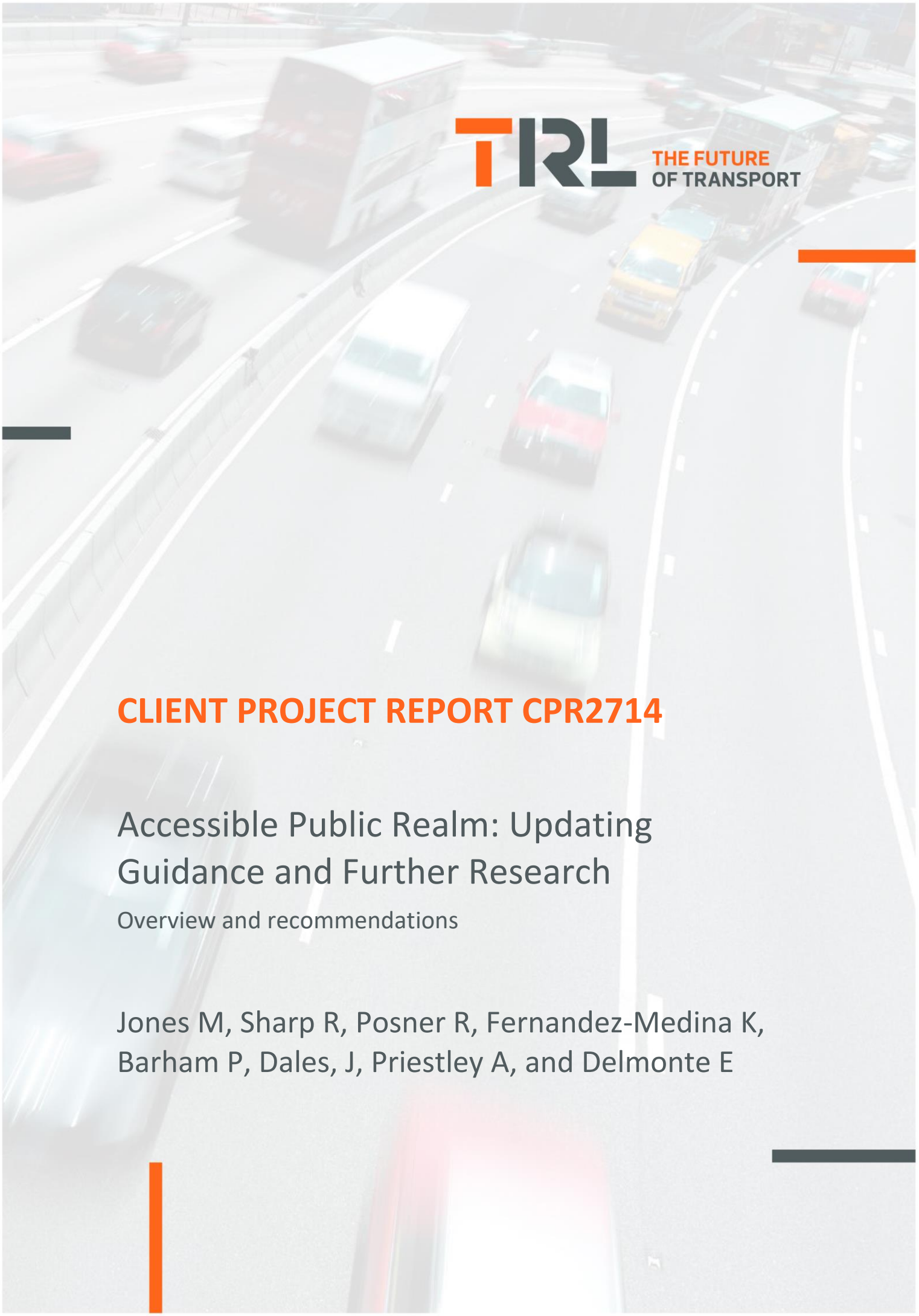

THE FUTURE OF TRANSPORT

CLIENT PROJECT REPORT CPR2714

Accessible Public Realm: Updating Guidance and Further Research

Overview and recommendations

Jones M, Sharp R, Posner R, Fernandez-Medina K, Barham P, Dales, J, Priestley A, and Delmonte E

Report details

Report prepared for:	Department for Transport		
Copyright:	© TRL Limited		
Report date:	January 2020		
Report status/version:	V6		
Quality approval:			
Anastasia Kounatidou (Project Manager)		Shaun Helman (Technical Reviewer)	

Disclaimer

Table of Contents

The following Technical Annexes are available as separate documents:

Technical Annex 1: Tactile paving (RQ1 & RQ4)

Technical Annex 2: A review of the dimensions of wheeled mobility aids (RQ2)

Technical Annex 3: Ageing, dementia, and non-visible disabilities (RQ6)

Technical Annex 4: Inclusion of mental health (RQ3)

Technical Annex 5: Review of potential new topics for inclusion in guidance (RQ5)

1 Executive summary

This report presents findings from research carried out by TRL, Urban Movement and Phil Barham Freelance Consulting to inform proposed updates to the Government guidance documents *Inclusive Mobility* (published in 2002); and *Guidance on the Use of Tactile Paving Surfaces* (published in 1998). The research considered themes identified in a scoping study carried out previously:

- Understanding the real-world implementation of tactile paving and how users interpret it
- Reviewing guidance on the dimensions of mobility devices
- Identifying new technologies and infrastructure not currently considered within *Inclusive Mobility*
- Investigating mental health, ageing, dementia, and non-visible disabilities, with a view to developing guidance for them

Research into tactile surfaces was conducted with users, stakeholders, and practitioners. There was support for simplification from both users and practitioners. While 76% of users correctly understood the meaning of blister paving, 49% correctly understood corduroy, and only 15% correctly understood at least one other surface type. Likewise, practitioners had good awareness of blister and corduroy, but the other surface types were less well-known. During site visits, participants generally found that the difference between the blister surface and all other surfaces was easily distinguishable but reported much greater difficulties with distinguishing between the linear surfaces (e.g. corduroy and ladder/tramline). Based on what has been found to be effective in current practice, a simplified approach to guidance is recommended: the (little-used) 'information' surface should be dropped and consideration should be given to further reducing the number of surface types. A key principle is that the need for tactile paving should be considered from the very start of schemes, following an integrated inclusive design process that reflects the public sector's obligations under the Equality Act. A well-designed scheme will minimise the requirement for tactile paving in the first place.

The study investigated whether there have been changes in the dimensions of wheeled mobility devices since *Inclusive Mobility* was published. A review of published and industry data, supported by a survey conducted at two public events and stakeholder consultations, found good evidence that there is greater availability of longer devices. This is at least in part due to the greater availability of electric mobility scooters, some of which are primarily intended for outdoor and on road use. In the absence of data on the frequency of use of each type of mobility device, it is not possible to conclude that there is an increase in the number of users who might be disadvantaged by size constraints. The evidence currently available suggests that the minimum length specified in *Inclusive Mobility* is still suitable for manual and electric wheelchairs and Class 2 mobility scooters.

The research on ageing, dementia, and non-visible disabilities identified various related functional limitations that affect ability to navigate the pedestrian environment. Particular difficulties include obstacles, uneven surfaces, crossing the road, navigating slopes and

ramps; and lack of confidence to travel. Several recommendations for improving inclusivity emerged from this study, some of which directly relate to updating existing guidance on the public realm. Pedestrian environments should be simpler, with distinct features and provision of clear information that aide navigation and confidence to travel. Other key recommendations included stricter implementation of guidance, greater collaboration between organisations, and improved training and education (focusing on the wider health agenda and encouraging empathy) for road users, organisations involved in travel and transport, and frontline staff members.

A literature review and survey of people with mental health conditions identified many aspects that adversely affected them and present barriers to their ability to navigate the built environment and travel. An important conclusion is that people with mental health conditions suffer disproportionately from the types of barriers and inconveniences that all transport and road users experience, so are more likely to be deterred by certain situations than others, potentially leading to total avoidance of certain modes of transport. Interventions or solutions were proposed for each travel mode that could help to overcome the identified barriers. Solutions covered vehicle design, highway infrastructure, information provision, journey preparation tools, enforcement and awareness of driving rules, improved reliability of services, and improved public awareness of mental health conditions and the barriers they pose. Some interventions were specific to the needs of people with mental health conditions, but the majority were aimed at general improvements to the provision of transport services and the quality and safety of pedestrian environments.

A literature review and stakeholder workshops were undertaken to consider whether the scope of the guidance in *Inclusive Mobility* should be broadened to cover new technologies and more recent developments in highway infrastructure. Additional guidance is recommended on:

- Bus stop bypasses – reflecting concerns about their impacts on people with impaired mobility, but acknowledging the benefits to cyclists
- Discouraging the mixing of cycle and pedestrian traffic on the same pathway
- Making cycling facilities accessible to disabled cyclists and the use of cycles as a mobility aid

Design guidance in other documents that focused on cycling infrastructure may also need to be updated to ensure consistency between sources. There are several current initiatives by DfT, Transport Scotland, and other government bodies that have a bearing on the design of the built environment, and more specifically cycling infrastructure, shared-space, side-road crossings, and new personal mobility devices; these will all need to be considered in any future updates. Guidance on new technologies should be included, but it should set out general design principles and avoid duplicating existing technology-specific standards.

Across all research questions covered in the study, several important cross-cutting conclusions were identified: all user groups could benefit from a simplified, comfortable, legible street environment and from user-friendly public transport supported by good easily-accessible information.

2 Introduction

2.1 Background to the project

DfT's draft Accessibility Action Plan contained a commitment to commission research to review two sets of Departmental guidance, with the aim of understanding how they need to be updated, these were:

- *Inclusive Mobility: A guide to best practice on access to pedestrian and transport infrastructure* (published in 2002); and
- *Guidance on the use of tactile paving surfaces* (published in 1998).

In 2018 DfT commissioned TRL to conduct a scoping study, involving a literature review and stakeholder consultation, which concluded that these documents need updating and identified several areas to be considered. The results of the Scoping Study were published as *Updating Guidance on the Accessible Public Realm* (Greenshields, Wells, Barham & Dales, 2018). The report identified six specific areas where further research is needed before the task of updating the written guidance can be undertaken. These were:

- Understanding why the real-world provision of tactile paving often does not follow the guidance
- Updating advice relating to the range and dimensions of mobility devices in current use
- Investigating the potential inclusion of mental health in the guidance
- Reviewing the number of tactile paving surfaces described in the guidance and investigating how these are understood, detected and differentiated by users
- Consideration of including new topics within *Inclusive Mobility*, to cover modern facilities and innovations
- Investigating ageing, dementia, and non-visible disabilities, with a view to developing guidance for them

TRL was commissioned to carry out this further research and engaged Urban Movement and Phil Barham Freelance Consulting as sub-contractors for some of the research. This report sets out the conclusions from the research and makes recommendations for taking forward the proposed updating of the guidance.

2.2 Overview of method

The six areas requiring further research were developed into formal Research Questions to which the method was designed to answer. Each Research Question (RQ) was led as a separate workstream, but with common research methods used; including a literature review for each RQ. The research methods used are summarised in Table 1.

Table 1: Research methods used

Research Question (RQ)	Methods used (each RQ involved a literature review)
RQ1- Why does the implementation of tactile paving often differ from guidance?	• Stakeholder consultation • Focus group • User survey • Site visits
RQ2- Mobility device categories and dimensions	• Stakeholder consultation
RQ3- Inclusion of mental health	• User survey
RQ4- How do users understand and differentiate between the different types of tactile surface?	• Stakeholder consultation • User surveys • Focus group • Site visits with walk/wheel-around
RQ5- New topics for guidance	• Steering group consultation • Stakeholder consultation
RQ6- Ageing, dementia, and non-visible disabilities	• Stakeholder consultation

2.3 Role of Steering Group

The project was overseen by a Steering Group which included membership from DfT, Transport Scotland and the Mobility Access Committee for Scotland. The Steering Group was consulted on key elements of the methods used, such as the design of surveys, and reviewed the reports.

2.4 Structure of this report

This report presents the key findings and recommendations from each of the workstreams. Results are presented as sections of the report in the following order, with some RQs combined:

- Review of guidance on tactile paving (RQ1 and RQ4)
- Review of the dimensions of wheeled mobility aids (RQ2)
- Ageing, dementia, and non-visible disabilities (RQ6)
- Inclusion of mental health in guidance (RQ3)
- Review of potential new topics for inclusion in guidance (RQ5)

The detailed research methods and findings for each RQ are provided as a series of Technical Annexes to this report, one for each of the above-named sections.

3 Review of guidance on tactile paving (RQ1 and RQ4)

3.1 Research questions

Two of the research questions considered in the research concerned the use of tactile paving and are reported together:

- RQ1: Why does the implementation of tactile paving often differ from guidance?
- RQ4: How do users understand and differentiate between the different types of tactile surface?

