional impacts of transport
5	social and distributional impacts
6	social values in transport
7	assessment of distributional impacts in transport
8	distributional effects of transport
9	distributional impacts of transport policy
10	understanding and measuring social and distributional impacts of transport
11	accessibility and transport
12	accidents children
13	transport social exclusion
14	transport children
15	transport older people ageing
16	transport black and minority ethnic
17	transport disabled
18	transport women
19	transport indices of multiple deprivation
20	transport young drivers
21	transport faith groups
22	transport pregnant young mothers
23	transport disadvantaged groups
24	transport lesbian, gay, bisexual, and transgender / LGBT
25	transport user benefits distribution
26	transport user benefits
27	transport affordability
28	community severance
29	forced relocation transport
30	transport forced migration
31	transport gender
32	transport health
33	transport impacts health
34	transport option value
35	transport accessibility
36	public transport accessibility
37	traffic accidents
38	traffic fatalities
39	transport accidents
40	transport security impacts
41	transit crime
42	transport air quality
43	transport noise pollution
44	transport noise nuisance
45	transport air quality health impacts
46	transport health impact assessment
47	transport fear of crime
48	transport cultural diversity
49	transport hazardous waste
50	social equity transport
51	social equality transport
52	social well being transport





## Appendix B – References

1. Ahern, A., Hine, J., Rural transport e Valuing the mobility of older people, *Research in Transportation Economics* 34 (2012) 27-34
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12. Delbosc, A., Currie, G., Exploring the relative influences of transport disadvantage and social exclusion on well-being, *Transport Policy* 18 (2011) 555–562
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35. Lucas, K., Tyler, S., Christodoulou, G., Assessing the 'value' of new transport initiatives in deprived neighbourhoods in the UK, *Transport Policy* 16 (2009) 115–122
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## **Appendix C – Robustness and relevance of the identified literature**

No	Publication reference	Relevance	Robustness
P01	Ahern, A., Hine, J., Rural transport e Valuing the mobility of older people, Research in Transportation Economics 34 (2012) 27-34		ROBUST
P02	Andrews, G., Parkhurst, G., Susilo, Y. and Shaw, J. The grey escape: Investigating older people's use of the free bus pass. Transportation Planning and Technology, 35 (1) (2012). pp. 3-15. ISSN 0308-1060		ROBUST
P03	Borjesson, M., Valuing perceived insecurity associated with use of and access to public transport, Transport Policy 22 (2012) 1–10		ROBUST
P04	Börjesson, M., Eliasson, J., Experiences from the Swedish Value of Time study, Transportation Research Part A 59 (2014) 144–158		ROBUST
P05	Browne, M., Allen, J., Nemoto, T., Patier, D., Visser, J., Reducing social and environmental impacts of urban freight transport: A review of some major cities, Social and Behavioral Sciences 39 ( 2012 ) 19 – 33		RATHER ROBUST
P06	Caulfield, B., Bailey, D., Mullarkey, S., Using data envelopment analysis as a public transport project appraisal tool, Transport Policy 29 (2013) 74–85		RATHER ROBUST
P07	Currie, G., Richardson, T., Smyth, P., Vella-Brodrick, D., Hine, J., Lucas, K., Stanley, J., Morris, J., Kinnear, R., Stanley, J., Investigating links between transport disadvantage, social exclusion and well-being in Melbourne - Updated results, Research in Transportation Economics 29 (2010) 287- 295		ROBUST
P08	Davison, L., Enoch, M., Ryley, T., Quddus, M., Wang, Ch., A survey of Demand Responsive Transport in Great Britain, Transport Policy 31 (2014) 47–54		ROBUST
P09	Delbosc, A., Currie, G., The spatial context of transport disadvantage, social exclusion and well-being, Journal of Transport Geography 19 (2011) 1130–1137		RATHER ROBUST / ROBUST
P10	Delbosc, A., Currie, G., Using Lorenz curves to assess public transport equity, Journal of Transport Geography 19 (2011) 1252–1259		NOT ROBUST / RATHER ROBUST
P11	Delbosc, A., Currie, G., Modelling the causes and impacts of personal safety perceptions on public transport ridership, Transport Policy 24 (2012) 302–309		RATHER ROBUST / ROBUST
P12	Delbosc, A., Currie, G., Exploring the relative influences of transport disadvantage and social exclusion on well-being, Transport Policy 18 (2011) 555–562		RATHER ROBUST / ROBUST
P13	Geurs, K., Zondag, B., de Jong, G., de Bok, M., Accessibility appraisal of land-use/transport policy strategies: More than just adding up travel-time savings, Transportation Research Part D 15 (2010) 382–393		RATHER ROBUST / ROBUST
P14	Geurs, K., T., Boon, W., Van Wee, B., Social Impacts of Transport: Literature Review and the State of the Practice of Transport Appraisal in the Netherlands and the United Kingdom, Transport Reviews: A Transnational Transdisciplinary Journal 29:1 (2009) 69-90, DOI: 10.1080/01441640802130490		RATHER ROBUST / ROBUST
P15	Goh, K.C.K., Currie, G., Sarvia, M., Logan, D., Bus accident analysis of routes with/without bus priority, Accident Analysis and Prevention 65 (2014) 18– 27		ROBUST
P16	Green, J., Muira, H., Mahera, M., Child pedestrian casualties and deprivation, Accident Analysis and Prevention 43 (2011) 714–723		Rather ROBUST
P17	Halden, D., The use and abuse of accessibility measures in UK passenger transport planning, Research in Transportation Business & Management 2 (2011) 12–19		NOT ROBUST / RATHER ROBUST
P18	Hamersma, M., Tillema, T., Sussman, J., Arts, J., Residential satisfaction close to highways: The impact of accessibility, nuisances and highway adjustment projects, Transportation Research Part A 59 (2014) 106–121		HIGHLY ROBUST
P19	Jephcote, C., Chen, H., Environmental injustices of children's exposure to air pollution from road-transport within the model British multicultural city of Leicester: 2000–09, Science of the Total Environment 414 (2012) 140–151		HIGHLY ROBUST
P20	Jephcote, C., Chen, H., Geospatial analysis of naturally occurring boundaries in road-transport emissions and children's respiratory health across a demographically diverse cityscape, Social Science & Medicine 82 (2013) 87-99		HIGHLY ROBUST
P21	Johnson, D., Jackson, J., Nash, Ch., The wider value of rural rail provision, Transport Policy 29 (2013) 126–135		NOT ROBUST / RATHER ROBUST
P22	Jones, P., Lucas, K. (2012) The social consequences of transport decision-making: clarifying concepts, synthesising knowledge and assessing implications, Journal of Transport Geography 21 (2012) 4–16		ROBUST

