

# ROAD NOTE 21

## Enhancing the mobility of people with disabilities

Part 2: Guidelines for Practitioners

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The views expressed in this guide do not necessarily reflect the UK government's official policies.



[hvtinfo@dt-global.com](mailto:hvtinfo@dt-global.com)



[www.transport-links.com](http://www.transport-links.com)



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<b>Abstract</b>	
Part 2 of RN 21 provides guidance to practitioners involved in the design and implementation of transport schemes, systems and provisions in low- and middle-income countries. It begins by introducing the concept of Universal Design which is followed by a discussion on mobility aids and the importance of achieving personal mobility with maximum independence. The remainder of the guide provides detailed best practice guidance and design standards pertinent to the design of 1) accessible vehicles 2) accessible infrastructure, and 3) accessible transport services and information. It includes entirely new sections on waterborne transport and school transport services.	
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## ABBREVIATIONS/ACRONYMS

RN21	Road Note 21 (Document name)
RN	Road Note
FCDO	Foreign, Commonwealth & Development Office
HVT	High Volume Transport
IMC	DT Global Ltd
SARA	Safety, Accessibility, Reliability and Affordability
DPO	Disabled Persons Organisation
WfW	Wheels for Wellbeing
RNIB	Royal National Institute of Blind People
ADI	Assistance Dogs International
GPS	Global Positioning system
UN	United Nations
UNESCAP	United Nations' Economic and Social Commission for Asia and the Pacific 1997
UNCRPD	United Nations' Convention on the Rights of People with Disabilities
IIT	Indian Institute of Technology
NGO	Non-Government Organisation
TAI	The Accessibility Institute
LMIC	Low to Middle Income Country
CLASP	Collaborative Labelling and Appliance Standards Programme
UK	United Kingdom
PSV	Public Service Vehicle
TfL	Transport for London
DPTAC	Disabled Persons Transport Advisory Committee
DETR	Department of the Environment, Transport, and the Regions
BRT	Bus Rapid Transit
AEI	Access Exchange International
ITP	Integrated Transport Planning
CFL	Chemins De Fer Luxembourgeois
PA	Public Announcement
G7	Group of 7

LEVC	London Electric Vehicle Company
TXe	Electrically Driven Taxi
LED	Light-Emitting Diode
ICE	Inspired Cycle Engineering
ISO	International Organization for Standardization
ITDP	Institute for Transportation and Development Policy
LTA	Land Transport Authority
N	Newton
dBA	Decibels
MM	Millimetres
Lux	Illumination
PAMIS	Promoting a More Inclusive Society
GAATES	Global Alliance on Accessible Technologies and Environments
CPTM	Companhia Paulista de Trens Metropolitanos
MCC	Muntinlupa Care Card
ENCTS	English National Concessionary Travel Scheme
SMS	Short Message Service
MTR	Mass Transportation Railway
RTI	Real Time Information
GTFS	General Transit Feed Specification
EU	European Union
SFO	Station Facility Operators
RDG	Rail Delivery Group
BELB	Bluetooth Low Energy Beacons
M	Metres
DEOC	Diversity & Equal Opportunity Centre
SITES	Portuguese-language Acronym for Integrated Special Education Transport System
VARID	Augmented Reality for Inclusive Design
PLM	People with Limited Mobility
USA	United States of America
TDD	Telecommunications Device for the Deaf
PRM TSI	Persons with Reduced Mobility Technical Specification for Interoperability

# Chapter 1

Introduction to Part 2



## Introduction to Part 2

RN21 is a good practice guidance document aimed at engineers, planners, central and local government officials, policy makers, transport operators and people with disabilities in developing countries, to enable them to work together towards improving the mobility of people with disabilities. The purpose of the guide is to enhance the mobility of disabled people.

RN21 is split into two main parts. Part 1, 'Guidelines for Policymakers', provides overarching guidance to policy makers on how best to approach creating more accessible transport for people with disabilities. Part 2 of this guide aims to provide detailed guidance to practitioners on how best to approach creating more accessible transport for people with disabilities.

The transport environment can have a very significant impact on whether people with disabilities are able to travel at all. Problems with a single part of a disabled person's trip-chain (the different journey stages that make up one complete journey) can make the entire journey impossible. For this reason, it is extremely important that all parts of the transport system, and all modes of travel, are as accessible as possible. There are also many non-infrastructure aspects of the transport system that are similarly important; such as the attitudes of staff or other passengers towards people with disabilities, the extent to which staff are trained to support people with disabilities when they are travelling, and/or whether people with disabilities can access information about their journey ahead of time. Following the principles of Universal Design, creating an accessible transport system benefits not only people with disabilities, but everybody.

As such, this part of the guide is aimed more at practitioners than policy-makers. This is because it focuses on the specific tools, layouts and materials which can be used to create more accessible transport environments. This part of the guide presents a mixture of minimum standards and best practice, showing that in many cases, relatively small interventions can have a significant impact for the accessibility of the transport system for people with disabilities. Implementing many of the suggestions

in this part of the guide requires an underpinning of policy and a wider understanding of disability in relation to transport in national/regional/state laws and the public consciousness – these are contained in Part 1 of the guide.

This guidance is loosely based around a disabled person's trip chain. This begins with a discussion of Universal Design and general good practice for design (Chapter 2), followed by a discussion of mobility aids (often a pre-requisite for people with disabilities to be able to move around in public space) (Chapter 3). This is followed by specific guidance for designing accessible vehicles (Chapter 4), infrastructure (Chapter 5) and accessible information and services (Chapter 6).

Throughout, this guide refers to examples of best practice from all over the world, presented as case study boxes, as well as examples of minimum standards from various countries which are considered to be best practice examples.

Readers should use this part of the guide to:

- Learn about the principles of Universal Design, and general concepts of best practice for accessible design (Chapter 2);
- Understand Mobility Aids, including what they are, how they should be designed, how eligibility should be assessed and where to start (Chapter 3);
- Understand how vehicles can be made more accessible, including public transport vehicles, taxis and private hire vehicles and cycles (Chapter 4);
- Understand how infrastructure can be made more accessible, including pedestrian infrastructure, transport interchanges and car parking (Chapter 5);
- Understand how to provide accessible information and processes for developing accessible transport services beyond the vehicles that are utilised (Chapter 6).



# Chapter 2

Universal Design



# Universal Design

## 2.1 The Concept of Universal Design

As discussed in Part 1 of this guide (Section 2-4, The Social Model of Disability), Universal Design is the most desirable approach for designing transport systems, tying neatly to the Social Model of Disability. Planners and designers of transport infrastructure, systems and services should follow the concept of Universal Design wherever possible. This would make them as accessible and useable as possible for the broad population, including people with disabilities and others.

Universal Design seeks to include as many people as possible. It can be defined as [\[1\]](#):

“The design and composition of an environment so that it may be accessed, understood and used:

- To the greatest possible extent;
- In the most independent and natural manner possible;
- In the widest possible range of situations;
- Without the need for adaptation, modification, assistive devices or specialised solutions, by any persons of any age or size or having any particular physical, sensory, mental health or intellectual ability or disability”.

The development of Universal Design in its current form began in the 1990s in the UK and the USA (often referred to as ‘inclusive design’), growing out of increasing calls for equal rights and design standards and often focused on architectural access by wheelchair users. Ideas of ‘barrier-free’ design and other design approaches that aimed to make environments more accessible for people with physical impairments were developed further to bring awareness to the benefits of more accessible environments for everybody. Changes in global demographics (including ageing populations) and trends (including the increased appreciation of ‘hidden’ disabilities) at the same time also supported the shift towards a concept of Universal Design [\[2\]](#).