The RQs follow conclusions from the Scoping Study (Greenshields et al., 2018) that there were often discrepancies between the guidance set out in *Guidance on the Use of Tactile Paving Surfaces* and the tactile paving that could be seen within the built environment. That study recommended that the number of tactile paving surface types described within *Guidance on the Use of Tactile Paving Surfaces* should be reviewed following research into how these are understood, detected, and differentiated by users in the real world. Understanding the reasons for non-compliance with the current guidance and how users interpret the surface types will ensure that better guidance can be produced.

3.2 Methods

RQ1 investigated the differences between guidance and implementation with practitioners. The work involved the following:

- Research staff undertook site visits to four local authority areas known to have examples of non-compliance
- Interviews were conducted with officers from the non-compliant areas
- An online survey of practitioners was undertaken using a questionnaire designed to explore the findings from the preceding tasks in more depth (27 responses from 20 local authorities)

RQ4 involved the following stages:

- A review of literature and guidance from the UK and elsewhere
- Conducting two focus groups (one in England and one in Scotland), with people who were either visually impaired or had impaired mobility, as well as officers from representative bodies
- An online survey of users to explore the findings from the focus groups with a wider audience (n = 256)
- Site visits to five local authority areas involving walk/wheel-throughs with groups of people with visual and other forms of mobility impairments

The detailed methodology, questionnaire design and analysis of responses is provided in Technical Annex 1 (a separate document).

3.3 Findings

Examples of the types of tactile paving currently specified are shown in Figure 1. No example of the 'information' paving was found.

Figure 1: Examples of tactile types observed during site visits

The user (RQ4) and practitioner (RQ1) feedback from the different research methods used was brought together and compared.

Headline findings from users are as follows:

- Of the 172 questionnaire participants who identified as blind or partially sighted (67% of total):
  - 76% correctly understood the meaning of the blister surface
  - 49% correctly understood the meaning of the corduroy surface
  - 15% correctly understood the meaning of at least one other type of surface
- During site visits, participants reported that the difference between the blister surface and all other surfaces was generally easily-distinguishable. However, participants generally reported much greater difficulties in distinguishing between the linear surfaces (e.g. corduroy and ladder/tramline)

- Cognitive overload: is there a need for so much and so many types of tactile paving? Keep it simple' and 'less is more'
- Tonal contrast is particularly useful for visually impaired users
- Consistency is key

Key findings from the practitioners were:

- Guidance should follow the ‘simple-logical-consistent’ principle
- Confusing layouts can arise from attempts to apply (perceived) complex guidance to complex streets
- Practitioners awareness is good for blister and corduroy, declines for ladder/tramline- others are not well known
- Concerns that corduroy and ladder/tramline are often confused
- Concerns about cyclists slipping on ladder/tramline
- Contractors often made mistakes and are not properly supervised on site
- Simplified guidance, with updated technical drawings, would be welcomed

A detailed comparison of user and practitioner comments on each surface type is given in Appendix A.

3.4 Recommendations

The research undertaken for RQ1 and RQ4 supports several specific recommendations in relation to updating the guidance. In addition, several other propositions can be made which will require further consultation, and possibly focused research and trials, before determining whether they should be incorporated within updated guidance. During this process, other initiatives should be considered, including those that are being undertaken by the DfT, Transport Scotland and other government bodies and which have a bearing on the design of the built environment (particularly in relation to cycling infrastructure and shared space). Recommendations are further detailed below.

3.4.1 Recommendations for updating the guidance

Recommendations for updating the design guidance are grouped into recommendations concerning the structure of the revised guidance, and recommendations giving specific design advice.

Recommendations on the structure and content of the guidance:

- The revised guidance should follow the ‘Simple-Logical-Consistent’ (SLC) principle (as established in ‘Key design principles’ in the introduction to the existing guidance)
- The overall structure should follow Introduction > Factsheets > Technical Drawings (one Factsheet of between two and four pages per surface is proposed)

- The 'Technical Drawings' section should provide examples of 'tricky situations'[1], as well as guidance on how to avoid such situations by considering the needs of blind and partially sighted (and other) users much earlier in the design process

Specific design recommendations:

- The guidance should recommend (and describe) a design process that considers the needs of blind and partially sighted people from the outset of a scheme, within an integrated and genuinely inclusive design process, reflecting the public sector obligations under the Equalities Act
- Guidance should stress the importance of avoiding the need for tactile paving in the first place and describe how this can be achieved through more thoughtful design of the public realm from the start of the design process
- Guidance should recommend that the overall design of schemes should avoid cognitive overload and describe (with examples) how this can be achieved
- Guidance should emphasise the road safety function of tactile paving provision, in addition to its roles in aiding navigation and providing information
- The platform edge (off street) surface should be used only within railway/ underground stations and should therefore be described in a separate section from the other surfaces, which are for deployment on the public highway
- Information surfaces can be deleted from the guidance
- The primacy of tonal contrast over colour contrast should be emphasised (and shown in the examples).

3.4.2 Propositions for further research and consultation

- Blister – this should only be used in accordance with the stated core purpose to warn of a crossing point where there is no detectable kerb, and not for stems leading to the crossing points (for which the guidance path surface may be preferable (see below))
- Hazard/corduroy – should be used as currently and as a replacement for ladder/tramline (see below)
- Platform edge (on-street)/lozenge – should be used for all tram/RT platforms (including, for consistency, those which may be off-street) and on raised bus stop platforms

[1] Common 'tricky situations' are encountered at the physically constrained junction corners where the tactile arrangements for perpendicular crossings clash/overlap and at the interface of the footway with segregated cycle tracks, especially where the cycle track arrangements are themselves complex (e.g. swap from one side of the road to the other at a crossing).

- Ladder/tramline – should no longer be used due to widespread user and practitioner confusion, and to safety concerns of cyclists; and should be replaced by hazard/corduroy laid in 'ladder' orientation across the whole path. (Safety concerns regarding cycling may be largely anecdotal but justify further exploration). The delineator strip can continue to be used
- Guidance – should continue to be used as currently specified, as well as for stems leading to the blister surface at controlled crossings
- How best to assess tonal contrast, for different materials in the wet and dry, may require further discussion/research

Several additional issues relating to tactile paving arrangements were raised by various participants during the conduct of the RQ1 and RQ4 research, and the following may be considered worthy of further deliberation:

- Separate provision for wheelchair users and visually impaired people within crossings to reduce the discomfort experienced by wheelchair users without compromising the safety of visually impaired people
- Dropped kerbs, without tactile paving, to enable people on cycles to transition between the carriageway and shared areas (analogous to conventional vehicular footway crossovers, e.g. for access to private driveways, where tactile paving is not usually deployed)
- Using different means to determine the direction in which users should find the crossing location (e.g. tactile arrows on top of push-button boxes)
- How near-future technological developments could provide certain types of information for visually impaired users to help remove reliance on tactile paving

More information about these recommendations and propositions, including potential revisions to the structure of the guidance, is provided in Appendix B.

The proposed changes would represent an evolution and simplification of current practices rather than requiring current infrastructure to be replaced. Even for the more far-reaching propositions, the intention is that people who are accustomed to current arrangements would not be confused when encountering surfaces laid out as proposed, as the primary meanings are largely maintained, and safety critical meanings are unchanged.

It is recognised that the rail industry uses its own standards and will continue to use blister paving at platform edges in stations for consistency with current practice in the UK and elsewhere.

4 Review of the dimensions of wheeled mobility aids (RQ2)

4.1 Research question

RQ2 addressed whether the human factors information on the space requirements of different types of wheeled mobility aid user published in *Inclusive Mobility* needs to be updated. In particular:

- Are the current categories of wheeled mobility aid still relevant?
- Have there been changes in the key dimensions of wheeled mobility aids currently in use? Specifically:
    - Height, length, and width when both occupied and unoccupied
    - Eye height of wheeled mobility device users when seated, and 'lap' height
- Are changes required to the minimum dimensions recommended in *Inclusive Mobility*, to ensure that facilities remain accessible?

The current dimensions in *Inclusive Mobility* are based on a large survey of users undertaken by TRL (Stait, Stone & Savill, 2000). This project sought to revisit those figures using a similar method, albeit on a much smaller scale.

4.2 Methods

Evidence was gathered by:

1. Reviewing published and industry data on the dimensions of wheeled mobility aids currently on the market in the UK
2. Taking measurements of a sample of volunteers in the wheeled mobility device they were using at each of two selected mobility-related public events

On the advice of representatives of the wheeled mobility device industry, information on the dimensions of current devices on the UK market was obtained from two key online databases, administered by the British Healthcare Trades Association (BHTA) and the Research Institute for Disabled Consumers (RiDC). In addition, a review of standards and research reports was undertaken to assess whether an alternative set of categories for wheeled mobility aids might be used, to replace those currently used in *Inclusive Mobility*.

The two events at which measurements were made of occupied wheeled mobility devices both took place at the NEC, Birmingham. They were Naidex (March 26-27, 2019) and The Big Event (June 28-29, 2019). Measurements were made using a combination of photogrammetry, using a digital camera mounted on a tripod, and some manual measurements using a tape measure.

The findings from these sources were reviewed with the Steering Group and consultation with several stakeholders. Consultees included the BHTA, MHRA, NAEP, NHS Supply, NHS England, RiDC (formerly RICA), the Rail Delivery Group and the Anthropometry of Wheeled Mobility Project at Buffalo University.

4.3 Findings

Since the previous TRL survey was undertaken in 1999 (Stait et al., 2000) there have been several changes to the mobility products available in the market. Specifically, there has been significant increase in the availability of electric 'mobility scooters', many of which are designed for use on roads and are somewhat larger than manual wheelchairs. This was demonstrated by comparing the information collected in the current project with the previous 1991 and 1999 surveys conducted by Stait et al. (2000) - see Table 2.

Full details of the method, sources, and findings for this RQ are set out in Technical Annex 2 to this report (a separate document).

Table 2: Comparison of dimensions appearing in *Inclusive Mobility* with data from TRL 2019 surveys and current industry data sources

Measurement	***Inclusive Mobility***	**Current market data** Class 2 (n=53)	**Current market data** Class 3 (n=33)	**TRL survey 1991** (n=382)	**TRL survey 1999** (n=745)	**2019 survey** Naidex (n=84)	**2019 survey** The Big Event (n=90)
Length mm (unoccupied)	1200-1250	1265	1606			1193	1278
Length mm (occupied)	1500[2]			1243	1273	1300	1300
Width mm (unoccupied)	700[3]	680	718	664	695	617	700
Width mm (occupied)	800-900[4]					700	755
Overall height mm (95th percentile)	1374			1377	1374	1392.5	1295.5
Eye height mm (5th percentile)	960					1020	934.5
Eye height mm (95th percentile)	1250					1222.5	1185.5
Knee height mm (5th percentile)	500					600	550

[2] The dimension of 1500mm in *Inclusive Mobility* reflects the 'worst-case scenario' of a wheelchair user having at least one leg extended straight in front of them.

[3] This is an approximate dimension published in *Inclusive Mobility*; the publication quotes its precise source as being the 706mm 95th percentile measurement for "electric wheelchairs", and the 702mm 95th percentile measurement for manual wheelchairs (both taken from Stait et al., 2000).

[4] Again, this is an estimate, rather than being based on empirical measurement. It uses the rounded-down figure of 700mm for the width of an unoccupied wheelchair and adopts the recommendation of the ISO Standard for wheelchairs (ISO 7193) that there should be an additional allowance of at least 50mm, preferably 100mm, should be allowed on each side of the wheelchair for the user's hands and elbows.

Measurement	*Inclusive Mobility*	Current market data Class 2 (n=53)	Current market data Class 3 (n=33)	TRL survey 1991 (n=382)	TRL survey 1999 (n=745)	2019 survey Naidex (n=84)	2019 survey The Big Event (n=90)
Knee height mm (95th percentile)	690					720	700

While the sample size obtained from the fieldwork undertaken in the current project was much smaller than in the previous surveys, the evidence that there have been some changes in size are reflected in the literature and industry data reviewed. Nevertheless, caution is needed when drawing conclusions as the sampling in the current study cannot guarantee to be representative of the population of users. Table 3 summarises a comparison by D'Souza, Steinfeld and Paquet (2009); highlighting the importance of electric mobility scooters.

Table 3: Data on the key dimensions of wheeled mobility devices (Source: D'Souza et al., 2009)

Measurement (all figures relate to the 95th percentile, and are in mm)	Manual wheelchairs (n=195)	Powered wheelchairs (n=146)	Electric mobility scooters (n=28)
Unoccupied length	1247	1313	1435
Unoccupied width	740	760	745
Occupied length	1342	1399	1435
Occupied width	780	822	840
Occupied height	1378	1393	1483

The key findings from empirical measurements and the database were that, considering the 95th percentile of mobility devices currently on the market in the UK:

- There has been an increase in the length
- The width has decreased slightly
- The lap height of occupants has increased slightly
- Evidence for changes in seated height (and hence eye height) is inconclusive

However, it is important to bear in mind that these conclusions are based on a combination of surveys at events and industry data. No evidence was found on the prevalence of the use of wheeled mobility aids of different sizes in the UK; it is therefore not possible to draw conclusions on the number of people who use specific categories of device, nor on the number of trips undertaken or the types of environment where they are used. Many of the larger models are intended for on-road and predominantly outdoor use. RiDC observed that

users of wheeled mobility devices tend to own more than one and use those devices for different purposes. This means that information on numbers of each type of device sold would not provide a good indicator of the extent to which their users may be disadvantaged by any size constraints. The lack of availability of such data was confirmed by the responses of stakeholders that were consulted following the initial data gathering stage of the research.

