Department for Transport

The Impact of a Person's Impairment when Accessing Transport and the Social and Economic Losses as a Result of Restricted Access

Rapid Evidence Review

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EXECUTIVE SUMMARY

A rapid evidence review[1] was undertaken by Integrated Transport Planning Ltd (ITP) and Plymouth University to explore the state of current knowledge on 'the impact of a person's impairment when accessing transport and the social and economic losses as a result of restricted access.' This focussed on two key research questions:

- What are the transport access barriers experienced by people with a range of impairments?
- What are the social, economic and commercial costs and benefits of implementing measures to overcome these barriers?

The approach taken to the rapid evidence review was based on current examples of good practice and included identification, sifting and review of published information and articles identified through database searches and contacts with stakeholder organisations.

Overall, the review found that the availability of evidence relating to transport barriers faced by people with specific impairment types is variable. The barriers for mobility and sensory impaired individuals are more clearly understood than those affecting people with a mental health, cognitive or behavioural impairment. This may be because overcoming the barriers experienced by individuals with a mobility or sensory impairment tend to require more tangible measures – for example the design of stops and stations or the provision of accessible information for sight impaired individuals. Conversely many of the measures related to overcoming barriers encountered by individuals with mental health, cognitive and behavioural impairment are less tangible. They often relate to enabling the individuals to confidently make journeys - for example, through provision of clear, concise and reliable information, or by training frontline staff to ensure they can effectively assist passengers, especially those with 'hidden' impairments.

The exploration of economic, social and commercial costs and benefits of accessible transport highlighted a distinct lack of evidence in this field. It appears that while it is generally accepted that a more accessible transport system will lead to social (and potentially economic) benefits, studies that investigate this in any depth are very rare. Evidence relating to the commercial costs and benefits is even more limited.

Based on the main evidence gaps identified in the review, it is recommended that the Department for Transport considers undertaking research in three key areas in order to improve policy decision-making on accessibility issues and improve appraisal of schemes and initiatives that include accessibility measures. These are:

- Research to further explore the impact of barriers to travel for individuals with cognitive, behavioural and mental health impairment, and potential solutions to overcome those barriers. This research should address the issue of how important barriers connected with the transport system are in restricting travel activity relative to other societal barriers. It should take account of the range of conditions that are connected to such impairments and draw conclusions on whether better 'widely-applicable' solutions can be found that are cost-effective.

[1] A rapid evidence review is a process similar to a systematic review, but undertaken when timescales and resource are limited.

- Research to quantify the economic, social and commercial benefits of making collective passenger transport more accessible through infrastructure, vehicle, information and 'softer' measures. This would be a significant research effort and could involve a range of techniques. If this could be done in a way that leads to robust results, it would help both public and private sector investors make better estimates of latent demand from people with impairments and make better-informed decisions in relation to accessible transport.
- Creation of a resource (printed or electronic) that can be used by designers, planners and transport professionals to identify measures to improve accessibility for a range of impairment types. This resource should contain 'what, why, where and how' information for a range of measures. It should also bring together information on approximate costs (capital and revenue) for a whole range of better accessibility features within transport schemes and initiatives. This would be valuable for initial appraisals and would also help commercial operators reach a better understanding of the scale of investment involved.

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1 INTRODUCTION

1.1 As society ages and disability becomes increasingly prevalent, it is more important than ever to ensure that individuals can remain independently mobile and experience the highest possible levels of wellbeing and quality of life. The availability of accessible ways of getting around from door to destination is fundamental to this. A number of improvements have been made in recent years, underpinned by an increased understanding of the barriers to travel, and supported by legislation at national and EU level such as the Public Service Vehicle Accessibility Regulations.

1.2 However, there are still concerns about the overall progress towards making the transport system more accessible, as highlighted in the House of Commons Transport Committee (2013b) report "Access to Transport for Disabled People". This report concluded that there would be widespread benefits from enabling and encouraging better access to transport, including better access to employment, healthcare, education and social activities. However, it expressed concern regarding the lack of a joined up approach to: accessible transport; improvements to buses and coaches; availability of information; disability awareness training for transport staff; travel training delivery; guidance on accessible transport design; and appraisal of schemes including accessible transport (amongst other things). It also highlighted that not all disability is visible, and therefore there is a need to understand the requirements of everyone with an impairment that affects their access to transport.

1.3 Building on these findings, this report provides an overview of what is known about the impact of a range of impairments on access to transport based on a rapid evidence review. In each case, a review of the extant evidence relating to the barriers and means of overcoming them is provided. This is intended to offer some context relating to which impairments we have a good understanding of, and which we need to know more about. The report goes on to cover the readily available evidence relating to the economic, social and commercial costs and benefits of making transport more accessible. Following this, a brief discussion of how these costs and benefits could be included in the appraisal process is provided. Finally, the concluding chapter offers some thoughts on the current extent of our understanding, and what actions are needed to enable further progress in this field.

2 METHOD

2.1 This chapter describes the approach that was adopted during the research. The main aim of the study was to undertake a rapid evidence review of available literature relating to the economic, social and commercial costs and benefits of restricted access to transport resulting from impairment. There were two sub-elements to this: a summary of the barriers experienced by people with a range of impairments; and consideration of what the latent demand from transport amongst each of these groups might be if access restrictions related to their impairment could be overcome.

2.2 The study used a rapid evidence review to collect information on economic, social and commercial impacts, and also drew upon this for information relating to barriers affecting people with a range of impairments. This was supplemented by additional searches to identify further documents relating to different impairments, and some supplementary analysis of datasets from Transport Focus and the Department for Work and Pensions (DWP). The method is described in full below.

2.3 A rapid evidence review is a process similar to a systematic review, but undertaken when timescales are limited. A variety of approaches exist to undertaking a rapid evidence review, and the methodology we adopted is based on current examples of good practice (see Civil Service Undated; Ganann *et al.* 2010; HM Treasury 2007; Khangura *et al.* 2012) We adapted these and undertook the research using the approach set out below.

2.4 **Step 1 - Identify knowledge users**: During the inception meeting we held an in-depth discussion with the client team at the Department for Transport (DfT) to identify the reasons why they had commissioned the project, and what they wanted to use the resulting report for. This enhanced our understanding of their needs and enabled us to design the project so that the outputs meet these needs.

2.5 **Step 2 - Question definition**: Also during the inception meeting with the client group, we explored the mains aims of the research. We identified that the main focus of this study is on the social, economic and commercial costs (with a view to feeding into longer term budgetary planning). As a result we developed two main questions that we sought to explore through the research. These are:

- What are the access barriers experienced by people with a range of impairments?
- What are the social, economic and commercial costs and benefits of implementing measures to overcome these barriers?

2.6 The review of access barriers was used to inform the review of economic, social and commercial costs, rather than to provide a comprehensive overview of access barriers for each individual impairment type. Existing work has comprehensively reviewed barriers (for some impairment types) and is signposted within the report.

2.7 **Step 3 - Search parameter definition**: Next we set out a list of search terms. Because we used a transport database (TRID) for the main search, we did not need to include terms for individual modes of transport. We included a range of terms that are used to denote

impairment internationally both currently and historically in order to ensure we captured as many reports as possible. The search terms we used were:[2]

- (accessibility OR accessible OR "universal design" OR "access for all" OR "barrier freedom" OR “barrier free” OR inclusive) AND (disabled OR disability OR impairment OR handicap OR impaired OR "special needs")

2.8 We also limited the search to documents produced between 2000 and 2015.

2.9 **Steps 4 and 5 - Database and other searches:** Next we ran the search on the TRID database which found 1184 documents, leaving 1181 after the removal of obvious duplicates. The abstracts and details for each of these were uploaded into Endnote, and exported to Excel to facilitate the filtering process.

2.10 As this was a rapid evidence review we selected one database that was felt to be the best source of academic papers, conference papers, reports and other documents that would be relevant to the research questions. However, in order to ensure our approach was appropriate we ran an additional search using Google and Google Scholar to check that we had (as far as possible) found all relevant documents. Using this approach, we identified an additional 25 texts.

2.11 In parallel with the online searches, we contacted a range of experts, comprising those suggested by the project steering group supplemented by our own contacts, to ask them to send through any documents that they were aware of. The people and organisations that were contacted were:

Table 2-1: Organisations contacted

Business Disability Forum	PTEG
Chamber of Shipping	SCOPE
Civil Aviation Authority	South Yorkshire ITA
Community Transport Association	Swansea University (Charles Musselwhite)
Department for Work and Pensions	Trailblazers (Muscular Dystrophy Campaign
Design for all Foundation	Transport for All
Guide Dogs	Transport for London
Members of the DfT Inclusive Mobility Group	Transport Scotland
Mental Health Action Group	University of Applied Sciences Erfurt
MIND	VISTA
Network Rail	West Midlands ITA
Passenger Focus (now Transport Focus)	

2.12 Finally, we publicised the research via social media (Twitter, LinkedIn and the ITP website). This process of wider consultation led to the identification of an additional 13 documents. After cleaning and checking, this left a total of 1219 document records in the database.

2.13 Alongside this search, we supplemented the section on barriers to transport relating to a range of impairment types with information from searches of other databases and Google to ensure we had collated as much information as possible. We also reviewed evidence from

[2] While some of these terms are no longer used in the UK, the age of the documents that we were searching for, alongside the international nature of the search, meant that is was appropriate to include them to identify as many relevant documents as possible.

Transport Focus[3] satisfaction surveys and the DWP Life Opportunities Survey (LOS) to enhance our understanding of barriers to transport use and satisfaction with transport services for people with specific impairment types.

2.14 The LOS provides some interesting quantitative figures on perceived transport barriers faced by people with different impairments. This is a relatively new large scale longitudinal survey of disability in Great Britain. It is the first major British national social survey to explore disability in terms of the social barriers to participation that people experience, and compares the experiences of disabled people with those of non-disabled people.

2.15 The first and second LOS waves were undertaken between 2009 and 2012 by the Office for National Statistics, having been commissioned by the DWP and the Office for Disability Issues (ODI). Full cross-sectional data is publicly available to users for the first wave, which questioned over 46,000 respondents. This data was subject to limited (unweighted) re-analysis within the rapid evidence review to look at barriers to travel reported by people with different types of impairment for different travel modes. Within the survey reasons for people not travelling at all or not as much as they would desire were explored through a set menu of reasons, where respondents could indicate multiple reasons. Different menus of reasons were used for the private car and for the various forms of public transport. These reasons comprised a mixture of difficulties and concerns associated with actually travelling (e.g. 'lack of help or assistance') and underlying personal conditions (eg. a health condition, illness or impairment). The results of this re-analysis are presented within each sections of Chapter 3 for different types of impairment.

2.16 **Step 6a – Abstract sifting**: Clearly, all of the database records identified were not relevant to the study. Therefore a three stage approach to identifying the relevant records was adopted. An initial "high level" sift was undertaken to remove those documents outside the scope of the study as a result of geographical location or document type. Documents were removed on the basis of geography if they related to developing countries AND did not specifically refer to costs and benefits. Documents were removed on the basis of document types if they were legislation, standards, codes of practices (without additional background research), or newspaper or magazine articles. This left a total of 654 documents.

2.17 Next a more in-depth abstract review process took place. Seven fields were identified: barriers to travel, overcoming barriers to travel, type of impairment, social costs and benefits, economic costs and benefits, commercial costs and benefits.

2.18 Each abstract was reviewed and according to its content, a "yes" or "no" was denoted under each field heading. This process was carried out by two researchers working together. To ensure consistency, they first carried out a review of 20 records together. Following this they regularly discussed the inclusion/exclusion criteria and double checked records at random to ensure the process remained consistent throughout.

2.19 Following this, a total of 230 document records were retained. The table below shows the fields each of them was categorised as relating to.

[3] Formerly Passenger Focus

Table 2-2: Database records in each category after abstract sift[4]

Barriers to travel	Overcoming barriers	Impairment type	Economic costs/benefits	Social costs /benefits	Commercial costs/benefits
129	139	54	72	79	54

2.20 The next stage of the research was to obtain the full text for each record. In some cases (where links to the full documents were provided), this was simple. However, in other cases it involved online searches, and/or sending emails to the authors in order to request the papers. Those that could not be located were removed from the database. In general these tended to be the older papers. At the end of this process, 197 document records remained.

Step 6b – Full text sifting: Once we had located the full text of the documents, we undertook a full text sift. The full texts were reviewed to ascertain whether they were relevant to the study based on the extent to which they were related to economic, social or commercial costs and benefits, and whether they provided evidence of this. Studies were included if they provided quantitative evidence of either micro or macro level costs or benefits, if they quantified the impact of not being able to travel, or if they qualitatively reported changes in behaviour as a result of more accessible transport. Those papers that met the criteria were retained and included in the analysis; those that did not were removed from the database. During this process, it became apparent that we had identified a number of documents that related to the appraisal of accessibly measures. We felt that this was best included in a separate report section, but for consistency the number of papers relating to it are shown in the table below.

Table 2-3: Number of papers remaining after full text sift[5]

Economic costs/benefits	Social costs /benefits	Commercial costs/benefits	Appraisal
9	15	18	20

2.21 A short summary was written for each paper, and details (as appropriate) of the method, sample size, and findings relating to the criteria above were recorded. Details were also recorded for those papers that related to barriers and overcoming barriers for a range of impairments types for use later. We considered applying quality criteria. However, because relatively little research was identified it was felt that all of the studies should be included, and their perceived quality noted during the analysis.

[4] The sum is greater than 230 because some papers were included in more than one section.

[5] Some papers were included in more than one section

Step 7 - Analysis:

2.22 Once we had completed the sifting process, we were left with a set of documents relevant to the aims of the study. Those relating to barriers and overcoming barriers for specific impairment types fitted into the brief review of this evidence (Chapter 3). Those relating to economic, social, and commercial costs and benefits, and appraisal were reviewed by section and the findings reported in Chapters 4 and 5

Summary

2.23 This section has described the method used during this study. It is important to read the remainder of this report bearing in mind that the findings are based on a *rapid* evidence review – which means it does not go to the same lengths as a full evidence review. As such, we limited the databases that were searched, and reported mainly on existing research evidence rather than undertaking new analysis of our own. That said, we tried to ensure the review is as complete as possible by supplementing the report with a review of barriers experienced by a range of impairment types (to provide context) and undertaking additional analysis of the Life Opportunities Survey to provide insight into barriers within the UK context that goes beyond what is currently published.

3 THE IMPACT OF IMPAIRMENT ON USE OF TRANSPORT

3.1 It has long been understood that impairment can have an impact on an individual's capability to undertake independent travel, and on their overall amount of travel. Research has suggested that individuals with a disability travel up to a third less than those without a disability (MORI 2002), and up to 75% of individuals with a disability in Scotland reported that they had difficulty travelling (Scottish Executive 2006). In a UK context, the Life Opportunities Survey identified that transport was an area of life in which 64% of adults experienced "participation restriction". However to put this in context, "participation restriction" was cited by 75% of people with impairment compared to 60% without impairment (Department for Work and Pensions 2012). Nevertheless, this in turn has an impact on an individual's ability to access a range of things, including employment, training, education, and social participation (Aongusa & Moore 2013).

3.2 Evidence suggests that, as a result of a range of barriers, individuals with a range of disabilities travel less than they would like to. This was explored in detail in the Scottish context where it was identified that *"overall, 70% of the sample indicated that, if travel were not a difficulty, they would travel more than they currently did" (Scottish Executive 2006:p.23).* This was investigated in more detail, as shown in Table 3-1, where "D" shows the level of latent demand for travel on public transport that exists due to transport barriers (rather than other factors).

Table 3-1: Percentage saying journey not made due to difficulties with travel

	Travel is reason don't make journey more (A)	Travel is reason don't want to make journey at all (B)	Travel is reason can't make journey (C)	Total (D) (A+B+C)
Away for holiday	4	2	7	13
Away for weekend	5	2	5	12
Visit friend or relatives	11	0	2	12
Daytime leisure	2	2	6	10
Evening leisure	0	3	6	9
Work/training or education	1	1	5	7
Supermarket shopping	4	0	2	6
Personal business	3	0	2	5
Convenience store/local shop	2	0	2	4
Day centre or similar	0	3	0	3
Other medical visits	1	0	0	2
Visit doctors	2	0	1	2
Hospital appointments	1	0	0	1

Source: Adapted from Scottish Executive (2006: p. 26)

3.3 The findings here are reinforced by other studies. For example, Transport for London carried out a survey with their passengers and found that 61% (of a sample of 381 disabled people) would travel more if barriers such as access and cost constraints were reduced. When the data is examined further variances between different impairments become apparent. For example, 76% of those with a mental health condition (55 people) said they would make

more journeys if there were less barriers, compared to 62% with a mobility impairment (Transport for London 2014).

3.4 Clearly then, this indicates that barriers within and related to the transport system are preventing individuals with impairment from travelling as much as they need or would like to. One area which may provide some insight into what these barriers could be is research relating to customer satisfaction. Transport Focus carry out annual surveys with passengers to investigate the levels of passenger satisfaction with bus and rail travel, including passengers who say they have a disability.

3.5 The 2014 survey showed that for both forms of transport the satisfaction levels of passengers with impairment were very similar to those without impairment[6]. Table 3-2 shows the percentage of bus passengers who stated they were dissatisfied with a selection of the characteristics of the transport system[7]. This indicates that in most cases, the lowest values in each range for passengers with and without a disability are the same; however there is more variation between the highest values in the range. In particular, passengers with a disability were more likely to be dissatisfied with aspects of the trip that were likely to cause them discomfort such as the seats, the driver attitude, time allowed to get to a seat before the vehicle moved and the smoothness of the journey.

Table 3-2: Percentage of bus passengers stating they are dissatisfied with each characteristic

Factor	All Passengers	Passengers saying they have a disability
Information provided at stop	7-23	6-25
Information provided in vehicle	2-7	2-9
Ease of getting on and off	1-6	1-7
Comfort of seats	5-15	5-20
Nearness to kerb at the bus stop	0-3	1-5
Helpfulness/attitude of driver	3-9	2-13
Time given to get to seat	3-11	4-18
Smoothness/freedom from jolting	5-16	5-25

Source: Transport Focus (2014). Ranges are as a result of data being provided by area

3.6 A similar survey was carried out with rail passengers and in 2012 a report focusing on the findings relating to individuals reporting a disability was produced. This showed that around 5 per cent of rail journeys are made by passengers with a disability. In terms of satisfaction, people with a disability report very similar levels of satisfaction with most aspects of the rail network to those without a disability (see Table 3-3). For example 82% of disabled passengers said their journey was 'good' or 'satisfactory' compared to 84% of all passengers. However slightly lower levels of satisfaction were reported by people with a disability about the security at stations and ease of getting on and off trains, but value for money was perceived to be better (Passenger Focus 2012).

[6] Just over 25% of respondents stated they had a disability

[7] A wider list of categories is reported. However, after reviewing them all, for brevity we selected those likely to be particularly pertinent to people with a disability.

Table 3-3: Percentage of passengers satisfied with aspects of rail travel

	With long-term disability/illness	Without long term disability/illness
At station		
Provision of information about train times/platforms	78	81
How request to station staff was handled	83	85
Facilities and services	49	50
Availability of staff	58	59
Attitudes and helpfulness of staff	71	72
On Train		
Ease of being able to get on and off	71	81
Comfort of the seating area	70	72
Availability of staff	58	59
Helpfulness and attitude of staff	72	71
Provision of information	71	70
Toilet facilities	40	37
Value for money for the price of ticket	55	44

Source: Passenger Focus (2012: p.18-21)

3.7 The similar levels of satisfaction/dissatisfaction for a range of characteristics are interesting, and are reflected slightly differently in a US study which found similar barriers to transport use existed for people with and without a disability. These included a lack of adherence to bus and airline schedules, a lack of seats; and insensitive drivers while walking or cycling (U.S. Department of Transportation 2003). Further, Mackett (2013) identified that similar barriers to accessing transport were encountered by older people with and without impairment.

3.8 However, this is not universally the case. For example, Transport for London (2014) found some areas where barriers were similar (overcrowding, unreliability, length of journey) and others where they were different (fear of knife crime, cost). The Scottish Executive (2006) found that adults with a disability were much more likely to cite health reasons and access as the main reasons they didn't use public transport, compared to adults without a disability who cited using their own car. Similar percentages in both groups said that they had no need to use the bus.

3.9 As such, whilst it is very useful to have an understanding of latent demand, barriers to travel and satisfaction, variation in what these show highlight that while many people with a disability experience barriers that prevent them using transport as much as they would like, the degree to which these barriers exist and impact an individual are highly variable. People who experience disability or impairment are a heterogeneous group, and different individuals will have different disabilities, with different causes - so the impact on every individual will be different. Indeed, the Passenger Focus Rail Survey discussed above highlighted *"differences between the experiences of people with different types of disabilities"* (Passenger Focus 2012: p.21). For example, it found that people with impaired eyesight are less satisfied with information provision at stations and passengers with less obvious disabilities are sometimes frustrated that staff view them with suspicion when they ask for help, compared to passengers using a wheelchair who they help freely.

3.10 So while some barriers to transport may span all impairment types (for example, access to information, attitudes of frontline staff and the design of infrastructure (Department for Transport 2008) the degree to which poor provision in each area will impact a person will vary depending on the type of impairment, and how it is experienced by the individual. The Transport for London (2014) survey cited above found that although all passengers expressed a need for transport information, disabled passengers were less likely to have access to the internet, placing greater emphasis on obtaining travel information from other sources. Furthermore, sensory impaired passengers require information in a variety of formats (Fürst & Vogelauer 2013), individuals with a mobility impairment require physical accessibility information (May *et al.* 2014) and individuals with a cognitive impairment or mental health condition require information in a simple format to make processing the information easier (International Transport Forum 2009).

3.11 Before this report moves on to explore the benefits and costs of a more accessible transport system, the following sections offer a summary of knowledge relating to the barriers experienced by individuals with a range of different impairments. The categories of impairment originally identified in the study brief were based largely on those used in the Life Opportunities Survey. During the analysis it became clear that some of the categories appeared to be relatively well documented, while others were much less so. In addition, some of the barriers experienced within different categories were very similar, and so for clarity we adjusted some of the categories as shown in Table 3-4.