Universal Design relates to all aspects of design, not just transport. By applying a Universal Design approach when designing transport services and infrastructure, people with disabilities with a wide range of impairments can be accommodated within the standard transport system. Not only does this have benefits for people with disabilities, it also makes environments more accessible for all users, and is often the most cost-effective way of providing accessible transport options.

Even so, designers are not expected to find one design solution that accommodates the needs of 100% of the population, as Universal Design is not one size fits all and different users will have different needs. Instead, Universal Design means that if more than one option is available for a design feature, designers should always choose the more inclusive feature. For example, when installing a handle on a door, it is always better to opt for a lever handle, rather than a door knob, as the lever handle can be opened using the elbow or a closed fist, benefiting people carrying shopping bags as well as people with limited strength in their hands [1].

#### Box 1: Universal Design, Inclusive Design or Design for All

Universal Design is sometimes referred to as Design for All or Inclusive Design. There are some subtle but important differences between these concepts, explained below:

##### Universal Design

Universal Design originated from design of the built environment and websites, and was initially applied in the context of government provision [3].

Both ‘Design for All’ and ‘Universal Design’ approaches pragmatically accept that it is not always possible for one solution to meet the needs of the entire population. Nevertheless, these approaches maintain that all mainstream approaches (e.g. transport systems) should be accessible to as many people as technically possible [3].

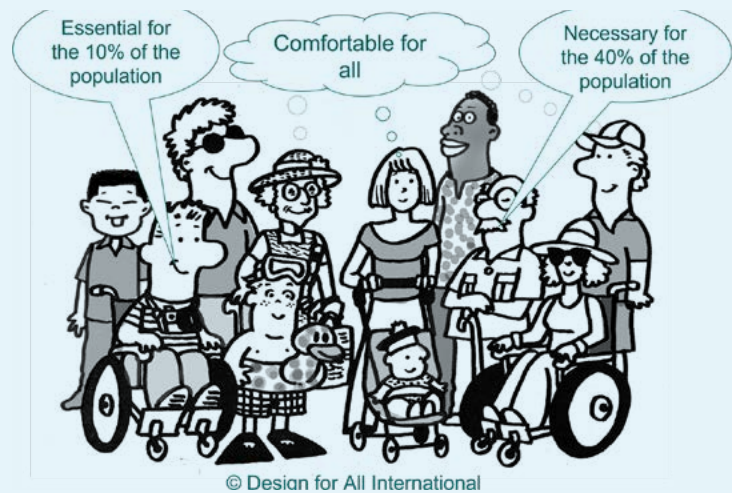
##### Design for All

Design for All is very similar to Universal Design and is often used as an interchangeable term. It is “the intervention into environments, products and

services which aims to ensure that anyone, including future generations, regardless of age, gender, capacities or cultural background, can participate in social, economic, cultural and leisure activities with equal opportunities” [4].

Design for All also developed from a built environment background [4], but sought to look beyond the needs of wheelchair users to encompass the experiences of people with a wider range of disabilities. It also seeks to consider the experiences of people who experience

limited mobility but may not be classified as ‘people with disabilities’, for example, people travelling with luggage or young children.



The Design for All Foundation suggests seven strategies which should allow a design solution to reflect the needs of all potential users. This begins with a single design that is accessible by all and ends with a specific customised product/approach for an individual.

Image: Design for All

### Inclusive Design

Inclusive design originated with product design and focuses on choosing an appropriate target market for a particular design, and making informed decisions to maximise the ‘Product performance indicators’ for that target market.

While inclusive design intends to extend the reach of mainstream products, it acknowledges the commercial constraints associated with satisfying the needs of the target market. However, for websites and the built environment (including transport), the target population is generally the whole population. [3]

In the context of this guide all three approaches are considered to have a broadly

equivalent meaning, reflecting their intent to recognise that making practical improvements to the accessibility of transport systems involves considering the needs of a wide cross-section of the population.

## 2.2 Principles of Universal Design

The requirements for an environment and practices that promote good mobility for all travellers will differ throughout the world. Factors as diverse as vehicle dimensions, the expectations of passengers, or local weather pattern will determine whether any specific solution for access problems applies in a particular locality. However, there are several core principles of Universal Design that can be applied in every context.

Universal Design is underpinned by seven core principles, which were developed in 1997 by a working group of architects, product designers, engineers and environmental design researchers [5]. The purpose of the principles is to guide the design of environments, products and communications. The principles "may be applied to evaluate existing designs, guide the design process and educate both designers and consumers about the characteristics of more usable products and environments." The Seven Principles are summarised in Table 1.

Table 1: Principles of Universal Design

Principle	What does this mean?	Guidelines for implementation
1: Equitable use	The design is useful and marketable to people with diverse abilities	<ul style="list-style-type: none"><li>• Provide the same means of use for all users: identical whenever possible; equivalent when not;</li><li>• Avoid segregating or stigmatising any users;</li><li>• Provisions for privacy, security, and safety should be equally available to all users;</li><li>• Make the design appealing to all users.</li></ul>
2: Flexibility in Use	The design accommodates a wide range of individual preferences	<ul style="list-style-type: none"><li>• Provide choice in methods of use;</li><li>• Accommodate right- or left-handed access and use;</li><li>• Facilitate the user's accuracy and precision;</li><li>• Provide adaptability to the user's pace.</li></ul>

3: Simple and Intuitive Use	Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills or current concentration level	<ul style="list-style-type: none"> <li>• Eliminate unnecessary complexity;</li> <li>• Be consistent with user expectations and intuition;</li> <li>• Accommodate a wide range of literacy and language skills;</li> <li>• Arrange information consistent with its importance;</li> <li>• Provide effective prompting and feedback during and after task completion;</li> </ul>
4: Perceptible Information	The design communicates necessary information effectively to the user regardless of ambient conditions or the user's sensory abilities	<ul style="list-style-type: none"> <li>• Use different modes (pictorial, verbal, tactile) for redundant presentation of essential information;</li> <li>• Provide adequate contrast between essential information and its surroundings;</li> <li>• Maximise "legibility" of essential information;</li> <li>• Differentiate elements in ways that can be described (i.e. make it easy to give instructions or directions);</li> <li>• Provide compatibility with a variety of techniques or devices used by people with sensory limitations.</li> </ul>
5: Tolerance for Error	The design minimises hazards and the adverse consequences of accidental or unintended actions	<ul style="list-style-type: none"> <li>• Arrange elements to minimise hazards and errors: most used elements, most accessible; hazardous elements eliminated, isolated or shielded;</li> <li>• Provide warnings of hazards and errors;</li> <li>• Provide fail safe features;</li> <li>• Discourage unconscious action in tasks that require vigilance.</li> </ul>
6: Low Physical Effort	The design can be used efficiently and comfortably and with a minimum of fatigue	<ul style="list-style-type: none"> <li>• Allow user to maintain a neutral body position;</li> <li>• Use reasonable operating forces;</li> <li>• Minimise repetitive actions;</li> <li>• Minimise sustained physical effort.</li> </ul>
7: Size and Space for Approach and Use	Appropriate size and space is provided for approach, reach, manipulation and use regardless of user's body size, posture, or mobility	<ul style="list-style-type: none"> <li>• Provide a clear line of sight to important elements for any seated or standing user;</li> <li>• Make reach to all components comfortable for any seated or standing user;</li> <li>• Accommodate variations in hand and grip size;</li> <li>• Provide adequate space for the use of assistive devices or personal assistance.</li> </ul>

Source: [\[5\]](#)

## General Good Practices

For many people with disabilities, each element of a journey presents unique challenges. If one part of a journey is not possible, this can often impact or even prevent the remainder of the journey, particularly if there are time limits (e.g. trying to reach a meeting or appointment). For this reason, it is useful to think about the accessible design of the individual stages of an accessible journey. This varies from person-to-person and journey-to-journey, but often begins with planning a journey and purchasing tickets for travel. It also extends through the journey-making process to include:

- Getting from home to a stop/terminal;
- Waiting in comfort;
- Boarding a vehicle;
- Using toilet facilities at any stage of the journey;
- Knowing where and how to alight a vehicle;
- Getting to the destination from the final stop/terminal.