4.4 Recommendations for future guidance

Reflecting the apparent increase in availability of larger mobility scooters, and after discussions with the Steering Group, it is recommended that the guidance needs to consider the following categorisation of wheeled mobility aid:

- Attendant-propelled wheelchair
- Active wheelchair
- Electric wheelchair
- Class 2 mobility scooter
- Class 3 mobility scooter

Class 2 and class 3 (which can include wheelchairs as well as scooters) are defined formally in regulation which specifies where they are permitted to be used[5].

The current research found that the mobility industry uses terms such as “sports”, “boot scooter”, “beach” and “off road” to target specific markets. Examples of such types of mobility aid featured in the sample of measurements taken at the two events during the project. However, it was decided that, given the small sample sizes and lack of precise definitions, these would not be used as separate categories in the analysis. There is also evidence, from manufacturers’ and dealers’ product ranges, of a growing tendency for models of device to have a “bariatric” version available (a medical term used for the study and treatment of obesity).

Current industry data show the availability of some larger models of wheeled mobility device, but no information is available on the extent to which these larger devices are used for public transport journeys in the UK. Given the lack of evidence on the prevalence of different categories of mobility devices in the UK, it was concluded that the evidence for increased availability of some larger devices on the market is not currently sufficient to justify recommending changes to the minimum dimensions of public transport infrastructure and pedestrian facilities. Existing evidence suggests that the minimum length specified in *Inclusive Mobility* is still sufficient for the first four classes of device listed above.

Updated guidance might be provided for the design of ticket counters and information desks, in the light of evidence for changes in wheeled mobility aid users’ knee height range. *Inclusive Mobility* currently quotes a range of 500mm to 690mm, which was based on available 5th percentile and 95th percentile figures provided by the research carried out by

[5] https://www.gov.uk/mobility-scooters-and-powered-wheelchairs-rules

TRL in 1999 (Stait et al., 2000). Using the same percentiles to define this range, the evidence gathered from surveys held at Naidex and The Big Event, in 2019, was that the range of knee heights was 600mm to 720mm and 550mm to 700mm, respectively. It is recommended, therefore, that for all design features for which knee height is an important parameter, a range of 550mm to 720mm is considered.

No compelling evidence was found to justify recommending further changes to *Inclusive Mobility* in relation to any of the following:

- Width of wheeled mobility aids (slight decrease since 2002)
- The manoeuvring space required for users of wheeled mobility devices
- Overall height or eye height of device users
- Overall mass of devices

Further research is needed to obtain robust evidence on the prevalence and use of different classes (particularly sizes) of wheeled mobility device. This would be a significant project as it would involve a large-scale survey with appropriate sampling to ensure representation of the population, and that would need to investigate the types of journeys users make as well as details of the mobility devices in use and their occupied and unoccupied dimensions.

5 Ageing, dementia, and non-visible disabilities (RQ6)

5.1 Research question

Considering ageing, dementia, and non-visible disabilities when designing inclusive pedestrian environments is important. The population is ageing and although ageing within the context of road safety has been widely researched, previous research has tended to focus on the older driver instead of the older pedestrian. Previous research on those with dementia or non-visible disabilities (i.e. disabilities that are not immediately obvious to others) as pedestrians is also limited.

The aims of RQ6 were to gain insight into the functional limitations associated with ageing, dementia, and non-visible disabilities, and to explore how these could be better catered-for within *Inclusive Mobility* and *Guidance on the Use of Tactile Paving Surfaces*. This study aimed to address four main research questions:

1. How can ageing, dementia, and non-visible disabilities be defined and what are their key associated functional limitations?
2. How do these functional limitations relate to the existing guidance and what parts of the guidance are most open to modification?
3. Are there any evidence-based practices or recommendations for the management of these functional limitations within pedestrian environments?
4. Would inclusion of ageing, dementia, and non-visible disabilities within the existing guidance be feasible and/or the most effective strategy for increasing inclusivity within the pedestrian environment?

5.2 Methods

To address the research questions, TRL conducted a set of three literature reviews on ageing, dementia, and non-visible disabilities, before holding a workshop and individual telephone consultations with nine stakeholders (including members of the DfT steering group) who had a range of expertise on relevant topics.

During the stakeholder engagement activities, two facilitators presented details of guidance included in *Inclusive Mobility* and *Guidance on the Use of Tactile Paving Surfaces* surrounding ageing, dementia, and non-visible disabilities, as well as findings from the literature reviews. The facilitators then encouraged the stakeholders to discuss and critique the literature review findings, before discussing how these findings could be applied to include ageing, dementia, and non-visible disabilities within the existing guidance documents.

Full details of the method, sources, and findings for this RQ are set out in Technical Annex 3 to this report (a separate document).

5.3 Findings

5.3.1 Ageing

Findings from the literature review on ageing and stakeholder engagement revealed that the key issues for older people in the pedestrian environment include:

- Obstacles (e.g. street furniture and uneven surfaces)
- Crossing the road (including identifying large enough gaps in traffic)
- Tactile paving (particularly when the pavement is sloped)
- Navigating slopes and ramps

These issues can increase the risk of injury caused by falls and trips and reduce feelings of safety amongst older people.

Recommendations from the literature and stakeholders regarding the design of the pedestrian environment to encourage active travel by older people included:

- Increased colour contrast
- The addition of safer and simpler walkways and pedestrian crossings
- Creating more rest points and accessible toilets
- Training for older people on how to navigate the pedestrian environment (ideally before their functional limitations become too severe) to increase their confidence to travel

5.3.2 Dementia

Existing literature on dementia and active travel was limited, but revealed that those with dementia can experience difficulties with:

- Crossing the road
- Walking on novel surfaces (but not specifically tactile paving)

Key recommendations from the review and stakeholders to encourage active travel amongst those with dementia were as follows:

- The personalisation of spaces and maintenance of instinctive understanding of the pedestrian environment can support the autonomy of those with Alzheimer's disease
- Avoidance of 'shared space' schemes and 'cross-use' of spaces, as these can be disorientating and confusing for those with dementia. Instead, simple environments with distinct spaces, clear lines of sight, and clear signage to support easy navigation and feelings of familiarity were recommended
- Increasing confidence to travel through providing training to those with dementia on how to navigate the pedestrian environment, ideally before their functional limitations become too severe

5.3.3 Non-visible disabilities

Non-visible disabilities encompass a diverse range of conditions. There are no established categories of non-visible disabilities, although the nature of non-visible disabilities can be classified as:

- Neurological (e.g. chronic pain or dizziness)
- Mental (e.g. mental illness or learning disabilities)
- Physical (e.g. musculoskeletal conditions, respiratory diseases, or cardiovascular disease)

Existing literature related to non-visible disabilities and active travel was limited, but key findings were as follows:

- Lack of confidence to travel is a major issue for those with non-visible disabilities and can be exacerbated by negative attitudes of frontline staff members, lack of easily-accessible information, and unfamiliar travel routes or environments
- Existing schemes (e.g. the 'Safe Places' scheme and travel training and buddying schemes) increase confidence to travel for those with non-visible disabilities

Stakeholders were opposed to 'shared space' schemes and 'cross-use' of spaces, and recommended distinct, regulated spaces in the pedestrian environment to support navigation and feelings of familiarity.

5.3.4 Discussion of findings

Despite the lack of previous literature on the link between active travel and the three conditions of interest (ageing, dementia, and non-visible disabilities), establishing ways to cater for these conditions within guidance on the accessible public realm is important. Maintaining mobility and participating in active travel support the health and well-being of

everyone, and are especially important for older people, those with dementia, and those with non-visible disabilities, particularly as the population is ageing and the prevalence of dementia and non-visible disabilities continues to rise. Design of the pedestrian environment is key to achieving inclusive mobility and encouraging active travel amongst as many segments of society as possible. In addition, where pedestrian environments are not easily navigable for older people or those living with dementia and other non-visible disabilities, individuals may find it difficult to access other services or facilities that are important to their mobility and independence, such as bus stops or railway stations (DfT, 2018). While designing for inclusive mobility is challenging, particularly given the heterogeneity of onset and severity of symptoms and functional limitations, identifying common risks can help support improved design.

Stakeholders identified common functional limitations across ageing, dementia, and non-visible disabilities, which include reduced sensitivity in feet, difficulties navigating unfamiliar routes, and impaired balance, mobility, memory, reasoning, and judgement. Generally, stakeholders thought guidance documents are not updated often enough and not used effectively by those who design the pedestrian environment. Although stakeholders felt that updating guidance would be beneficial, it cannot improve inclusivity alone.

In terms of other general recommendations for improving inclusivity, stakeholders felt that the environment should be as safe and accessible as possible for everyone to use, instead of making specific adjustments for certain demographics. Further key stakeholder recommendations included the formation of comprehensive, consistent guidance that is easily-adaptable to specific situations and environments, improved collaboration between organisations when creating and implementing guidance, and increased enforcement to ensure guidance is followed appropriately. Stakeholders also emphasised the importance of including older people, those with dementia, and those with non-visible disabilities in the formation of guidance.

Furthermore, stakeholders offered specific recommendations relating to the design of the pedestrian environment, such as wide walkways that are better-maintained, less cluttered, and provide enough room for pedestrians to walk around tactile paving if required. Additionally, stakeholders highlighted the importance of providing information in various ways and formats, such as through an individual's carer, accessible and clear directional signage and bus timetables, and the provision of both audible and visual information.

Education and cultural change as ways of improving inclusivity were mentioned frequently by stakeholders, such as improving the general awareness of, and attitudes towards, ageing, dementia, and non-visible disabilities. Stakeholders also recommended training on inclusive design for those who design pedestrian environments and implement those designs, as well as improved training (or improved implementation of training) for frontline staff members in the pedestrian environment, which should focus on identifying pedestrians who may need help, responding to issues, and communicating effectively and respectably with everyone. Stakeholders believed that service providers should be responsible for training staff to recognise those who may need help rather than on the individual to draw attention to their condition (e.g. by wearing distinctive lanyards or badges, which some individuals were not comfortable with).

5.4 Recommendations for future guidance

The issues raised by the stakeholders and identified in the literature review have implications beyond the two specific guidance documents that are the focus of the current project. Recommendations for future guidance include:

- Updating the guidance more regularly to reflect the ever-increasing complexity of traffic and ever-changing demographics of the population
- Developing comprehensive, consistent guidance that can be adapted to specific situations and environments
- Recommendations around the design of the pedestrian environment to be included in the guidance (e.g. creating simpler and more consistent environments with distinct features to encourage feelings of familiarity for pedestrians and providing easily-understandable information)

Although updating the guidance would have clear benefits, this study has also identified various other ways in which inclusivity could be improved, including:

- Stricter implementation of guidance
- Greater collaboration between organisations
- Improved inclusivity training and education for all organisations and staff involved in transport and active travel, pedestrians, and other road users

Overall, attention should focus on the wider health agenda behind encouraging active travel and on encouraging a greater degree of empathy in society.

This study has also identified the following areas which require further research:

- Improving understanding of specific aspects of the pedestrian environment that discourage people from walking
- Exploring the extent of the issues faced by individuals when navigating the pedestrian environment
- Identifying key differences or similarities between specific requirements of each demographic when navigating the pedestrian environment
- Determining whether implementation of the existing *Inclusive Mobility* guidance encourages active travel by certain demographics

6 Inclusion of mental health in guidance (RQ3)

6.1 Research question

To date guidance has had a primary focus on physical mobility and visual impairment. However, evidence shows that mental health can affect our travel behaviour and that our transport systems can impact mental health while travelling. The wide range of mental health difficulties makes it difficult to understand the impact that it can have on an individuals' ability to navigate the built environment. Research in this RQ aimed to:

1. Categorise the types of mental health difficulties experienced in England and Scotland
2. Determine the prevalence rate of each of these mental health difficulties in England and Scotland
3. Identify the barriers and needs of each mental health difficulty in navigating the built environment and determine which can be addressed through infrastructure changes

Having identified the needs recommendations were developed as to how current guidance could be updated to explain how those needs can be met in practice.

6.2 Methods

The research was undertaken as three tasks; the first two involved literature reviews and the third was a survey of members of the public who have experience of living with a mental health condition. The task aims and methods are summarised in Table 4.