Table 3-4: Changes to impairment categories

Original impairment categories	Reasons for merging categories
Vision	No change
Hearing	No change
Mobility	No change
Dexterity	Merged with mobility impairments as research identified that in many cases people with dexterity impairments either also had mobility impairments or faced similar problems.
Stamina / breathing / fatigue	Not included as a separate section, although elements of reporting in the mobility section are relevant.
Learning	Learning and memory impairments were combined to look wholly at cognitive functional impairments.
Memory	
Mental health	No change
Behavioural	No change

3.12 The following sections provide an overview of each of the categories in turn, and offer a summary of the barriers, and ways in which these can be overcome.

Visual impairment

People with visual impairment have varied needs depending on the degree of impairment. It is important to recognise the diversity of these needs to ensure that people with no sight and people with some residual sight are catered for. The barriers that they encounter are physical (relating to barriers in the built environment) communicative (relating to accessing information) and functional (relating to use of services). People with a visual impairment report higher levels of anxiety before and during a trip, difficulty accessing information before and during the journey and difficulty boarding and alighting. Some of these barriers

can be mitigated through good design, staff training and good practices in terms of information provision.

3.13 Visual impairment is an umbrella term used to describe people who have limited or no vision. Over 285 million people are estimated to be visually impaired worldwide (WHO 2014) with impairment ranging from 'slightly impaired', which includes those that are partially sighted, to 'severely sight impaired', which includes those who are classed as legally blind (RNIB 2015). Individuals with a slight impairment have some vision; however, they may need assistance in carrying out everyday tasks such as reading and wayfinding. Most individuals that have a severe sight impartment do not have any vision and may need Braille, raised-line drawings, audio recordings, and/or other non-visual media to be able to access material that is typically viewed visually. Bearing in mind the differences in visual capacity, people with visual impairment cannot be seen as a homogenous group, rather their needs are diverse and as such they will require different solutions to overcome barriers to travel (Atkin 2010).

Barriers

3.14 Visual impairment can lead to a number of barriers to movement and an increased reliance on auditory, olfactory or tactile feedback to determine spatial location and navigate. The barriers can be loosely categorised as physical, communicative and functional.

3.15 Physical barriers relate to spatial awareness and the difficulties that are encountered when moving with limited vision. Individuals with a slight visual impairment may be able to see sunlight or colours which can help in orientation. However this is unlikely to be the case for individuals with severe sight impairment. Navigating around permanent obstacles (e.g. cycle racks, traffic sign poles, benches, lamp posts and newspaper boxes) and temporary blocks (construction works, crowds) can be very difficult.

3.16 Barriers can also appear when there is a change to the standard street layout. For example, the recent emergence of the 'shared space' concept creates a plethora of safety concerns for visually impaired individuals. The lack of kerbs and street markings make it very challenging to navigate across that space, particularly since kerbs are used by guide dogs or a cane to help identify the edge of the pavement and crossing points (Mackett *et al.* 2010) making the spaces unfamiliar and increasing the risk of an accident.

3.17 Communicative barriers relate to accessing information and interacting with other people. Visually impaired people are also more likely to rely on audible information while travelling. Visually impaired individuals have reported problems with availability of audible information - in particular incomprehensible announcements where the frontline staff talked too fast or did not speak in 'plain English'. As such, staff awareness and empathy when communicating with visually impaired people can be viewed as an area that could be improved through additional staff training (Furst & Vogelauer 2011), which in turn would reduce dependency on friends and family while travelling (Gallagher, 2011).

3.18 Functional barriers concern an individual's ability to use a particular form of transport and concerns barriers that could be unnoticed by those that have no visual impairment. For example, orientation and crossing roads, purchasing a ticket from a self-service machine, boarding transportation, and accessing travel information about transport services all impact an individual's ability to use a particular mode. In many cases, websites have been reported

to be inaccessible and timetables and displays have text that is too small to read, or may have reflective protective glass which prevents visually impaired people from easily accessing the information (Furst & Vogelauer 2011).

3.19 The study team's analysis of the LOS first wave data provided some quantification of the perceived barriers to travel by different modes for people with impaired vision (defined here as causing moderate, severe or complete difficulty with undertaking everyday tasks), as shown in Table 3-5 and Table 3-6. By comparison with people without significant impairments, these show that for vision-impaired people:

- Anxiety / lack of confidence, difficulty getting to and from stations and stops, lack of help or assistance, difficulty with seeing signs, and overcrowding, are more significant issues for all 'collective' forms of transport.
- Difficulty getting in and out of transport vehicles is a more significant issue across all forms of transport.
- Cost is a more important barrier across all transport modes, perhaps reflecting lower incomes.
- Attitudes of staff and passengers, fear of crime, delay and disruption, and lack of information, while generally being reported as a barrier by a relatively small proportion, are all more significant considerations than for the non-impaired population.

3.20 It is worth noting that some of these reported barriers (as with the results presented later for other impairments) may not be directly related to impaired vision, but may be connected with other impairments or age of respondents.

Solutions

3.21 There are a range of solutions that can help people with visual impairments use transport more easily. Many of these are well-known, but in recent years there has been an emergence of new technologies that can provide additional personalised information.

3.22 Overcoming the physical barriers to transport differs depending on the level of impairment. Those with residual sight are often able to tell the difference between light and dark and thus need tonal contrasts to aid their vision (Furst & Vogelauer 2011). People who have no vision require alternative solutions such as the removal of street clutter, the introduction of tactile paving and for drivers to stop close to the pavement (Furst & Vogelauer 2011). To ensure the design of better streets it is important to enable people to document their experiences and requirements of specific places to allow designers make a more informed plan with accessibility for visually impaired people in mind (Gallagher, 2011).

Communication barriers can be overcome by providing visual information and audio announcements in parallel. The provision of short and clear announcements at stations and on vehicles improves comprehension for those with a visual impairment. Ideally, supplementing this with the option to receive SMS and MMS text messages for important announcements would enable people to receive information in the best format for them. This can be backed up by the provision of frontline staff with disability awareness training so that they are able to understand the barriers faced when travelling by public transport people with a visual impairment and provide suitable assistance and support (Furst and Vogelauer, 2011).

Table 3-5: Reasons reported by LOS respondents with impaired vision for not using a private motor vehicle as much as desired

Private motor vehicle	Respondent details				Percentage of people who don't go out in household vehicle or go out less than desired citing different reasons / barriers											
Type of impairment	Number with impairment	Number with impairment and vehicle in household	Number who don't go out in household vehicle or go out less than desired (excluding those who don't want or need to)	Percentage of people with impairment and household vehicle who don't use it or use it less than desired	Costs	Parking problems	Too busy or not enough time	Caring responsibilities	A health condition, illness or impairment	A disability	Vehicle not suitable / not adapted	Attitudes of other people	Lack of help or assistance	Difficulty getting in / out of vehicle	Vehicle not available when needed	Other reasons
Vision impairment	1179	613	271	44.2	27.3	8.9	4.8	2.2	27.7	22.5	2.6	2.6	2.6	5.5	5.9	15.1
No impairment	35685	29779	13614	45.7	8.8	2.0	3.1	1.0	0.5	0.2	0.2	0.5	0.1	0.0	2.3	5.1

Table 3-6: Reasons reported by LOS respondents with impaired vision for not using public transport options as much as desired

		Respondent details			Percentage of people who don't use mode (excluding those who don't want or need to) or use it less than desired citing different reasons / barriers																			
Travel mode	Type of impairment	Number with impairment	Number who don't use mode or use it less than desired (excluding those who don't want or need to)	Percentage of people with impairment who don't use mode or use it less than desired	Transport unavailable	Cost	Overcrowding	Attitudes of staff	Attitudes of passengers	Delay and disruption to service	Fear of crime	Lack of information	Anxiety / lack of confidence	Difficulty getting to stop or station	Caring responsibilities	Difficulty getting in or out of the transport	Difficulty getting from stop or station to destination	Lack of space	Lack of help or assistance	Too busy / not enough time	A health condition, illness or impairment	A disability	Seeing signs or hearing announcements	Unable to book a seat	Other reasons
Local bus	Vision impairment	1179	481	40.8	12.1	12.9	6.2	3.1	4.2	6.9	6.2	3.5	12.1	17.3	2.9	21.8	18.9	4.6	13.3	5.4	36.8	28.9	9.1	1.2	9.4
	No impairment	35685	17233	48.3	10.5	7.4	2.5	0.8	1.9	4.2	1.4	2.5	0.5	2.2	0.7	0.8	2.1	1.1	0.4	3.8	0.6	0.3	0.0	0.1	7.1
Long distance bus or coach	Vision impairment	1179	493	41.8	5.1	21.7	7.7	1.2	3.4	6.1	4.3	4.3	13.4	12.0	4.3	16.8	14.2	6.5	9.9	3.2	38.7	30.2	8.1	1.2	15.4
	No impairment	35685	17195	48.2	3.9	10.1	2.9	0.6	1.3	3.2	1.0	1.4	0.8	2.2	1.1	0.7	2.1	2.5	0.3	3.7	1.3	0.3	0.1	0.3	9.9
Underground	Vision impairment	1179	476	40.4	46.0	6.7	5.7	1.1	1.9	1.9	4.8	0.6	6.5	4.8	1.7	7.6	5.3	3.6	4.2	0.6	17.4	12.2	2.7	1.3	3.6
	No impairment	35685	18279	51.2	22.3	2.3	1.8	0.1	0.4	0.5	1.0	0.2	1.0	0.4	0.3	0.4	0.3	0.6	0.1	0.9	0.2	0.1	0.1	0.0	0.9
Local train	Vision impairment	1179	456	38.7	11.0	21.5	5.7	1.8	2.2	3.9	3.5	0.9	9.4	14.3	1.8	14.9	15.6	2.4	8.3	1.8	34.2	25.0	5.3	1.1	5.5
	No impairment	35685	16746	46.9	7.8	7.9	1.3	0.2	0.4	1.6	0.6	0.5	0.4	2.4	0.5	0.5	1.9	0.5	0.3	1.8	0.4	0.2	0.1	0.1	2.6
Long distance / intercity train	Vision impairment	1179	443	37.6	5.9	32.5	6.1	1.6	2.0	4.3	3.8	1.8	9.9	12.4	2.3	13.5	13.5	3.4	8.8	1.4	32.3	24.4	6.8	0.9	6.1
	No impairment	35685	16733	46.9	3.1	14.8	1.8	0.2	0.4	1.6	0.6	0.5	0.4	1.7	0.6	0.5	1.4	0.7	0.3	2.4	0.5	0.2	0.1	0.3	2.9
Taxi or minicab	Vision impairment	1179	349	29.6	2.3	53.0	0.6	1.7	0.0	0.6	1.1	0.3	4.3	1.4	1.1	5.7	2.6	0.6	3.4	0.9	16.3	12.0	1.1	0.3	1.4
	No impairment	35685	15997	44.8	0.9	16.3	0.1	0.3	0.0	0.1	0.4	0.0	0.3	0.0	0.2	0.2	0.0	0.0	0.1	0.2	0.1	0.0	0.0	0.0	0.8

3.23 Functional barriers can be surmounted through appropriate design taking into account the needs of people with a visual impairment. For example, websites should be designed in accordance with the latest guidance (e.g. World Web Consortium) using contrasting colours and offering various text display sizes. In addition, information such as maps and timetables at public transport stops and stations should be provided at eye height and use anti-reflective glass to reduce glare. Timetables, maps and assistance flyers should all be available in large print to increase accessibility and ticket machines can be made more accessible with voice outputs and variable font size (Furst & Vogelauer 2011)

3.24 Many of these solutions are complemented by wayfinding technology. This is a growing industry which aims to transform the way people with visual impairments orientate themselves and move in the pedestrian environment. While traditional travel training focusses on orientation and mobility training (learning how to get from A to B or using canes and guide dogs to avoid obstacles (Maston 2000)), advances in technology have seen the emergence of technological tools that provide spatial information to aid wayfinding and crossing roads in real time.

3.25 Through the use of infrared technology, tools can be used to aid severely sight-impaired people at road crossing points by providing spatial information such as the geometry of the road, street name and direction (Chen-Fu 2012). The technology also has the ability to wirelessly request signal timing from crossing signals at road junctions to provide text to speech regarding the road crossing. Similarly, Remote Infrared Audible Sign (RIAS) technology used in San Francisco, provides 'talking sign' information to blind pedestrians (Maston 2000). An evaluation of this identified that users found public transport was easier to use and walking times between locations were faster. It also helped people to move independently with fewer people asking for help in finding their destination (Marston & Golledge 2004).

3.26 There is some concern about investing in such technologies because of the fast-paced rate of development. The Rail Safety and Standards Board (RSSB) evaluation of the RNIB's React wayfinding technology for rail stations highlighted cost-effectiveness as a barrier and identified the risk of technologies being superseded in the medium term by newer technologies (Rail Safety and Standards Board 2010). This highlights in general the challenges that will be faced by planners, local authorities and transport providers in the future to balance the cost-effectiveness of the technology against the social benefits of increased independence and social integration. However, developments in the availability and use of portable devices, such as Smartphones, might lead to opportunities to improve communication with text to speech display and descriptive audio on vehicles (Rutenberg, 2007) and in the wider environment,

Conclusion

3.27 The barriers to travelling with a visual impairment vary significantly depending on the degree of the impairment. The range of measures that can be used to mitigate these barriers is wide-ranging, and the most appropriate measures will vary. Since technology has been changing rapidly, it is important that people designing infrastructure and buildings stay abreast of the latest developments. Furthermore, it is vital that planners and designers recognise that people with some residual sight require different measures to those with no sight (and that measures that assist one may not assist the other). Finally, disability awareness training is

vital so that staff are equipped and confident to assist passengers with any degree of sight impairment.

Example guidance

Atkin (2010) 'Sight Line: Designing better streets with for people with low vision.

DETR (1998) Guidance on the use of tactile paving.

Guide Dogs (2010) Inclusive Streets: Design principles for blind and partially sighted people.

RTiG Inform (2012) Meeting the needs of disabled travellers: A guide to good practice for bus passenger technology providers.

World Wide Web Consortium (1999) W3C Web Content Accessibility Guidelines.

Hearing impairment

Hearing impairment can vary in severity, with some individuals having some hearing, whilst others are profoundly deaf. As such, the barriers that they experience tend to relate to accessing information before and during a journey, and safety risks during emergencies, or in situations where multi-use paths exist. These can be overcome by providing information in a range of formats, and ensuring staff have disability awareness training to help them understand the needs of people with a hearing impairment.

3.28 Hearing impairment is used to describe people with any degree of hearing loss. It incorporates both mild impairments, such as an individual experiencing difficulty hearing people talk, through to a more profound loss of hearing such as deafness. Individuals who have a mild hearing impairment are sometimes referred to as 'hard of hearing'; they still have a degree of residual hearing which can be increased with supportive hearing aids. Deafness is usually refers to hearing loss that is so severe there is very little or no functional hearing remaining. Individuals can be born with acute hearing impairments but they can also be 'deafened' at any stage in their life; in both instances a lack of hearing can create a barrier to using transport (Action on Hearing Loss 2014a). Some individuals use hearing aids to help improve the range of their hearing. They are designed to help users hear every day sounds such as the doorbell and telephone, and improve their ability to hear speech and can improve the confidence of users whilst talking to people.

3.29 With regard to transport choices, hearing impairment can affect certain aspects of travel but not others. For example, Thorslund (2012) found that people with hearing loss were less likely than individuals without a hearing impairment to have a driving licence. However, for those that had a driving licence, their hearing impairment did not affect how much they travel. For those that did not drive; although hearing loss seemed to impact on the transport choices of some individuals, when assessing the group as a whole there were no specific forms of transport that were used more or less than others (Thorslund 2012).

3.30 Nevertheless there are still functional and psychological barriers to transport use. The functional barriers refer to how accessible the system is (for example, if there is both audible and visual travel information) while the psychological barriers refer to the way the individual thinks and feels about using that service. *'While the physical barriers are the most visible, the mental [psychological] ones are the most persistent and hardest to combat'* (Fürst & Vogelauer 2012: p.382).

Barriers

3.31 The main barriers experienced by people with a hearing impairment relate to being able to communicate with staff and listen for announcements before and during the journey. If an individual is unable to hear announcements while travelling they may feel less confident about making trips, and might be at increased risk of injury during an emergency. People often experience problems at stops and stations if information is given by loudspeaker. With limited or no ability to hear these announcements hearing impaired passengers can be left uninformed.

3.32 Rutenberg (2007) found that access and interpretation of travel announcements at stations and on-board vehicles was a key barrier for those with impaired hearing. Specific problems with acoustic announcements included their quality and speed - for example, at stations background noise prevented clear comprehension of the announcement and on-board vehicles drivers were criticised for speaking too fast. Similar problems were reported by hearing-impaired travellers using coaches and aeroplanes (Rutenberg & Hunter-Zaworski 2007).

3.33 Communication can also present a barrier in terms of giving and receiving information to station staff. For example, purchasing a ticket from the bus driver or asking for directions can all become more challenging if you cannot hear or have difficulty in hearing. These barriers in communication can lead to other perceived barriers based on an individual's interpretation of how well they will be supported by frontline staff in using public transport (Action on Hearing Loss 2014a). A bad experience using public transport, such as lack of assistance from frontline staff, could lead to anxiety or stress when completing the journey and result in the individual being less likely to make that journey again.

3.34 Finally, the design of public transport and urban realm can be a barrier for people with a disability because they feel unable to use these environments safely. While physical barriers and safety concerns appear to be less of a barrier to transport use for hearing impaired individuals, compared to the general population, there are still some potential problems. For example Furst and Vogelauer (2011) highlighted that shared walk and cycle paths can create safety risks if not clearly signposted and separated because individuals with a hearing impairment may not necessarily hear if a bike is passing.

3.35 Analysis of the Life Opportunities Survey first wave data for people with impaired hearing is shown in Table 3-7 and Table 3-8. Interestingly, these tables show similar patterns to those included earlier for people with impaired sight. By comparison with people without significant impairments, these show that for hearing-impaired people:

- Anxiety / lack of confidence, difficulty getting to and from stations and stops, lack of help or assistance, difficulty with hearing announcements, and overcrowding, are all more significant issues for all 'collective' forms of transport.
- Difficulty getting in and out of transport vehicles is a more significant issue across all forms of transport.
- Cost is a more important barrier across all transport modes, perhaps reflecting lower incomes.

Table 3-7: Reasons reported by LOS respondents with impaired hearing for not using a private motor vehicle as much as desired

Private motor vehicle	Respondent details				Percentage of people who don't go out in household vehicle or go out less than desired citing different reasons / barriers											
Type of impairment	Number with impairment	Number with impairment and vehicle in household	Number who don't go out in household vehicle or go out less than desired (excluding those who don't want or need to)	Percentage of people with impairment and household vehicle who don't use it or use it less than desired	Costs	Parking problems	Too busy or not enough time	Caring responsibilities	A health condition, illness or impairment	A disability	Vehicle not suitable / not adapted	Attitudes of other people	Lack of help or assistance	Difficulty getting in / out of vehicle	Vehicle not available when needed	Other reasons
Hearing impairment	1150	755	242	32.1	32.2	12.8	6.2	1.7	25.2	13.2	1.2	1.2	1.7	8.7	5.0	8.7
No impairment	35685	29779	13614	45.7	8.8	2.0	3.1	1.0	0.5	0.2	0.2	0.5	0.1	0.0	2.3	5.1

Table 3-8: Reasons reported by LOS respondents with impaired hearing for not using public transport options as much as desired

		Respondent details			Percentage of people who don't use mode (excluding those who don't want or need to) or use it less than desired citing different reasons / barriers																		
Travel mode	Type of impairment	Number with impairment	Number who don't use mode or use it less than desired (excluding those who don't want or need to)	Percentage of people with impairment who don't use mode or use it less than desired	Transport unavailable	Cost	Overcrowding	Attitudes of staff	Attitudes of passengers	Delay and disruption to service	Fear of crime	Lack of information	Anxiety / lack of confidence	Difficulty getting to stop or station	Caring responsibilities	Difficulty getting in or out of the transport	Difficulty getting from stop or station to destination	Lack of help or assistance	Too busy / not enough time	A health condition, illness or impairment	A disability	Seeing signs or hearing announcements	Unable to book a seat	Other reasons
Local bus	Hearing impairment	1150	432	37.6	21.3	10.4	3.7	3.5	3.2	5.8	4.6	3.5	9.0	17.4	3.9	17.8	15.3	7.4	3.5	28.7	19.9	6.5	0.5	10.0
	No impairment	35685	17233	48.3	10.5	7.4	2.5	0.8	1.9	4.2	1.4	2.5	0.5	2.2	0.7	0.8	2.1	0.4	3.8	0.6	0.3	0.0	0.1	7.1
Long distance bus or coach	Hearing impairment	1150	436	37.9	8.0	25.7	7.8	1.4	3.2	4.1	6.0	2.1	12.2	12.6	2.5	12.6	9.6	5.5	3.2	33.5	21.3	7.8	1.8	13.3
	No impairment	35685	17195	48.2	3.9	10.1	2.9	0.6	1.3	3.2	1.0	1.4	0.8	2.2	1.1	0.7	2.1	0.3	3.7	1.3	0.3	0.1	0.3	9.9
Underground	Hearing impairment	1150	469	40.8	56.9	5.5	4.3	0.4	0.9	0.9	2.8	0.6	4.9	3.8	1.3	4.3	3.2	1.1	1.1	11.5	6.6	1.9	0.2	3.0
	No impairment	35685	18279	51.2	22.3	2.3	1.8	0.1	0.4	0.5	1.0	0.2	1.0	0.4	0.3	0.4	0.3	0.1	0.9	0.2	0.1	0.1	0.0	0.9
Local train	Hearing impairment	1150	419	36.4	16.7	25.5	5.5	2.1	2.9	2.9	3.8	0.7	6.9	12.9	1.9	8.6	8.8	3.8	1.9	21.2	14.6	3.8	1.0	7.4
	No impairment	35685	16746	46.9	7.8	7.9	1.3	0.2	0.4	1.6	0.6	0.5	0.4	2.4	0.5	0.5	1.9	0.3	1.8	0.4	0.2	0.1	0.1	2.6
Long distance / intercity train	Hearing impairment	1150	381	33.1	9.4	34.1	4.2	2.6	2.9	3.7	3.7	1.6	7.1	12.3	1.8	9.2	8.4	5.0	2.1	24.7	17.8	6.8	0.3	8.4
	No impairment	35685	16733	46.9	3.1	14.8	1.8	0.2	0.4	1.6	0.6	0.5	0.4	1.7	0.6	0.5	1.4	0.3	2.4	0.5	0.2	0.1	0.3	2.9
Taxi or minicab	Hearing impairment	1150	325	28.3	3.7	56.9	0.0	0.9	0.0	0.9	0.6	0.9	3.1	1.2	1.2	4.6	0.6	1.5	0.3	12.0	7.4	0.6	0.3	2.5
	No impairment	35685	15997	44.8	0.9	16.3	0.1	0.3	0.0	0.1	0.4	0.0	0.3	0.0	0.2	0.2	0.0	0.1	0.2	0.1	0.0	0.0	0.0	0.8

- Attitudes of staff and passengers, fear of crime, delay and disruption, and lack of information, while generally being reported as a barrier by a relatively small proportion, are all more significant considerations than for the non-impaired population.