P23	Kamruzzaman, Md., Hine, J., Analysis of rural activity spaces and transport disadvantage using a multi-method approach, <i>Transport Policy</i> 19 (2012) 105–120		Rather ROBUST / ROBUST
P24	Karou, S., Hull, A., Accessibility modelling: predicting the impact of planned transport infrastructure on accessibility patterns in Edinburgh, UK, <i>Journal of Transport Geography</i> 35 (2014) 1–11		RATHER ROBUST
P25	Keuken, M.P., Jonkers, S. Zandveld, P., Voogt, M., Elshout van den, S., Elemental carbon as an indicator for evaluating the impact of traffic measures on air quality and health, <i>Atmospheric Environment</i> 61 (2012) 1-8		ROBUST
P26	Kim, S., Ulfarsson, G.F., Hennessy, J.T., Analysis of light rail rider travel behavior: Impacts of individual, built environment, and crime characteristics on transit access, <i>Transportation Research Part A</i> 41 (2007) 511–522		ROBUST
P27	Koopmans, C., Groot, W., Warffemius, P., Annema J.A., Hoogendoorn-Lanser, S., Measuring generalised transport costs as an indicator of accessibility changes over time, <i>Transport Policy</i> 29 (2013)154–159		ROBUST
P28	Laird, J., Geurs, K. Nash, Ch., Option and non-use values and rail project appraisal, <i>Transport Policy</i> 16 (2009) 173–182		RATHER ROBUST
P29	Langford, M., Higgs, G., Fry, R., Using floating catchment analysis (FCA) techniques to examine intra-urban variations in accessibility to public transport opportunities: the example of Cardiff, Wales, <i>Journal of Transport Geography</i> 25 (2012) 1–14		RATHER ROBUST
P30	Li, H., Raeside, R., Chen, T., McQuaid, R.W., Population ageing, gender and the transportation system, <i>Research in Transportation Economics</i> 34 (2012) 39-47		RATHER ROBUST
P31	Ljungberg, A., Local public transport on the basis of social economic criteria, <i>Research in Transportation Economics</i> 29 (2010) 339-345		ROBUST
P33	Lucas, K. Transport and social exclusion: Where are we now? <i>Transport Policy</i> 20 (2012) 105–113		ROBUST
P34	Lucas, K., Jones, P. Social impacts and equity issues in transport: an introduction. Guest editorial. <i>Journal of Transport Geography</i> 21 (2012) 1–3		ROBUST
P35	Lucas, K., Tyler, S., Christodoulou, G., Assessing the 'value' of new transport initiatives in deprived neighbourhoods in the UK, <i>Transport Policy</i> 16 (2009) 115–122		ROBUST
P36	Maffii, S., Parolin, R., Ponti, M., Social marginal cost pricing and second best alternatives in partnerships for transport infrastructures, <i>Research in Transportation Economics</i> 30 (2010) 23-28		ROBUST
P37	Medda, F., Land value capture finance for transport accessibility: a review, <i>Journal of Transport Geography</i> 25 (2012) 154–161		RATHER ROBUST
P38	Moliner, E., Vidal, R., Franco, V., A fair method for the calculation of the external costs of road traffic noise according to the Eurovignette Directive, <i>Transportation Research Part D</i> 24 (2013) 52–61		RATHER ROBUST / ROBUST
P39	Mulley, C., Tyson, R., McCue, P., Rissel, Ch., Munro, C., Valuing active travel: Including the health benefits of sustainable transport in transportation appraisal frameworks, <i>Research in Transportation Business &amp; Management</i> 7 (2013) 27–34		RATHER ROBUST / ROBUST
P40	O'Donoghue, R.T., Broderick, B.M., Delaney, K., Assessing the impacts of infrastructural road changes on air quality: A case study, <i>Transportation Research Part D</i> 12 (2007) 529–536		ROBUST
P41	Olowoporoku, D., Hayes, E., Longhurst, J., Parkhurst, G., Improving road transport-related air quality in England through joint working between Environmental Health Officers and Transport Planners, <i>Local Environment: The International Journal of Justice and Sustainability</i> , 16:7 (2011) 603-618, DOI: 10.1080/13549839.2011.582859		RATHER ROBUST
P42	Olowoporoku, D., Hayes, E., Longhurst, J., Parkhurst, G., The rhetoric and realities of integrating air quality into the local transport planning process in English local authorities, <i>Journal of Environmental Management</i> 101 (2012) 23-32		RATHER ROBUST
P43	Page, M., Kelly, Ch., May, A., Jones, P., Forrester, J. (2009) Enhancing Appraisal Methods to Support Sustainable Transport and Land Use Policies, <i>EJTIR</i> , ISSN: 1567-7141, Issue 9(3) pp. 296-313		RATHER ROBUST
P44	Preston, J., Rajé, F., Accessibility, mobility and transport-related social exclusion, <i>Journal of Transport Geography</i> 15 (2007) 151–160		RATHER ROBUST
P45	Preston, J., Epilogue: Transport policy and social exclusion—Some reflections, <i>Transport Policy</i> 16 (2009) 140–142		RATHER ROBUST
P46	Raerino, K. (Ngāti Awa, TeArawa) Macmillan, A.K., Jones, R.G. (Ngāti Kahungunu), Māori, I., Perspectives on urban transport patterns linked to health and wellbeing, <i>Health &amp; Place</i> 23 (2013) 54–62		RATHER ROBUST