Table 4: Tasks and methods used in RQ3

	Task 1	Task 2	Task 3
Aim	Identify the current mental health difficulties experienced in England and Scotland	Identify which mental health difficulties are most prevalent and which do not have reliable statistics to determine prevalence Identify gaps in reporting where no statistics could be identified for specific mental health difficulties	Engage with members of the public who have experience of living with a mental health condition to understand their experiences and barriers faced when travelling Identify potential solutions to address these barriers
Methods	**Review of the literature** • Published literature • Government reports • NHS reports • National mental health charity reports and resources	**Review of the literature** • Most up-to-date NHS data for England and Scotland • NHS digital reports • Adult Psychiatric Morbidity Survey • Scottish Health Survey • National charity reports (e.g. Mental Health Foundation) • National representative bodies (e.g. Royal	**Public survey** • Mental health difficulties experienced • Demographics, including travel behaviour • Impact that mental health has on travelling • Impact of transport systems on travelling • Solutions to address these barriers

	Task 1	Task 2	Task 3
		Institute of Psychiatrists)	

The questions in the survey were informed by the findings of the literature review and considered travelling and navigating the built environment as a pedestrian, cyclist, bus, and rail user. All mental health conditions identified in the literature review were included in the survey. An online survey system was used, and the questionnaire was promoted through social media, TRL's participant database[6] and support was sought from stakeholder organisations. The survey stage of this RQ was reviewed by TRL's full ethics committee[7] and was granted ethical approval.

Full details of the methods and findings are provided in Technical Annex 4 (a separate document).

6.3 Findings

The findings from the literature review allowed identification of the wide range of mental health conditions currently experienced in England and Scotland. They also demonstrated several limitations, primarily that to this date the prevalence rates of numerous mental health conditions are still unknown. The absence of reliable statistics for so many mental health conditions is a barrier to understanding the ways in which mental health and the built environment interact, and consequently in designing a built environment that is truly inclusive and ensures safe mobility for all.

[6] This is a database consisting of a list of people who have agreed to be contacted for any surveys conducted by TRL.

[7] TRL's full ethics committee consists of TRL's Academy Director, TRL's chief scientists, two senior technical staff members who are experts in ethical procedures, the project's technical reviewer, as well as an external panel member who has considerable experience in the relevant field.

A sample of 81 people responded to the survey. Findings are indicative of the barriers experienced not representative. 70.5% identified as female, 21.3% identified as male and 8.2% chose not to provide a gender. There was a wide range of travel behaviour, but overall the most common modes of transport were car use as a driver, and walking (see Table 5). A wide range of ages were represented, with the majority being in the middle age groups (40-59). Most of the participants were either in full-time (36.1%) or part-time employment (21.3%), retired (13.1%) and 11.5% were unable to work due to health conditions.

Table 5: Sample's travel behaviour

Frequency of travel	Car driver	Car passenger	Bus	Train	Tube	Tram	Taxi	Cycling	Walking	Motorcycle
Everyday	36.1%	1.6%	4.9%	3.3%	0%	0%	0%	0.0%	36.1%	0%
1-3 days a week	11.5%	45.9%	11.5%	8.2%	4.9%	0%	3.3%	1.6%	14.8%	0%
4-6 days a week	29.5%	4.9%	8.2%	0%	0%	0%	0%	6.6%	21.3%	1.6%
About once a fortnight	3.3%	14.8%	4.9%	8.2%	3.3%	0%	3.3%	1.6%	13.1%	1.6%
About once a month	0.0%	14.8%	6.6%	8.2%	9.8%	1.6%	9.8%	8.2%	8.2%	0.0%
Less than once a month	1.6%	14.8%	36.1%	59.0%	55.7%	16.4%	59.0%	14.8%	4.9%	3.3%
Never	18.0%	0.0%	26.2%	13.1%	23.0%	73.8%	24.6%	62.3%	1.6%	91.8%
Not applicable	0%	0%	1.6%	0%	3.3%	8.2%	0%	4.9%	0%	0%

Participants experienced all the mental health categories identified in the literature review as summarised in Table 6; these are also shown graphically in Figure 2.

Table 6: Mental health conditions experienced by participants

Mental health difficulty	Number of participants affected	Sub category (number of participants affected in parenthesis)
Anxiety	52	Generalised anxiety disorder (37) Social anxiety (29) Health anxiety (9) Body dysmorphic disorder (4) Perinatal anxiety (4) Prefer not to say (4)
Depression	50	
Stress	50	
Panic disorder	29	
Phobias	19	Claustrophobia (19) Agoraphobia (8) Emetophobia (1) Prefer not to say (3)
Ante-natal/post-natal depression	18	
Post-traumatic stress disorder	17	
Autism	12	
Seasonal affective disorder	12	
Obsessive compulsive disorder	12	
Eating disorder	12	
Substance disorder[8]	8	Alcohol dependence (3) Drug dependence (2) Prefer not to say (3)
Personality disorder	7	Anti-social personality disorder (2) Avoidant personality disorder (2)

[8] Substance disorders are not to be regarded as impairments for the purposes of the Equality Act 2010

Mental health difficulty	Number of participants affected	Sub category (number of participants affected in parenthesis)
		Borderline personality disorder (2) Paranoid personality disorder (2) Dependent personality disorder (1) Histrionic personality disorder (1) Obsessive compulsive personality disorder (1) Paranoid personality disorder (1) Schizoid personality disorder (1)
ADHD	6	Psychotic disorder (6)
Psychotic disorder	6	Schizophrenia (2) Schizoaffective disorder (2) Delusional disorder (1)
Bipolar	5	Bipolar I (2) Prefer not to say (3)
Other	1	Dissociative disorder (1)

Participants identified several impacts on their ability to travel and navigate the built environment. These are summarised in Table 7.

Table 7: Impacts of mental health on travel behaviour

Impact on travel behaviour	Travel mode
Journey issues (e.g. route planning difficulties)	Pedestrian, bus, train
Avoidance (e.g. avoiding crowds, noisy environments, travelling at night, total avoidance)	All
Unsafe practices (e.g. dangerous behaviours)	Pedestrian
Infrastructure design (e.g. confined spaces)	Pedestrian, bus, train
Accessibility (e.g. physical difficulty)	All
Personal effort (e.g. self-conscious)	Cyclist
Physical safety (e.g. fear of crashing into others; previous personal injury; personal experience)	Cyclist, train
Associated activities (e.g. concern over waiting alone; concerns about having the correct money and purchasing tickets)	Bus, train

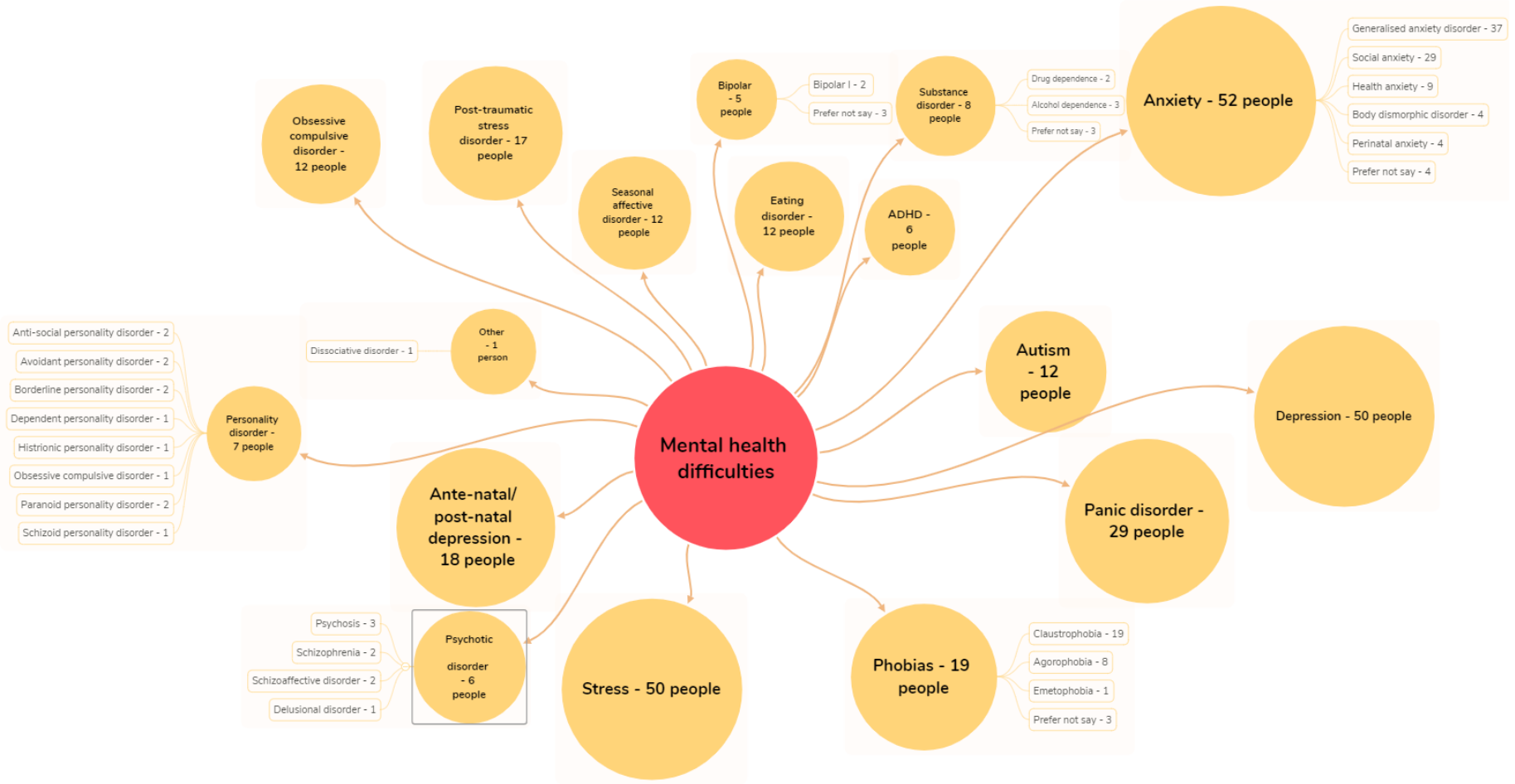

Figure 2: Mental health conditions experienced by participants

Table 8: Negative effects of travelling on mental health

Theme	Reported impact on mental health	Travel mode affected
Infrastructure design/maintenance (e.g. confined spaces; artificial environments; obstructed walkways; lack of dedicated cycling infrastructure/ storage)	Increased anxiety; Increased stress	Pedestrian, cyclist
Atmosphere (e.g. noise, air quality; congested roads; artificial lighting)	Increased anxiety	Pedestrian, bus, train
Route navigation and planning (e.g. unfamiliar routes/environments; navigation difficulties)	Increased anxiety; Increased stress	Pedestrian, cyclist, bus, train
Provision of information (e.g. large volume of information; complex information/signage)	Increased anxiety	Bus, train
Other people (e.g. unpredictable/ unsafe behaviour; lack of travel companion; busy environments)	Increased anxiety; Increased stress	Pedestrian, cyclist, bus train
Vehicle design (e.g. lack of escape during transit; difficulties to alight; poor ventilation)	Increased anxiety	Bus, train
Bus service attributes (e.g. lack of control; non standardised customs)		Bus
Bus stop design (e.g. secluded bus stops; poor lighting; inadequate seating; lack of shelter)		Bus
Train station design (e.g. Lack of facilities; narrow platforms; difficulties with entry/exit barriers)	Increased anxiety; Exacerbated claustrophobia	Train
Train service attributes (e.g. train delays; changes to route; lack of control)	Increased anxiety	Train

Participants identified positive impacts of travel on their mental health. Significantly, these were linked only to walking and cycling, not bus or train, highlighting the benefits of active travel that have been identified in the literature (Posner, 2017). They reported decreased anxiety and generally improved mental health.

6.4 Recommendations for future guidance

Participants identified many interventions across all modes discussed that would help to overcome the barriers they had identified. Solutions covered vehicle design, highway infrastructure, information provision, enforcement and awareness of driving rules, and improved reliability of services. Some interventions were specific to the needs of people with mental health conditions; however, the majority could be considered to reflect good

practice in the provision of transport services and a good quality and safe street environment for all road users.

The key recommendations from this research question are that:

a) The needs of those living with mental health conditions need to be included in the inclusive mobility guidance

b) Mental health must be included as part of the wider realm of inclusive mobility

c) The findings from this research were indicative of the barriers experienced, further research should be carried out with a broader sample, particularly the mental health conditions that were less represented in this research, to ensure that these are representative

d) Several solutions were identified, those relating to infrastructure, vehicle design and information provision should be a priority as part of the review of inclusive mobility guidance

e) Other solutions must also be addressed in parallel to ensure the most effective outcome

f) Review and changes need to be made in partnership with key stakeholder and members of the public

Table 9: Overview of solutions identified by survey participants

Solution	Travel mode affected
Infrastructure	All
Vehicle design	Bus, train
Information provision	All
Journey preparation	Pedestrian, general
Improving awareness of mental health difficulties	General
Enforcement and awareness of legislation	Cyclist, bus, train
Other: Additional staff	Bus, train, general
Other: Reliability of public transport	Bus, train, general

Table 9 (above) summarises the solutions across all modes to the barriers identified and more detail on each solution is provided below (where available).