3.36 While some of these observations may appear counter-intuitive, it is worth reiterating that some of the reported barriers may not be directly related to hearing loss, but may be connected with other impairments or age of respondents.

Solutions

3.37 Clearly there are ways that some of the barriers can be surmounted. To overcome barriers relating to hearing auditory travel information, information can also be presented visually, for example by using captioning on TV screens or LED monitors to support audio announcements, and providing real-time 'text-to-speech' conversion of information from drivers. For users of hearing aids, induction loops at stops and stations and on-board vehicles can help them pick up sounds more clearly and reduce any background noise (Action on Hearing Loss 2014a), (Rutenberg 2007).

3.38 In situations where written comprehension may be a problem (for example for children, or individuals whose first language is not English) the use of pictograms should be considered. A recent study explored this and found value in using pictograms to support audio announcements in both emergency and non-emergency scenarios (Mobley & Matherly 2012). The most easily understood pictograms were those relating to a material item (e.g. turn off electronic devices) and the least understood were abstract actions (e.g. calm down, help is coming). There may be secondary benefits of using written information or pictograms for other passengers such as those using in-ear headphones, or in particularly noisy or busy situations.

3.39 Alongside changes to the way information is shared, it is also important to raise awareness amongst frontline staff of how to interact with individuals with a sensory impairment such as hearing loss (Rutenberg & Hunter-Zaworski 2007) so that they feel confident to provide assistance and information. Finally, accessibility needs to be considered at the design stage during new developments to ensure that people with a hearing impairment are not put at unnecessary risk due to poorly designed shared walking and cycle ways.

Conclusion

3.40 The overarching findings from this review highlight the importance of clear and consistent information in a format that is accessible for hearing impaired passengers and the importance of awareness training to mitigate communication barriers with frontline staff. Overcoming this second barrier will also help tackle attitudinal barriers towards disability in society and make the journey more enjoyable and accessible for hearing impaired passengers.

Example guidance

Action on Hearing Loss (2014c) Access to air travel for people with hearing loss.

Action on Hearing Loss (2014a) Access to public transport for people with hearing loss.

Action on Hearing Loss (2014b) Access to waterborne vessels for people with hearing loss.

RTiG Inform (2012) Meeting the needs of disabled travellers: A guide to good practice for bus passenger technology providers.

Mobility impairment

Mobility impairment can vary in severity, and can be a result of a range of conditions or events. This means that the impact on individuals can be varied – with some individuals being able to walk short distances while others need to use a wheelchair. As such, many of the barriers experienced are physical and relate to the design of vehicles, stops and stations and other aspects of the built environment. Adherence to best practice guidance can help to mitigate some of the barriers, but attention also needs to be given to providing adequate information to help individuals plan their journeys, and disability awareness training to help staff assist individuals with mobility impairment.

3.41 In 2012 the Department for Work and Pensions estimated that 6.5 million people in the UK experienced a long-term mobility impairment which affected their ability to carry out day-to-day activities (Department for Work and Pensions 2013: p.1). These types of impairments typically result in a restricted range of movement which impacts on the individual's ability to move freely. The severity and length of impairment varies significantly depending on the root cause, which means that the impairment could be temporary or permanent, affecting the upper body and/or lower body.

3.42 Conditions and disabilities that inhibit movement include those involving loss of stamina and increased fatigue, broken bones, amputation, paralysis, cerebral palsy, stroke, multiple sclerosis, muscular dystrophy, arthritis, and spinal cord injury (University of Washington 2015). There are a wide range of mobility aids available to help individuals travel independently, including walking sticks and frames, wheelchairs, power-assisted wheelchairs and mobility scooters. However, because many parts of the UK's transport network were built prior to the introduction of accessibility regulations (Department for Transport 2012) some areas of the network remain inaccessible or only accessible with assistance.

3.43 Evidence from research identifies some distinct differences in the leisure travel patterns of those with impairment, compared to those without. Mobility was identified as a significant barrier and individuals tended to choose recreational activities which had a lesser financial impact, such as visiting friends and relatives or tending to their allotment. Furthermore, activities out of the town centre were preferred, especially by individuals with a low level of mobility. However transport was not the only barrier influencing individuals' leisure activities, with health-related, financial, education or organisational barriers also having an impact (Taylor & Jozefowicz 2012).

Barriers

3.44 The 2005 Disability Discrimination Act (Department for Transport 2005) and the subsequent 2010 Equalities Act (Government Equalities Office 2013) have strengthened legislation relating to disabled people's rights to equal access, with accessible vehicles and public spaces becoming more commonplace. Nevertheless, people with mobility impairments still encounter a range of barriers to transport use. These barriers (and ways of overcoming them) are documented to a far greater extent in the literature than those relating to other impairments. As such, this section simply provides a summary of some of the main barriers

and solutions, with the reference list providing links to a range of sources of further, and more detailed, information.

3.45 Pedestrian environments can present physical barriers for people with mobility impairments because uneven surfaces, high kerbs and narrow pavements make it challenging to manoeuvre with or without a mobility aid. This means that even if individuals can leave their home they may not be able to reach their destination due to inaccessible street design (Szczerbinska-Speakman & Matthews 2014). Barriers can also arise as a result or temporary features such as roadworks, A-boards and parked cars which limit access for some people with mobility impairments. The World Bank (2013) recommends that although some temporary barriers can be quickly removed *"re-education of drivers and re-location of street vendors…will require major long-term enforcement and/or close coordination between different municipal departments"* (The World Bank 2013:, p.15).

3.46 Barriers to public transport use have been well documented as part of Muscular Dystrophy's '*Trailblazers*' campaign which reported 'real-life' examples of the barriers faced when using the bus, coach, train and the London Underground. Common barriers included faulty or missing equipment, such as a ramp or lift, which made the transport inaccessible. Once on-board a bus often there were issues regarding the number of wheelchair spaces, lack of turning space and other transport users occupying the wheelchair spaces. Finally, one of the most frustrating barriers was a lack of consistency in the accessibility of the network - for example, not all vehicles on a bus route were accessible which meant that wheelchair users often had to wait for several buses to pass before they could board. If there were no accessible options the user would need to look for another more expensive option such as a train or a taxi.

3.47 Specific barriers to the use of trains include the gap between the platform and the train and the height of the step onto the train. A number of disabled passengers suggested that there was not always enough time at station stops to disembark the train easily and at times they would be waiting a long time to receive assistance from a member of staff (Passenger Focus 2012).

3.48 In contrast to bus and rail, the barriers to air and waterborne travel have historically not been explored in as much detail. Recent research by Griffiths (2011) suggests that the accessibility of waterborne transport is much more challenging because accessibility not only depends on the design of the boat and pier, but also there are challenges related to tidal fluctuation, the lifespan of the vessel and the assurance of providing accessibility throughout the whole journey.

3.49 A recently published consumer research report for air travel highlighted that *"for consumers with restricted mobility or a disability, access issues were cited as a reason for not flying by a substantial proportion (40%), and of those who had flown in the last 12 months, around one-third were uncertain that their needs would be met"* (Civil Aviation Authority 2015:Foreward). Poria (2009) highlighted particular barriers to accessing the toilet on-board the aircraft with many passengers avoiding using the facilities which meant that sometimes passengers could have a very uncomfortable and potentially humiliating journey (Chang 2012). Passengers were also dissatisfied with the distance between the toilets and their allocated seats. Issues raised aside from accessibility include the treatment and

consideration given to the transportation of individuals when at check- in and when boarding and alighting the aircraft (Chang & Ching 2011).

3.50 Driving with mobility impairment largely depends on the extent of the impairment and the areas of the body it affects. For example, after a stroke weaknesses or paralysis in the upper and lower body can affect an individual's ability to use traditional vehicle controls and there may be other impairments to do with sight, cognition and fatigue (Stroke Association 2012). For impairments where recovery takes place, individuals can return to car use after advice from a medical professional and (if required) approval from the DVLA. More severe and permanent impairments (for example, resulting from amputation) require overcoming practical barriers to vehicle use and are likely to involve further adaptations to make the vehicle accessible (RICA 2012).

3.51 Alongside these practical barriers to transport use, psychological and communication barriers impact on the frequency of transport use. Psychological barriers refer to the apprehension and worry individuals experience because they fear they might not be able to access transport due to a physical barriers. For example, this might include anxiety related to the potential for a lift at a rail station to be broken, preventing an individual from completing their journey. To compound these psychological barriers, some individuals feel stigmatised and belittled because the attitudes of staff and passengers are not always sympathetic to their needs, leading to them feeling like a 'second class citizen' (Muscular Dystrophy 2009:p.2). A lack of training in both how to help mobility impaired passengers board and alight vehicles as well as knowledge of using specialist equipment is also a barrier (Muscular Dystrophy 2009).

3.52 Analysis of the Life Opportunities Survey first wave data for people with a mobility or dexterity impairment is shown in Table 3-9 and Table 3-10. By comparison with people without significant impairments, these show that for mobility/dexterity-impaired people:

- Difficulty getting in and out of transport vehicles is, perhaps unsurprisingly, a more significant issue across all forms of transport.
- Difficulty getting to and from stations and stops, lack of help or assistance, overcrowding and anxiety / lack of confidence are all much more significant issues for all 'collective' forms of transport.
- Cost is a more important barrier across all transport modes, again perhaps reflecting lower incomes.
- Attitudes of staff and passengers, fear of crime, delay and disruption, and lack of information, while generally being reported as a barrier by a relatively small proportion, are all more significant considerations than for the non-impaired population.

Solutions

3.53 Individuals with mobility impairment can increase their mobility through the use of various aids, such as a walking stick, frame or wheelchair. However the transport system also needs to be accessible to enable individuals with these aids to use it. This requires both infrastructure and information about accessible transport to enable individuals to plan and undertake their journeys.

Table 3-9: Reasons reported by LOS respondents with impaired mobility / dexterity for not using a private motor vehicle as much as desired

Private motor vehicle	Respondent details				Percentage of people who don't go out in household vehicle or go out less than desired citing different reasons / barriers											
Type of impairment	Number with impairment	Number with impairment and vehicle in household	Number who don't go out in household vehicle or go out less than desired (excluding those who don't want or need to)	Percentage of people with impairment and household vehicle who don't use it or use it less than desired	Costs	Parking problems	Too busy or not enough time	Caring responsibilities	A health condition, illness or impairment	A disability	Vehicle not suitable / not adapted	Attitudes of other people	Lack of help or assistance	Difficulty getting in / out of vehicle	Vehicle not available when needed	Other reasons
Mobility impairment	3222	2069	856	41.4	38.0	9.9	3.3	4.4	39.5	28.9	2.6	2.6	3.0	14.4	5.4	11.6
Dexterity impairment	2182	1421	620	43.6	37.3	10.8	3.5	4.8	39.2	29.4	3.1	1.8	3.1	13.7	5.2	14.0
No impairment	35685	29779	13614	45.7	8.8	2.0	3.1	1.0	0.5	0.2	0.2	0.5	0.1	0.0	2.3	5.1

Table 3-10: Reasons reported by LOS respondents with impaired mobility / dexterity for not using public transport options as much as desired

		Respondent details			Percentage of people who don't use mode (excluding those who don't want or need to) or use it less than desired citing different reasons / barriers																		
Travel mode	Type of impairment	Number with impairment	Number who don't use mode or use it less than desired (excluding those who don't want or need to)	Percentage of people with impairment who don't use mode or use it less than desired	Transport unavailable	Cost	Overcrowding	Attitudes of staff	Attitudes of passengers	Delay and disruption to service	Fear of crime	Lack of information	Anxiety / lack of confidence	Difficulty getting to stop or station	Caring responsibilities	Difficulty getting in or out of the transport	Difficulty getting from stop or station to destination	Lack of help or assistance	Too busy / not enough time	A health condition, illness or impairment	A disability	Seeing signs or hearing announcements	Unable to book a seat	Other reasons
Local bus	Mobility impairment	3222	1453	45.1	12.0	10.3	6.9	2.7	4.2	6.3	4.5	3.4	12.3	25.7	2.4	31.5	23.4	12.1	2.3	48.2	41.5	3.6	1.3	8.5
	Dexterity impairment	2182	952	43.6	13.4	12.7	8.7	2.8	4.1	7.1	6.0	2.7	12.7	22.2	3.4	29.3	21.5	12.8	2.7	43.3	39.8	3.4	1.3	10.0
	No impairment	35685	17233	48.3	10.5	7.4	2.5	0.8	1.9	4.2	1.4	2.5	0.5	2.2	0.7	0.8	2.1	0.4	3.8	0.6	0.3	0.0	0.1	7.1
Long distance bus or coach	Mobility impairment	3222	1424	44.2	6.3	22.1	6.5	1.9	2.5	3.3	4.0	2.7	12.2	17.3	3.3	22.2	15.8	8.0	2.5	50.6	40.2	3.8	1.1	12.1
	Dexterity impairment	2182	960	44.0	5.6	24.0	8.4	2.1	2.9	4.7	4.7	2.7	13.1	14.7	4.2	19.6	14.1	9.5	2.8	46.6	36.8	3.9	1.6	14.6
	No impairment	35685	17195	48.2	3.9	10.1	2.9	0.6	1.3	3.2	1.0	1.4	0.8	2.2	1.1	0.7	2.1	0.3	3.7	1.3	0.3	0.1	0.3	9.9
Underground	Mobility impairment	3222	1402	43.5	58.3	4.9	5.1	0.8	1.4	0.8	3.7	0.6	6.6	6.3	0.9	7.8	6.6	3.6	0.6	20.5	16.7	1.2	0.7	1.6
	Dexterity impairment	2182	924	42.3	56.8	4.3	6.5	0.8	1.7	1.3	5.4	0.9	8.8	6.1	1.2	6.5	6.3	4.3	1.0	18.0	16.3	0.9	0.6	1.9
	No impairment	35685	18279	51.2	22.3	2.3	1.8	0.1	0.4	0.5	1.0	0.2	1.0	0.4	0.3	0.4	0.3	0.1	0.9	0.2	0.1	0.1	0.0	0.9
Local train	Mobility impairment	3222	1290	40.0	14.9	20.3	4.3	1.6	2.4	2.6	3.3	1.1	9.4	19.4	2.2	18.7	16.9	7.0	1.2	39.8	33.2	2.8	1.0	5.2
	Dexterity impairment	2182	873	40.0	14.8	22.7	6.0	1.5	2.5	3.6	3.7	1.5	10.2	17.8	3.4	17.0	17.1	8.1	1.6	36.9	31.3	2.6	1.3	6.0
	No impairment	35685	16746	46.9	7.8	7.9	1.3	0.2	0.4	1.6	0.6	0.5	0.4	2.4	0.5	0.5	1.9	0.3	1.8	0.4	0.2	0.1	0.1	2.6
Long distance / intercity train	Mobility impairment	3222	1210	37.6	8.3	31.5	5.1	1.7	2.2	2.6	3.3	1.6	10.7	16.2	2.3	17.8	15.2	6.8	0.9	42.2	34.7	3.1	0.7	5.6
	Dexterity impairment	2182	864	39.6	7.1	32.5	5.7	1.7	2.5	3.6	2.8	1.7	10.8	14.6	3.0	14.9	14.4	6.8	1.4	37.5	32.2	2.9	0.8	6.7
	No impairment	35685	16733	46.9	3.1	14.8	1.8	0.2	0.4	1.6	0.6	0.5	0.4	1.7	0.6	0.5	1.4	0.3	2.4	0.5	0.2	0.1	0.3	2.9
Taxi or minicab	Mobility impairment	3222	916	28.4	2.6	59.1	0.3	1.9	0.3	0.5	1.3	0.4	4.7	2.4	0.5	7.6	2.9	3.4	0.3	20.3	16.9	0.5	0.2	2.6
	Dexterity impairment	2182	665	30.5	2.6	59.8	0.5	1.4	0.3	0.9	1.4	0.9	5.6	1.4	0.8	7.2	2.6	3.9	0.6	17.7	15.8	0.8	0.3	2.9
	No impairment	35685	15997	44.8	0.9	16.3	0.1	0.3	0.0	0.1	0.4	0.0	0.3	0.0	0.2	0.2	0.0	0.1	0.2	0.1	0.0	0.0	0.0	0.8

3.54 Accessibility information is often viewed as vital for people with mobility impairments when planning a journey (May *et al.* 2014). However, even where information is available there is still the view that it is not always up-to-date or accurate (Commons Select Committee 2013) meaning individuals may not have confidence in it. In response to this, various online information sources have been developed. However in an evaluation of one resource that used crowd-sourcing, users found the resource helpful, but had concerns about the trustworthiness, credibility and reliability of the volunteered information (May *et al.* 2014). Nevertheless, this indicates that there is scope for information to be provided online to aid an individual's journey planning, but it must be from a trustworthy source and should be kept up-to-date.

3.55 Overcoming barriers within the pedestrian environment centre on modifying the physical environment to make it easier for people to move seamlessly within the space. The Department for Transport (2008) recommended that local authorities should adhere to best practice guidelines for pedestrian environments to ensure that all crossings have drop kerbs and tactile paving and all signals have bleepers and rotating cones. Ideally modifications should be done in consultation with users to ensure they are placed where they are needed most.

3.56 As an example, Leeds City Council retro-fitted drop kerbs on popular routes identified through a scheme where individuals with mobility impairment identified priority routes which required modification. This approach benefited both the council and the local people as the council was able to target funding on routes that were likely to be well used and people with mobility impairment were able to directly influence the improvements made in their area system. It showed that small changes made to the design of streets can transform the accessibility of a route to foster greater independence (Szczerbinska-Speakman & Matthews 2014).

3.57 Overcoming barriers to bus use can be particularly challenging due to the number of operators in the UK. However, the Public Service Vehicle Accessibility Regulations (PSVAR) that were introduced in 2000 aim to standardise accessibility requirements for all buses and coaches operating in the UK. Operators are obligated to ensure their vehicles meet these regulations although the Government acknowledges that *"many vehicles cannot be modified to meet the requirements or that it is not cost effective to do so. These vehicles may continue in service for a period representing the end of their economic life"* (Driver and Standards Vehicle Agency 2014:, para. 3). This may be one of the reasons that not all buses and coaches are fully accessible. To overcome confidence barriers, users need assurance that stations and vehicles are always accessible because at the moment accessibility is not universal on all bus routes, or even on all buses along one specific route (Muscular Dystrophy 2009; Pettersson 2009).

3.58 Improvements to buses can be split into improvements at stations and stops, and on-board vehicles. At many stations and stops, improving access for mobility-impaired people focuses upon ensuring that ramps and lifts are in place to enable movement between floor surfaces, that there is sufficient shelter at bus stops to ensure that waiting facilities are appropriate for wheelchair users (Department for Transport 2008), ensuring that there is level boarding at bus stops, and enforcing parking regulations at bus stop to ensure buses are able to align next to the kerb (Pettersson 2009). On-board vehicles, improvements include ensuring there is adequate space for wheelchair users (Department for Transport 2008) and that there is

appropriate safety equipment (Muscular Dystrophy 2009), low-level stop buttons and sufficient wheelchair spaces.

3.59 Coaches pose specific barriers to people with mobility impairment because step-free access or a lift is necessary to access the vehicle. Although the PSVAR state that coaches must be accessible by 2020, the method of enabling mobility impaired passengers board and alight the vehicle are not prescribed. Although research has been carried out to investigate the best methods for improving accessibility, there is still debate about whether vehicle-based lifts or station-based lifts are most appropriate (Rutenberg & Hunter-Zaworski 2007). Bewick *et al.* (2005) demonstrated that it was possible to introduce an accessible coach service between Bath and Victoria Coach Station in London, although successful use required good liaison between the operators and infrastructure providers. While mobility-impaired passengers appreciated the accessibility improvements to the vehicle, usage was not high enough to draw meaningful conclusions. These two studies highlight that, although some solutions to coach accessibility have been trialled, there is a limited amount of research to estimate demand and develop best practice.

3.60 Rail improvements require the reassessment of accessibility both at the station and on-board trains. Station accessibility improvements include low ticket kiosks and accessible ticket machines, the presence of ramps or lifts to enable access to platforms features and features such as ramps to aid carriage access (Whitten 2003). On board the train there should be a clear allocation of wheelchair and priority spaces, luminance contrast and accessible toilet facilities (Whitten 2003). It should be recognised that the design and implementation of these accessibility features is constrained by the space limitations of the train carriage (Whitten 2003) and the Department for Transport (2008) suggests that further research needs to be carried out to identify the best methods for bridging the gap between the platform edge and the train. Assistance at stations could also be improved by ensuring that staff were available to assist passengers in disembarking the train (Muscular Dystrophy 2009).

3.61 Improvements to waterborne travel involve making the vessels and ports more accessible, as well as improving awareness regarding accessibility information. Physical improvements to ports include accessible parking, toilets, gangways, ticket kiosks, adapted surfaces to minimise slippage, lifts and accessible signage. On-board the vessel, improvements should be made to ensure wheelchairs can pass down gangways, as well as lifts or ramps for level changes and an accessible toilet. It is also recommended that daily information is available on the impact of tides which can directly influence how accessible the vessel will be. For example, at low tide a ramp connecting the land to the vessel can have a very steep incline. It is also recognised that there should be sufficient information available to enable onward travel from the port (Griffiths 2011).

3.62 As with waterborne travel, there are a number of physical improvements that can be made to airports and aircraft to make the journey accessible and more enjoyable for those with mobility impairment. Chang (2012) identified that improvements to air travel at the airport should include slip resistant floor, boarding priority and convenience of wheelchair consignment and retrieval. When boarding and de-planing, assistance should be given to individuals and distances between toilets and cabin seats should be short. For both air and waterborne forms of transport it is apparent that addressing the issues of accessible toilets, especially for long-distance travel, is essential for ensuring that passengers travel comfortably for the duration of the journey.