P48	Sham, R., Samsudin, N., Rahman, K., Managing Public Transport Service Operation in Reducing Travel Fear Factor, Procedia - Social and Behavioral Sciences 101 ( 2013 ) 338 – 344		RATHER ROBUST
P49	Sham, R., Soltani, S.H.K., Shamb, M., Mohamed, S., Travel Safety Fear Factor among Vulnerable Group of Travelers: The Urban Scenario, Procedia - Social and Behavioral Sciences 50 ( 2012 ) 1033 – 1042		RATHER ROBUST
P50	Shergold, I. and Parkhurst, G. Transport-related social exclusion amongst older people in rural Southwest England and Wales. Journal of Rural Studies: Special Issue on Growing Old in Rural Places, 28 (4) (2012) pp. 412-421. ISSN 0743-0167		RATHER ROBUST
P51	Shergold, I., Parkhurst, G. and Musselwhite, C., Rural car dependence: An emerging barrier to community activity for older people. Transportation Planning and Technology, 35 (1) (2012) pp. 69-85. ISSN 0308-1060		RATHER ROBUST
P52	Shergold, I., Parkhurst, G., Operationalising 'sustainable mobility': the case of transport policy for older citizens in rural areas, Journal of Transport Geography 18 (2010) 336–339		RATHER ROBUST
P53	Shi, J., Zhou, N., A quantitative transportation project investment evaluation approach with both equity and efficiency aspects, Research in Transportation Economics 36 (2012) 93-100		ROBUST
P54	Smith, N., Hirsch, D., Davis, A., Accessibility and capability: the minimum transport needs and costs of rural households, Journal of Transport Geography 21 (2012) 93–101		RATHER ROBUST
P55	Stanley, J., Lucas, K., Social exclusion: What can public transport offer?, Research in Transportation Economics 22 (2008) 36–40		RATHER ROBUST
P56	Stanley, J.K., Hensher, D.A, Stanley, J.R., Vella-Brodrick, D., Mobility, social exclusion and well-being: Exploring the links, Transportation Research Part A 45 (2011) 789–801		NOT ROBUST / RATHER ROBUST
P57	Tajima, R., Fischer, T.B., Should different impact assessment instruments be integrated? Evidence from English spatial planning, Environmental Impact Assessment Review 41 (2013) 29–37		RATHER ROBUST
P58	Thomopoulos, N., Grant-Muller, S., Incorporating equity as part of the wider impacts in transport infrastructure assessment: an application of the SUMINI approach. Transportation (2013) 40:315–345. DOI 10.1007/s11116-012-9418-5		RATHER ROBUST
P59	Wee van, B., Hagenzieker, M., Wijnen, W., Which indicators to include in the ex ante evaluations of the safety effects of policy options? Gaps in evaluations and a discussion based on an ethical perspective, Transport Policy 31 (2014) 19–26		ROBUST
P60	Welch, T.F., Mishra, S., A measure of equity for public transit connectivity, Journal of Transport Geography 33 (2013) 29–41		ROBUST
P61	Wright, S., Nelson, J., Cooper, J., Murphy, S., An evaluation of the transport to employment (T2E) scheme in Highland Scotland using Social return on investment (SROI). Journal of transport Geography 17 (2009) pp457-467		ROBUST
P62	Hodgson, S., Namdeo, A., Araujo-Soares, V., Pless-Mulloji, T., 2012. Towards an interdisciplinary science of transport and health: a case study on school travel. Journal of Transport Geography 21, 70–79.		ROBUST
P63	Milne, E.M.G., 2012. A public health perspective on transport policy priorities. Journal of Transport Geography 21, 62–69.		ROBUST