Infrastructure solutions:

- Improved pedestrian footpaths:
    - Ensuring that they are maintained and clear
    - Unshared with other road users
    - Where possible in green areas removed from traffic

    - Improving footpaths in rural areas should be a priority
    - Improved lighting regardless of location or footfall
    - Where possible widening streets and pavements
    - Reduce/remove on pavement car parking
- Increased number of pedestrian crossings and where possible to include traffic lights
- Removing/reducing the use of underpasses and enclosed walkways
- Improved signage
    - Clarity of signs that are for pedestrian (including street names)
    - Improving signposting of information
    - Ensuring signs are at a good height and kept clear
    - Reducing intrusive advertising
- For cyclists:
    - Increased cycle infrastructure
    - Dedicated cycle lanes, where possible in green environments and removed from traffic
    - Improved maintenance and upkeep of infrastructure, including ensuring good road surface
    - Reducing/removing shared pavements
    - When on shared pavements:
        - Increased width of pavements
        - Pavements must not be cut up by driveways and cyclists must have priority over cars
- Bus stops:
    - Increased number of bus stops in rural areas and reducing the distance between stops
    - Improved lighting
    - Use of bus shelters as opposed to bus stops
    - Improved maintenance of bus stops
    - Use of electronic billboards
- Trains:
    - Changing direction of escalators to match peak time at stations to improve crowd management and reduce bottle necks (to be used at barriers when exiting train platforms)
    - Reducing the gap between the train and the platform, by increasing the width and length of steps that allow participants to board/leave the train

- Increasing number of lifts at station
- Changing the materials used on station concourses and platforms to reduce noise

Vehicle design recommendations:

- Bus:
  - Quiet areas on buses:
    - Separate area
    - Restricted mobile phone use
    - Increased seating
    - Lower deck of buses
    - Close to exit
  - Increased ventilation:
    - Increasing the number of windows that can be opened
  - Improving access to emergency exits:
    - Supplemented with improved information on how to exit safely
  - Information provision:
    - Increasing the number of screens in buses informing of the upcoming stops
    - Information to be provided by spoken announcements
    - Standardisation of vehicle design nationally
- Train:
  - Improving or supplementing quiet areas with 'mental health friendly areas':
    - New areas for those living with mental health conditions OR supplementing current quiet coaches
    - Improved ventilation
    - Natural lighting, or lower lighting
    - Increased seating and reducing standing capacity
    - Dedicated tickets
  - Reducing the use of automatic doors (including toilet doors)
  - Increased number of toilets on train
  - Simplified exit routes:
    - Information on how to exit trains should also be simplified
  - Continued and more widespread use of screens to provide information and updates about next stop and arrival times/delays

    - Difficult to 'design flaws out' retrospectively: effort should be made to build new trains to address these needs

Information provision recommendations:

- Across all modes of transport need to improve way information is provided
- Improved online information provision
- Ensure information is clear (simple and easy to understand)
- Improve signposting of information:
    - This must include location of available staff particularly in trains and bus stations
- Improved use of technology
    - Remove the need to speak to staff
- Providing information of alternative routes that are quieter, away from traffic, well-lit
    - This must be clearly signposted
- Consistency in how information is presented across all travel systems in the UK
    - Including bus and train timetables; bus and station maps
    - Consistency in colours used for different road signs, particularly ones for pedestrians and cyclists
- Train
    - Improved use of technology
        - Tools providing live departure, arrival, and platform information
        - Personalised information provision
    - Informing passengers of station changes and platform information for subsequent trains
    - Train maps like the ones found on the London underground
    - Improved signage
        - Clearer to reduce the need to seek assistance
        - Signs to be less obstructed
        - Easier to read
        - Information points and boards to be more clearly signposted
    - Train guards to announce the next station ahead of arrival at stations more consistently
        - Information must be provided well in advance
    - Improving ticket definitions, specifically what trains are included in which tickets

        - Must be presented at ticket purchase points and online
- Bus
    - Include route maps on buses
        - Like the ones found on London underground
        - These should be made available online
    - Improve visibility of bus stop names
    - Clearly indicate bus fares, pricing schemes and how payment should be made
    - Information to be presented at bus stops, bus stations, on-board and online
    - Use of electronic signs to provide real-time information to be included at bus stops
    - Supplemented with online information that can be accessed through travel apps
    - Timetables to be kept up-to-date at bus stops
        - Information to be made available online
- Pedestrian
    - Opportunities to access information in an audio format
        - Allowing pedestrians to access information more discreetly
        - Allowing pedestrians to receive information without having to look down at phone/map and match information to their environment more rapidly

An important overarching conclusion is that people with mental health conditions suffer disproportionately from the sorts of barriers and inconveniences that all transport and road users experience, so are more likely to be put off completely by situations that others might put up with, leading to total avoidance of certain modes of transport. On the other hand, this means that interventions designed to make travel more comfortable and attractive to people with mental health conditions will have the benefit of improving transport services and the environment for all users.

7 Review of potential new topics for guidance (RQ5)

7.1 Research question

The research for this RQ set out to consider whether and if so, which additional topics such as new public transport technologies and innovative forms of transport infrastructure should be included in a future update of the Government's guidance on the accessible public realm; with a focus on *Inclusive Mobility*. A further objective was, for each new topic, to understand what fresh material should be included. The research also considered whether there was material that is no longer relevant and should be removed from the current version of *Inclusive Mobility*.

7.2 Methods

The activities of the current research built upon the output of a predecessor scoping study, as set out in the report *Updating Guidance on the Accessible Public Realm* (Greenshields et al., 2018). The first task was to review the conclusions of the scoping study to identify existing material that might be omitted from the guidance and new items that should be considered for inclusion in a revised version of *Inclusive Mobility*. There was then collaboration with the client and the Project Steering Group to finalise a list of items that should be taken forward for further consideration.

Ten potential new items were selected and divided into two groups, one featuring innovations in transport infrastructure affecting cyclists and pedestrians, and the other concerning new technologies and the use of online public transport information. Each of these groups of items became the subject of discussion at a stakeholder workshop. The workshops were organised as follows:

Workshop 1. New infrastructure relating to cyclists and pedestrians

- Bus stop bypasses
- Shared cycle / pedestrian pathways
- Cycles as a mobility aid and the needs of disabled cyclists
- Pedestrian crossing control boxes

Workshop 2: New technologies and the use of online information

- Touch screens
- Real-time information in stations and in vehicles
- Contactless ticketing
- Website accessibility
- Smartphone apps
- Wayfinding technologies used by blind and partially-sighted people

A list of invitees was developed, in collaboration with the Project Steering Group, tailored to the topics that were to be discussed. Enough time was provided to enable attendees to comment on the items discussed at the other workshop. The workshops were relayed by a web-meeting service to those who were not able to attend in person, and those unable to participate in either workshop were also emailed separately to elicit their opinions.

Discussions with the stakeholders were informed by a literature search which also served to gather information to support any subsequent drafting of new material for *Inclusive Mobility*. The sources of literature targeted were guidance documents published by government agencies, authoritative standards and guidance documents from the UK and Europe, policy statements and campaign materials disseminated by organisations championing the interests of older and disabled people and publications describing good practice in accessible and inclusive design. A formal literature search was also conducted of academic and research databases.

Full details of the methods used and findings are set out in Technical Annex 5 (a separate document).

7.3 Findings

There was agreement on content considered to be outdated that can be removed in future updates and several points of detail that need to be updated. These are set out in Appendix C.

7.3.1 Bus stop bypasses

Reservations were expressed by organisations representing the interests of people who are blind or partially-sighted as to the safety of bus stop bypasses. However, these concerns are counter-balanced by a great deal of work that is being undertaken on the benefits to cyclist safety, and to designing bus stop bypasses so that they are safe for everyone to use. A section on their accessible design should be included in the revised guidance.

7.3.2 Shared cycle / pedestrian pathways

Strong views were expressed by stakeholders to the effect that mixing pedestrians and cyclists on the same pathway is potentially dangerous, and therefore undesirable, and so should not be a policy choice.

7.3.3 Cycles as a mobility aid and the needs of disabled cyclists

There was agreement with the principle that *Inclusive Mobility* should feature the needs of disabled cyclists as well as disabled pedestrians. There is increasing awareness of the extent to which disabled people use cycles as a mobility aid; although there are questions as to the practical consequences of granting cycles the same status as mobility aids as wheelchairs and mobility scooters.

7.3.4 Pedestrian crossing control boxes

All issues relating to the design of pedestrian crossing control boxes are fully covered in the relevant statutory documents.

7.3.5 New technologies and the use of online information

The new technologies identified considered in this research are all at an advanced stage of development, and so are the subject of a large body of existing detailed standards and design guidelines specific to each technology. There was a strong consensus that the revised guidance should avoid detailed technical specifications, and instead focus on broad design principles. The text should explain why certain design features are important for disabled people, and then 'signpost' the reader to the specific standards and guidelines that will explain how accessibility can be achieved. There was also a consensus that all six of the areas of 'new technology' identified should be considered in the guidance.

7.4 Recommendations for future guidance

Several top-level recommendations are made which are set out below. In some cases, these refer to more detailed discussion, as set out in Appendix C and Technical Annex 5.

- Remove outdated content from *Inclusive Mobility* (Pelican Crossings, the 'information' tactile surface, panel information displays at bus stops, provision of public telephones) (see Appendix C for details).
- Include a section on bus stop bypasses in the forthcoming redraft of *Inclusive Mobility*; design guidance in other documents focused on cycling infrastructure may also need to be updated to ensure consistency between sources.
- Text should be included that discourages the mixing of cycle and pedestrian traffic on the same pathway. This recommendation has implications for other design guidance on cycling and pedestrian infrastructure, such as LTN 1/12 'Shared Use Routes for Pedestrians and Cyclists'.
- Guidance should be provided on how to make cycling facilities accessible to disabled cyclists. The revised guidance should also raise awareness of the extent to which disabled people might use a cycle as a mobility aid.

Regarding the recommendations above, it is important to note there is already a significant amount of design guidance specifically on cycling infrastructure that highway engineers are likely to look to for advice on this topic in the first instance. They may not consult *Inclusive Mobility* unless they are prompted to do so by guidance or sources of information that they are already familiar with. Consequently, it is recommended that the primary sources of guidance on cycling infrastructure design are also updated to be consistent with new advice in *Inclusive Mobility*.

- Guidance on new (ICT and internet-based) technologies should be included, but it should set out general design principles – the 'Why' – and avoid duplicating existing technology-specific standards – the 'How.'
- Updated guidance should cover all new technologies that are featured in the research (touchscreens, real-time information in stations and vehicles, contactless ticketing, website accessibility, smartphone apps and wayfinding technologies for partially sighted and blind people).
- A section on pedestrian crossing control boxes should be included in the forthcoming redraft of *Inclusive Mobility* and be based closely on the text of the relevant statutory documents.

As part of the process of consulting on the proposed additions to the guidance, several points of detail were noted that require updating or otherwise amending to reflect more recent guidance, terminology, or practice. Any amended version of *Inclusive Mobility* should place greater emphasis on the importance of the accessibility of public transport relating to all members of society, according to the principles of Universal Design. Its introduction should also mention the issues of sensory impairment and the needs of people with a learning disability, given that they are specifically covered later in the document. Similarly,

consideration should also be given to referring to the needs of people living with mental health issues, or who are neurodiverse.

8 Conclusions

Research into the implementation of tactile surfaces and how users interpret the different types currently recommended was undertaken with users, stakeholders, and practitioners. There was support for simplification from both users and practitioners. In practice, while most users were able to reliably identify blister paving, just under half recognised corduroy and only a minority recognised other types. Likewise, practitioners had good awareness of blister and corduroy, but the other surface types were less well-known. Based on what has been found to be effective in current practice, a simplified approach to guidance is recommended, with a reduction in the numbers of surface types (from seven to four for future schemes) to be considered through further consultation, research, and trials. A key principle is that the need for tactile paving should be considered from the very start of schemes, following an integrated inclusive design process that reflects the public sector's obligations under the Equality Act.

The study investigated whether there have been changes in the dimensions of wheeled mobility devices since *Inclusive Mobility* was published. A review of published and industry data, supported by a survey conducted at two public events and stakeholder consultations, found good evidence that there is greater availability of longer devices. This is at least in part due to the greater availability of electric mobility scooters, some of which are primarily intended for use outside and on roads. However, in the absence of data on the level of use of each type of mobility device, it is not possible to conclude that there is an increase in the number of users who might be disadvantaged by size constraints. The evidence currently available suggests that the minimum length specified in *Inclusive Mobility* is still sufficient for manual and electric wheelchairs and Class 2 mobility scooters.

The three literature reviews and stakeholder engagement conducted for the study on ageing, dementia, and non-visible disabilities identified various related functional limitations that affect ability to navigate the pedestrian environment. Particular difficulties include obstacles, uneven surfaces, crossing the road (including identifying safe gaps in the traffic), navigating slopes and ramps, and lack of confidence to travel. Several key recommendations for improving inclusivity emerged from this study, some of which directly relate to updating existing guidance on the public realm such as forming comprehensive guidance that reflects the ever-changing demographics of the population and increasing complexity of traffic; older people, those with dementia, and those with non-visible disabilities should be involved in the formation of such guidance. Additionally, pedestrian environments should be simpler, with distinct features and provision of clear information that aide navigation and confidence to travel. Other key recommendations included stricter implementation of guidance, greater collaboration between organisations, and improved training and education (focusing on the wider health agenda and encouraging empathy) for road users, organisations involved in travel and transport, and frontline staff members.