3.63 For all modes of public transport, disability awareness training helps to ensure frontline staff are aware of best practice procedures relating to assisting people with mobility impairment and to feel confident and able to provide assistance. The Department for Transport (2008) recommends that this is standardised across all forms of transport and that it should extend to all staff who provide a service, not just frontline staff. Knowing that staff will be present and able to provide assistance will help individuals to overcome some of the psychological barriers to transport use.

3.64 Modifications to vehicles can enable people with mobility impairment to keep driving, or travelling as a passenger. These adaptations exist to facilitate or improve vehicle operation and control, to stow mobility aids or to help getting in and out of the vehicle. Adaptations include hand controls, electronic accelerators, left foot accelerators, pedal modifications, steering aids, swivel seats (to get into and out of the car) and an electronic hoist (Mobability 2015). Observation devices can also be used to help people with limited trunk or neck movements to travel independently in a vehicle. Recent research by Luke *et al.* (2008) concluded that although such devices would help people travel, it was from a comfort and confidence perspective, rather than actually alleviating the presence of the impairment.

3.65 Once the individual has reached their destination, consideration needs to be given to the availability of parking. Some mobility-impaired individuals will be eligible for a Blue Badge that will enable them to park close to their destination (Department for Transport 2012). However, consideration should also be given to the design of car parks, to enable people with mobility impairments to park in larger spaces and be able to fully open their doors.

Conclusions

3.66 Clearly there are a wide range of physical and psychological barriers that limit the ability of a person with mobility impairment to use the transport system. However, this summary has highlighted that these are relatively well understood compared to the barriers and solutions available for people with other types of impairment. Nevertheless, the fact that many of the solutions relate to changes to vehicles and infrastructure means that they are relatively expensive to implement. Clearly much progress has been made towards improving the physical accessibility of the transport network, and continued work in this area combined with disability awareness training for staff should make the transport network even more accessible in the future.

Example guidance

Department for International Development (2014). ORN 21 Enhancing the Mobility of Disabled People: Guidelines for Practitioners.

Department for Transport & Transport Scotland (2010), Accessible Train Station Design for Disabled People: A Code of Practice.

Department for Transport (2002), Inclusive Mobility.

ECMT (2006b) Improving Transport Accessibility for All: A Guide to Good Practice (Chapter 2).

Highways England (2012). Design Manual for Roads and Bridges.

Marine Guidance Note (2006), Designing and operating smaller passenger vessels: Guidance on meeting the needs of persons with reduced mobility.

Cognitive impairment

Cognitive impairments relate to an individual's ability to perceive, organise and integrate information. As such, individuals with cognitive impairment can experience barriers to travel associated with collecting and processing information, and anxiety about undertaking complex trips. These can be overcome through approaches such as travel training to help individuals learn certain trips and become confident to undertake them. Presentation of information in simple, easy to digest formats can also be helpful. Finally, disability awareness training should include information about assisting people with cognitive impairment so that staff are able to confidently provide advice.

3.67 Cognitive impairment relates to a limitation in a person's ability to perceive, organise and integrate information (Abreu 1987). It covers a wide range of impairment types including learning disabilities, traumatic brain injury and age-related dementia or stroke. Cognitive impairments can be both innate and acquired. Innate impairments are usually present from birth and include learning difficulties, autism and dyslexia. Conversely, acquired impairments can be a result of a brain injury such as stroke or dementia. Further, acquired impairments such as dementia present some unique barriers because they develop over time, and as such their impact on travel and transport is likely to develop over time. In many instances acquired cognitive impairments are also coupled with physical impairments such as mobility issues or fatigue. Coping with two impairment types can compound the challenges in using transport networks and although individuals can live independent lives they may need help in specific areas (International Transport Forum 2009).

3.68 The impact of cognitive limitations on a person's travel choices varies significantly depending on the extent of the impairment and the individual's ability to deal with those limitations. (Abreu 1987). Feeley (2009) studied the impact of cognitive impairments, specifically autism, on a person's transport horizons and found that 50% of people said transport was a barrier to taking part in work activities and 48% for non-work activities. Pertinently, this shows that there is a desire to use public transport, but the barriers that are currently faced prevent further use. These barriers often lead individuals who can no longer drive to express a preference for receiving a lift from a caregiver rather than using public transport (Risser *et al.* 2012). This suggests that work to help individuals overcome these barriers could increase public transport use and independent travel.

3.69 With particular regard to dementia, there can be a safety risk relating to individuals who are drivers because dementia can have a profound effect on an individual's ability to drive (Wheatley *et al.* 2014). People with dementia are more likely to become lost, travel too slowly, not wear a seatbelt or be involved in a collision, than the general population (Breen *et al.* 2007; Eby *et al.* 2012). Most car accidents involving drivers with dementia occur close to home, while travelling at low speeds to shops or leisure sites that are frequented regularly (Byszewski *et al.* 2013). However, people with dementia often fail to recognise their declining ability to drive, meaning that friends or family have to broach the issue with them and the advice is not always well received. Friends, family or the individual may seek the support of a doctor for advice, but while individuals with mid to late stage dementia are classified as unfit to drive, there is no such distinction for those with early stage dementia (Carter *et al.* 2015; Iverson *et al.* 2010).

Barriers

3.70 The barriers to travel can be largely categorised as 'internal' and 'external', with an individual's use of transport dependent on their ability to balance these two factors (Risser, Iwarsson & Stahl 2012). Internal barriers relate to an individual's thoughts and perceptions of their ability to use public transport whilst external barriers comprise environmental and situational factors (Rosenkvist *et al.* 2009).

3.71 Cognitive limitations can restrict an individual's ability to obtain and process information relating to the use of public transport and how they perceive their ability to cope in an unfamiliar or unpleasant scenario (Rosenkvist 2008). Internal barriers include a lack of self-confidence and self-esteem coupled with a desire to 'feel normal'. These feelings can be exacerbated when using public transport. For example, if an individual encounters difficulties communicating with frontline transport staff or incorrectly assesses a traffic situation, feelings of inferiority and humiliation can be intensified (Risser, Iwarsson & Stahl 2012). The anxiety and stress caused by this negative experience can deter further travel and lead to a preference for using specialised transport services such as dial-a-ride to avoid pressure from other passengers (Rosenkvist *et al.* 2009). Often cognitive impairments don't lead to any physical symptoms, and this can lead to lead to members of the public and frontline transport staff misinterpreting an individual's actions and not being able to provide assistance (House of Commons Transport Committee 2013a).

3.72 External barriers refer to both physical and environmental factors which impact on an individual's ability to use a form of transport. For example processing information in a fast moving environment can lead to avoidance of using a particular form of transport. In addition, circumstances such as needing to navigate through a busy bus terminal building or catch three different buses on their route home involves processing a wealth of information and carrying out multiple tasks in seemingly pressurised environment, which can be both mentally and physically draining (Lamont *et al.* 2013; Risser, Iwarsson & Stahl 2012). Certain cognitive impairments such as dementia may also lead to diminished abilities in judgement, multi-tasking, reaction times and spatial skills which can mean that making unfamiliar journeys, or dealing with unforeseen events during a journey is difficult (Beverley Foundation 2008).

3.73 Comprehension of public transport also presents a barrier. For example, people with dyslexia can struggle to process complex travel information and thus require easy-to-read timetables and network maps (Lamont, Kenyon & Lyons 2013). Individuals with acquired impairments who have had to cease driving may be unfamiliar with public transport, which can make the process of using it even more stressful and confusing. Obtaining travel information prior to making the trip is preferable to enable an individual to prepare and not have to seek information while travelling (Risser, Iwarsson & Stahl 2012).

3.74 Table 3-11 and Table 3-12 show the results of analysis of the LOS first wave data for people with learning, intellectual or memory impairments. By comparison with people without significant impairments, these show that for people with such impairments:

- Parking problems are more of an issue in relation to travel by private car.
- Anxiety / lack of confidence, overcrowding, and difficulty getting to and from stations and stops are all more significant issues for all 'collective' forms of transport.

- Cost is a more important barrier across all transport modes, again perhaps reflecting lower incomes.
- Attitudes of staff and passengers, fear of crime, delay and disruption, and lack of information, while generally being reported as a barrier by a relatively small proportion, are all more significant considerations than for the non-impaired population.

Solutions

3.75 Helping individuals overcome their internal barriers to transport use can be challenging as it involves teaching them how to surmount their established and often negative perceptions of transport. Education and training for individuals and frontline transport staff appears to be the best way of tackling this barrier. For example, travel training can reassure individuals and give them the confidence to make familiar journeys (Risser, Iwarsson & Stahl 2012). Having well trained staff at stations and on-board public transport is also beneficial for those with cognitive impairments (Rosenkvist *et al.* 2009). Changes in attitudes towards those with an impairment is a low cost way of encouraging more transport use (International Transport Forum 2009), although changing ingrained attitudes and perceptions can often be a gradual process.

3.76 For individuals, the process of driving cessation can feel like a loss of independence and some people question the assessment process (Byszewski *et al.* 2013). To make this procedure more acceptable there is emerging evidence that advance planning and gradual discussion around driving cessation is preferred. Taking this pro-active and enabling approach provides the individual with time to adjust to the idea of not driving and to create a plan for alternative transport (Byszewski *et al.* 2013).

3.77 Information provided prior to a trip should be easy to understand and clearly presented in a number of sources. The same applies to information provided during a trip (for example network maps, bus timetables and transport announcements) which should be 'easy to understand' information. Rhodes (2003) recommends providing both audio and visual announcements, extending the length of display time to help people process the information and reducing the ambiguity of announcements by making them simple and concise. Lamont (2008) concurred with this, suggesting that when making audible announcements, transport staff should make sure they speak clearly and use only the important words within the sentence. Information can also be improved through the use of simple text, graphics and colour contrasting and talking signs. If unforeseen events (such as delays) occur, clear communication and passenger assistance should be available to help people with dementia re-plan their journeys (House of Commons Transport Committee 2013a).

3.78 Some of these solutions to transport provision are already being implemented. For example, Fürst and Vogelauer (2012) found that some transport operators in Germany already provided information in an easy to understand format which included spoken announcements alongside displayed information, the provision of information in the native language for migrants, the use of pictograms, guidance systems and ticket machines. Evidence from Transport for London (2012) supports this move towards more accessible travel information with major improvements made in the city since the London Olympics.

Table 3-11: Reasons reported by LOS respondents with learning, intellectual or memory impairments for not using a private motor vehicle as much as desired

Private motor vehicle	Respondent details				Percentage of people who don't go out in household vehicle or go out less than desired citing different reasons / barriers											
Type of impairment	Number with impairment	Number with impairment and vehicle in household	Number who don't go out in household vehicle or go out less than desired (excluding those who don't want or need to)	Percentage of people with impairment and household vehicle who don't use it or use it less than desired	Costs	Parking problems	Too busy or not enough time	Caring responsibilities	A health condition, illness or impairment	A disability	Vehicle not suitable / not adapted	Attitudes of other people	Lack of help or assistance	Difficulty getting in / out of vehicle	Vehicle not available when needed	Other reasons
Learning impairment	854	557	345	61.9	18.3	3.8	3.8	2.3	7.8	7.0	0.9	1.7	1.7	2.6	2.6	6.4
Intellectual impairment	237	164	136	82.9	3.7	2.9	0.0	0.0	5.9	6.6	0.7	0.7	1.5	1.5	2.2	4.4
Memory impairment	1181	665	368	55.3	27.7	7.9	3.3	3.3	28.0	20.7	2.2	3.0	3.3	7.6	6.0	9.5
No impairment	35685	29779	13614	45.7	8.8	2.0	3.1	1.0	0.5	0.2	0.2	0.5	0.1	0.0	2.3	5.1

Table 3-12: Reasons reported by LOS respondents with learning, intellectual or memory impairments for not using public transport options as much as desired

		Respondent details			Percentage of people who don't use mode (excluding those who don't want or need to) or use it less than desired citing different reasons / barriers																		
Travel mode	Type of impairment	Number with impairment	Number who don't use mode or use it less than desired (excluding those who don't want or need to)	Percentage of people with impairment who don't use mode or use it less than desired	Transport unavailable	Cost	Overcrowding	Attitudes of staff	Attitudes of passengers	Delay and disruption to service	Fear of crime	Lack of information	Anxiety / lack of confidence	Difficulty getting to stop or station	Caring responsibilities	Difficulty getting in or out of the transport	Difficulty getting from stop or station to destination	Lack of help or assistance	Too busy / not enough time	A health condition, illness or impairment	A disability	Seeing signs or hearing announcements	Unable to book a seat	Other reasons
Local bus	Learning impairment	854	494	57.8	10.7	16.2	6.7	3.4	4.9	7.3	3.6	5.1	9.7	5.5	1.6	3.4	4.9	3.4	3.0	10.7	9.3	1.2	0.6	7.3
	Intellectual impairment	237	169	71.3	3.6	5.3	4.1	0.6	3.0	3.0	1.8	0.6	7.1	3.0	0.6	1.2	2.4	1.2	2.4	5.9	6.5	1.8	0.6	3.0
	Memory impairment	1181	592	50.1	10.1	14.7	8.3	3.0	6.1	6.3	5.4	3.5	17.1	14.2	3.4	16.6	12.7	9.3	2.5	35.5	24.0	2.9	1.4	6.8
	No impairment	35685	17233	48.3	10.5	7.4	2.5	0.8	1.9	4.2	1.4	2.5	0.5	2.2	0.7	0.8	2.1	0.4	3.8	0.6	0.3	0.0	0.1	7.1
Long distance bus or coach	Learning impairment	854	515	60.3	5.4	23.5	5.6	2.3	2.7	3.3	4.7	4.1	10.1	5.0	1.4	3.9	4.3	2.7	3.3	15.5	11.5	2.3	2.1	8.5
	Intellectual impairment	237	184	77.6	1.1	8.2	4.3	1.6	1.6	2.2	2.7	1.1	5.4	2.2	1.6	3.3	2.2	1.6	1.1	9.8	12.0	2.7	1.1	3.3
	Memory impairment	1181	625	52.9	5.6	25.1	8.6	2.2	3.4	4.0	5.9	2.6	18.1	10.1	2.4	11.2	9.3	6.2	2.9	38.4	24.2	4.5	1.8	10.1
	No impairment	35685	17195	48.2	3.9	10.1	2.9	0.6	1.3	3.2	1.0	1.4	0.8	2.2	1.1	0.7	2.1	0.3	3.7	1.3	0.3	0.1	0.3	9.9
Underground	Learning impairment	854	508	59.5	27.0	5.3	2.8	0.6	0.8	1.4	2.2	0.6	4.3	1.6	1.0	1.6	1.0	1.2	0.4	6.5	4.7	0.4	0.6	1.8
	Intellectual impairment	237	177	74.7	11.9	2.3	2.3	0.0	0.0	0.0	0.6	0.0	2.3	0.6	1.1	0.6	1.1	1.1	0.0	2.8	3.4	0.6	0.6	0.6
	Memory impairment	1181	603	51.1	41.6	6.3	5.6	0.8	2.0	1.3	3.5	0.3	10.3	3.8	1.8	4.5	4.0	2.5	1.2	15.9	10.6	1.0	1.0	2.5
	No impairment	35685	18279	51.2	22.3	2.3	1.8	0.1	0.4	0.5	1.0	0.2	1.0	0.4	0.3	0.4	0.3	0.1	0.9	0.2	0.1	0.1	0.0	0.9
Local train	Learning impairment	854	484	56.7	7.0	16.9	4.5	2.1	1.7	3.5	2.3	1.2	7.0	5.2	1.0	2.1	2.7	2.3	1.0	10.7	8.7	1.2	0.4	3.5
	Intellectual impairment	237	172	72.6	2.9	4.7	2.3	0.6	0.6	0.6	0.6	0.0	4.7	2.3	0.6	0.6	2.3	2.3	0.6	5.2	7.6	2.3	0.6	1.2
	Memory impairment	1181	567	48.0	10.8	20.3	7.2	2.1	3.2	3.9	3.5	1.1	13.4	9.2	2.5	9.0	9.2	4.4	1.6	31.2	19.4	2.3	1.1	4.6
	No impairment	35685	16746	46.9	7.8	7.9	1.3	0.2	0.4	1.6	0.6	0.5	0.4	2.4	0.5	0.5	1.9	0.3	1.8	0.4	0.2	0.1	0.1	2.6
Long distance / intercity train	Learning impairment	854	494	57.8	4.3	25.5	6.3	2.2	2.6	3.2	3.2	2.6	8.5	5.3	1.0	3.2	3.0	3.2	1.6	12.6	9.3	2.6	1.2	3.2
	Intellectual impairment	237	176	74.3	4.0	10.2	5.1	1.7	2.3	1.7	2.3	1.1	4.5	3.4	1.1	1.7	3.4	3.4	0.6	5.1	9.1	2.8	0.6	2.8
	Memory impairment	1181	555	47.0	6.1	29.4	7.9	1.8	2.9	3.2	4.0	2.9	15.1	8.8	2.7	9.5	8.6	4.9	2.0	30.8	20.0	3.4	0.5	6.5
	No impairment	35685	16733	46.9	3.1	14.8	1.8	0.2	0.4	1.6	0.6	0.5	0.4	1.7	0.6	0.5	1.4	0.3	2.4	0.5	0.2	0.1	0.3	2.9
Taxi or minicab	Learning impairment	854	464	54.3	0.9	31.5	0.0	0.9	0.0	0.2	1.3	0.2	2.4	0.2	0.4	1.1	0.2	0.9	0.6	4.5	3.9	0.6	0.2	1.1
	Intellectual impairment	237	168	70.9	1.2	10.1	0.0	0.6	0.0	0.0	1.2	0.0	2.4	0.0	0.0	1.2	0.0	0.6	0.0	2.4	4.8	0.6	0.0	0.6
	Memory impairment	1181	498	42.2	1.0	46.8	0.6	1.2	0.2	0.6	0.8	0.2	6.8	1.0	1.0	2.8	0.6	1.2	0.6	14.1	10.0	0.6	0.4	2.2
	No impairment	35685	15997	44.8	0.9	16.3	0.1	0.3	0.0	0.1	0.4	0.0	0.3	0.0	0.2	0.2	0.0	0.1	0.2	0.1	0.0	0.0	0.0	0.8

3.79 To help individuals better manage the external environment there are practical steps that can be taken to make it easier to navigate in busy environments. For example, this includes provision of easy to read pre-journey information, real time audio and visual information and announcements, and simple and clear information at stops and stations (International Transport Forum 2009). Many of these design features fall under the banner of 'universal design' which try to design the built environment so it is usable for everyone, regardless of their age, ability, or status in life (Story 1998).

3.80 Many of the barriers for people with cognitive functional limitations are similar to those with mental health issues and Rosenkvist *et al.* (2009) draws further similarities to barriers faced by older people. This suggests that improvements made to overcome barriers to cognitive functional limitations have a much wider application and could enhance public transport use for the rest of society.

Conclusion

3.81 Cognitive functional limitation is an umbrella term encompassing a wide range of complex and varied impairments, with many of the barriers and solutions spanning these. Internal barriers are often faced when people feel judged on their ability to use a form of transport and the external barriers are based on the complexity of obtaining and processing information. These are similar to the barriers faced by other groups, such as those with mental health impairments, and older people. As such, actions taken to reduce barriers for people with a cognitive impairment are likely to have a positive impact far beyond this group.

Example guidance

Department for Transport (2011) Travel Training: Best Practice Guidance.

International Transport Forum (2009) Cognitive Impairment, Mental Health and Transport: Designing with everyone in mind.

RTiG Inform (2012) Meeting the needs of disabled travellers: A guide to good practice for bus passenger technology providers.

Mental health impairment

Mental health impairment is clearly less well understood than some of the other impairments. That said, there is evidence that it can lead to barriers that prevent individuals travelling independently. These are often related to the availability and presentation of information, and confidence. As such, efforts to improve the presentation of information to make it easier to understand, and to offer training to individuals and staff could help to minimise some of the barriers.

3.82 Mental illness refers to a wide range of mental health conditions that can affect an individual's thoughts, feelings and behaviour. It is the largest single cause of disability in the UK and the economic and social costs in England are estimated to be around £105 billion each year (Mental Health Action Group 2011). The implications of poor mental health are just as serious as those associated with physical impairments. Mental health conditions affect one in four people during their lifetime and include illnesses such as depression, anxiety disorders, schizophrenia, eating disorders and addictive behaviours (MIND 2013). Terms like 'depression' and 'anxiety' are often used in everyday language which means sometimes people underestimate how serious and debilitating they can be.

3.83 Transport provides a way of overcoming the isolation of mental illness and builds confidence in social interaction. However, "given that public transport plays such a significant role in social inclusion it is surprising to find very little research about the relationship between good access to public transport and good mental health" (Mental Health Action Group 2011: p.5). As the travel needs of those with a mental health condition are little understood by both government and service providers it leads to confusion over how to improve services for them (International Transport Forum 2009). Over 50% of people with a mental health condition that participated in a study for the Highland Community Care Forum said they no longer used a private car, with the bus and taxis as the main alternatives (Highland Community Care Forum 2009). Buses were cited as popular because they were free (typically these people were able to access a concessionary pass) and passengers could get to know the drivers. There was also the assurance that they didn't have to drive and they could relax and observe the countryside. 83% of respondents said that transport was important to their health and vital to their recovery

Barriers

3.84 For an individual with mental health impairment, the use of public transport is not without its barriers. Mental health conditions can lead to a reduction in functional capacity which can limit an individual's ability to perform everyday tasks, affecting their concentration, memory and communication. The Mental Health Action Group consulted with individuals to understand their experiences of using public transport. One participant said that *"Having a mental illness can be like an army moving base. They [the army] would plan every part of that trip to make sure that there was support from land, sea and air to make it to their destination. The same is for us."* (Mental Health Action Group 2011: p.5). This shows that even contemplating using public transport can be a significant task and if not planned correctly can be a traumatic and challenging experience.

3.85 One of the most prevalent barriers is coping with a fast moving and constantly changing environment. Mental illness can lead to individuals struggling to process large amounts of information, or to concentrate or deal with busy situations. If they are making an unfamiliar journey or encounter a delay to their planned journey it can lead to increased anxiety and stress. In a scenario where individuals already experience difficulty in busy environments this added stress will have a significant impact on their desire and perceived ability to travel again (Mental Health Action Group 2011). Some individuals may also experience limitations in social skills which could lead to a lack of empathy and understanding from others. Without compassion and understanding there is a risk that the stigma and prejudice experienced by people with a mental illness will continue.