The following chapters of this document are split out in this way to help facilitate incorporating accessible design into each individual stage of the journey.

However, there are some general good practice statements that apply in the majority of instances relating to transport. These four areas of good practice are ‘SARA’ – Safety, Accessibility, Reliability and Affordability. Each subsequent chapter in this part of the guide uses these as a way to structure an overview of how to achieve accessibility for people with disabilities.

### 2.2.1 Safety

There are many aspects of the built environment that impact perceived and actual risk to people’s safety. While these problems can affect all travellers, they can create bigger barriers for people with disabilities who may be less able to detect and respond to an unsafe situation. For instance, people walking with difficulty may be slower to

avoid moving vehicles when crossing a street; or visually impaired people may be unable to detect and avoid unexpected obstacles in their path. As a result, safety concerns and perceived risk often prevent people with disabilities from travelling altogether.

Safety improvements benefit all travellers, and not just those with disabilities. Specific principles that the practitioner can apply when addressing safety issues, particularly as they relate to the needs of disabled travellers, include:

- Removal of obstructions that could injure travellers. Visualise a continuous three-dimensional travel path that is clear from obstacles, such as signposts, potholes and overhanging branches. Ensure vehicle entrances, aisles and seats are free from sharp or protruding edges;
- Provision of adequate warnings and information to prevent travellers from getting into danger. Where obstacles cannot be removed, provide clues to inform trip makers of their existence by using highly contrasting paint or sometimes even by putting physical barriers in place;
- Prolong the time available to accomplish certain tasks. For example, provide longer signal settings for street crossings. Train bus drivers to keep the bus stationary until passengers who experience difficulty when mobilising on-board a vehicle, and may therefore require more time, have reached their seat;
- Improve security to assist vulnerable passengers. Provide adequate lighting at stations and bus stops.

### **2.2.2 Accessibility**

Accessibility relates to the ability to access and use all parts of the transport system:

- Clear the way of physical barriers, such as kerbs at street crossings. Remember that users of wheelchairs, tricycles, crutches and walking sticks, require or prefer both a step-free surface and extra space to accommodate their mobility aids;
- Many people with disabilities have reduced physical strength or stamina. The design and operation of infrastructure and services therefore needs to promote ease of movement – including short walking distances along the most direct routes,

no steep slopes, easy entry into vehicles, adequate provision of grabrails and seats to rest on;

- A simple design and layout make facilities such as stations and pedestrian areas easier for visually impaired persons to negotiate, but also assists cognitively impaired people, visitors and occasional users.

### 2.2.3 Reliability

Reliability relates to consistency across all the elements of a journey, both in time and spatially across physical infrastructure, vehicles, and facilities. For a trip to be possible at all, the entire journey – including for instance the footway to the bus stop, the entrance into the bus, the journey in the bus, the exit and the footway to the destination – need to be accessible. Therefore, reliability requires attention to be paid to the whole trip chain. There are various types of reliability:

- Reliability over time: if a disabled passenger can use an accessible bus to get to work in the morning, they must be able to trust that an accessible bus will be available again for the return journey.
- Journey time reliability: people that are connecting onto more than one transport service will rely on their journey operating to schedule. If there are delays at certain stages of the journey, travellers could miss connections later on.
- Mechanical reliability: if a rail station is advertised as being accessible through the installation of lifts, then the lifts need to be in working order to avoid users becoming stranded.
- Information reliability: because accessible facilities/services are usually mixed with non-accessible ones, it becomes very important for the disabled traveller to be able to ascertain beforehand whether a specific facility or service is accessible. Consistent use of the international accessibility symbol to identify fully accessible services is useful. People with disabilities often have a more limited ability to respond to unforeseen circumstances. Timely, real-time information on expected waiting times, service changes or delays enhances their ability to make alternative plans if needed. Reliable signage in terminals or at stops benefits all users.

## 2.2.4 Affordability

People with disabilities often have lower incomes, and in developing countries are often among the poorest cohorts in society. In lower income countries people with disabilities, or their families, must often prioritise affordability over other considerations, if they are to travel at all. Thorough consideration of affordability in the design of a transport system is therefore crucial, and often requires clear funding and monitoring commitments to ensure that investments in more accessible built environments, transport vehicles and other facilities do not only remain the preserve of those who can afford to use them.

Affordability is also important from the transport provider or government's point of view, as budgets for transport, including access improvements, are typically very limited in developing countries. For this reason, some of the lower-cost options discussed in these guidelines may be appropriate as part of an incremental access strategy. Some high-level approaches for improving affordability for people with disabilities include:

- Many countries allow people with disabilities to travel on public transport at a reduced fare or no fare at all;
- Financial assistance for mobility aids including wheelchairs, canes or crutches provides a basic level of personal mobility for people with disabilities or physical impairments;
- Providing assistance (and relevant staff training) free of charge for people with disabilities can make an otherwise impossible journey available (e.g. assistance changing between buses for someone with a visual impairment) and may be cheaper than updating vehicles or terminal infrastructure in the short-term;
- Ensuring that ongoing transport costs associated with accessing inclusive facilities – such as schools – are budgeted for and monitored in a way that prevents the under-utilisation of such facilities and the marginalisation of people with disabilities on lower incomes. There are many examples of specialised schools being constructed, but people who experience mobility impairments, and/or who have complex needs, being unable to access them due to the cost and availability of suitable transport services.



## 2.3 Design Standards

Design standards have been developed in some areas that can be useful in implementing Universal Design principles for transport infrastructure, systems and services. For example, these set out minimum requirements for new or updated transport infrastructure to accommodate the accessibility needs of people with disabilities, as well as people without disabilities who can experience challenges when making journeys. This includes aspects such as footway widths, kerb heights, the use of tactile paving, the use of signage, and vehicle specifications.

Throughout this guide, examples of relevant design standards are presented, in many cases acting as a minimum baseline for achieving accessibility. Local adoption of design standards should be based on local data and environments wherever possible - for example, occupied wheelchair dimensions can vary significantly between countries.

### Box 2: Case study – Accessibility standard for public transportation (Solo, Indonesia)

In general, Indonesia has comprehensive legislation regarding the rights of persons with disabilities as well as their access to different modes of transportation. In 2006, the city of Solo adopted two standards: the Standard of Public Building, and the Standard of Public Facilities. Both of these include accessibility for people with disabilities and is managed by the City Space Management Office. The Standard aims to “improve accessibility, safety and the dignity of disabled and older people by supporting self-sufficiency and well-being.”

Solo’s Standard provides “a reference for development activities, which includes the technical planning and execution of constructions, thereby contributing to the creation of an accessible built environment. The Standard consists of a series of detailed plans on how to build accessible facilities. Concerning information and communication, all Solo government officials now receive, for example, free training in sign language. In addition, Disabled People’s Organisations promote the availability of sign language interpreters in government offices, terminals, and railway stations, etc., and governmental offices are providing computers with

screen readers.” The Standard has also been the trigger for the development of further local regulations on equality for people with disabilities.