A literature review and survey of people with mental health conditions identified many aspects of their travel experience that adversely affect them and present barriers to their ability to travel. An important conclusion is that people with mental health conditions suffer

disproportionately from the types of barriers and inconveniences that all transport and road users experience, so are more likely to be deterred by certain situations than others, leading to total avoidance of certain modes of transport. To help overcome the identified barriers, interventions or solutions were identified across all modes and related to vehicle design, highway infrastructure, information provision, journey preparation tools, enforcement and awareness of driving rules, improved reliability of services, and improved public awareness of mental health conditions and the barriers they pose. Some interventions were specific to the needs of people with mental health conditions, but the majority were aimed at generally improving the provision of transport services and the safety of the pedestrian environment.

A literature review and stakeholder workshops were undertaken to consider whether the scope of the guidance in *Inclusive Mobility* should be broadened to cover new technologies and more recent developments in highway infrastructure. There was general agreement that *Inclusive Mobility* contains outdated content that can be omitted and several points of detail that need to be updated. Additional guidance is recommended on:

- Bus stop bypasses, reflecting concerns about their impacts on people with impaired mobility, but also acknowledging the benefits to cyclists
- Discouraging the mixing of cycle and pedestrian traffic on the same pathway
- Making cycling facilities accessible to disabled cyclists and the use of cycles as a mobility aid'

Design guidance in other documents which focused on cycling infrastructure may also need to be updated to ensure consistency between sources. There are several current initiatives by DfT, Transport Scotland, and other government bodies that have a bearing on the design of the built environment and specifically cycling infrastructure, shared-space, side-road crossings, and new personal mobility devices; these will all need to be considered in future updates. Guidance on new technologies should be included, but it should set out general design principles and avoid duplicating existing technology-specific standards.

Across all research questions covered in the study, several important cross-cutting conclusions were identified: all user groups could benefit from a simplified, comfortable, legible street environment and from user-friendly public transport supported by good and easily-accessible information.

9 Acknowledgements

TRL is grateful for the support for this research from the project Steering Group members:

Graeme McQuaker
Sally Gibbons
Keith Robertson
Sue Sharp

In addition, TRL is also thankful to those who participated in the workshops, focus groups and site visits, as well as for the support of the following individuals and organisations:

Alzheimer's Society

Anxiety UK

British Healthcare Trades Association (BHTA)

Centre for Accessible Environments (CAE)

Chartered Institute of Highways and Transportation (CIHT)

Chris Price

Community Transport Association (CTA)

Driving Research

Institute for Transport Studies (ITS)

International Longevity Centre UK

Martin McConaghy, idacs Ltd

Medicines and Healthcare products Regulatory Agency (MHRA)

National Association of Equipment Providers (NAEP)

NHS England

NHS Supply

Niki Glazier

Rail Delivery Group

Research Institute for Disabled Consumers (RiDC)

Roger Mackett

The Anthropometry of Wheeled Mobility Project at Buffalo University

Transport for All

Transport for London (TfL)

Transport Scotland

Wheels for Wellbeing

Karen Russell

10 References

Department for Transport (2002). *Inclusive mobility*. London, UK: Department for Transport.

Department for Transport (2018). *The inclusive transport strategy: achieving equal access for disabled people.* London, UK: Department for Transport.

Department of the Environment, Transport and the Regions (1998). *Guidance on the use of tactile paving surfaces*. London, UK: Department of the Environment, Transport and the Regions.

D'Souza C, Steinfeld E and Paquet V (2009). *The anthropometry of wheeled mobility project at Buffalo: a comparison of wheelchair dimension values with ISO/CD TR 13570-2. Report prepared for: ISO TC173 SC1 WG1.* London, UK: IDEA Center, University of Notre Dame.

Greenshields S, Wells A, Barham P, and Dales J (2018). *Updating guidance on the accessible public realm (CPR2559).* Crowthorne, UK: TRL Ltd.

Posner R (2017). *Mental health and transport: a review of the literature*. Unpublished.

Stait RE, Stone J and Savill TA (2000). *A survey of occupied wheelchairs to determine their overall dimensions and weight: 1999 survey (TRL Report 470).* Crowthorne, UK: TRL Ltd.

Appendix A Summary of user and practitioner feedback on each tactile surface type

Table 10: Summary of user and practitioner feedback on each tactile surface type

Surface type	Users: Level of understanding of meaning	Users: Detection and distinction	Practitioners: Comments & Issues	Additional Comments from walk/wheel-abouts
Blister	Very wide understanding that this indicates where there is a crossing point where there is no kerb upstand. Limited knowledge of directional purpose of alignment of blisters. Some confusion with use as stems, though this seems to have limited practical implications as many (most?) users already know their routes and use stems as reminders for anticipated crossings.	Readily detected by most people, though many struggled to detect directionality of alignment. Some confusion over its key use as a carriageway edge marker and its use as stems. Most users are unaware of and/or fail to distinguish 800mm/1200mm depths.	By far the most commonly used and well understood surface. Key problems are in relation to trying to achieve standard layouts in constrained locations (e.g. junction corners), which often lead to clashes or large wedges. Related queries about use for both edges and stems; the prescribed width of stems (1200mm) compared to edges (800mm) as the latter would seem more critical not to miss; the possibility of doing away with the minimum 800mm (leads to wedges) or of allowing the 'Westminster curve'.	Metal studs generally disliked: widely regarded as being slippery when wet; generally more painful for people with sensitive feet; too hot for guide dogs' feet in summer; and more uncomfortable – even an obstacle – for wheelchair users. Numerous examples of over-worn natural stone blisters, showing the importance of good maintenance/ replacement regimes.
Corduroy	Commonly, but not universally understood as meaning 'hazard'. Most often expected to mean, in practice, 'watch out for steps'. Because of multiple meanings, also reasonably	Seems to be readily recognised as 'different' to surrounding flat surface, but individual ribs or alignment not	Most commonly used/intended for use as a warning for steps or at the transition of shared areas. In the real world, often mistakenly used as ladder; issues of lack of contractor awareness and/or of site supervision.	Where present (e.g. top and bottom of steps) commonly found to be laid just 400mm deep. Steps often link public to private realm and notable that steps with corduroy at one end did not have any at other. Some

Surface type	Users: Level of understanding of meaning	Users: Detection and distinction	Practitioners: Comments & Issues	Additional Comments from walk/wheel-abouts
	well understood as a general 'watch out'.	easily detected (not that this is necessarily intended).		corduroy units especially difficult or uncomfortable to negotiate for users with small-wheeled wheelchairs.
Platform/ off-street	Commonly understood as meaning 'platform edge' when in a railway station. Not widely understood as being different from regular blister, but station context means this is unimportant in practice.	Not readily distinguished from regular blister; but unimportant in practice.	Known of by some practitioners, but rarely used in practice as few LA officers work in railway station contexts.	One particularly busy mainline station visited had no tactile paving on any of its platforms. Most users could not readily detect difference in blister alignment from standard on-street blister paving.
Platform/ on-street (lozenge)	Relatively low levels of understanding of meaning at the population level; likely because this surface type is relatively uncommon in the real world.	Readily detected and distinguished, especially when expected.	Greater LA practitioner awareness, especially in cities with trams (Edinburgh, Manchester), but issue that tram schemes tend to be the province of consultants/contractors, not LA officers. Some LAs (e.g. in South Yorkshire) use for raised bus stop platforms. This may seem logical but is strictly non-compliant.	Where encountered (Edinburgh and Manchester) lozenge paving was readily detected as being quite different from all other tactile paving surfaces. Some queries, however, as to whether it is as immediately detectable at blisters in good condition.
Ladder/ Tramline with	General meaning is commonly confused with corduroy (assumed to be marking shared area	Ladder/tramline relatively readily detected, including directionality.	Next best-known after blister and corduroy, but many questions. Hard to achieve compliant layouts in some contemporary walk/cycle	Where encountered (Edinburgh, Manchester, Bristol) was the source of much discussion and confusion, sometimes because

Surface type	Users: Level of understanding of meaning	Users: Detection and distinction	Practitioners: Comments & Issues	Additional Comments from walk/wheel-abouts
delineator strip	transition). The meaning of the orientation is also poorly understood by many. Both types of confusion may relate to lack of training and/or inconsistency of deployment (e.g. ladder/tramline sometimes reversed; corduroy fairly regularly used instead of ladder).	Some users cannot easily distinguish it from guidance path; although this may be due to limited experience of the latter. The delineator strip seems to be readily detected by visually impaired people walking alongside, but easier to miss if approached from a more perpendicular angle.	arrangements (*Guidance on the Use of Tactile Paving Surfaces* diagrams reflect the inherent complexity and risk of confusion). Consistency of installation hampered by confusion with corduroy and lack of clarity/perceived illogicality of ladder/tramline walk/cycle set-up. Cycle campaigners report common concern over tramline, especially in wet, such that many cyclists prefer ladder. Consistent queries about need for 2400mm depth.	corduroy had been used as 'ladder' alongside standard tramline. Wheelchair users prefer the tramline orientation but do not generally want to be on the cycling side. Recognition that some cyclists prefer ladder ('rumble strip') to tramline, especially in wet. Several instances of ladder being used instead of corduroy at thresholds of shared areas.
Guidance	Not widely understood. Where the meaning is known, most commonly association with use in train/bus stations, shopping centres, open spaces (on the continent).	Directionality is readily detected; but not easily distinguished from ladder/tramline.	Purpose well understood, but relatively little experience (not least because its prescribed use covers a narrow range of situations). Considered an obvious replacement for blister for stems but concerns about user confusion if this were done in practice.	Only encountered in two locations, where it was not deployed as prescribed. Generally good understanding of its intended purpose. Several positive anecdotes of experience in European cities. Generally positive response in

Surface type	Users: Level of understanding of meaning	Users: Detection and distinction	Practitioners: Comments & Issues	Additional Comments from walk/wheel-abouts
				discussions to idea that it could be used for stems at crossings.
Information	Very little understanding of meaning, and where known almost always a matter of theory, not practice.	So little-known as to be a surface that no-one thinks to detect.	Limited awareness, and no practical experience.	Not encountered.

Appendix B Recommendations and propositions for revised guidance on tactile surfaces

The notes and recommendations in the following table are a synthesis of the many and varied inputs to the *Guidance on the Use of Tactile Paving Surfaces* update received through the RQ1 and RQ4 workstreams. The practical implications arising from some of the recommendations (e.g. to reduce the number of surfaces used and to modify slightly the meaning assigned to some) are considered Technical Annexes RQ1 and RQ4 (separate documents).

In overview, the proposals below are an attempt to provide a picture of what would be better for users (and practitioners) if the provision of tactile paving surfaces in the real world was:

(a) Simplified

(b) Considered much earlier as an integrated part of a properly inclusive design process

(c) Understood as a vital safety feature to be provided in the context of the relevant provisions of the Equality Act 2010, including the Public Sector Equality Duty

Generally, revised guidance could be provided in a simple three-section format, as follows:

1. Introduction – overview, context, etc. As concise as possible. Key points of focus should be on achieving layouts that are Simple, Logical and Consistent; ensuring tactile paving provision is practiced as an integral part of genuinely inclusive processes of street/highway design and maintenance; and stressing the safety aspects of tactile paving in the context of the Equality Act 2010
2. Description – of the basics for each surface. This should be user-focused, simple & punchy. Suggest the objective is that each surface should be presented in the form of an easy-to-understand factsheet, that is suitable for use in training users. The only graphic in each should be the standard plan/profile figure. Illustrative photos or sketches can be provided. Aim for 2-4 pages each
3. Technical Drawings – user representative organisations and many practitioners value these as clear 'how to do it' guides. For different reasons, both groups are keen to limit the discretion that practitioners must depart from the guidance, intentionally or otherwise. These drawings will need a comprehensive review once changes to overall guidance are agreed; and should actively address typical 'tricky situations' showing how standard approaches can reasonably be varied (e.g. stems to reach the nearest shoreline if possible, so non-perpendicular arrangements allowed to achieve this)

Detailed recommendations and propositions for updating *Guidance on the Use of Tactile Paving Surfaces* are presented below, structured according to the structure of the current document.