3.86 On top of the cognitive barriers faced when using transport, there are practical barriers too. Travel costs, overcrowding, reliability and comfort were all factors that impacted an individual's enjoyment of the journey and in turn their likelihood of using it again (Highland Community Care Forum 2009). Often income within this group is below average due to employment status, and transport costs can pose a barrier that prevents individuals accessing voluntary work, education and social networks (Penfold *et al.* 2008).

3.87 Table 3-13 and Table 3-14 show the results of analysis of the LOS first wave data for people with impaired mental health. By comparison with people without significant impairments, these show that for people with impaired mental health:

- Parking problems, lack of help and difficulty getting in or out of the vehicle are more of an issue in relation to travel by private car.
- Anxiety or lack of confidence stands out as a much more significant issue for all 'collective' forms of transport.
- Getting to and from a stop or station is a more significant issue, as is getting in or out of a vehicle.
- Cost is a more important barrier across all transport modes, again perhaps reflecting lower incomes.
- Attitudes of staff and passengers, fear of crime, delay and disruption, and lack of information, are all more significant considerations than for the non-impaired population.

Solutions

3.88 Journeys can be made more manageable and easier by ensuring there is sufficient accessible information available to help individuals plan their trip and obtain information whilst making that journey (Penfold *et al.* 2008). Consideration should be given to the way that information about a route or system is produced and disseminated as individuals with mental health issues can struggle with complex network maps and timetables that are difficult to read. At stops and stations the audible and visual information should be provided in parallel to reinforce announcements and messages to passengers. Finally, with regards to information, the use of clear and simple signage can help individuals navigate easily around unfamiliar areas and avoid confusion that is caused by too many signs. These improvements to information provision will not only aid those with a mental health condition but all travellers (International Transport Forum 2009).

3.89 Overcoming the perceived barriers to travel, such as confidence in carrying out a journey, requires a more individualised approach. Travel awareness training is one method of familiarising individuals with their most common journeys. Usually the training is carried out with a travel buddy or guide to give confidence to that person to make the journey. It is also recommended that frontline staff are trained to help them recognise when individuals require additional help and encourage them to show empathy rather than ignorance or indifference towards their needs (International Transport Forum 2009; Penfold *et al.* 2008). Frontline staff should be made visible at stops and stations to provide reassurance to passengers that assistance is available if required.

3.90 Finally, the physical design of transport hubs should be considered to ensure it is easy to navigate. This will help those with a mental health condition by enabling them to navigate easily through the station, avoiding distraction and confusion. Universal design is the end goal for many countries in making their transport networks accessible. On the surface these design changes may only appear to benefit those with a mobility impairment. However, the benefits are felt more widely, including those with a mental health condition and the wider travelling public (International Transport Forum 2009).

Table 3-13: Reasons reported by LOS respondents with impaired mental health for not using private motor vehicle as much as desired

Private motor vehicle	Respondent details				Percentage of people who don't go out in household vehicle or go out less than desired citing different reasons / barriers											
Type of impairment	Number with impairment	Number with impairment and vehicle in household	Number who don't go out in household vehicle or go out less than desired (excluding those who don't want or need to)	Percentage of people with impairment and household vehicle who don't use it or use it less than desired	Costs	Parking problems	Too busy or not enough time	Caring responsibilities	A health condition, illness or impairment	A disability	Vehicle not suitable / not adapted	Attitudes of other people	Lack of help or assistance	Difficulty getting in / out of vehicle	Vehicle not available when needed	Other reasons
Mental impairment	1450	865	408	47.2	36.0	6.9	5.4	6.6	29.4	18.9	3.7	3.2	5.4	9.3	8.3	12.7
No impairment	35685	29779	13614	45.7	8.8	2.0	3.1	1.0	0.5	0.2	0.2	0.5	0.1	0.0	2.3	5.1

Table 3-14: Reasons reported by LOS respondents with impaired mental health for not using public transport as much as desired

Travel mode	Type of impairment	Respondent details			Percentage of people who don't use mode (excluding those who don't want or need to) or use it less than desired citing different reasons / barriers																			
		Number with impairment	Number who don't use mode or use it less than desired (excluding those who don't want or need to)	Percentage of people with impairment who don't use mode or use it less than desired	Transport unavailable	Cost	Overcrowding	Attitudes of staff	Attitudes of passengers	Delay and disruption to service	Fear of crime	Lack of information	Anxiety / lack of confidence	Difficulty getting to stop or station	Caring responsibilities	Difficulty getting in or out of the transport	Difficulty getting from stop or station to destination	Lack of help or assistance	Too busy / not enough time	A health condition, illness or impairment	A disability	Seeing signs or hearing announcements	Unable to book a seat	Other reasons
Local bus	Mental impairment	1450	631	43.5	13.5	26.0	11.3	4.4	8.1	10.0	7.8	5.7	27.6	11.3	4.4	13.3	11.9	7.9	5.1	30.1	21.6	2.5	1.6	9.0
	No impairment	35685	17233	48.3	10.5	7.4	2.5	0.8	1.9	4.2	1.4	2.5	0.5	2.2	0.7	0.8	2.1	0.4	3.8	0.6	0.3	0.0	0.1	7.1
Long distance bus or coach	Mental impairment	1450	695	47.9	6.2	39.0	13.7	3.2	5.5	6.9	7.1	3.2	29.4	8.1	4.5	8.8	8.1	6.3	4.0	34.1	21.2	2.9	1.4	11.1
	No impairment	35685	17195	48.2	3.9	10.1	2.9	0.6	1.3	3.2	1.0	1.4	0.8	2.2	1.1	0.7	2.1	0.3	3.7	1.3	0.3	0.1	0.3	9.9
Underground	Mental impairment	1450	675	46.6	48.4	10.1	6.8	0.7	1.8	0.9	3.6	0.3	15.7	2.5	1.5	3.4	2.4	2.7	1.0	13.3	7.6	0.7	0.7	2.1
	No impairment	35685	18279	51.2	22.3	2.3	1.8	0.1	0.4	0.5	1.0	0.2	1.0	0.4	0.3	0.4	0.3	0.1	0.9	0.2	0.1	0.1	0.0	0.9
Local train	Mental impairment	1450	611	42.1	10.0	30.8	10.5	2.1	3.9	5.1	5.4	2.0	23.1	8.7	3.1	7.9	8.5	5.1	2.9	27.2	17.3	1.6	1.0	5.9
	No impairment	35685	16746	46.9	7.8	7.9	1.3	0.2	0.4	1.6	0.6	0.5	0.4	2.4	0.5	0.5	1.9	0.3	1.8	0.4	0.2	0.1	0.1	2.6
Long distance / intercity train	Mental impairment	1450	627	43.2	6.2	43.9	11.3	1.6	3.5	4.1	4.9	2.4	22.3	8.5	3.0	6.1	7.7	4.1	3.0	27.6	16.7	2.6	1.3	6.5
	No impairment	35685	16733	46.9	3.1	14.8	1.8	0.2	0.4	1.6	0.6	0.5	0.4	1.7	0.6	0.5	1.4	0.3	2.4	0.5	0.2	0.1	0.3	2.9
Taxi or minicab	Mental impairment	1450	553	38.1	1.4	61.3	0.7	1.3	0.2	0.2	0.7	0.7	9.2	0.7	1.4	2.4	0.4	1.4	0.7	9.8	7.6	0.2	0.0	1.6
	No impairment	35685	15997	44.8	0.9	16.3	0.1	0.3	0.0	0.1	0.4	0.0	0.3	0.0	0.2	0.2	0.0	0.1	0.2	0.1	0.0	0.0	0.0	0.8

Conclusions

3.91 Clearly, the barriers faced by people with mental health impairments in relation to transport are not yet well recognised or understood. That said, there is clearly scope to improve the transport system to enable people with mental health impairments to travel more easily. Many of the challenges they face relate to difficulty coping with unfamiliar situations. Therefore solutions can be implemented that are low-cost and simple - for example, raising someone's confidence through travel training, provision of accessible information and the training of frontline staff to provide a positive travel experience and reinforce their desire to do it again. Although this is an area that requires further research, the improvements in accessibility could generate greater social benefits for the individuals and economic and commercial benefits for the transport providers.

Example guidance

Department for Transport (2011) Travel Training: Best Practice Guidance.

International Transport Forum (2009) Cognitive Impairment, Mental Health and Transport: Designing with everyone in mind.

RTiG Inform (2012) Meeting the needs of disabled travellers: A guide to good practice for bus passenger technology providers.

Behavioural impairment

Knowledge about behavioural impairments is relatively limited compared to that related to other types of impairment. However, some of the barriers experienced are linked to those experienced by individuals with cognitive or mental health impairment. They include difficulties processing information, difficulties communicating and difficulties coping with changes to routine. There is some evidence to suggest that travel training and better provision of information can be used to help overcome these barriers, although more research is required in this field.

3.92 Behavioural impairments affect the way in which individuals interact with others in social situations. Attention Deficit Hyperactivity Disorder (ADHD) and Autism Spectrum Disorder (ASD) are the most common conditions associated with behavioural impairments and are often considered as 'hidden' because there are no associated physical impairments (The National Autistic Society 2015). From an outsider's perspective it may appear that a child with a behavioural impairment is just naughty or as an adult they are anti-social. However, it is much more complex than that. The exact causes are not yet known, but it is thought to be a combination of genetic and environmental factors (The National Autistic Society 2015).

3.93 The most common type of behavioural disorder is ADHD which can be described *as "a heterogeneous behavioural syndrome characterised by the core symptoms of hyperactivity, impulsivity and inattention"* (NICE 2008). Those with ADHD may find it very challenging to concentrate, become restless easily and show impulsive behaviour. The condition is often diagnosed in childhood and although some of the symptoms may diminish with age many people will go on to have significant difficulties in adulthood (ADHD Foundation 2014).

3.94 Behavioural impairments do not affect people universally, rather spectrum conditions such as ASD mean a range of impairments can be experienced. Those with low functioning ASD could have significant difficulties in speaking, communicating with others and understanding

how to behave in social situations. Those with higher functioning ASD or Asperger's Syndrome (a form of ASD), can have an average or above average intellect but struggle to cope in social scenarios (Feeley 2009). Everyday life can be challenging to someone with ASD as the fast-paced, ever changing environment means that it can be confusing and distressing. Communication with others is particularly challenging because individuals can find it difficult to read facial expressions and body language meaning they cannot always relate to others and this can lead to social isolation (The National Autistic Society 2015).

3.95 In terms of transport demand, Feeley (2009) found similarities in the amount that people with and without ASD wanted to use transport. However, due to barriers related to their condition many were unable to use conventional public transport to meet their demands. This means that they have a greater reliance on lifts from parents and friends. Feeley (2009) also found that 81.6% of survey participants with ASD relied on lifts compared to just 16.8% that used public transport. Those with lower functioning ASD seem to have fewer transport choices and therefore have a greater reliance on specialist transport services, whereas those with high functioning ASD were able drive themselves and use public transport (Feeley 2009).

3.96 There are very few studies available that look in-depth at the barriers and solutions to using transport with a behavioural impairment. As such the following paragraphs are based on a combination of research studies and medical websites.

Barriers

3.97 Barriers to everyday transport are a common problem for those with ASD with 50% of respondents to one survey citing transport as a barrier to employment, 72% to education and 83% to leisure (Feeley 2009). These barriers are generally psychological rather than physical because using public transport or navigating pedestrian areas requires individuals to effectively process large amounts of information, communicate with others and react or re-plan a journey if needed.

3.98 People with ASD often rely on routines to provide certainty and stability to enable them to cope with day to day life. This can create a barrier public transport use because it is not always predictable for example, those with ASD *" can get fixed on an overly-narrow mental image of a bus or train: as far as they're concerned, the right bus looks like this, and if the company changes the logo or plasters some colourful ads all over the sides, your son or daughter might be determined that this is the wrong bus and they're not getting on it"* (Ambitious about Autism 2015:, section 4). This is compounded by communication problems that may mean those with ASD are unable to seek for help or information from staff. This can relate both to challenges with speech and language but also in interacting with others. Finally, some people experience sensory sensitivity towards lights and sounds which makes travelling on a busy bus or train unpleasant and overwhelming (The National Autistic Society 2015).

3.99 Table 3-15 and Table 3-16 show the results of analysis of the LOS first wave data for people with behavioural impairments. By comparison with people without significant impairments, these show that:

- Anxiety or lack of confidence stands out as a much more significant issue for all 'collective' forms of transport.
- Overcrowding on collective forms of public transport is a more significant issue.

- Getting to and from a stop or station is a more significant issue.
- Cost is a more important barrier across all transport modes, again perhaps reflecting lower incomes.
- Attitudes of staff and passengers, fear of crime, delay and disruption, and lack of information, while being reported as a barrier by a relatively small proportion, are all more significant considerations than for the non-impaired population.

Solutions

3.100 There are a number of steps that can be taken to help alleviate the anxiety experienced when using public transport. Ambitious about Autism (2015) provides a wealth of practical advice on how to use public transport with a child. This includes planning the journey carefully and explaining to the child how to overcome anxiety, offering incentives, investing in ear defenders to reduce background noise and undertaking travel training. Feeley (2009) also suggested that travel training is one of the best methods for enabling public transport use. Familiarisation with the journey helps to educate individuals about how to use different forms of transport. Despite this, only 15.8% of survey respondents had actually received travel training, suggesting there was a need to encourage uptake and also provide information about a range of transport options (Feeley 2009).

Conclusion

3.101 This section has identified that behavioural impairments are complex, vary significantly depending on the individual and can have a constraining impact on their ability to use transport. Although some research has been carried out on the impact of behavioural impairments it is an area that requires further research to confidently determine the best solutions to encourage greater travel.

Example guidance

Department for Transport (2011) Travel Training: Best Practice Guidance'.

RTiG Inform (2012) Meeting the needs of disabled travellers: A guide to good practice for bus passenger technology providers.

Table 3-15: Reasons reported by LOS respondents with behavioural impairment for not using a private motor vehicle as much as desired

Private motor vehicle	Respondent details				Percentage of people who don't go out in household vehicle or go out less than desired citing different reasons / barriers											
Type of impairment	Number with impairment	Number with impairment and vehicle in household	Number who don't go out in household vehicle or go out less than desired (excluding those who don't want or need to)	Percentage of people with impairment and household vehicle who don't use it or use it less than desired	Costs	Parking problems	Too busy or not enough time	Caring responsibilities	A health condition, illness or impairment	A disability	Vehicle not suitable / not adapted	Attitudes of other people	Lack of help or assistance	Difficulty getting in / out of vehicle	Vehicle not available when needed	Other reasons
Behavioural impairment	414	247	181	73.3	14.9	3.3	2.2	2.2	9.4	6.1	1.7	2.8	2.8	5.0	5.5	7.2
No impairment	35685	29779	13614	45.7	8.8	2.0	3.1	1.0	0.5	0.2	0.2	0.5	0.1	0.0	2.3	5.1

Table 3-16: Reasons reported by LOS respondents with behavioural impairment for using public transport options less than desired

		Respondent details			Percentage of people who don't use mode (excluding those who don't want or need to) or use it less than desired citing different reasons / barriers																			
Travel mode	Type of impairment	Number with impairment	Number who don't use mode or use it less than desired (excluding those who don't want or need to)	Percentage of people with impairment who don't use mode or use it less than desired	Transport unavailable	Cost	Overcrowding	Attitudes of staff	Attitudes of passengers	Delay and disruption to service	Fear of crime	Lack of information	Anxiety / lack of confidence	Difficulty getting to stop or station	Caring responsibilities	Difficulty getting in or out of the transport	Difficulty getting from stop or station to destination	Lack of help or assistance	Too busy / not enough time	A health condition, illness or impairment	A disability	Seeing signs or hearing announcements	Unable to book a seat	Other reasons
Local bus	Behavioural impairment	414	264	63.8	6.1	14.8	8.0	2.7	4.9	6.8	6.1	3.0	20.5	4.2	1.5	4.5	4.2	3.4	1.1	16.7	11.4	1.5	1.5	2.3
	No impairment	35685	17233	48.3	10.5	7.4	2.5	0.8	1.9	4.2	1.4	2.5	0.5	2.2	0.7	0.8	2.1	0.4	3.8	0.6	0.3	0.0	0.1	7.1
Long distance bus or coach	Behavioural impairment	414	304	73.4	4.9	20.4	7.2	3.0	3.0	4.6	5.9	3.6	20.7	5.6	2.0	3.6	4.6	2.6	1.6	20.4	12.5	0.7	1.0	5.9
	No impairment	35685	17195	48.2	3.9	10.1	2.9	0.6	1.3	3.2	1.0	1.4	0.8	2.2	1.1	0.7	2.1	0.3	3.7	1.3	0.3	0.1	0.3	9.9
Underground	Behavioural impairment	414	291	70.3	25.8	5.8	5.8	0.3	1.4	0.7	2.1	0.3	12.0	2.4	0.7	1.7	1.7	1.0	0.3	10.0	8.2	0.7	1.0	1.0
	No impairment	35685	18279	51.2	22.3	2.3	1.8	0.1	0.4	0.5	1.0	0.2	1.0	0.4	0.3	0.4	0.3	0.1	0.9	0.2	0.1	0.1	0.0	0.9
Local train	Behavioural impairment	414	277	66.9	6.1	14.1	6.9	1.8	2.9	2.9	2.5	2.5	16.6	5.8	0.7	1.8	2.9	4.0	1.4	16.2	11.6	0.7	0.4	2.2
	No impairment	35685	16746	46.9	7.8	7.9	1.3	0.2	0.4	1.6	0.6	0.5	0.4	2.4	0.5	0.5	1.9	0.3	1.8	0.4	0.2	0.1	0.1	2.6
Long distance / intercity train	Behavioural impairment	414	272	65.7	2.6	20.6	7.0	1.8	3.3	4.0	3.7	2.2	18.0	5.9	1.5	2.9	3.3	3.3	1.5	17.6	13.2	1.8	0.4	4.4
	No impairment	35685	16733	46.9	3.1	14.8	1.8	0.2	0.4	1.6	0.6	0.5	0.4	1.7	0.6	0.5	1.4	0.3	2.4	0.5	0.2	0.1	0.3	2.9
Taxi or minicab	Behavioural impairment	414	269	65.0	1.1	27.1	0.4	1.1	0.4	0.0	1.9	0.4	7.4	1.1	0.4	0.7	0.0	1.9	0.0	7.8	7.1	0.4	0.0	0.4
	No impairment	35685	15997	44.8	0.9	16.3	0.1	0.3	0.0	0.1	0.4	0.0	0.3	0.0	0.2	0.2	0.0	0.1	0.2	0.1	0.0	0.0	0.0	0.8

Summary

3.102 This section has explored the general barriers that exist in relation to accessing a range of transport services, and investigated how these barriers are experienced by people with a range of impairments. It is clear from this that some types of impairment (mobility, and to a degree sight and hearing) are much more clearly understood than others (such as mental health, behavioural and cognitive). This means that information about how these barriers can be overcome is also much clearer. Furthermore, in most cases information about barriers and solutions is rather general and does not relate to specific modes, or only seems to relate to public transport. The exception to this is mobility impairment where information regarding barriers and solutions is available specifically in relation to distinct modes of transport.

3.103 Interestingly however, some barriers seem to cross most of the groups. For example, anxiety about making trips is a significant issue for all of the groups. This may be because individuals are unsure whether transport will be accessible, or related to whether they will be able to access information during the trip, or for myriad other reasons. However tackling this anxiety could be helpful in enabling individuals to make more trips. In addition, it appears that access to information before and during the journey is a key factor in enabling any individual with impairment to make a trip. The format of this information needs to meet specific needs depending on the impairment, but in general, clear reliable information is paramount.

3.104 There is very little information about latent demand related to individual impairment groups. Whilst we have some understanding of the barriers that are experienced, research into the extent to which more trips would be made if these barriers were overcome is lacking. Any attempt to quantify latent demand without further research (for example to establish the extent to which transport is the main barrier, and the influence of other factors) is likely to be highly inaccurate. We simply don't know the proportion of people with each type of impairment who are not travelling as a result of the barriers, and we don't know about the impact of multiple impairments.

4 EVIDENCE OF SOCIAL, ECONOMIC AND COMMERCIAL COSTS AND BENEFITS OF RESTRICTED ACCESS

Introduction

4.1 A major aim of this study was to explore the extent to which the economic, commercial and social costs and benefits of a fully accessible transport system have been assessed and quantified. During the filtering process (see Chapter 2) it quickly became clear that very few studies have undertaken detailed exploration of this issue. This is a field in which little new research has been undertaken since 1994 (Fearnley *et al.* 2009; Maynard 2007c) when Fowkes *et al.* (1994) identified potential cross sector savings attributable to accessible public transport of between £256 million and £1161 million at 1990 prices. It appears that this lack of research may be a result of the apparently axiomatic nature of the benefits of accessible transport– and as such it is simply accepted that a more accessible transport system *will* lead to economic, social and (less obviously) commercial benefits at the individual and system scale. Nevertheless, the word "may" is used in many of the studies that discuss benefits of accessible transport, indicating that benefits are deemed likely but have not been proven.

4.2 In accordance with the approach described in Chapter 2, this study sought to identify evidence relating to the economic, social and commercial costs and benefits relating to accessible transport. This chapter discusses the results of that process, looking first at economic costs and benefits, before considering social and then commercial ones. Each section offers a discussion of the main points emanating from the evidence, before giving a brief summary of each report in a table. Full references can be found in Chapter 6.

Economic factors

Very little evidence was identified that quantified economic outcomes as a result of making transport more accessible. Further, there was very little evidence that (qualitatively or quantitatively) explored changes in behaviour which could be modelled in order to enable a better understanding of how these might lead to benefits to the economy. However there is some evidence of savings to the public sector as a result of projects that reduce reliance on special transport services.

4.3 It was very difficult to identify any papers that had measured and quantified the economic benefits and costs (to individuals, the public sector or more generally). As Maynard (2007c) mentions, *"the benefits can include: increased employability, and thus reduced reliance on state benefit; increased ability to use goods facilities and services, and thus input into the local and national economy; and improved health through greater mobility, and thus reduced use of domiciliary and specialist services. These benefits have been described qualitatively in a number of places, but few attempts have been made to quantify them, or monetise them"* (p.98).