Position 32 was moved to reports; position 47 was removed as it was outdated.

Legend:

	Paper has a wider coverage either across several indicators or provides information on overall transport appraisal or is a literature review.
	Paper highly relevant / relevant
	Paper possibly relevant / Difficult to assess
	Paper rather not relevant
	Paper highly robust or robust
	Paper rather robust or difficult to assess
	Paper rather robust or not robust

ROBUSTNESS was assessed following the following guidance:

The reviewer will try to assess the robustness of the evidence source and the methodology used to his/her best knowledge and judgment. There is a significant variety of evidence sources and methodologies used in the scientific world and the reviewer will not be familiar with all of them. Therefore, to ensure that the conclusions drawn and recommendations made are based on sufficiently robust methodologies applied in the most relevant evidence sources, we propose to use the following short guidance to assess the level of robustness of the evidence sources and methodologies used in these sources:

Summary comment on the robustness of the methodology used. We will follow the follow guidelines to establish whether the methodology used is robust or not:

- A) Evidence source and methodology highly robust - there is a literature review included in the paper that presents a number of similar approaches and similar results
- B) Evidence source and methodology robust - there is no literature review in the paper, however, there is at least 3 publications identified (UK or other) that come to similar conclusions or results
- C) Evidence source and methodology rather robust - there is literature review in the paper that provides contradictory approaches and conclusions but there is at least 3 publications identified (UK or other) that come to similar conclusions, or, there if no literature review, there are various publications identified that have contradictory approaches or conclusions but there is at least 3 publications that use similar approaches or come to similar conclusions
- D) Evidence source and methodology robustness unverified - a one off market study or publication using a new methodology or arriving to conclusions that are difficult to be verified though other respected and relevant publications in the field, or, there is insufficient information to assess the methodology used.

**Appendix D – Pro-formas and Report Summaries (see excel)**

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