1. INTRODUCTION
• Emphasise the Simple-Logical-Consistent (SLC) principle • In keeping with this, the recommendations and propositions concerning the seven surfaces within the existing *Guidance on the Use of Tactile Paving Surfaces* are as follows: 1. **Blister**. Proposition that this should only be used in accordance with the stated core purpose to warn of a crossing point where there is no detectable kerb, and not for stems leading to the crossing points 2. **Hazard/corduroy**. Proposition that the use of this surface should be extended to cover situations for which ladder/tramline are currently specified 3. **Platform edge (off-street)**. Recommendation that this is considered is a separate section as not being appropriate for the public highway 4. **Platform edge (on-street)/lozenge**. Proposition that this should be used for all tram/LRT platforms (even when these are off-street for consistency) and to warn of the edge of raised bus stop platforms 5. **Ladder/tramline**. Proposition that this should be deleted, with the corduroy surface used instead 6. **Guidance path**. Proposition that this should be used as currently specified and for stems leading to crossing points 7. **Information**. Recommendation that this be deleted • Stress critical safety aspects, in addition to navigation/information functions • No-one wants more than is necessary: cognitive load for VIPs; discomfort for some others • Underline Equality Act considerations, including PSED • The need to consult/engage effectively with users affected, both directly and indirectly, and with other stakeholders • The need for trade-offs because of different user requirements • Design: promote the need to consider access for blind and partially sighted people from the outset of scheme design, so that tactile layouts can be as SLC as possible. Tactiles are not a sticking plaster to make inherently awkward layouts better • Design: note on dropped kerb design here, not overloading the text of the blister section • Design: note on depths of arrangements (400mm-800mm-1200mm); and safety aspects of these, here rather than spread across individual sections; and where variations may be allowable • Maintenance: importance of maintaining feature height/distinctiveness over time • Maintenance: where and why using smaller blocks may be preferable to 400mm x 400mm slabs

2. TACTILE PAVING SURFACES
2.1 – Blister Surface for Pedestrian Crossing Points

There is a lot of text in the existing guidance about crossings themselves and the need to consult, etc. Some of this is no longer needed, and much of what is still needed would sit better in the Introduction.	
Retain. But use to indicate/warn of crossings only; in keeping with existing core statement of purpose.	
a. Purpose	Proposed revised core statement: *"The purpose of the blister surface is to indicate and provide a warning of the presence of a crossing point to visually impaired people who would otherwise, in the absence of a kerb upstand >25mm high*, find it difficult to differentiate between where the footway ends and the carriageway begins. The surface is therefore an essential safety feature for this group of road users where the footway is flush with the carriageway to enable crossing by wheelchair users and others to cross unimpeded."* * The question of whether 25mm remains an appropriate boundary between what is/is not 'flush' should be subject to further consideration.
b. Definition	As existing, with simple diagram (Figure 2). Could add one or two non-technical graphics (e.g. colour drawing) to illustrate typical circumstances where blister paving will be deployed (e.g. zebra, signalised junction, simple side street crossing).
c. Application	*The blister tactile surface should be installed in the absence of an upstand at both controlled and uncontrolled crossing points where either:* • *The footway has been dropped flush with the carriageway* • *The carriageway has been raised to the level of the footway* Stick to core statement of purpose. Consider no longer using for stems, as this is (a) inherently at odds with the basic purpose and (b) leads to unnecessarily confusing layouts, especially at junction corners with two crossings perpendicular to one another. Review guidance on colour and tonal contrast. These do not help blind people but can give additional assistance to some partially sighted people. This implies they are not safety critical and so relaxation can be considered where the case is made (e.g. sensitive built environments or at 'continuous footway' treatments).
d. Maintenance	Delete this section. The guidance in this sub-section is essentially generic and common to all surfaces. To enable the chapters on surfaces to be as clear and concise as possible, Maintenance would be best covered in a short, distinct section that applies to all surfaces (e.g. within the Introduction chapter).
e. Layout	This section should be greatly reduced in size – it currently runs to 25 pages and 16 figures. Almost all of this, including the technical drawings, could/should be placed in Section 3.
2.2 – Corduroy Hazard Warning Surface	
Retain. But broaden application to act as a warning for all circumstances where a warning is necessary but neither blister nor lozenge is appropriate. Low levels of user recognition/understanding and high levels of confusion concerning ladder/tramline	

suggest a less-is-more approach will enable better application of the simple-logical-consistent principle.	
a. Purpose	Proposed revised core statement: *"The corduroy surface conveys the message 'hazard, proceed with caution'. Its purpose is to warn visually impaired people of the presence of hazards not indicated by the blister or lozenge surfaces (which have a specific meaning), including steps, the approach to on-street tram or raised bus platforms, and level crossings. It is also used to mark the transition between a footway and an area/path that can be shared with people on cycles. The surface should be used to warn of flush transitions between footway and carriageway away from designated crossing points (where the blister surface is used)."* (This core statement of purpose – and those for other surfaces – could be shortened by leaving the descriptive second half to the 'Application' section.)
b. Definition	As existing, with simple diagram (Figure 19). Could add one or two non-technical graphics (e.g. colour drawing) to illustrate typical circumstances where blister paving will be deployed (e.g. steps, shared paths – both 956 & 957 arrangements).
c. Application	*The corduroy surface can be used for any situation (except at pedestrian crossing points - see 2.1) where visually impaired people need to be warned of a hazard and advised to proceed with caution, for example:* • *At the top and bottom of steps* • *At the foot of a ramp to on-street tram or raised bus platforms (but not other ramps)* • *At a level crossing* • *Where people could inadvertently walk directly on to a platform at a railway station* • *Where a footway/footpath joins a shared (walking/cycling) route or space* *Stress the need for consistent 800mm depth (with an allowance of up to 1200mm where used in circumstances currently covered by ladder/tramline).* *The surface must not be used to warn of obstacles.* (Could add an explicit link to the use of Guidance Path to guide people around obstacles, which is part of the existing core statement of purpose for that surface.)
d. Maintenance	See note in 2.1 in this table.
e. Layout	This section could be much shorter, or placed entirely, along with the technical drawings, in Section 3.
Chapter 3 – Platform Edge (Off-Street) Warning Surface	

Relocate this section. This surface is not for use on the public highway, and should be placed in a separate section, as being largely irrelevant to the use of tactile paving surfaces in the public realm.	
2.3 – Street Platform Edge Warning Surface	
Retain**.** But use at on- and off-street LRT/tram platforms; and at raised platforms at bus stops. This surface was developed because of the risk that the platform edge (off-street) warning surface could be confused in the street environment with the blister surface used at pedestrian crossing points (see 2.1). This concern remains valid. However, there is no danger of similar confusion if lozenge is used on off-street platforms. Blind and partially sighted users on walkabouts found it easy to detect and distinguish lozenge. The existing *Guidance on the Use of Tactile Paving Surfaces* states that "the surface is not recommended for use at raised bus stops", but no reason is given. Some authorities already do use it in this way (e.g. in South Yorkshire) and there do not seem to be any obvious safety or navigation issues were this practice to become commonplace.	
a. Purpose	Proposed revised core statement: *The purpose of the street platform edge warning surface is to warn visually impaired people that they are approaching the edge of a tram/LRT platform, or a raised bus platform.*
b. Definition	Essentially as existing, with simple diagram (Figure 26 in *Guidance on the Use of Tactile Paving Surfaces*). Could add one or two non-technical graphics (e.g. colour drawing) to illustrate typical circumstances where blister paving will be deployed (e.g. on-street tram and bus, and off-street train).
c. Application	*The lozenge surface is recommended for use at all tram/LRT platform edges. It is also recommended for use at the edge of raised bus stop platforms.*
d. Maintenance	See note in 2.1 in this table.
e. Layout	There is only one technical drawing in *Guidance on the Use of Tactile Paving Surfaces* (Figure 27) but, even so, this should be placed in Section 3.
Chapter 5 – Segregated Shared Cycle Track/Footway Surface and Central Delineator Strip	
Delete this section. The existing 'Purpose' section notes that these surfaces should only be used "where it is not possible to achieve segregation (between people walking and cycling) by a level difference". The arrangements covered by this chapter are therefore essentially a concession. In addition, there are several indications that the disbenefits of permitting these arrangements outweigh any benefits. • Many users do not know what the surface means in general or what the different orientations signify • A third 'linear' surface increases the chance of user confusion. Corduroy needs to be retained, while guidance path has a clear and defined purpose; and although it is	

comparatively rare at present, it has the potential to be used for stems leading to blister surface crossing points (see 2.1 and 2.4 in this table)
- Non-compliant layouts are common, e.g. corduroy used instead of ladder or ladder/tramline being swapped
- Figures 30 to 35 of *Guidance on the Use of Tactile Paving Surfaces* help to show how inherently complex and hard-to-interpret the arrangements might be, even in 'perfect' circumstances. This points towards the potential for a much simpler arrangement to be preferable in practice
- Cycling campaigners report numerous incidents of people on bicycles crashing while traversing sections of ladder, especially when wet. (The prescribed depth of 2400mm may also be an issue.) Such concerns mean that some people prefer to cycle over the ladder (rumble strip) surface, which negates the purpose of the arrangement

The recommendation is therefore that the delineator strip is retained, but both ladder and tramline at the thresholds are replaced by corduroy across both sides. The message communicated may be less sophisticated, but clarity and simplicity will be enhanced.

2.4 – Guidance Path Surface

Retain; and consider use for stems leading to blister paving at controlled pedestrian crossing points.

a. Purpose	Proposed revised core statement: *"The guidance path surface has been designed so that people can be guided along the route either by walking on the tactile surface or by maintaining contact with a long cane. Its core purpose is twofold: to act as a 'stem' guiding visually people to an adjacent controlled crossing point where the blister surface has been provided; and to guide visually impaired people along a route when the traditional cues, such as a property line or kerb edge, are not available. It can also be used to guide people around obstacles, for example street furniture in a pedestrianised area."*
b. Definition	As existing, with simple diagram (Figure 36 in *Guidance on the Use of Tactile Paving Surfaces*). Could add one or two non-technical graphics (e.g. colour drawing) to illustrate typical circumstances where blister paving will be deployed (e.g. as a stem to a controlled crossing; in a large public space).
c. Application	*The guidance path is recommended for use in the following circumstances:* • *As a 'stem' leading to the blister surface at adjacent controlled crossing points* • *Where the traditional guidance given by a standard footway between the property line and carriageway does not exist (for example, in a pedestrian precinct)* • *Where pedestrians need to be guided around obstacles (for example, in a pedestrian precinct): although care should be taken in siting street furniture to ensure that such problems are not created*

	• *Where visually impaired people need to find a specific location* • *In transport terminals to guide people between facilities*
d. Maintenance	See note in 2.1 in this table.
e. Layout	Technical drawings to be placed in Section 3. Consider using ISO model of blister paving squares at guidance path crossings.
Chapter 7 – Information Surface	
Delete this section. Remove this surface from the list. It is extremely rare in practice; almost no-one knows what it means; and its purpose is not considered necessary or even beneficial in terms of either navigation or safety.	
PRACTICAL IMPLICATIONS OF RECOMMENDED CHANGES	
Blister surface. No change is proposed to the use of this surface as per its core statement of purpose as a warning of the transition between footway and carriageway. As to the recommendation that it no longer be used for stems (guidance path to be used instead), it is not considered that there is a pressing need for existing blister stems (which are commonplace) to be immediately replaced, though a programme of gradual replacement as part of maintenance and capital works is recommended. Priority for replacement should be targeted on locations (e.g. physically constrained junction corners with two perpendicular crossings) where blister stems overlap or form wedges, both of which arrangements are confusing. **Corduroy surface**. Its generic function (Hazard: proceed with caution) should be stressed. Its use to replace ladder/tramline – in 'ladder' orientation across the whole threshold (and to a depth of no more than 1200mm) – should be expedited wherever possible, due to the high levels of confusion (both for users and practitioners) and generally low levels of user satisfaction (shared across visually impaired people, wheelchair users and people on cycles). **Platform edge (off-street) surface**. It is recommended that this surface is retained but discussed in a separate section, to avoid confusion with the surfaces used on the public highway. **Platform edge (on-street) surface**. No change is proposed concerning its current use. As for the recommendation it should be used as a raised bus stop platform edge warning, this is considered unlikely to cause user confusion, and indeed its use for this purpose is already commonplace in some local authority areas (though none visited specifically for this study.) **Ladder/tramline surface and delineator strip**. It is proposed that the use of ladder/tramline is discontinued and that existing installations are replaced as soon as practicable with corduroy surface in the standard 'ladder' orientation across the whole threshold (see under corduroy above). The use of the delineator strip should be retained. **Guidance path surface**. The use of guidance path for stems leading to blister surface at crossings – replacing the use of the blister surface for that purpose – is proposed for	

immediate adoption. While there is no general pressing need to replace existing blister stems, replacement should be expedited in locations where the used of blister stems currently causes confusion (see under blister above).

Information surface. The discontinuation of the use of this surface will cause no problems in practice due to it being almost never used or encountered and being almost entirely unknown by users.

3. SAMPLE LAYOUTS + TECHNICAL DRAWINGS
Updated versions of the still-relevant technical drawings from *Guidance on the Use of Tactile Paving Surfaces*, with some deletions and additions. Photos and/or 3D visualisations could accompany plans where they are helpful for illustrating the context, especially where achieving the standard layouts is tricky. This Section should also cover 'permitted departures' from standard layouts: such as (for discussion) stems at non-perpendicular angles to enable them to reach the back of footway.