4.4 Furthermore, even these benefits are not universally supported by scientific evidence. For example, Christensen (2014) explored the link between transport availability, density and employment. It found that population density and transport did not seem to have an effect on the employment of people with a disability. The lack of evidence was reflected by the Department for Transport (2008) which cited potential benefits, but often found that there was not enough evidence to quantify these. For example, the report noted that that while

evidence suggests that travel training may help people travel more, and use public transport thus reducing demand for social services transport, there isn't enough evidence to quantify the benefits.

4.5 As shown in Table 4-1, four of the studies (Avancena 2012; Szczerbinska-Speakman & Matthews 2014; Wang & Winn 2010; Wretstrand *et al.* 2007) explored potential economic benefits and costs in relation to their impact on public sector spending. Wang and Winn (2010) noted that while much work had been undertaken in Victoria (Australia) to make transport systems compliant with accessibility legislation, the impact of this on individuals with impairment had been overlooked. This meant that sometimes investment in (frequently expensive) improvements may not be delivering the intended benefits, and therefore might not be delivering best value for money.

4.6 Szczerbinska-Speakman and Matthews (2014) describe an approach to ensuring public money is spent where it is most needed by getting local scooter and buggy users to report where features (such as dropped kerbs) are missing. This was judged to be an efficient way of using public funds, and seemed to have increased access to shops for scooter and buggy users (although this was only based on anecdotal observation). A study by Avancena (2012) looked at the implementation of free travel on bus and rail for passengers with a disability. This study identified that during the 2011 financial year 2.5 million trips were potentially shifted from paratransit (approx. $34 per trip) to fixed route services (<$1 per trip).

4.7 In Sweden a range of publicly funded transport services (some special transport services trips, healthcare, school transport, regular public transport) were merged into one service which theoretically met the needs of everyone. Free travel was also provided for users of the service. As a result of this, demand for more expensive special transport services trips declined in two out of the three locations, there was a decrease in costs to the municipality and a positive cost-benefit result for the free fare policy. However the research highlighted that it was difficult to quantify the wider benefits which may have further reinforced the positive impact of this policy.

4.8 Two studies were identified that looked at actual changes in travel behaviour and the potential economic impact of this (Carter & Le Masurier 2006; Steer Davies Gleave 2015) – although these were both post-intervention survey so are reliant on the perceptions of participants. Carter and Le Masurier (2006) found that following the construction of the tram in Nottingham (which is designed to be physically accessible), mobility impaired passengers were able to travel more than they previously could. Particularly relevant in terms of economic impacts is that fact that wheelchair users were making 8% more shopping trips and 45% trips to leisure activities; people with difficulty walking were making 90% more shopping trips and 33% more leisure trips and people with buggies and bags were making 75% more shopping trips.

Table 4-1: Evidence relating to economic factors

Authors	Title	Economic factors
Avancena (2012)	The power of choice: the benefits of free fare for elderly and disabled customers on fixed route services.	This research identified that as a result of the availability of free travel on fixed route services, passengers with a disability were using fixed route bus or rail services rather than paratransit. As a result, the study estimates that during the 2011 financial year, the scheme has potentially shifted 2.5 million trips from paratransit (at a cost of approx. $34 per trip) to fixed route services (at a cost of less than $1 per trip). The system is now administered using smartcards, and operators reimbursed the fare for the trip.
Carter and Le Masurier (2006)	In the Town, and in the Country, Can We Make a Real Difference for the Mobility Impaired?	This study evaluated (qualitatively and quantitatively) the impact of the first Nottingham tram line (NET) on the mobility impaired. The survey included: 167 mobility impaired passengers (26 wheelchair users, 44 walking difficulties, 97 buggies and heavy bags). It found that, following the construction of the tram many mobility impaired passengers were able to travel more than they had previously. It identified that wheelchair users were making: 80% more shopping trips, 45% more visits to friends/relatives, 45% more leisure activities; people with difficulty walking were making 90% more shopping trips, 38% more visits to friends/relatives, 33% more leisure activities; and people with buggies and bags were making 75% more shopping trips and 61% more visits to friends and relatives.
Christensen (2014)	The Relationship between Transportation, Density, and the Employment of Individuals with Disabilities	This paper investigates the relationships between employment, transport access, population density and disability. In relation to this study, it finds that population density and transport access to not seem to have an effect on the employment of people with a disability. However individuals with disabilities were more likely to be unemployed than those without disabilities.
Department for Transport (2008)	Assessment of Accessibility Standards for Disabled People in Land Based Public Transport Vehicles	This study explored the accessibility of land based public transport on behalf of the DfT. Amongst other things, it looked briefly at the potential for cost-benefit analysis of a range of measures, stating that "while it is not feasible to make a formal cost-benefit analysis…it is possible to give an indication of the practicality of making changes" (p. 134). The report lists some approximate costs of features that could make public transport and taxis more accessible, but reference to benefits tend to be qualitative and potential rather than actual (e.g. improvements to boarding and alighting *could* help vehicles to run on time). Regarding travel training, the study reviews other research and concludes that while there is evidence to suggest it helps people travel more and may enable people to use public transport instead to social services transport, there isn't enough evidence to quantify the benefits. There is also limited evidence on the effectiveness of improved information provision (for example RTPI or audible and visual enhancements).
Maynard (2007c)	The economic appraisal of transport projects: the incorporation of disabled access	The paper suggests that the benefits of improved accessibility are likely to include employability, increased ability to access goods, facilities and services, input to the local and national economy, improved health and reduced dependence on special services. However these have not been quantified, and are often only included in appraisal qualitatively.

Steer Davies Gleave (2015)	Impacts of Station Accessibility Improvements	This study was the follow-up to Duckenfield *et al.* (2010) and explored the impacts of the Access4All programme in more detail. It used passenger, railcard user and lift user counts, surveys, interviews, and access audits. The improvements were found to have impacted upon station usage, with 33% of wheelchair users, 19% of hearing impaired users and 15% of mobility impaired users stating that they had significantly or slightly increased their trips as a result. However comparisons between the 2010 research and this study found that awareness of the improvements had dropped, the reported increase in trips had dropped (from 24% in 2010 to 11% now) and the number of people who thought that others would be encouraged to use the station had dropped (from 80% in 2010 to 59% now). The study suggests that many of the improvements were not visible enough, and it was felt that awareness and usage may be improved by increased visibility in the form of signage and promotion. The data collected during the study was used in an appraisal of the cost-benefit based on Webtag. This used actual costs for each of the six stations, and included benefits based on increase in quality for existing and new users, and decreases in car trips, emissions, accidents and congestion for non-users. This found a BCR for each station of between 11.3 and -0.17. The variance can be explained by differences in user growth, difference in the size of the target user group and differences in operational costs. Overall the programme is deemed to be a success with the overall benefits outweighing the costs.
Szczerbinska-Speakman and Matthews (2014)	Retrofitting an Accessible Highway: A User-Led Approach	This study reviews a user-based approach to making improvements to paths to make routes more accessible for disabled people using scooters and buggies. It used a referral based system and asked disabled people to identify areas of a route that made it inaccessible. The council would then install drop kerbs or other infrastructure to improve accessibility. The paper highlights economic benefits including targeting the most urgent areas, making the best use of council funds by making improvements where they were most needed, and through increasing access to local shops. However the latter is only based on anecdotal observation and the benefits are not quantified.
Wang and Winn (2010)	Making Public Transport Services More Accessible - Lessons Learned in Victoria, Australia	This report highlights that while improvements to accessibility (in this case in Victoria, Australia) might be compliant with standards, they are not necessarily improving access and helping people with disabilities to overcome barriers. This means that (sometimes expensive) improvements may not be delivering their intended benefits, meaning that investment by authorities and transport operators is not offering best value for money. More evaluation is needed to address this.
Wretstrand, Danielson and Wretstrand (2007)	Integrated Organization of Public Transportation: Accessible Systems for All Passengers	This paper describes a study of one recent project in a rural area that has aimed to integrate different publicly funded transportation systems (special transport services, healthcare, rural transport) into one single concept, combining regular public transport with transportation services for children, adolescents, older and disabled passengers. The services had a zero fare policy. Evaluation has shown a decrease in special transport services trips in two of the three locations; a decrease in municipality costs; and a positive cost benefit result for the free fare policy. The research also highlighted that it is difficult to quantify the wider benefits.

4.9 However, inferences that can be made from this are limited because of a lack of knowledge of how people were meeting their shopping needs prior to the tram, and whether their spending had increased and their need for support decreased. This means that the conclusions which can be drawn about the impact on the economy and on the public sector are very limited. A separate study by Steer Davies Gleave (2015) identified increases in trip making of up to 11% following accessibility improvements at railway stations (predominantly platform to platform access improvements), but the purposes of these trips are not specified, so wider benefits to the economy are unclear.

4.10 Overall, this section has highlighted how little is known about either the micro, or macro-economic impacts of accessible transport systems. We tried to limit this study to those reports that provide actual evidence of economic factors, and if possible quantify the impact. However these are so few that we also included those that quantify changes which are likely to have an economic impact. Nevertheless, this only tells us that there are likely to be benefits at both micro- and macro-economic scales, but these are very difficult to quantify without significant additional research. Furthermore the limited evidence that does exist relates wholly to physical accessibility, thus providing no evidence of other approaches to improving accessibility for people with a variety of impairments.

Social factors

It is almost universally accepted that improved access to transport will have social benefits. However, studies that explore this at anything more than a qualitative level are very rare. Many studies look at this issue prior to any adaptations to the transport system, and are therefore exploring the barriers that exist as a result of restricted access rather than the results of improving access. Further, studies tend to be rather general in nature, and do not explore the detail of the measures that would be needed for an individual to overcome the barriers affecting them personally and enable greater independent use of the transport system.

4.11 It is relatively commonplace for articles promoting measures to create accessible transport to state that there will be social benefits as a result of the improvements. Indeed this is backed up by research that suggests mobility has a positive impact on quality of life and wellbeing (e.g. ESRC 2011; Gabriel & Bowling 2004; Musselwhite & Haddad 2010). As shown in Table 4-2, a number of studies have considered the barriers to travel experienced by people with impairment (Aongusa & Moore 2013; Blais & El-Geneidy 2014; Department for Transport 2008; Feeley 2009; Gallagher *et al.* 2011; Lamont 2008; Mental Health Action Group 2011; Pettersson 2009) and drawn conclusions about the resultant social impact emanating from these barriers. Predominantly through primary research with users (with a range of impairment types) these studies suggest a lack of accessible transport has “an impact” on social participation, wellbeing, access to opportunities, social inclusion, access to opportunities (including employment), community participation, loneliness and an individual’s travel sphere.

4.12 Based on this evidence, and the impact of mobility on wellbeing and quality of life, it could be assumed that schemes which help individuals make trips *should* lead to positive social impacts. Therefore theoretically, demonstrating that accessible design can lead to increased patronage amongst impaired users (such as demonstrated by Duckenfield, Higbee and Holt

(2010) and Steer Davies Gleave (2015)) may provide enough evidence that social benefits exist without the need for detailed study.

4.13 However, actual evidence of the social benefits resulting from accessible transport is very limited making it hard to confirm this assertion, and to include these social benefits in scheme proposals or appraisals. Furthermore, most of the studies are rather general and don't go into detail about what measures are required to enable individuals with a range of impairments to access transport. This means that it is difficult to identify what action will lead to greatest social benefits. Indeed as Wang and Winn (2010) note, simply providing compliant infrastructure does not necessarily mean individuals are able to use the transport system, therefore practical evaluation of outcomes is essential.

4.14 Two studies (Carter & Le Masurier 2006; Samuel *et al.* 2013) were identified that reported the social benefits of schemes from the perspective of what they enable users to do. The first quantified the increase in social interaction, quality of life, independent travel and community participation as a result of the Nottingham tram and quality of life improvements as a result of the Lincolnshire Interconnect DRT scheme (Carter & Le Masurier 2006). However a detailed method is not provided for this study, so it can only be used to give an indicative idea of effects. The second identified improvements in stress levels, sense of control, and community participation as a result of a transport voucher scheme for adults with disabilities (Samuel *et al.* 2013).

4.15 In addition, Maston (2000) evaluated the impact of remote infrared audible signage and found that as a result of the system, users stated that they could save money, and more easily find jobs. However the scale of this was once again not measured. Finally Fearnley *et al.* (2011) undertook cost-benefit analysis using willingness to pay valuations and used these to show the point at which the benefit / cost ratio is greater than 1. They called this the point at which the scheme becomes socially profitable, although this is based on passenger valuations rather than the measurement of an actual benefit.

4.16 In terms of social costs and benefits, the existence of evidence demonstrating the positive impact of independent mobility and motility on an individual's quality of life and wellbeing implies that, by virtue of the opportunities it provides, a more accessible transport will also have a positive impact. However gaps in the evidence mean that quantifying the likely social impact of a range of potential improvements is almost impossible. In addition, once again most of the evidence relates to physical accessibility, omitting other aspects of the transport system that could be improved, possibly more cheaply.

Table 4-2: Evidence related to social factors

Authors	Title	Social benefits
Aongusa and Moore (2013)	The Geographical Distribution of Barriers to Transport Accessibility for People with Disabilities in Ireland	Transport was identified as being a barrier to completing education by 9.47% of respondents in rural areas, but only 1.73% in urban areas. A similar result was found in relation to the extent to which a lack of transport discouraged an individual from seeking a job where 1.79% were discouraged in rural areas and only 0.34% in gateway cities. Finally, a lack of transport was a far greater barrier to social participation in rural areas (16.38%), than in gateway cities (6.79%, large towns (9.76%) or small towns (13.57%). Transport was a barrier to social participation across all disability types, but was most likely to be cited as a barrier by individuals with mobility and dexterity disabilities.
Blais and El-Geneidy (2014)	Better Living through Mobility: The Relationship between Access to Transportation, Well-Being and Disability	Access to public transport has a significant impact on wellbeing, especially for people with mental/cognitive disabilities. It has a greater impact on wellbeing than income and not having access to transit or being able to afford personal transport is detrimental to wellbeing and can lead to social exclusion.
Carter and Le Masurier (2006)	In the Town, and in the Country, Can We Make a Real Difference for the Mobility Impaired?	This study evaluated (qualitatively and quantitatively) the impact of the first Nottingham tram line (NET) on the mobility impaired. The survey included: 167 mobility impaired passengers (26 wheelchair users, 44 walking difficulties, 97 buggies and heavy bags). It also briefly looked at the Interconnect DRT scheme in rural Lincolnshire. It found that, following the construction of the tram many mobility impaired passengers were able to travel more than they had previously. It found that NET (wheelchair users): 83% get out and about more than before, 75% have increased social interaction, 90% have improved quality of life due to improved ease of boarding and alighting (95%) and ability to travel independently (65%). NET (difficulty walking): 60% get out and about more than before, 52% have increased social interaction, 91% have improved quality of life due to ease of boarding and alighting (90%) and ability to travel independently (52%). NET (buggies and bags): 42% get out and about more than before, 62% have increased social interaction, 78% have improved quality of life due to improved ease of boarding and alighting (89%), because it is cheaper (49%) and because it is so much quicker (59%). NET has increased community participation leading to significant improvements in quality of life, and the impact is greater the greater the level of mobility impairment. Interconnect: 35% disabled reported improved quality of life (but this is less than reported improvement to QoL for elderly women, no car available and young).
Department for Transport (2008)	Assessment of Accessibility Standards for Disabled People in Land Based Public Transport Vehicles	This study looked at progress towards accessible transport for disabled people. As part of this it made an attempt to assess the costs and benefits of measures to make transport more accessible. However the conclusions tended to be qualitative in nature. The research found that travel training could lead to improved self-confidence, independence and social interaction. Many of the benefits of accessible features are felt by all passengers rather than just those with disabilities, leading to an overall service improvement.

Duckenfield, Higbee and Holt (2010)	Measuring the Benefits of the Access for All Programme	This study presents the results of research undertaken to determine the benefits to passengers of the Access for All programme, a Department for Transport funded initiative to improve access to key stations on the rail network. It used at station passenger interviews (quota sample, n=2262), station user counts (4 at survey stations, 4 at control stations), mystery shopping, ticket sales data to evaluate impact. A4A programme stations were rated more highly that control stations by people with a range of mobility limitations (general mobility impairments, sight impairments, hearing impairments and those with bulky luggage). A benefit cost ratio for the programme of improvements of 2.9: 1 was identified, apparently as a result of increased patronage as a result of the programme. This figure is based purely on benefits to those with impairment and encumbered passengers. The programme was thought to lead to an increase in use across various groups. Based on self-reported data, there was an increase in demand amongst passengers with impairments (11%), passengers with heavy luggage (5%) and passengers without impairment (1%). Control stations showed almost no passenger change. This is backed up by ticket sales data showing that A4A stations experienced growth in disabled rail card use 24% higher than control stations, and growth in senior rail card use 44% higher than control stations.
Fearnley, Flügel and Ramjerdi (2011)	Passengers' valuations of universal design measures in public transport.	This article summarises how the benefits of universal design extend beyond those with impairment to the wider travelling population. It does this by using a stated preference survey to demonstrate the high valuations given to universal design by passengers. Real time information at the stop on a screen is the most valued, with local maps and announcements regarding departure changes being much less valued. Ideally the next stop should be announced via speaker and screen, but the willingness to pay values for just speaker or just screen are only one NOK lower. Low vehicle floor and elevated kerb stop is valued more highly than just low floor by approx. 4NOK. A shelter with a sitting place is valued approx. 2 NOK higher than one without a sitting place. This research suggests that universal design measures are likely to be socially profitable in any urban setting with a minimum public transport ridership. A bus shelter with seating produces a net social benefit at 14 passengers per day.
Feeley (2009)	Evaluating the Transportation Needs and Accessibility Issues for Adults on the Autism Spectrum in New Jersey	This paper explores the transport needs and accessibility issues for adults in the autistic spectrum via a survey with them, or their carers. It finds a heavy reliance on friends and family for transport, and that transport presents a significant barrier to employment. Transport is a barrier to work and community participation - better travel training might help individuals to overcome this barrier. However other barriers are ranked more highly than transport (for example job opportunities) in terms of their impact on finding employment.
Gallagher *et al.* (2011)	Mobility and access to transport issues as experienced by people with vision impairment living in urban and rural Ireland	This paper uses qualitative research to explore the transport experiences of people with visual impairments living in Ireland. It shows that there is a lack of accessible transport and a perceived lack of understanding of the impact of a visual impairment. It finds that a lack of accessible transport leads to increased dependency on family and friends. Better access to transport would help to overcome loneliness.
Lamont (2008)	Understanding and Addressing Dyslexia in Transport Provision	This paper discusses the impact that Dyslexia has on an individual's ability to interpret travel information and the effect this has on their ability to make unfamiliar to new journeys on the transport network, linking in part to social exclusion as a result of inadequate travel information. The social costs of not providing clear and comprehensible travel information for people with

		dyslexia could lead to a reduced travel sphere with individuals only making familiar journeys rather than using travel information to aid unfamiliar, new trips. This lack of diversity in the type of trips could be classed as a social exclusion and a social cost to the individual
Maston (2000)	Towards an Accessible City: Removing Functional Barriers for the Blind and Vision Impaired: A Case for Auditory Signs	This study reviews the effects of Remote Infrared Audible Signage (RIAS). It found that RIAS will help people find jobs and increase their income; almost all participants said they would help them save money that they currently spend on getting travel assistance. Blind users said they would increase their use of transit with RIAS. Subjects said they would be willing to pay more than previously believed as they said that increased mobility would be worth paying the full fare.
Mental Health Action Group (2011)	Mental Health and Public Transport	This report used a self-selecting survey to identify the barriers to transport use experienced by people with mental health impairment. The evidence from the paper decisively confirmed that public transport and good mental health are intrinsically linked. Poor access to public transport leads to social isolation, worsening mental health and poor opportunities. Good access on the other hand enables recovery, reintegration into society and better prospects for quality of life.
Pettersson (2009)	Priorities for the Use of Bus Transport by Disabled People, Older People and Parents with Young Children in Buggies	This study used a literature review, mystery shopper trips, and self-completion surveys with disabled users of bus services, focus group discussions with parents with buggies and case studies to identify the priorities of a range of different users of transport services. The research conducted with users strongly identified the importance of having good and easy access to bus services to achieve better social inclusion, widen job and training opportunities and give people access to essential solutions.
Samuel *et al.* (2013)	Benefits and quality of life outcomes from transportation voucher use by adults with disabilities.	This paper describes the results from a survey of participants in a transport voucher programme with a range of impairments in Michigan, USA. It found that a transport voucher programme can lead to improvements in emotional wellbeing, community participation, and overall quality of life. It can also facilitate better stress levels (61.2%) and enable people to feel a sense of control over their lives (55.4%). Participants felt more respected and equal to others in the community as a results of the programme (47.7%) and felt that it gave them more time to relax (50%). Participants indicated they were able to spend more time in the community as a result of the voucher programme (61.2%). However the programme did not necessarily help the participants to maintain a job or develop skills and continue education. Overall, 53.7% of participants felt that their lives were better as a result of the programme.
Steer Davies Gleave (2015)	Impacts of Station Accessibility Improvements	This study is a follow-up to Duckenfield, Higbee and Holt (2010) and explores the use of the station and perceptions of passengers in more detail, five years after the original research. Most of the research relates to appraisal and economic benefits, however the study found that 33% of wheelchair users, 19% of hearing impaired passengers and 15% of mobility impaired passengers reported increased trip making following the improvements.
Wang and Winn (2010)	Making Public Transport Services More Accessible - Lessons Learned in Victoria, Australia	This paper presents some key findings and discusses lessons learned in Victoria from an audit of a programme to make public transport more accessible for people who face mobility challenges in Victoria. It found that compliance with standards does not necessarily equate to better access where the compliant infrastructure not actually be accessible due to other barriers. The paper concludes that the Victorian Department for Transport has complied with standards but didn't

		adequately measure impact of changes. The paper stresses that it is critical to evaluate the practical outcomes for disabled people.

Commercial Factors

Some of the studies reviewed refer to the costs to an operator, or other body, of installing measures that can improve accessibility. However, perhaps understandably, there is no single reference point at present that pulls this indicative cost information for different measures together. Such a reference point would be very useful at initial scheme planning and appraisal stages. In terms of commercial benefits, there is some limited evidence of growth in patronage as a result of measures to improve accessibility, although this is by no means a well-developed area of research. Research also indicates a "willingness to pay" for improvements amongst passengers with impairment, and those without. However, there is no evidence of how this translates to practice.