Source: [\[6\]](#)

# Chapter 3

## Mobility Aids



# Mobility Aids

## 3.1 Importance of Achieving Personal Mobility

The term ‘personal mobility’ is used here to describe people’s independent movement, such as by walking or wheeling. As most people’s journeys begin and end this way, the ability to travel short distances independently is a crucial element of the travel chain. Many people with disabilities require a mobility aid – such as a wheelchair, crutches, a long cane or assistance dog – to achieve personal mobility. Some may rely on support from a companion in order to mobilise over short distances between buildings and travel modes.

Resource constraints prevent many people in developing countries from gaining access to the mobility aids and rehabilitation services that they need. The World Health Organisation estimates that only 5 - 15% of the people requiring assistive technology (of all types) have access to it in many low and middle-income countries.

[\[7\]](#)

This section describes different types of mobility aid available and provides examples of how affordable devices have been constructed and supplied through locally based projects.

### 3.1.1 Basic principles

#### Safety

- Everyone should be able to travel safely – irrespective of the impairments they experience;
- Mobility aids should be maintained to ensure they are safe to use;
- Training in how to use mobility aids correctly should be provided to people with disabilities;
- Transport vehicles must be capable of securing wheelchairs and their occupants properly for transport;

- Wheelchair users should determine whether their wheelchair can be safely carried/restrained in vehicles used to transport it, and/or whether they can safely transfer to a seat on-board (if preferred);
- Safety features such as wheelchair brakes and restraints in-vehicle should not be omitted to save on production costs;
- Visibility features such as lights or reflective strips can help keep mobility aid users safe when travelling at night.

### Accessibility

- People with disabilities need to be informed about the availability of mobility aids so that they can make an informed choice;
- Local production and supply of mobility aids should be encouraged where international safety and quality standards can be met;
- Wheelchairs (and particularly self-propelled wheelchairs) need to be lightweight;
- The mobility device (including wheels and tyres) needs to be suitable for the local environmental and weather conditions;
- The needs of the individual should be considered when choosing a mobility aid – for example, ensuring it is comfortable for the user and that it has the correct features, such as a headrest.

### Reliability

- Mobility aids should be constructed to cope with the rough terrain found in many developing countries;
- Wheelchairs should be regularly maintained to work well.

### Affordability

- The cost of mobility aids should be affordable for the vast majority of people who need them;
- The local production and supply of mobility aids may need to be subsidised.

## 3.2 Types of Mobility Aid

The term mobility aid covers a wide range of assistive devices suitable for people with various types of disability. The main types of mobility aids are:

- Wheelchair;
- Tricycle;
- Trolley;
- Bicycle and hand-cycle;
- Mobility scooter;
- Walking stick (cane);
- Crutches;
- Walking frame (walker);
- Lower limb prosthesis/orthosis;
- Long cane;
- Guide cane;
- Assistance dog;
- Mobile apps.

### 3.2.1 Wheelchairs, Tricycles and Trolleys

The three main types of wheelchair are:

- Self-propelled;
- Electric powered;
- Attendant-propelled.

Wheelchairs should be selected based on the needs of their user. For example, where a person has good mobility in their upper body, they may be able to self-propel their wheelchair. If they do not, they may require an attendant-propelled chair or electric powered chair. When choosing a wheelchair, both the abilities and the wishes of the individual should be considered, i.e. just because a disabled person is able to push their own wheelchair does not necessarily mean that they will want to. Footplate height should be adjustable, and the design and provision of a headrest will depend on individual need.


All types of wheelchairs, tricycles and trolleys should be well-balanced, and users should avoid hanging heavy bags on the back of their chair. This is essential as if the wheelchair is improperly balanced it is likely to topple over on an incline, potentially resulting in injury to the user and damage to the wheelchair.

Most seated wheelchair, tricycle or trolley users travel below the eye-level of the average pedestrian and much lower than motor vehicles with high cabins. Visibility strips and lights can help to make users more visible to other road and footway users, especially during hours of darkness. Flags or poles may be helpful for trolleys, which tend to be particularly low.




Environmental factors must be considered when selecting an appropriate mobility aid. The pros and cons of design features should be closely examined. For example, wider wheels can help with rougher terrain and sandy environments, but wider wheels are less efficient in energy expenditure.

Table 2 illustrates through photographs and highlights the advantages and disadvantages of different types of wheelchairs for people living in developing countries.



Table 2: Advantages and disadvantages of different types of wheelchair

Type of wheelchair	Advantages	Disadvantages
<div>Manual – four-wheel seated</div> <div></div> <div>Source: <a href="#">NYS DEC</a></div>	<div>Can be used indoors and outdoors;</div> <div>Numerous designs;</div> <div>Can be attendant propelled (if handles are fitted);</div> <div>Wheelchairs with collapsible frames can be folded and stored;</div> <div>Large rear wheels make them easier to push up and down kerbs and ramps;</div> <div>Can be made to be lightweight.</div>	<div>Less suitable for rough terrain, especially those manufactured for use in developed countries;</div> <div>May cause fatigue for longer journeys.</div>



Type of wheelchair	Advantages	Disadvantages
<p>Manual – three-wheel seated</p>  <p>Image Source: <a href="#">Engineering for Change</a></p>	<p>Suitable for rural or mountainous areas; Can be attendant propelled (if handles are fitted); Can be made to be lightweight.</p>	<p>Less suitable for use indoors; May cause fatigue for longer journeys.</p>
<p>Attendant propelled</p>  <p>Image Source: Joe Van Eeckhout for Human Rights Watch</p>	<p>Can be used by people unable to propel themselves (e.g. children or those with no upper limbs); Can be folded and stored.</p>	<p>User cannot self-propel, meaning the user has less independence; Difficult to manoeuvre over rough ground and kerbs.</p>
<p>Electric powered</p> 	<p>Less tiring for user so can travel further; Can be used by people who are unable to propel themselves.</p>	<p>Expensive; Heavy; Difficult to transport in other vehicles; Most models are manufactured in developed countries; May be difficult to obtain spare parts/batteries.</p>



Type of wheelchair	Advantages	Disadvantages
<p>Standing wheelchair</p>  <p>*The pictured manual standing wheelchair was developed by the Center for Bionic Medicine at the Shirley Ryan AbilityLab. The pictured device is a research prototype and not yet commercially available.</p>	<p>Beneficial for the user's health; Enables the user to interact with people at eye level; Easy to manoeuvre.</p>	<p>Much less common; Expensive.</p>
<p>Special seating for children</p>  <p>Image Source: <a href="#">Wheelchairs of Hope</a></p>	<p>Can be modified as the child grows.</p>	<p>Made to individual specification so more expensive.</p>

Type of wheelchair	Advantages	Disadvantages
<p>Tricycle</p>  <p>Image Source: Mulindi Japan One Love Project</p>	<p>Can travel longer distances; Suitable for rough terrain or mountainous areas; Available as a standalone product or trike attachment for some wheelchair models.</p>	<p>Not suitable for use indoors; Cannot be carried safely in other vehicles inc. public transport; The user must be able to transfer to other mobility aid as tricycles generally cannot be used indoors; Size and weight.</p>
<p>Trolley</p> 	<p>Useful for performing ground level tasks.</p>	<p>Difficult to manoeuvre; Not suitable for most pedestrian environments; Low visibility to other road users, including moving traffic; Cannot be carried safely in vehicles.</p>

### 3.2.2 Bicycles / Hand-cycles

Bicycles and balance bikes should not be overlooked as mobility aids as they are used by some people with disabilities to enhance personal mobility. Standard and adapted bicycles may be used as mobility aids, depending on the preferences and / or capabilities of the user.

### Box 3: Case Study: Wheels for Wellbeing

'Wheels for Wellbeing' (WfW) is a London based award-winning charity, which enables people with disabilities of all ages and abilities to enjoy the benefits of cycling. It runs inclusive cycling sessions for disabled cyclists and their family, carers, or friends, allowing people with disabilities to find a cycle which suits them and offering ongoing support. The charity also works to promote greater awareness of disabled cyclists and the importance of inclusive cycling infrastructure.