Appendix C Discussion on recommended changes to 'Inclusive Mobility'

D.1.2 Section – Basic Human Factors Information

This section disaggregates "disability" in terms of Locomotion, Seeing, Hearing, Reaching / Stretching / Dexterity, and Learning Disability. There is a need to look for more recent evidence to verify, and potentially update, some of the statistics cited, for example:

- "Approaching 70% of disabled people have locomotion difficulties: those with walking difficulties outnumber wheelchair users by about 10:1"
- "…there are almost two million people in Great Britain with a significant sight loss"
- "…there are over eight million deaf or hard of hearing people in the UK of whom approaching 700,000 are severely or profoundly deaf"
- There is a need to look for more recent human factors evidence relating to people
- All references to wheelchair dimensions need to be updated, to reflect the full range of products on the market
- Walking distance figures are derived from research carried out in the late 1980s
- Reference is also made to data from the USA; again, any updates on these data need to be examined

Note that the ISO Standard for wheelchairs (ISO 7193) consists of several sections, and it will be necessary to consider all updates, as well as standards from elsewhere.

D.1.3 Section – Footways, Footpaths and Pedestrian Areas

Stakeholders suggested that additional guidance was needed on the following:

- Appropriate gradients
- Colour contrast, including the use of stickers etc to warn against collision with glass doors and windows
- Pavement parking (legislation is planned in Scotland)
- Other obstructions, in particular the encroachment of "café tables" which is dealt with briefly; however, revised guidance might provide more detail on the use of pavements by cafés and restaurants, given that 'café culture' has been embraced, in the UK, to a larger extent than it had been when *Inclusive Mobility* was first published
- There is a section on Road Crossings, which needs to be updated according to the Local Transport Notes (LTN) and other circulars that have been issued by the Department for Transport since the publication of *Inclusive Mobility*; these should include details of the design of puffin crossings, toucan crossings and pedestrian count-downs. The revised guidance should emphasise that Pelican crossings are no longer prescribed and that no new ones may be installed

D.1.4 Section – Car Parking

This section refers to the provision of designated parking spaces for Blue Badge holders wherever conventional parking spaces are provided, in both Local Authority provided car parks, and car parks provided for the public by private companies.

Guidance covers the site and location of designated parking spaces, the percentage of parking spaces that should be designated for older and disabled people, the detailed design of accessible parking bays, signage & marking and the design of parking control (i.e. payment) equipment.

There may be a need to review the suitable proportion of designated parking spaces in light of the current proportion of blue badge holders. There may also be a need to consider other developments related to Blue Badges since 2002, such as any changes connected with the prevention of fraudulent use of a Blue Badge and enforcement.

D.1.5 Section – Bus Stops

The guidance covers the spacing of bus stops, the design and dimensions of raised boarding areas (including kerb heights), the design and positioning of shelters, the design and positioning of bus stop flags, seating at bus stops, and timetable information.

"…research that shows that, for disabled people, bus use falls off sharply if the distance [between bus stops] is more than 200 metres…". There is a need to investigate whether more up-to-date research has been carried out on this issue.

Reference is made to the Public Service Vehicles Accessibility Regulations 2000 (PSVAR), where they relate to the maximum acceptable gradient of a bus boarding ramp.

"…research by Greater Manchester Passenger Transport Executive…". There is a need to check the findings of more recent research that has been carried out into the same issue.

"…new designs of 'panel' bus stops provide more space for information." This advice might be reconsidered, given that such displays are unpopular with many disabled people, given that wheelchair users and people of shorter stature are typically only able to read the information that is located at a certain height on these panels. (There is a recommendation in the main report to discourage the use of 'panel' bus stops.)

There is no consideration of the provision or design of Variable Message Signs, or of any other type of electronic display.

It is recommended that TfL's 2017 Accessible Bus Stop Design Guidance is reviewed as a potential source of updated information, and a search may be made for other alternative sources which cater for areas different to London.

D.1.6 Section – Taxi Ranks

This is a very short section, which provides general guidance concerning the siting, design and signing of taxi ranks. "At present, over 80 Licensing Authorities have introduced mandatory orders requiring some or all of the taxis within their area to be wheelchair accessible." This statement is clearly outdated and needs to be updated if it is to be retained.

D.1.7 Section – Access to and within Transport-related Buildings

This is a large and comprehensive section. Consideration should be given to the following revisions:

- Consideration should be given to how much of the Building Regulations apply to such buildings in any case and whether there is unnecessary duplication
- Reference is made to an "American guideline" (Federal Register, Vol.56, No.173). There is a need to check for updates on this guideline and related guidelines
- The document admits that recommended dimensions for features such as steps and stairs are based on research carried out in the 1970s and 1980s, and on the length of a size 9 shoe. There is need to check more recent research to verify that these guidelines remain relevant for today's population
- There is also reference made to Australian standards. There is need to check current Australian guidance, to review any changes in the dimensions quoted

D.1.8 Section – Transport Buildings: Facilities

Detailed recommendations are provided on the design of public telephones. Consideration should be given to whether such guidance is necessary, (subject to any requirement for a minimum number of public telephones being available in case of emergency), due to the growing prevalence of the use of mobile 'phones. The definitions regarding obstructions relating to public telephones might be extended to cover other obstructions or be replaced altogether. (It should be noted that it is a recommendation in the main report that public telephones should not be included in the redrafted guidance.)

There may be a need to review guidance on the accessibility of ticket machines from the perspective of blind and partially-sighted users (especially touch screens) and people with learning disabilities. There may be a need to add detail regarding contactless payments or other payment mechanisms.

Reference is made to the type of seating provided by Merseyside PTE. This is very likely to be an outdated reference.

Regulations from the USA and guidelines from Australia are quoted concerning the number of spaces for wheelchair users that should be provided as a proportion of the total number of fixed seats. There is need to check documentation for updates if these references are to be retained.

While there is a comprehensive section on toilet facilities this is based on superseded building regulation documents. A consultation has recently been concluded on introducing 'Changing Places' standards into Building Regulations[9] so the outcome of this consultation will need to be considered when it is published.

D.1.9 Section – Signage and Information

This section makes specific reference to the needs of people who are blind or partially-sighted, and people who are deaf or hard of hearing, but also emphasises the general

[9] https://www.gov.uk/government/consultations/changing-places-toilets

advantage of “simplicity”, which can help everyone, but particularly people with learning disabilities. The section also emphasises the importance of good signage in relation to emergencies and evacuation procedures. Further emphasis may need to be given to the importance of consistency and clarity of signage, for example for people with dementia.

Reference is made to guidelines from the USA on minimum letter heights – if such a reference is to be retained, then it will be necessary to establish the most up-to-date information from this source.

Detailed data are provided on the size requirements for symbols, citing Transport Canada as the source. There is a need to check whether more recent information is available.

There are new types of signage/legibility features (e.g. relating to Legible London and similar initiatives) and there may also need to be consideration of the emergence of new technologies for navigation.

D.1.10 Section – Lighting

This section explains the principles of reflection and glare etc. and describes how lighting can be used to give directional guidance. There were no particular issues raised with this section, except that the “Code of Practice for Road Lighting”, BS5489 document has since been updated.

D.1.11 Section – Access in the Countryside

The BT’s “Countryside for All” (1997) publication is acknowledged as being the source of most of the recommendations made in this section, which covers the dimensions of rural paths, gateways, bridges & boardwalks, steps, seating & resting places, viewing points and information displays. There were no particular issues raised with this section, except that the BT “Countryside for All” (1997) guidelines have since been updated by the Fieldfare Trust.

D.1.12 Section – Consultation, Training and Management

This section emphasises the importance of “consultation and participation”, and of involving key stakeholder organisations. There is a sub-section on “disability awareness training” for staff, with recommendations as to the main content of such training.

The sub-section on “disability awareness training” will require some updating to bring it in line with current thinking in this subject area.

D.1.13 Section – Glossary, Bibliography and Useful Addresses

Information is outdated and should be updated as appropriate.

D.1.14 Superseded References within the Document

The following superseded references were found within *Inclusive Mobility*:

- Disability Discrimination Act (1995)
- Legislation on reasonable adjustments (Oct. 1999)
- The “Strategic Rail Authority”

- The SRA's "Train and Station Services for Disabled Passengers"
- Part V of the DDA
- British Standard BS8300 (a new version was published in late 2018)
- The DfT's Mobility and Inclusion Unit
- Institution of Highways and Transport
- The IHT's "Reducing Mobility Handicaps – Towards a Barrier Free Environment"
- "The DDA"
- The Royal National Institute for Deaf People (RNID)
- ISO Standard for Wheelchairs (ISO 7193)
- Local Transport Note (LTN) 2/86 "Shared Use by Cyclists and Pedestrians" which has been superseded by LTN 1/12 "Shared Use Routes for Pedestrians and Cyclists"
- Traffic Advisory Leaflet (TAL) 4/91 "Audible and Tactile Signals at Pelican Crossings" dates from Nov. 1991. There is a need to provide updates from subsequent TALs62, (such as TAL 05/05 "Pedestrian Facilities at Signal-controlled Junctions")
- It is understood that this guidance will be superseded by the Traffic Signs Manual Chapter 6, which is currently being drafted
- The Traffic Signs Regulations and General Directions has been updated, with the latest version being 2016, including 'H' marking which is still prescribed in TSRGD 2016 as Diagram 1026.1 (at Schedule 11 Part 4 Item 17)
- "…push button units used in Great Britain must first be approved by Traffic Control and Lighting, in Bristol." This has been superseded by the TOPAS product registration
- Reference is made to BS 7997 "Products for Tactile Paving Surface Indicators", which provides construction standards for paving materials. There is a 2003 version of this Standard, which should be referenced
- The "Railway Inspectorate"
- "'Blue (formerly Orange) Badge' holders" – Reference to the Blue Badge's former colour should now be omitted
- TAL 5/95 "Parking for Disabled People" dates from 1995
- The SRA's "Train and Station Services for Disabled Passengers" is referenced
- Section 5.4 appears to show unlawful road markings for on-street bays
- "Greater Manchester Passenger Transport Executive"
- "The information provided on [the timetable] display should also include directions to and distance of the nearest public telephone…". Consideration should be given to omitting this, and similar, guidance, given the increasing rarity of public telephones
- "Code of Practice for Means of Escape for Disabled People", BS5588, Part 8, (1988). This guidance has been revised several times

- BS8300, which has recently been revised, is referred to when dealing with ramps and gradients
- “European Lift Standard” (April 2000). This guidance has been revised several times, most recently in 2017
- “Merseyside PTE”
- The detailed section on the design and provision of toilets carries an acknowledgement of having drawn heavily from BS8300 “Design of Buildings and their Approaches to Meet the Needs of Disabled People”, Part M of the Building Regulations (1991) and Part T of the Technical Standards (Scotland) (1990). All of these source documents have been superseded several times
- Reference to “Sign Design Guide” (2000), which has since been updated. This document does not cover traffic signs, which are separately covered by the “Traffic Signs Manual and the Traffic Signs Regulations and General Directions”
- “Legibility of Timetables, Books and Leaflets”, (DPTAC, 1996). This document was updated by the Association of Transport Co-ordinating Officers in Sep 2002, with “minor updates and corrections” made in May 2003
- “Code of Practice for Road Lighting”, BS5489. This document has since been updated
- “British Telecom (BT)”
- BT’s “Countryside for All” (1997). These standards & guidelines have since been updated by the Fieldfare Trust
- “Guidance on Full Local Transport Plans”, Department for Transport, (Mar. 2000). The most recent update of this document appears to have been in July 2009
- “Encouraging Walking”, Department for Transport, (Mar. 2000) – several policy documents have superseded this document, some of which have included cycling within their remit

D.1.15 Outdated terminology

Potentially outdated terminology has been highlighted. No attempt is made in this analysis to perform a comprehensive audit of the language used, on the grounds that when the documents featured in this project are redrafted appropriate terminology will be used. For example, it will be natural to refer to “engagement” instead of “consultation”. Furthermore, not every example of outdated terms used throughout the documents, (such as references to “impairment”), are highlighted in this table, as these can be eliminated during any future drafting process.

- “Sensory and cognitive impairments”
- “People with mobility impairments”
- “Physical, sensory or mental impairment”
- Reference to “elderly” people

- The reference to “cash tills” is now rather obsolete and should be replaced with a more modern equivalent term. Similarly, references to “ticket barriers” and “automatic ticket vending machines” should be updated
- “Ambulant disabled people”
- “Colostomy changing shelf”
- “Hard of hearing people”
- References to “consultation” might be replaced with references to “engagement”

Accessible Public Realm: Updating Guidance and Further Research

Abstract

This report presents findings from research carried out by TRL, Urban Movement and Phil Barham Freelance Consulting to inform proposed updates to the Government guidance documents *Inclusive Mobility*; and *Guidance on the Use of Tactile Paving Surfaces*. The research considered the following themes:

- Understanding the real-world implementation of tactile paving and how users interpret it
- Reviewing guidance on the dimensions of mobility devices
- Identifying new technologies and infrastructure not currently considered within Inclusive Mobility
- Investigating mental health, ageing, dementia, and non-visible disabilities, with a view to developing guidance for them

The research involved literature reviews, stakeholder consultation, surveys and focus groups with practitioners and users; and site- visits. The report recommends potential changes and additions to the guidance and identifies where further research would be beneficial.

TRL
Crowthorne House, Nine Mile Ride,
Wokingham, Berkshire, RG40 3GA,
United Kingdom
T: +44 (0) 1344 773131
F: +44 (0) 1344 770356
E: enquiries@trl.co.uk
W: www.trl.co.uk

2714