4.17 As mentioned in the introduction, on a project level the commercial costs, at least from a construction perspective, are relatively easy to quantify. Quotes can be obtained from suitably qualified suppliers, and these can be included in economic and financial appraisals. Establishing the costs on a wider scale, such as a city centre, appears to be rather more complex because it requires extensive assessment of a whole network including all modes of transport. As such, while some work exists looking at the cost of making transport accessible (Department for Transport 2008; ECMT 2001; KFH Group 2000; Macdonald 2006), there is no up-to-date work that provides useful evidence of costs in a UK context. Clearly though, when compared to other factors, costs are relatively easy to obtain and will be most accurate if they are obtained for a specific scheme.

4.18 However a quick reference guide listing costs of standard adaptations could be useful (some reports such as Department for Transport (2008) do include some costs, but they are relatively hidden). In addition it should be noted that the costs of more major works are greatly reduced if they are included at the design and construction phase of a project (Whitten 2003), and changes to existing infrastructure are likely to be more costly.

4.19 The evidence identified in this area (see Table 4-3 at the end of this subsection) fits into three main categories: changes to patronage levels, journey time savings and willingness to pay for improvements. Eight papers were identified that related to actual (Avancena 2012; Duckenfield, Higbee & Holt 2010; ECMT 2006a; GFK *et al.* 2013; Steer Davies Gleave 2015) or potential (Fearnley *et al.* 2009; Litman 2007; Waara 2013) changes in patronage following changes to make the transport system more accessible. Unfortunately though, limited detail is given about the method used to collect data in most of these studies (with the exception of Duckenfield, Higbee and Holt (2010) and Steer Davies Gleave (2015)) meaning it is difficult to rely on the findings.

4.20 The actual changes in patronage levels reported occurred as a result of changes to make rail and bus stations, stops or services more accessible, or in one case as a result of a free fare programme that led to passengers switching to fixed route transport from special transport services (with operators being reimbursed for the additional passengers that they carried). Two of the studies relate to growth in the total number of passengers (impaired or unimpaired) and report growth of 20-25% and16% (ECMT 2006b; GFK *et al.* 2013). The other two only consider passengers with impairment, with one reporting a shift to fixed route transport of 2.5 million trips during 2011, and the other showing growth in disabled rail card use at Access4All stations 24% higher than at control stations (Avancena 2012; Duckenfield, Higbee & Holt 2010).

4.21 Both Duckenfield, Higbee and Holt (2010) and Steer Davies Gleave (2015) also look at patronage change using self-reported data to explore the impact of the Access4All programme. While the accuracy of this would need validation, data from both studies shows that across all users (impaired and not impaired) there were increases in trip making as a result of the measures (with impaired users reporting a greater increase). It is noteworthy though that the effect seemed to decrease over time, with a smaller proportion reporting an increase in 2015 compared to 2010 (11%/24%). As such, while this indicates a positive outcome, the scale is unclear. Nevertheless, changes in patronage as a result of the project were used within an economic appraisal of the project and demonstrate an overall BCR of 2.4:1 over a 60 year appraisal period. This indicates that (based on user and externality benefits versus construction and maintenance costs) the project is a good investment.

4.22 The remaining three studies relate to potential changes in patronage as a result of measures to make transport more accessible (although none of these studies quoted any likely figures). Waara (2013) posited that the provision of journey planning information is important because it can influence an impaired individual's decision about whether to make a journey. Fearnley *et al.* (2009) indicate that universal design measures are often perceived as quality improvements amongst the general public, and as such may lead to increase in patronage. Looking more generally at service quality improvements, Litman (2007) cites evidence to suggest that measures often described as "universal design" can also be considered as "quality improvements" and quotes some evidence to suggest this can lead to increases in general patronage on public transport.

4.23 Moving on to consider journey time, two studies (Karekla *et al.* 2011; Odeck *et al.* 2010) identified that operators could potentially benefit from operational cost savings as a result of faster boarding and alighting due to accessibility measures. However these were both based on modelling rather than studies of actual modifications. Alongside reductions in operational costs due to time savings, Karekla, Fujiyama and Tyler (2011) also suggested operational costs would be reduced as a result of a project to improve accessibility on the London underground due to a reduction in number of trains and drivers required, and reduced maintenance costs.

4.24 Finally, five studies (Fearnley, Flügel & Ramjerdi 2011; Maston 2000; Maynard 2007c; Maynard 2007a; Suzuki *et al.* 2007) identified the potential price people were willing to pay for accessibility improvements to the transport system. Four of these studies used stated preference techniques to identify valuations for a range of universal design measures on board vehicles and at stops and stations (and in one case for a special transport service). They indicated that both individuals with an impairment, and the wider public value accessible transport measures, although the values are for specific "options" and therefore can't necessarily be applied to all projects.

4.25 Whether the values could translate into additional revenue for operators is debatable as hypothetical "willingness to pay" is not the same as actual willingness to pay, and fare increases may not be well received. Macmillan (2004) notes that the difference between actual willingness to pay and hypothetical willingness to pay (in this case for environmental interventions) can be as much a 1:4, mainly due to participants basing responses on what they would like to pay rather than what they can actually afford, and lacking understanding of the actual measures. The final study (Maston 2000) found that blind public transport users

would be willing to pay more for a service equipped with remote infrared audible signage and would also increase their use of public transport services.

4.26 In summary, this section has identified a lack of evidence relating to actual (rather than potential) costs and benefits as a result of measures to make the transport system more accessible. Furthermore, the measures that are considered are mostly (although not exclusively) those that will have an impact on physical accessibility, mostly at railway stations. Nevertheless this section has highlighted that measures to improve accessibility are likely to have a benefit or value to the wider population – something which should be considered when assessing impact.

Summary

This chapter has explored evidence from the past 15 years that relates to the economic, social and commercial costs and benefits relating to an accessible transport system (or lack thereof). The main finding that can be drawn from this is that there is a dearth of high quality (or in some cases any) evidence relating to benefits and "costs" or losses. Furthermore the evidence that does exist mainly relates to physical improvements to transport infrastructure (mainly at stops and stations or on vehicles) and does not investigate the field more widely. In-particular there has been a focus on access at stations, and there is a lack of evidence relating to the impact of softer measures such as information provision and travel training.

4.27 Nevertheless the evidence in existence implies that there are likely to be benefits at micro- and macro scale of improved accessibility linked to the greater potential to make trips. It is therefore necessary to consider the extent to which this evidence is "enough" to justify continued investment in accessibility, and if not, what additional evidence should be sought.

Table 4-3: Evidence related to commercial factors

Authors	Title	Commercial benefits
Avancena (2012)	The power of choice: the benefits of free fares for elderly and disabled customers on fixed route services.	This research identified that as a result of the availability of free travel on fixed route services, passengers with a disability were using fixed route bus or rail services rather than paratransit. A paratransit trip costs Access Services approx. $34, and a trip on fixed route transit costs on average less than $1. Average yearly increase in passengers eligible for paratransit between 2005 and 2011 was 21.7%. However during the same year, the number of paratransit trips only increased 3.6% per year. It is estimated that during 2011, the Free Fare programme has shifted 2.5million trips from paratransit to fixed route - a large cost saving. Operators of fixed route services also benefited because they are reimbursed for the additional trips by older and disabled people.
Department for Transport (2008)	Assessment of Accessibility Standards for Disabled People in Land Based Public Transport Vehicles	This study includes some costs for various very specific measures, although these are from 2008. It also reviews a range of other studies and concludes that bus quality partnerships (which include some accessibility measures) have led to increases in patronage in some locations.
Duckenfield, Higbee and Holt (2010)	Measuring the Benefits of the Access for All Programme	This study presents the results of research undertaken to determine the benefits to passengers of the Access for All programme, a Department for Transport funded initiative to improve access to key stations on the rail network. It used at station passenger interviews (quota sample, n=2262), station user counts (4 at survey stations, 4 at control stations), mystery shopping, and ticket sales data to evaluate impact. A4A programme stations were rated more highly that control stations by people with a range of mobility limitations (general mobility impairments, sight impairments, hearing impairments and those with bulky luggage). A benefit cost ratio for the programme of improvements of 2.9: 1 was identified, apparently as a result of increased patronage as a result of the programme. This figure is based purely on benefits to those with impairment and encumbered passengers. The programme was thought to lead to an increase in use across various groups. Based on self-reported data, there was an increase in demand amongst passengers with impairments (11%), passengers with heavy luggage (5%) and passengers without impairment (1%). Control stations showed almost no passenger change. This is backed up by ticket sales data showing that A4A stations experienced growth in disabled rail card use 24% higher than control stations, and growth in senior rail card use 44% higher than control stations.
ECMT (2006a)	Improving Access to Public Transport	This report looks at the improvements made to make public transport more accessible in a number of European cities. It discusses the processes involved and the outcomes. In Grenoble, a 23.4% increase in wheelchair passengers over a 2 year period was reported following accessibility improvements. Bus use overall has increased since the improvements by 35%. However the report states that it is difficult to quantify increases in passenger numbers as a result of accessibility improvements, but overall a number of cities reported 20-25% increase in passenger numbers following accessibility improvements. Nevertheless it concludes that while accessibility improvements have an associated cost, they will also have benefits in terms of increased levels of ridership.

Fearnley *et al.* (2009)	Benefit of Measures for Universal Design in Public Transport	This study describes a number of focus groups and a survey that was undertaken to gain a better understanding of passenger perceptions of universal design in transport in Norway. A range of measures have been implemented, including (at the stop) easy access, tactile paving, shelter, seating, real-time information and elevated kerbs, (on the bus/tram) clearly marked route and destination, space for pram, bicycle, wheelchair, announcement of next stop, screen showing next stop. The majority of universal design measures were appreciated by people surveyed as being "quality enhancements" rather than being intended for special needs groups. Real-time information and shelters and seats at stops were the most commonly noticed measures.
Fearnley, Flügel and Ramjerdi (2011)	Passengers' valuations of universal design measures in public transport.	This article summarises how the benefits of universal design extend beyond those with impairment to the wider travelling population. It does this by using a stated preference survey to demonstrate the high valuations given to universal design by passengers. Real time information at the stop on a screen is the most valued, with local maps and announcements regarding departure changes being much less valued. Ideally the next stop should be announced via speaker and screen, but the willingness to pay values for just speaker or just screen are only one NOK lower. Low vehicle floor and elevated kerb stop is valued more highly than just low floor by approx.4NOK. A shelter with a sitting place is valued approx. 2 NOK higher than one without a sitting place. A bus shelter with seating produces a net social benefit at 14 passengers per day. The paper contains an extensive list of WTP values collected from international studies.
GFK *et al.* (2013)	Economic impact and travel patterns of Accessible Tourism in Europe	This report reviewed the economic impact of a range of accessible tourism measures in Europe. One of the measures included was work to make the Barcelona Metro more accessible. During the period 1997-2006, the population of Barcelona has increased 5.3% while journeys on FGC have increased by 69%. This is thought to be attributable to a range of factors including, but not limited to the accessibility of stations and trains. Passenger satisfaction has also increased over time as more stations have become accessible. According to analysis undertaken by FGC, renovating a station to make it accessible increases passenger numbers by 16%.
Karekla, Fujiyama and Tyler (2011)	Evaluating accessibility enhancements to public transport including indirect as well as direct benefits	This study evaluates the potential costs and benefits of raising the whole platform on the Victoria Line of the London Underground, and widening the doorways to facilitate easy level boarding. It takes into account costs (construction and weekend closures) and benefits (reduction in trains, drivers, maintenance and journey time savings) over the first and subsequent 24 years. Due to reduced boarding times, a project such as this provides a BCR of between 1.16 (taking into account only morning peak journey time reductions), and 1.98 (taking into account morning and evening peak journey time reductions) over 25 years. Customer satisfaction was not taken into account which may further improve the BCR.
Litman (2007)	Valuing Transit Service Quality Improvements: Considering comfort and convenience in transport project evaluations	Passengers exhibit a willingness to pay for service quality improvements. This might include building improvements, ease of boarding and alighting, station announcements, platform surface, signage, seating, lifts and escalators, information, and lighting which would also be beneficial to people with disabilities. Further, travellers might be willing to pay for real-time information on board and at stops/stations which would enable then to better plan their journeys and inform them of any delays. This type of information can also increase ridership levels.

Macdonald (2006)	Accessibility of Coaches and Long Distance Buses for People with Reduced Mobility - Cost 349	This report discusses the costs of making coaches and long-distance buses accessible. It finds that capital cost of wheelchair accessible vehicles can be as little as 2% for ramp access and up to 10% for a high floor lift access solution.
Maston (2000)	Towards an Accessible City: Removing Functional Barriers for the Blind and Vision Impaired: A Case for Auditory Signs	This study reviews the effects of Remote Infrared Audible Signage (RIAS). It found that RIAS will help people find jobs and increase their income, almost all participants said they would help them save money that they currently spend on getting travel assistance. Blind users said they would increase their use of public transport with RIAS. They would also be willing to pay more than previously as increased mobility would be worth paying the full fare for.
Maynard (2007a)	Monetising the Benefits of Disabled Access in Transport Appraisal	The paper outlined that respondents (both with and without an impairment) were willing to pay more for accessible transport – indicating that investing in this infrastructure it will bring about benefits for all. As people without limited mobility are also willing to pay more for accessible rail stations (as outlined in the survey) this would suggests wider commercial and economic benefits if stations were enhanced to improve access. The research concluded that willingness to pay increases as the access method improves.
Maynard (2007c)	The economic appraisal of transport projects: the incorporation of disabled access	This research posits that costs are fairly easy to identify and often included in the cost benefit analysis quantitatively. Benefits are not usually included in cost benefit analysis. As a way of rectifying this, the study reports on primary research to identify willingness to pay for improved accessibility. On average across all passengers, willingness to pay was 0.48p for stairs and a lift, or 0.15p or stairs and a ramp. These values were higher for passengers with a disability or impairment, and older passengers.
Odeck, Hagen and Fearnley (2010)	Economic Appraisal of Universal Design in Transport: Experiences from Norway	This paper outlines that universal design leads to increased quality as well as better access. An example of low floor buses is provided which suggests that universal design will reduce boarding and alighting time for buses and will increase the level of comfort experienced. If the individuals with impairment save time entering and exiting the bus, it is likely that other users will too. Travel time savings may generate more traffic on route however the bus company may experience efficiency gains due to time saved. The paper outlines the annual benefits to the operator of introducing universal design, All values are provided in Norwegian NOK, found in Table 5 in the paper.
Steer Davies Gleave (2015)	Impacts of Station Accessibility Improvements	This study was the follow-up to Duckenfield, Higbee and Holt (2010) and explored the impacts of the Access4All programme in more detail. It used passenger, railcard user and lift user counts, surveys, interviews, and access audits. The improvements were found to have impacted upon station usage, with 33% of wheelchair users, 19% of hearing impaired users and 15% of mobility impaired users stating that they had significantly or slightly increased their trips as a result. Changes in passenger numbers at the stations, and railcard use at the stations however was inconsistent across the 6 study stations, with some outperforming other (non A4A) stations in the regions, and others showing less growth. Comparisons between the 2010 research and this study found that awareness of the improvements had dropped, the reported increase in trips had dropped (from 24% in 2010 to 11% now) and the number of people who thought that others would be encouraged to use the station had dropped (from 80% in 2010 to 59% now). The data collected

		during the study was used in an appraisal of the cost-benefit based on Webtag. This used actual costs for each of the six stations, and included benefits based on increase in quality for existing and new users, and decreases in car trips, emissions, accidents and congestion for non-users. This found a BCR for each station of between 11.3 and -0.17. The variance can be explained by differences in user growth, difference in the size of the target user group and differences in operational costs. Overall the programme is deemed to be a success with the overall benefits outweighing the costs.
Suzuki *et al.* (2007)	Study on Application of the Socioeconomic Evaluation Technique to Traffic Barrier-Free Improvement/Development Projects	The paper provides estimated values for the cost/ willingness to pay of individuals for elevator projects and special transport services. It found that the willingness to pay values were approximately equal to the construction and maintenance costs of lifts at stations, and to the present charges to users of special transport services. The article concluded that these values can therefore be usefully applied to cost benefit modelling of proposed measures was effective, and with more research to collect additional data on socio-economic impacts, may be usefully applied in the future.
Waara (2013)	Traveller Information in Support of the Mobility of Older People and People with Disabilities: User and Provider Perspectives	This study investigated the importance of traveller information in enabling disabled people to make more journeys. The report showed the need to plan trips is important for all disabled people in terms of confidence and re-assurance, however for certain sub-groups the ability to access this information can influence the decision about whether or not they make that journey. Providing more traveller information it does not necessarily increase the number of trips, however it increases the individuals confidence in planning and executing the trips.
Whitten (2003)	Design of Accessible Public Transport	One of the aims of accessibility measures is to eliminate the need to provide direct assistance to disabled passengers, limiting the burden and associated costs for operators of providing direct assistance. Eliminating need for direct assistance is also critical as operators move towards driver only / driverless trains. Involving users at design stage helps to identify issues up front and help avoid costs and delays if change requests are made after the design has been produced. The paper advocates flexible interior design to allow operators to change the car design at minimal cost. Providing accessible rolling stock is simple and cost effective when included at the design phase.

5 ACCESSIBLE TRANSPORT AND APPRAISAL

During the course of this review, one of the issues that emerged related to the inclusion of the benefits resulting from accessible design in the appraisal process for new projects. Numerous authors highlight the importance of this, and some suggest approaches to surmounting it. These generally utilise stated preference approaches to generate "willingness to pay" values for certain measures, or sets of measures (most commonly in relation to access to railway station platforms). However there is limited evidence of how these reflect reality, and as such the degree to which they offer an accurate measure of the benefits.

5.1 As this review was under way, it became apparent that including the costs of accessibility measures in project appraisal is much simpler than including the benefits or gains resulting from it. The studies reviewed as part of this work indicate that this is an emerging issue. At the moment it appears that while the costs of accessibility measures are included in appraisal, the benefits are often not (Cook 2014; Fearnley *et al.* 2009; Maynard 2007b). In part this is because the costs are relatively easy to identify, while the benefits are much more difficult (Lewis 2012; Rail Safety and Standards Board 2010; Wolfe & Suen 2007) especially in terms of quantifying and including quality of life and wellbeing impacts (Cook 2014; Orr 2010).

5.2 Where an attempt has been made to include benefits, they are often only recorded as benefits to people with an impairment, rather than the wider population, and approaches can be rather ad hoc (Maynard 2007c; Odeck, Hagen & Fearnley 2010). Further, some authors question whether the traditional econometric approach to appraisal is really suitable for the planning and assessment of accessibility measures when the needs of the individuals who will benefit are complex and multi-faceted (Aongusa & Moore 2013). As a result of this, a number of authors have explored how the benefits can be monetised, either for use during appraisal (Douglas 2011; Fearnley, Flügel & Ramjerdi 2011; Maynard 2007c; Nitta *et al.* 2004; Odeck, Hagen & Fearnley 2010; Steer Davies Gleave 2015), or as a prioritisation tool to help decide which measures offer best value for money (Ferrari *et al.* 2014; Mackett, Achuthan & Titheridge 2010; Martens 2012).

5.3 In terms of monetising the benefits for use during appraisal, approaches tended to focus on stated preference studies that are often used to value realistic potential options. In general such approaches use the concept of "consumer surplus" to identify the difference between the fare, and what the consumer would be willing to pay for certain features. The difference between the values is the "benefit" to the consumer, or their "willingness to pay".

5.4 The most common application of these approaches so far has been in the exploration of the "value" of passenger lifts, or other features to improve platform to platform access at stations (Douglas 2011; Maynard 2007c; Nitta, Nakahira & Takahashi 2004). Others have explored more widely and cite valuations for a range of improvements including lighting, dropped kerbs and bus and tram information and access measures (Fearnley, Flügel & Ramjerdi 2011; Nitta, Nakahira & Takahashi 2004; Odeck, Hagen & Fearnley 2010). In most cases, the valuations given by passengers demonstrated that accessibility measures are valued both by individuals with impairments, and other groups of users. Using this approach, measures to improve accessibility usually appear to demonstrate good value for money.

5.5 Odeck, Hagen and Fearnley (2010) took the process one step further by attempting to ascertain values for increases in patronage as a result of changes to make the transport system more accessible (representing a potential benefit to the operator). However, they noted that these values are not presently included in many appraisal processes. An alternative approach is adopted by Karekla, Fujiyama and Tyler (2011) who attempt to model the benefits of an accessible design project focussing on operational costs and journey time savings. This is one of the only attempts to take into account wider benefits, and suggests there would be a positive benefit cost ratio over 25 years.

5.6 As discussed, one of the main barriers preventing the inclusion of accessible design benefits in appraisal is the lack of usable monetised values. It may be possible to gather some values from other studies, such as those that explore general passenger "willingness to pay" for quality improvements to transport services. Fearnley *et al.* (2009) demonstrate that often non-impaired passengers perceive accessible design features such as real time information to be quality improvements, rather than features to assist people with impairment. This means that they may "value" these features, and these values can be included in appraisal alongside the (often higher) "willingness to pay" values from people with impairment (Litman 2007).

5.7 As well as undertaking research to collate values, some of the papers attempted to apply their values in cost benefit analysis to demonstrate how willingness to pay can be used in these scenarios. In two cases the values far outweighed the costs of construction or inclusion of accessible transport features. (Fearnley, Flügel & Ramjerdi 2011; Maynard 2007c) while in the remaining case the willingness to pay values were approximately equal to construction and maintenance costs (Suzuki *et al.* 2007).

5.8 However "willingness to pay" values may not be the panacea they appear to be. One main issue with willingness to pay valuations is that they are rather arbitrary measures that are perhaps best used to draw comparisons between potential measures, rather than to decide if a measure will be beneficial in and of itself. They give an indication of the value passengers place on a measure, but the best use of this may be relative to other measures since the value doesn't represent an actual realisable economic or commercial benefit. Since willingness to pay valuations have been found to be overestimates of actual willingness to pay (Macmillan 2004) further exploration is needed to understand how willingness to pay can be best used in relation to accessible transport, and the extent to which they are representative of the wider value of accessibility measures.