Source: [\[8\]](#)

Image: Wheels for Wellbeing

Handcycles are a type of tricycle that are powered by a pedal mechanism rather than more traditional lateral push movements. Handcycles are quite flexible in design and the support that they offer to the user. One significant benefit of handcycles is that the user's hands do not come into contact with anything the wheels pick up from the ground, as often occurs with a manual wheelchair. Hand-cycles can improve accessibility when crossing challenging terrain and have wider health benefits, as an effective aerobic activity. For further information on bicycles and handcycles see Chapter 4, Section 3 (Accessible Cycles).

### 3.2.3 Mobility scooters

A mobility scooter is a mobility aid with a similar function to an electric wheelchair. Scooters may be suitable for individuals who require less physical support from their mobility aid. They are generally used by people who experience difficulty when walking but who can transfer from their device freely. In countries where mobility scooters are common, there is some debate about whether they should travel on the footway or on the road. Some countries, such as the UK, have regulations which help to differentiate

between scooters which may be used on the road and scooters which may not, depending on the size and speed of the model. Mobility scooters generally occupy more space than a manual or power assisted wheelchair and have larger turning circles. They are not always suitable for public transport. As most mobility scooters are relatively expensive to purchase and are powered by electricity, they may not be suitable for some areas of low- or middle-income countries.

### **3.2.4 Walking aids**

Walking aids include walking sticks, crutches, and walking frames.

Walking aids are used to provide support, greater stability, and balance for the user. A walking aid can also help maintain an upright posture and facilitate the user's stride and walking speed.

For all types of walking aids, it is essential to ensure the aid is the correct height for the user. If the aid is too high the user will be unable to transfer sufficient weight to the aid; if it is too low, the user will have poor posture.

People often use walking sticks or crutches for short-range mobility within the home, school, or workplace.

Walking sticks provide support for people who have difficulty walking. Depending on the amount of support required one or two sticks can be used. Walking sticks are usually made from wood or metal and come with a variety of handles:

- Crook handles are the most common and can be hooked over the arm when not in use, but they do not allow the same amount of grip as other types;
- For those who require more stability, a swan neck handle or offset handle will spread the user's weight centrally over the base of the stick;
- Contoured handles can be more comfortable to use as they spread the pressure over a wider area of the palm.

The latter types of handle tend to be more expensive to produce and are less widely available in some developing countries.

The two main types of crutches are underarm crutches and elbow crutches.

Crutches shift the force of upright movement from the legs to the upper body. They are more manoeuvrable than a walking frame and can be used on steps and stairs. Crutches should be used in pairs.

Walking frames are the most stable walking aid suited to indoor use, although good pedestrian infrastructure can also make them useable outdoors. Walking frames tend to be difficult to manoeuvre and cannot be used to go up and down stairs. Wheels can be fitted to some frames to make them more maneuverable. There are two types of walking frame, hand and forearm, with the latter encouraging a more upright posture.

### 3.2.5 Lower limb prostheses and orthoses

A lower limb prosthesis (artificial limb) or orthosis (limb support, such as a calliper or brace) can enable some people to walk without the use of crutches or a walking stick, while others use a prosthesis or orthosis in conjunction with another walking aid. Prosthetic limbs and orthosis are normally distributed through rehabilitation service centres as they require specialist assessment and fitting by trained technicians.



Figure 1: Orthotic leg brace



Figure 2: Prosthetic leg

Image 1: Orthotic Technical Services, Victoria, Australia

Image 2: Blatchford.co.uk

### 3.2.6 Long stick and guide canes (white stick/canes)

Visually impaired people can be trained to use a long or guide cane to enable them to travel independently. A long cane is used to help the user scan the immediate environment and identify hazards such as the edge of the kerb and step depths. A long cane should reach above the user's sternum (breastbone) when the user is standing upright, and the cane tip is touching the ground between their legs. The length of the user's walking stride will also affect the length of cane required.

Figure 3 shows a long cane user.

Guide canes are shorter than a long cane, reaching just above waist level when the user is standing upright with the tip of the cane touching the ground between their legs. The guide cane can be used in a diagonal position across the lower part of the body for protection or used to check for kerbs and steps by using a scanning technique. Long and guide canes should not be used as a means of physical support.

Symbol canes are typically held in front of an individual to let people around them know that they are partially sighted. Red and white banded canes (of all types) are used to show that an individual experiences both a hearing impairment and sight loss.

The Royal National Institute of Blind People (RNIB) provides some helpful guidance on the different types of canes and their applications [\[9\]](#).

Image Source: Jay Galvin



Figure 3: Red and white cane user

### 3.2.7 Assistance dogs

In some countries, dogs are trained to assist people with a variety of disabilities with day-to-day tasks. The training is expensive and is undertaken over a lengthy time period. There are three main kinds of assistance dogs:

- **Guide dogs** - A dog that guides individuals who are blind or visually impaired.
- **Hearing dogs** - A dog that alerts individuals who are deaf or hearing impaired to specific sounds.
- **Service dogs** - A dog that works for individuals with disabilities other than blindness or deafness. They are trained to perform a wide variety of tasks including but not limited to: pulling a wheelchair, bracing, retrieving, alerting to a medical crisis, and providing assistance in a medical crisis.

It is important to raise awareness among members of the public and transport operators on the difference between assistance dogs and pets, and the need for consistency and reliability in the built environment so that assistance dogs can be as effective as possible. It can also be important to raise awareness so that passengers are not scared of service dogs accompanying visually impaired people when they are travelling, and to educate people so they permit access to service dogs in all environments that visually impaired people need to go (e.g. supermarkets, hospitals, libraries, banks and other facilities).

#### Box 4: Assistance Dogs International

Assistance Dogs International, Inc. (ADI) is a worldwide coalition of non-profit programmes that train and place Assistance Dogs. Founded in 1986 from a group of seven small programmes, ADI has become the leading authority in the Assistance Dog industry.

“Members of ADI meet regularly to share ideas and conduct business regarding educating the public about assistance dogs, Advocating for the legal rights of people with disabilities





partnered with assistance dogs, and the setting of standards and establishing guidelines and ethics for the training of these dogs.”

Source: [\[10\]](#)

### 3.2.8 Mobile app technology

Several mobile phone applications that use GPS and other technologies to assist people with disabilities with navigating the built environment are available for free or at low cost. The available apps cater to a wide range of disabilities.

#### Box 5: Case Study: Be My Eyes App

The Be My Eyes app connects visually impaired people in need of assistance with simple visual confirmation tasks to sighted volunteers via live one-way video call. Tasks might include reading a street name or using a ticket machine. Be My Eyes is available in over 150 countries with over 180 languages to choose from.

The app allows people who have a visual impairment to build confidence in leading an independent life. It also ‘bridges the gap’ between the visually impaired users and those who support them, promoting understanding and acceptance both at an individual and corporate level.

Founder Hans Jørgen Wiberg, who is blind himself, insists that the Be My Eyes service is available for free to ensure it can be used in low- and middle-income countries around the world. “According to the UN, 90% of blind people are living in low-income areas. That’s why we’re looking into how we can spread the word of Be My Eyes in developing countries.”

A video on Be My Eyes is available here: [Be My Eyes Video Link](#)

This app is also mentioned in relation to journey planning, in Box 46: Case Study: Moovit.