5.9 Furthermore, while a range of values for different accessibility measures can be collated from the studies listed in Table 5-1, their use may be limited by virtue of the fact that they come from a range of sources, and their relevance in other contexts, and as part of package of measures has not been investigated. Therefore further work needs to be undertaken to explore how these values accurately relate to different contexts and different groups, and identify whether it is necessary (if they are being used in appraisal) to collect new values on a project by project basis to account for local variation.

5.10 Nevertheless, Steer Davies Gleave (2015) offer a useful worked example of an economic appraisal for an existing programme (Access4All) which details the process of assessing what they consider to be the benefits to users, non-users and train operating companies. This shows how the benefits can be monetised so that they can be included in the appraisal

process, but further consideration is needed regarding the accuracy of this approach, and the degree to which it captures all of the benefits.

5.11 Appraisal may also be used to prioritise accessibility improvements, as demonstrated by three studies. Martens (2012) considers that cost benefit analysis may not be the best approach for ranking transport improvements because they often focus on time-savings, reduction in motoring costs and environmental impacts omitting the smaller scale effects and cannot accurately take account of benefits to impaired individuals. However Ferrari *et al.* (2014) suggest prioritisation by time saving can be effective, and may enable the benefit to non-impaired users (in terms of decreased boarding and interchange times) to be accounted for. Finally Mackett, Achuthan and Titheridge (2010) suggest prioritisation is undertaken by comparing costs to defined benefits, such as the increase in the number of people who can walk to the shops) drawing on mapping techniques.

5.12 It is clear from the evidence that the costs and benefit of measures to improve accessibility should be included in the appraisal process. What is significantly less clear is how the benefits resulting from these measures should be quantified. The literature suggests that valuations such as those gathered via stated preference surveys could be useful, but we have only limited evidence of the accuracy of these in reality. Therefore further research is required to identify the most appropriate approach to appraisal, and to test the utility of existing valuations, and ascertain the extent to which they can be used as a representation of the wider social and economic benefits that may occur as a result of an accessible transport system.

Table 5-1: Evidence related to appraisal

Authors	Title	Measuring costs and benefits
Aongusa and Moore (2013)	The Geographical Distribution of Barriers to Transport Accessibility for People with Disabilities in Ireland	This research suggests that traditional econometric approaches to transport and spatial planning (including analysis of choices and travel purposes) are less useful to ascertain the needs of those with disabilities whose regular mode of travel is determined by a range of factors including individual capabilities. This means that in any new project their needs require careful assessment.
Cook (2014)	How Accessible Are the Public Transport Networks of Berlin and London?	This paper suggests that cost benefit analysis does not take into account improvement in (objective and subjective) quality of life and welfare impacts meaning they can appear expensive. Also wider groups benefit from improvements, for example parents with pushchairs and people with luggage benefit from lifts. In addition people using mobile phones may benefit from tactile coloured lines warning of the edge of a platform.
Douglas (2011)	Estimating the User Benefit of Rail Station Lifts	This paper reviewed a number of research studies that had attempted to value passenger lifts at railway stations. Three approaches were identified: Mechanistic, passenger behaviour surveys (stated preference, stated behaviour and rating surveys) and observation studies. A wide range was identified in terms of the economic benefits to passengers of railway station lifts. The reasons for such variations were threefold: the studies took place over a 25 year period, different approaches were used and some studies did not differentiate by passenger type (impaired and not impaired). In all cases, there was a positive value to passengers (impaired and not impaired) of lifts. The value in general is greater for passengers with impairment, in-particular mobility impairment. Lifts are preferred to ramps by impaired and non-impaired passengers. The paper advocates taking elements of all three approaches to develop an approach that takes into account lift use with lift benefit, location and mobility status. However it is noted that such an approach may lead to too great a focus on the quantifiable at the expense of qualitative benefits.
Fearnley *et al.* (2009)	Benefit of Measures for Universal Design in Public Transport	The authors posit that "the basis for calculations of the socio-economic benefits of universal design is the passengers' valuation of the measures. Unfortunately there is little research based empirical data to build on here" (p.10). Subsequently they undertake a study to evaluate the implementation of accessible design measures in a number of locations (covered in full in “commercial” section).
Fearnley, Flügel and Ramjerdi (2011)	Passengers' valuations of universal design measures in public transport.	Following on from their previous paper, the authors once again raise the importance of monetising the benefits of universal design: "there is a need to monetise benefits of universal design measures such that the economic benefits can be demonstrated in mainstream appraisal process" (p.83). This article summarises how the benefits of universal design extend beyond those with impairment to the wider travelling population. It does this by using a stated preference survey to demonstrate the high valuations given to universal design by passengers. Real time information at the stop on a screen is the most valued, with local maps and announcements regarding departure changes being much less valued. Ideally the next stop should be announced via speaker and screen, but the WTP values for just speaker or just screen are only one NOK lower. Low vehicle floor and elevated kerb stop is valued more highly than just low floor by approx. 0.4NOK. A shelter with a sitting place is valued approx. 2 NOK higher

		than one without a sitting place. This research suggests that universal design measures are likely to be socially profitable in any urban setting with a minimum public transport ridership. A bus shelter with seating produces a net social benefit at 14 passengers per day. The authors include an extensive list of values of universal design measures collected using stated preference techniques in the study.
Ferrari *et al.* (2014)	Improving the Accessibility of Urban Transportation Networks for People with Disabilities	This paper presents an approach to facilitate prioritisation of accessible station upgrades. It uses the London underground as an example to illustrate how a number of data sources can be combined to prioritise station upgrades that will result in the greatest time savings for people with mobility impairments. It suggests that upgrades to the rail network that increase accessibility for disabled users by reducing the need for difficult multi-modal interchanges could even benefit other users by reducing the time needed for safe boarding and alighting at bus stops. However the study is only exploratory and the modelling has not been tested in reality.
Karekla, Fujiyama and Tyler (2011)	Evaluating Accessibility Enhancements to Public Transport Including Indirect as Well as Direct Benefits	This study evaluates the costs and benefits of raising the whole platform on the Victoria Line of the London Underground, and widening the doorways to facilitate easy level boarding. It takes into account costs (construction and weekend closures) and benefits (reduction in trains, drivers, maintenance and journey time savings) over the first and subsequent 24 years. Due to reduced boarding times, a project such as this provides a BCR of between 1.16 (taking into account only morning peak journey time reductions), and 1.98 (taking into account morning and evening peak journey time reductions) over 25 years. Customer satisfaction was not taken into account which may further improve the BCR.
Lewis (2012)	The economic and social benefits of accessibility: A decision support framework for South Asia	This study suggests that society tends to give more weight to the costs of accessibility than to the benefits. Although it finds that some countries are trying to address this through judicial and regulatory frameworks. It identifies a number of ways through which countries have tried to identify the benefits to balance against costs, including an example from the US Department for Justice regulatory impact assessment which suggests three benefit categories existed from people with, and without disabilities: use, option and existence. The paper goes on to suggest that because the costs of accessibility are much easier to identify and quantify than the benefits, cost-benefit balancing requires a deep understanding and correspondingly comprehensive framework for identifying and measuring benefits" (p.8). However while a framework is suggested for assessing values, there are no suggestions about how to assess values in each category.
Litman (2007)	Valuing Transit Service Quality Improvements: Considering comfort and convenience in transport project evaluations	Passengers exhibit a willingness to pay for service quality improvements. This might include building improvements, ease of boarding and alighting, station announcements, platform surface, signage, seating, lifts and escalators, information, and lighting which would also be beneficial to people with disabilities. Further, travellers might be willing to pay for real-time information on board and at stops/stations which would enable then to better plan their journeys and inform them of any delays. This type of information can also increase ridership levels.

Mackett, Achuthan and Titheridge (2010)	Increasing Accessibility Cost-Effectively for People Who Are Socially Excluded	This paper explores a method of ranking transport improvements based on impairment (in this case associated with old age, but the authors' state it could also be applied to individuals with any impairment) as a way of prioritising accessibility improvements. It uses the cost of improvements and a measure of benefits (for example number of people who can walk to the city centre or number of shops within a radius) to rank improvements according to cost effectiveness. However it is reliant on assumptions and would require further testing in practice, especially to establish how benefits should be measured.
Martens (2012)	Priority-Setting for Inclusive Transportation System	The paper outlines how a cost : benefit analysis may not be the best method for prioritising accessible design as they often focus on travel time savings, reduction motoring costs and minimisation of environmental impacts. While the paper is focussed on prioritising accessible design projects, it highlights that cost: benefit analysis needs to overcome barriers relating to the assessment of services (such as information); the assessment of small scale projects at multiple locations; and the benefits to individuals and to their support network (rather than just to individuals).
Maynard (2007c)	The economic appraisal of transport projects: the incorporation of disabled access	This thesis suggests there has been little attempt to quantify benefits, with very little new research since 1995 when a study by Fowkes, Oxley and Heiser (1994) estimated savings from £256 million to £1161 million could result from enabling people with a disability to access the transport system. The benefits are likely to include employability, increased ability to access goods, facilities and services, input to the local and national economy, improved health and reduced dependence on special services. However these have not been quantified, and are often only included in appraisal qualitatively. The author undertakes some original research to identify willingness to pay for improved platform to platform access which reveals positive values for stairs plus a lift across all user groups (impaired and non-impaired). This is applied to 2 existing appraisals (Cross Rail and London Hackney Interchange) to show how these willingness to pay values can offer an alternative approach to enable benefits of accessibility infrastructure to be included in appraisal. Interestingly the author notes that in the existing Crossrail appraisal a social benefit multiplier has been used which suggests that for every £1 increase in revenue there was a £2.01 social benefit, although the reasoning behind this is unavailable.
Maynard (2007b)	The Place of Disabled Access in Economic Appraisal in the UK	The paper suggests that the lack of monetised information is detrimental to the business case for accessible transport infrastructure. It suggests that there is a lack of guidance for scheme planners on how the benefits of accessible transport can be included in appraisal, and this in return is detrimental to the business case since only the costs are included in the modelling.
Nitta, Nakahira and Takahashi (2004)	Study on Application of the Socioeconomic Evaluation Technique to Traffic Barrier-Free Improvement/Development Projects	The paper provides estimated values for the cost/ willingness to pay of individuals for elevator projects and special transport services. It identified that users were willing to pay additional fares of almost the cost of the potential project. The paper concluded therefore that this technique could be useful in the appraisal process.
Odeck, Hagen and Fearnley (2010)	Economic Appraisal of Universal Design in Transport: Experiences from Norway	This paper states that universal design in transport benefits everyone, and as such should be accurately included in the appraisal of transport projects. It uses a literature review to obtain values for various universal design features, and then applies these values in three model appraisals. The results of these show positive cost benefit ratios: 2.85 for low floor buses, 0.31

		for high curbs at a bus stop and 0.25 for enhanced lighting at bus stops. The authors states that these ratios show that all of the projects are socio-economically profitable and have a high rate of return for government funds invested. The authors conclude that it is possible to measure the benefits of universal design in monetary terms so that they can be included in the appraisal process. However most of the values come from stated preference surveys. There are also potential increases in patronage, but these are not currently allowed for in the appraisal process.
Orr (2010)	Evaluation of Transport Accessibility for Elderly and Disabled People: A Proposal for an Activity-Based Quality of Life Approach	This paper highlights the importance of including quality of life in appraisals for transport projects that will improve accessibility for individuals with a disability. The author suggests that this would better capture the benefits to individuals of improved transport.
Rail Safety and Standards Board (2010)	Evaluating wayfinding systems at stations	This paper evaluates wayfinding systems at stations, including REACT. As part of this a cost benefit analysis is undertaken. This highlights that while costs are relatively easy to estimate, the benefits are much harder. Much of the quantification of benefits is based on estimates of time and accident savings, and improvements in accessibility to destinations and equality. This was particularly tricky for time savings, where consultation with users and other stakeholders indicated that assessment of time savings was very difficult and would vary depending on the individual. The paper concludes by saying that systems benefitting a wider group of passengers whilst also providing benefits to passengers with visual impairments have a stronger business case than just building the technologies to help a specific disabled sub-group. The paper highlighted that there was some uncertainty about the quantification of the costs and benefits of current and future technologies including REACT and concludes by stating the GB rail industry should not invest in this technology right now.
Steer Davies Gleave (2015)	Impacts of Station Accessibility Improvements	This study was the follow-up to Duckenfield, Higbee and Holt (2010) and explored the impacts of the Access4All programme in more detail. It used passenger, railcard user and lift user counts, surveys, interviews, and access audits. The improvements were found to have impacted upon station usage, with 33% of wheelchair users, 19% of hearing impaired users and 15% of mobility impaired users stating that they had significantly or slightly increased their trips as a result. Changes in passenger numbers at the stations, and railcard use at the stations however was inconsistent across the 6 study stations, with some outperforming other (non A4A) stations in the regions, and others showing less growth. Comparisons between the 2010 research and this study found that awareness of the improvements had dropped, the reported increase in trips had dropped (from 24% in 2010 to 11% now) and the number of people who thought that others would be encouraged to use the station had dropped (from 80% in 2010 to 59% now). The data collected during the study was used in an appraisal of the cost-benefit based on Webtag. This used actual costs for each of the six stations, and included benefits based on increase in quality for existing and new users, and decreases in car trips, emissions, accidents and congestion for non-users. This found a BCR for each station of between 11.3 and -0.17. The variance can be explained by differences in user growth, difference in the size of the target user group and differences in operational costs. Overall the programme is deemed to be a success with the overall benefits outweighing the costs.

Suzuki *et al.* (2007)	Study on Application of the Socioeconomic Evaluation Technique to Traffic Barrier-Free Improvement/Development Projects	The paper provides estimated values for the cost/ willingness to pay of individuals for elevator projects and special transport services. It found that the willingness to pay values were approximately equal to the construction and maintenance costs of lifts at stations, and to the present charges to users of special transport services. The article concluded that these values can therefore be usefully applied to cost benefit modelling of proposed measures was effective, and with more research to collect additional data on socio-economic impacts, may be usefully applied in the future.
Wolfe and Suen (2007)	Evaluation of Airport Improvements for Older Adults	This paper discusses the pros and cons of two methods of evaluating the financial viability of airport investment - Return on investment and Benefit-Cost analysis. It posits that cost: benefit may be a more appropriate tool for assessing accessibility measures because it focusses more on public welfare than return on investment. It suggests that many improvements that are made to help people with a disability may actually help a far greater population. However it notes that establishing accurate values in relation to improvements is complex, especially for intangible benefits.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 This study explored two main things: the transport barriers associated with a range of impairments; and economic, social and commercial costs and benefits resulting from overcoming them. Overall it showed that the availability of evidence relating to specific impairment types is variable, with the barriers and solutions relating to some impairments such as mobility being well understood, while those relating to others (for example, cognitive impairment) are not. In general, there is a dearth of evidence relating to the economic, social and commercial costs and benefits and this has wide ranging consequences for individuals with impairment, and for improvements to the transport system. It also creates an issue with regard to the inclusion of benefits in the appraisal of projects to increase the accessibility of the transport system.

Impairment-specific barriers to travel

6.2 The review identified disparities in how well we understand the barriers for different impairment types, which has a direct impact on understanding how the barriers can best be overcome. For example, the barriers for mobility and sensory impaired individuals are more clearly understood than those affecting people with a mental health, cognitive or behavioural impairment. This may be because overcoming the barriers experienced by individuals with a mobility or sensory impairment tend to require more tangible measures – for example the design of stops and stations or the provision of accessible information for sight impaired individuals. Conversely many of the measures related to overcoming barriers encountered by individuals with mental health, cognitive and behavioural impairment are less tangible. They often relate to enabling the individuals to confidently make journeys - for example, through provision of clear, concise and reliable information, or by training frontline staff to ensure they can effectively assist passengers, especially those with 'hidden' impairments.

6.3 Nevertheless while some barriers are specific to particular impairments, one factor that spans many of the impairment groups is feeling anxious about making a trip as a result of impairment. This is frequently linked to a lack, or perceived lack, of information and/or assistance provided before or during the trip. For example, a lack of information about vehicle accessibility could prevent a mobility impaired individual from making a trip, while a lack of clear timetable information might cause an individual with a cognitive impairment to experience a higher level of anxiety and be deterred from travelling in the future. Therefore access to information before and during the journey is a key factor in enabling any individual with impairment to make a trip. The format of this information will need to meet specific criteria depending on the impairment, but in general, clear reliable information is paramount.

6.4 Numerous potential means of overcoming the barriers are reported. However, there is little quantitative evidence in relation to the effectiveness of many of these, especially the softer ones such as travel training and staff disability awareness training. The available evidence often indicates positive benefits for individuals, but the approaches used to collect this evidence are often not described or the evidence is purely anecdotal. This often means that subsequent calculations of wider benefits tend to rely on broad assumptions.

6.5 There is very little information about latent demand related to individual impairment groups. Whilst we have some understanding of the barriers that are experienced, research into the extent to which more trips would be made if these barriers were overcome is lacking. Any

attempt to quantify latent demand without further research (for example to establish the extent to which transport is the main barrier, and the influence of other factors) is likely to be highly inaccurate. We simply don't know the proportion of people with each impairment who are not travelling as a result of the barriers, and we don't know about the impact of multiple impairments.

Costs and benefits of a more accessible transport system

6.6 The exploration of economic, social and commercial costs and benefits of accessible transport highlighted a distinct lack of evidence in this field. It appears that while it is generally accepted that a more accessible transport system will lead to social (and potentially economic) benefits, studies that investigate this in any depth are extraordinarily rare. However, this is mitigated to a degree by the fact that much of the work to make the transport system more accessible is justifiable on the basis of the high level evidence that does exist in relation to the role of mobility in quality for life (e.g. Musselwhite and Haddad (2010)), or is mandatory as a result of legislation.

6.7 Furthermore, evidence relating to the commercial costs and benefits is even more limited. In relation to cost, gathering together some generalised costs in a single reference point (eg. a guide) may be useful for initial scheme planning and appraisal and could demonstrate that achieving accessibility doesn't have to be expensive. More accurate site-specific information can be relatively easily obtained by an individual undertaking work in this area at the detailed design stage. Benefits are harder to quantify. There is some evidence that (in certain circumstances) there may be commercial benefits as a result of measures to improve accessibility, but evidence is limited and this area warrants further exploration to ascertain the extent of these and how they can be maximised. If research can demonstrate commercial benefits, operators may be encouraged to invest more in accessibility measures.

6.8 Overall there is a lack of evidence regarding the actual and relative benefits of measures to improve accessibility. Therefore further research to investigate what these benefits are and how they could most accurately be measured is needed. The complexity of this should not be underestimated though. The heterogeneous nature of transport users combined with a wide range of potential measures delivered across a variety of contexts means that developing a proper understanding of the costs and benefits will be difficult. Nevertheless, improving understanding will increase society's ability to include the benefits of accessible transport measures in the appraisal process alongside the costs.

Identifying unmet demand

6.9 One of the areas that this study endeavoured to investigate was whether enough evidence exists to quantify the changes in demand that would result from a more accessible transport system. In order to answer this, a range of data sources were explored. Surveys of the barriers that individuals experience in relation to transport indicate that there is some unmet ("latent") demand for transport amongst people with impairment. Individuals often state that they are prevented from accessing shops, services, jobs and social activities as a result of an inaccessible transport system.

6.10 However it is likely that for some people transport is not the only (or even the main) barrier. For example, in terms of employment, the availability of suitable jobs can also be an issue. While surveys such as the LOS help us to understand the barriers experienced by individuals with a range of impairments, they do not tell us the extent to which these barriers are

suppressing travel demand. Further, the absence of any ranking means that it is impossible to draw conclusions about the barriers that are more or less important and where people have multiple impairments, which impairments are most closely related to the cited barriers. We also know that there are similarities between the barriers cited by people with impairment and those without, indicating that impairment may not always be the limiting factor leading to latent demand.

6.11 A better understanding of latent demand, and of the best measures to help individuals overcome barriers and release that demand could be explored via additional research. Such research would need to be of sufficient depth to go beyond what is already out there. Ideally it would explore scenarios (in terms of sets of measures, and resultant changes in behaviour) to engender an in-depth understanding of what could be done, and the resultant impact this would have on travel behaviour.

Recommendations

6.12 The preceding paragraphs have provided some discussion of the gaps in the knowledge base that have been identified through this research. Clearly, the three areas are all interlinked, and all three require work in order that we can properly understand what works, for who, in what circumstances. Essentially it is necessary to develop the nascent knowledge base into something that provides a proper degree of understanding of the benefits of overcoming barriers to travel for people with a range of impairments (and as far as possible identifies if the benefits can be quantified). This needs to be complemented by substantive evaluation of measures, especially softer ones, so that any solutions that are delivered stand the best chance of being effective. Additional research will also help overcome barriers associated with the appraisal process by deepening understanding of what the benefits are, and how they could be monetised.

6.13 Based on the main evidence gaps identified in the review, we would recommend that DfT considers undertaking research in three key areas in order to:

- improve policy decision-making on accessibility issues; and
- improve appraisal of schemes and initiatives that include accessibility measures.

6.14 These are:

- Research to further explore the impact of barriers to travel for individuals with cognitive, behavioural and mental health impairment, and potential solutions to overcome those barriers. This research should address the issue of how important barriers connected with the transport system are in restricting travel activity relative to other societal barriers. It should take account of the range of conditions that are connected to such impairments and draw conclusions on whether better 'widely-applicable' solutions can be found that are cost-effective.
- Research to quantify the economic, social and commercial benefits of making collective passenger transport more accessible through infrastructure, vehicle, information and 'softer' measures. This would be a significant research effort and could involve a range of techniques including stated preference surveys, gaming and/or ex-post evaluation of schemes. If this could be done in a way that leads to robust results, it would help both public and private sector investors make better decisions in relation to accessible transport.

- Creation of a resource (printed or electronic) that can be used by designers, planners and transport professionals to identify measures to improve accessibility for a range of impairment types. This resource should contain 'what, why, where and how' information for a range of measures. It should also bring together information on approximate costs (capital and revenue) for a whole range of better accessibility features within transport schemes and initiatives. This would be valuable for initial appraisals and would also help commercial operators reach a better understanding of the scale of investment involved.

6.15 Finally, we would recommend that the follow-on 'framework scoping study' associated with our rapid evidence review focuses on developing the scope of these three pieces of research. This would involve working with members of the DfT Inclusive Mobility Group to develop three draft research specifications that could be considered for future funding by DfT. This would include estimating potential budgets and timeframes for each piece of work as well as aims, objectives, scope and required outputs from each research project.

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