Source: [\[11\]](#)



## 3.3 Good practice

### 3.3.1 The role of governments

Since the early 1990s the United Nations, and governments around the world, have been aligning approaches on the design and production of assistive devices to meet the personal mobility needs of people with disabilities. Documents produced on this topic by the UN in 1993 (UN, 1993) and the United Nations' Economic and Social Commission for Asia and the Pacific 1997 (UNESCAP, 1997) have since been superseded by Article 20 of the UN Convention on the Rights of People with Disabilities (UNCRPD).

This states that parties signing up to the UNCRPD shall take effective measures to ensure personal mobility with the greatest possible independence for people with disabilities, including by:

- Facilitating the personal mobility of persons with disabilities in the manner and at the time of their choice, and at affordable cost;
- Facilitating access by persons with disabilities to quality mobility aids, devices, assistive technologies and forms of live assistance and intermediaries, including by making them available at affordable cost;
- Providing training in mobility skills to persons with disabilities and to specialist staff working with persons with disabilities;
- Encouraging entities that produce mobility aids, devices and assistive technologies to take into account all aspects of mobility for persons with disabilities. [12]
- It is important for people with disabilities to be consulted at all stages about the design, production and supply of mobility devices.

### 3.3.2 Locally made devices

For many people living in some developing countries, the range of available wheelchairs is limited. Mass produced wheelchairs in developing countries are usually designed for use in hospitals and are limited in range and size, making them

unsuitable for constant use. People frequently have to travel long distances to obtain a mobility device, as the supply is limited to a few locations. Thus, local production provides people who have disabilities with greater access to mobility aids which are more appropriate to their needs. In the absence of trained technicians, rehabilitation self-help services may also be an option. Locally produced mobility aids should follow international safety standards.

### Box 6: Case Study: Innovation and entrepreneurship in assistive equipment design

Universities and start-ups around the world continue to be involved in the research and development of innovative assistive equipment designs. Two notable examples that have been developed in India are:

**Flexmo:** An axillary crutch developed by a group of students from IIT Delhi. It is durable and slip-resistant in all terrains and also provides forward propulsion leading to lower energy consumption. Its shock absorption lessens the fatigue and pain that some crutch users commonly experience and results in a higher quality of life for users.

Source: [13]

[Flexmo Video Link](#)

**Arise:** A 'Standing Wheelchair' developed by IIT Madras. Its unique design enables users to self-propel themselves into a standing position, thereby affording them a higher degree of day-to-day independence. Further details are available here:

[Arise Standing Wheelchair Video Link](#)

Source: [14]



Image: TTK Center for Rehabilitation Research and Device Development (R2D2),

Department of Mechanical Engineering, Indian Institute of Technology Madras, Chennai, India

### 3.3.3 Local workshops

A number of successful workshops have been established in developing countries. These workshops often employ local people, including those with disabilities, to produce and distribute mobility aids. The mobility aids are constructed out of locally available materials so they can be easily repaired and maintained. Community workshops can also produce custom-made devices to meet individual needs and repairs. The workshops provide employment for people with disabilities and increase their opportunities of employment elsewhere by teaching transferable skills.

A number of NGOs provide training for technicians and assistance in setting up a workshop. They provide advice on:

- The equipment needed to build mobility aids;
- Appropriate designs;
- Training in metalwork skills etc.;
- Sourcing local materials;
- Marketing services to other people with disabilities and rehabilitation services;
- Finding local partners;
- Gaining support of business and government.

Funding is required to establish new production workshops and provide business skills training, loans and partial subsidies for consumers.

### 3.3.4 Imported devices

Several projects in developed countries help provide mobility aids for people living in developing countries, by collecting mobility aids that are no longer used. These mobility aids are repaired and distributed through local organisations in developing countries. Some mobility aids, such as prosthetics, are dismantled and the parts used in local workshops. Other projects work to help organise supply chains that ensure that Low to Middle Income Countries (LMICs) can access the mobility aids that they need – such as the CLASP programme [\[16\]](#).

### Box 7: Case Study: Motivation Direct Ltd

The UK based NGO Motivation runs a social enterprise that designs and supplies wheelchairs all around the world. Making mass-produced flatpack designs that are still highly adjustable, every wheelchair can be fitted to suit different individual's size, needs and environment. The parts are manufactured in China, boxed and packed into shipping containers where they are distributed to where they are required, including low- and middle-income countries. Tens of thousands of people have received a Motivation wheelchair.

Source: [\[17\]](#)

### 3.3.5 Wheelchair design guidelines

Wheelchairs used in developing countries need to withstand rougher terrain and often need to be repaired more frequently than those used in developed countries. The World Health Organization's 'Guidelines on the provision of Manual Wheelchairs in less resourced settings' [\[18\]](#) suggests that wheelchairs should meet the following criteria:

- Meets the user's needs and environmental conditions;
- Include adequate cushioning;
- Ensure wheelchair stability to prevent injury;
- Be lightweight;
- Simple function for folding and unfolding the wheelchair;
- Provide proper fit and postural support;
- Smooth edges to prevent cuts;
- Be safe and durable;
- Be available in the country;
- Be obtained, maintained and services sustained in the country at an affordable cost.

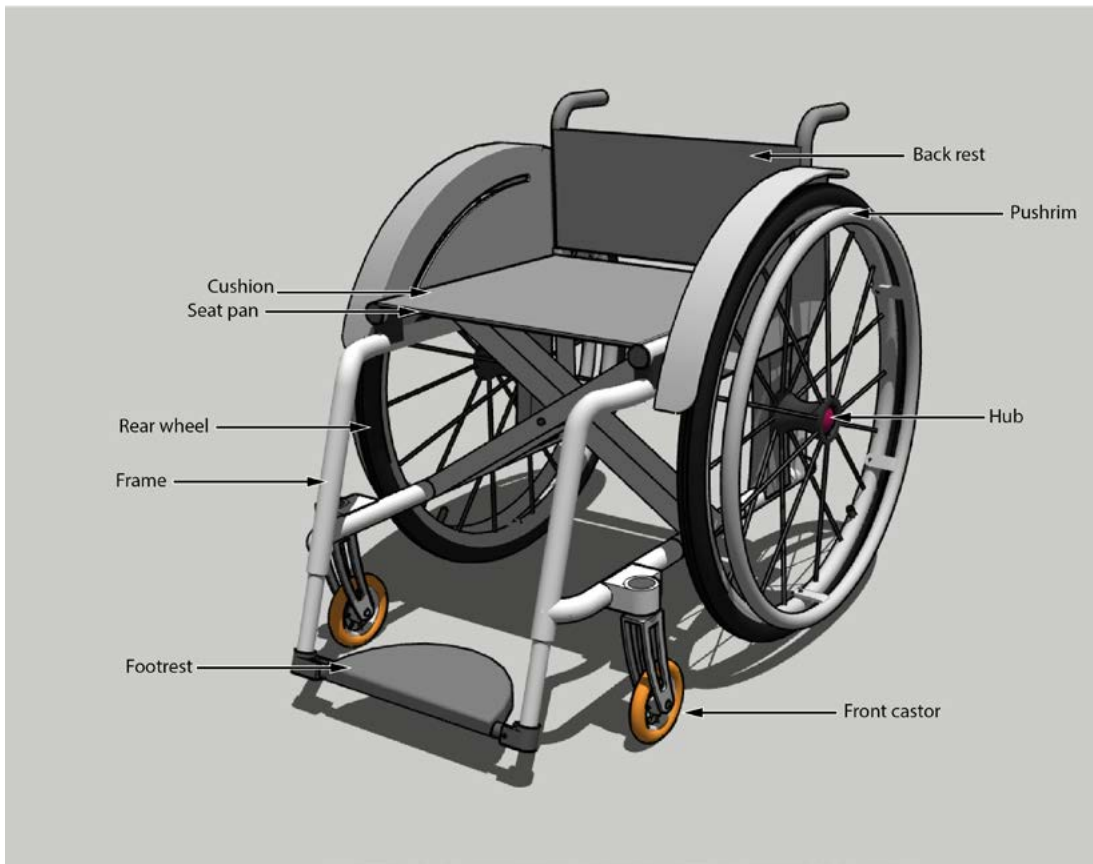


Figure 4: Example of a wheelchair and its fundamental features

It is important that the wheelchair provides a stable seating base. This makes it easier to transfer to and from the wheelchair and for the user to sit unaided in the wheelchair. A seat that is too large or too small exposes the user to a higher risk of pressure sores as their body weight will not be distributed evenly over the seat or be supported adequately. Wheelchairs that can be adjusted for the user are more effective.

### 3.3.6 Training

People with disabilities require training in how to use mobility aids to enable them to travel independently.

For people with a vision impairment, mobility training teaches them how to use sensory cues and landmarks so they can orientate themselves in the environment. They are also taught how to use a long cane to check for hazards and the depth and position of steps and kerbs.

Local governments can help by producing local design standards for wheelchairs, which better reflect the availability of resources and relevant environmental factors. These standards can be used to upskill local manufacturers and labourers so that they are able to make and repair mobility aids.

See also Chapter 6, Section 8 regarding staff and traveller training, including wheelchair training.

### 3.3.7 Mass production in developing countries

Some components of mobility aids, such as castor wheels for wheelchairs and knee joints, are amenable to large-scale production and where parts can be locally sourced at an affordable price to fit blueprint designs, mass production within country is a possibility.

#### Box 8: Case Study: SafariSeat wheelchair

SafariSeat is a wheelchair design for people in developing countries. It is low cost, all-terrain and is made available to users through donations or microcredit. SafariSeat is manufactured with simple tools and materials, like bicycle parts, which makes it easy to repair by any bike shop.



Image: SafariSeat

The project, launched in 2016 via a crowdfunding campaign, has evolved into an NGO (SafariSeat, Sweden) and a social company (TAI, Kenya). SafariSeat is now in mass production, and distribution is ongoing in Kenya.

Source: [\[15\]](#)

### 3.3.8 Funding

The cost of mobility aids should be kept at a level that is affordable for people who need them. In some countries, grants are available for people with disabilities with low incomes to purchase mobility aids.

Government funding should be committed to producing design standards to ensure that wheelchairs which are developed within the country meet or exceed minimum quality and safety standards. Poor mobility aid design is a risk to the long-term health of an individual and their safety.

## 3.4 Assessing need

Mobility assessments are helpful to ensure that a disabled person has the most suitable mobility aid for their condition. This is often undertaken by a therapist, such as an occupational therapist, physiotherapist, or in some cases a nurse, who has undergone training in needs assessment and will be linked to rehabilitation services. Regular assessment is required to ensure continued appropriateness of mobility aids, especially for children.

The assessment should begin by addressing the reason for the referral and the desired outcome. This includes the disabled person's perspective on how a mobility aid would help them and a discussion about impacts of their disability on their personal mobility, as well as establishing whether they are currently using a mobility aid. (The definition of a mobility aid should not be too prescriptive, as a person may be using a crude or adapted object as a mobility device in the absence of a traditional aid).

Next, a physical assessment should take place. This should involve taking the measurements of the individual and a period of mobile observation if the person is able to demonstrate how they move or how they use their current mobility aid. It should also consider the duration of the need and whether an individual's needs are likely to change in the short or medium term. This should be the basis for deciding on a review date.

There may be occasions where a person already has the most appropriate mobility aid but is not using it correctly. Training and advice should be given on how to properly use the device. If the person is unable to use the device correctly without difficulty, a different device may be required.

Finally, newly prescribed mobility aids should be tested by the individual to find the most appropriate fit. Factors such as size, comfort and suitability for purpose should be considered. Once a suitable device has been found, adjustments should be made to components as required.

A review is recommended after several months to address any issues which were not evident during the initial assessment.

#### **Box 9: Case study – Motivation Direct Ltd. – improving on how wheelchairs are provided in India**

The NGO Motivation is working with partner organisations, government institutions and hospitals in India to train staff so that they are better able to fit and adjust wheelchairs according to World Health Organization standards. The organisation is exploring new ways to connect with people with disabilities who most urgently need support, recognising that not all people with disabilities will be able to travel to a healthcare clinic or set location as a result of poor accessible infrastructure and transport or a current lack of mobility aid.

Source: [\[17\]](#)

### **3.5 Considerations for low and middle-income countries**

- Wheelchairs and other wheeled mobility aids may be required to fit into crowded living quarters and should fold or be agile enough to manoeuvre in these environments. If this is not possible the device may be stored outside and must be made from durable materials which will not rust or degrade in wet weather;
- Pedestrian infrastructure may not be to a consistent standard or well maintained and wheelchairs may need to travel across rugged terrain. Wheelchairs must be



robust and have good traction and stability;

- Parts should be removable and replaceable, as wheelchairs used in low- and middle-income countries are likely to need frequent maintenance and will generally be used over a longer lifespan;
- In areas where electricity is not readily available or affordable, power assisted wheelchairs which require battery charging will not be suitable.

### 3.6 Where to start?

Mobility aids should be made available wherever possible, free of charge or at low cost, and should be designed with the specific context in mind. Looking at currently available mobility aids is a good first step, before moving towards improving the availability and quality of aids. Mobility aids must be locally relevant and repairable using available local materials. Distribution programmes must take into account the income of people with disabilities in the target area.

A number of resources are available to support local efforts at improving the availability and quality of mobility aids. Some of them are:

- Boeijen van A G C, Flier P, Oldenkamp I, Toetenel O, Vermeulen R and Verweij J (1995). Tricycle Production Manual. Delft: CICAT/FIDE
- BOND (British Overseas NGOs for Development). Directory of UK based NGOs working in developing countries with people with disabilities. [www.bond.org.uk](http://www.bond.org.uk)
- Guide Dogs for the Blind Association, South Africa. [http:// www.guidedog.org.za/](http://www.guidedog.org.za/)
- Handicap International – funds training for people involved in rehabilitation in association with local partners such as Mobility India. [www.handicap-international.org.uk](http://www.handicap-international.org.uk)
- His Wheels International – hand-pedalled trikes blueprints. <http://www.hiswheels.org/>
- Whirlwind Wheelchair Network – Database of workshops and projects. [http:// whirlwind.sfsu.edu/general\\_info/database/db4-99.html](http://whirlwind.sfsu.edu/general_info/database/db4-99.html)
- Jaipur Limb Campaign – train local people how to manufacture and fit low cost artificial limbs. <https://rotary-site.org/jaipur-limb>

- Motivation - Search 'Wheelchair production' for guides including drawings and technical information on wheelchair production for a variety of wheelchairs. <https://www.motivation.org.uk/>
- Victoria Hand - training local engineers to use 3D Printers to create prosthesis. <https://www.victoriahandproject.com/>

# Chapter 4

## Accessible Vehicles



# Accessible Vehicles

Accessible vehicles are crucial for supporting people with disabilities and encouraging them to build their confidence and travel independently. It is important that vehicles are equipped with the necessary features to assist people with disabilities and ensure they feel safe while travelling; without this, many people with disabilities could be reluctant to travel. This section covers vehicle requirements to maximise accessibility for people with disabilities and address safety issues for different types of vehicles.

Many vehicles have long life spans, and it may take some time to completely transform the design of a vehicle. Those vehicles which can be altered need to meet the needs of both wheelchair users and passengers travelling in the seats. However, there are a variety of simple design changes or retrofit upgrades that can be made, at a relatively low cost, which can make a significant positive difference to the way vehicles are perceived and used.

Introducing new vehicle design features that support people with disabilities are often beneficial to all users and will improve the overall passenger experience for everybody. For example, improving the accessibility of the vehicle entrance will make it easier for people with disabilities to board and alight, which helps shorten journey times and enhances service punctuality. It is important to make best use of the space that is available and ensure both passengers and vehicles are safe. A vehicle's size, interior space, weight, and operational speed all determine the safety features required onboard. The ultimate purpose for introducing these features is to enable more people to travel comfortably, and in a way that they can truly rely on.

## 4.1 Accessible Public Transport Vehicles

### 4.1.1 Buses

In recent years, significant gains have been made in the accessibility of buses in Europe, South America, and Asia. While improvements have been made to public

transport in LMICs, it is more common for vehicles to be designed in a way that prevents some people with disabilities from travelling, such as high floors, steep steps, and narrow seat spacing. This section considers incremental improvements to conventional buses and their operation to help people with disabilities to board, travel in, and alight from such vehicles more easily, quickly and safely. Solutions like clear signage, adequate handrails and prioritised seating can be implemented at low cost and help to retain existing users as well as to attract new ones and boost revenue. To capture the maximum benefits, usability improvements to vehicles should be coordinated with improvements to infrastructure.

#### 4.1.1.1 Basic principles

##### Safety

- People with disabilities should be able to travel safely – whether travelling in a wheelchair or using a seat within a vehicle;
- Dedicated wheelchair space(s), facing forwards or backwards of the direction of travel, should be provided if people are to travel safely while seated in a wheelchair;
- Smooth driving and braking while the bus is being operated to avoid injury to vulnerable passengers;
- Push buttons within easy reach to request a stop without the passenger leaving their seat;
- Handrails and stanchions for boarding, alighting and standing passengers.

##### Accessibility

- Step-free boarding into buses via ramps, lifts, or the provision of low floor vehicles;
- Where steps are required, they should allow easy and unhindered boarding;
- Step edges (noses) and hazards highly visible;
- Priority seats reserved for use by disabled passengers near to the entrance or close to the driver for assistance;
- Priority seats backed by legislation that requires non-disabled passengers to keep them free or relinquish them in the event they are required by a disabled passenger;
- Easy stowage of mobility aids (such as wheelchairs, walking sticks) for instances where a disabled passenger prefers to transfer to a seat on the vehicle;

- Clear signage indicating bus route/destination, fare, and other relevant information;
- Bell/light activation to inform driver of request to stop.

### Reliability

- All advertised accessibility features available and working;
- Buses stop in same place every time, especially where there is a dedicated boarding point;
- Clear announcement of major stops;
- Bus driver and/or conductor providing helpful service and assistance;
- Bus services stay on advertised routes and do not deviate from them.

### Affordability

To the Provider:

- Retrofit existing buses with low-cost features that benefit disabled passengers and people who experience limited mobility;
- Introduce wheelchair access route by route.

To the User:

- Concessionary fares could be considered;
- Integrated tickets/smart/contactless payment can help to simplify entry onto the vehicle.

#### 4.1.1.2 Bus entrance

LMICs can often have buses with high floors, typically 1m above ground level, due to their affordability (in comparison with low floor buses) and their suitability to rugged operating conditions. The height and steepness of steps in high-floor buses are often major barriers to users with disabilities. Entrances can be improved through adequate design of steps and installation of handrails and grab handles.

Since specifications for steps vary somewhat across different countries, and local circumstances dictate what can be achieved, a useful starting point is to state what is considered ‘ideal’ from the point of view of enabling the largest number of people with disabilities to enter and exit buses easily and safely. Working back from there,

one can then determine what is adequate to aim for in the short to medium term. The UK’s Disabled Persons Transport Advisory Committee has advised on ‘ideal’ specifications for enabling people with disabilities to enter and exit buses safely, but acknowledges that many operators cannot meet these standards with existing fleets, so included less-than- ideal specifications that may be used during a transition period [\[19\]](#). Table 3 summarises both the ideal and the transitional specifications for vehicles which are not designed with a low floor (no longer applicable in the UK). In the UK, Public Service Vehicle (PSV) accessibility regulations (2000) [\[20\]](#) now require all buses carrying more than 22 passengers to be low floor. Bus operators, regulators, and other stakeholders in developing countries should apply their own judgment to draw on these specifications.

Table 3: Ideal and transitional specification for bus entrances (no wheelchair access)

Item	Ideal specification	Transitional specification
Maximum first step height	250mm	325mm
Maximum height for subsequent steps	200mm	225mm
Maximum number of steps (total)	3	3
Maximum ground to floor height	650mm	775mm
Minimum depth of steps	300mm (280mm on vehicles less than 2.5m wide)	
Step risers	Vertical, smooth, flat, colour contrast edge/nose	
Minimum ceiling height at door	1.8m above first step	
Entrance width between handrails	min 700mm, max 850mm (single stream) min 530mm, max 850mm (for wider doorways with central handrail). Handrails to start within 100mm from outside edge of first step.	

[\[19\]](#)

Low floor buses provide step-free boarding to wheelchair users and all other passengers and it is advisable that the vertical distance between the kerb and the bus floor at the entrance should not exceed 1.5cm [\[21\]](#). In recent years, buses have



been designed so that vehicle suspension can be lowered to allow the bus to meet the height of the kerb, which can be done at the request of the passengers [22]. This has largely been introduced in higher income countries. In LMIC country contexts the same outcome can be achieved through the provision of raised boarding platforms at bus stops (see Chapter 5: 3 for more detail).

#### Box 10: Case Study: London Buses

All Transport for London buses have a single-step entry and low-floor design in the front part of the vehicle, and either a sloping gangway or a step towards the back over the driver axle. Many London buses have a door at the front for boarding and a door in the centre for alighting. Powered ramps are usually fitted to the centre doors where wheelchair users are most likely to board



Image: Transport for London

and alight. Push buttons are onboard to alert the driver that the powered ramp needs to be deployed. Although all London Buses have the ability to ‘kneel’ (lower the suspension to meet the height of the kerb), it should be noted that “if the ‘kneeling’ system operates on the front axle alone, the front door will be lower than the centre door. Alternative configurations include tilting of the nearside of the bus or lowering of the entire vehicle.” Dedicated priority seats are available on all TfL buses and are located near to the entry and exit doors with handrails. If people with disabilities struggle with standing on the bus, they can apply for a free ‘Please offer me a seat’ badge to make people aware that they require a seat [23].

Source: [24]

Where a doorway is not within the driver’s direct field of view, a push button could be installed on the outside of the vehicle next to the door to request operation of a boarding aid. This button should be placed as close as possible to the doorway,



between 850mm and 1100mm above road level, be capable of operation with the palm of the hand, have colour contrast, and ideally be illuminated when pressed [25].

The entrance should be well-lit at foot level to help people that are boarding and alighting the vehicle, and bus doorways should have an unobstructed height of at least 1800mm from the point of entry pressed [25]. Doorways should be 850mm wide to allow a wheelchair to enter.

A low-cost way to lower the distance to the first step without interfering with the need for high clearance of the bus chassis, is to use a foldable or retractable step attached to the stairwell. The step is deployed automatically when the door opens, or manually by the driver via a lever by their seat.



Figure 5: Retractable front step

Image Source: GM Coachwork

#### 4.1.1.3 Handrails and stanchions

As fear of falling is a major deterrent for bus use among some older people or people with disabilities, provision of adequate handrails can be of major assistance. Handrails at the entrance are very important and even more so when step height and depth depart from the 'ideal' dimensions of Table 3. Entrance handrails should extend as far out towards the entering passenger as possible, starting from a point within

100mm from the outside edge of the first step. Handrails are needed on both sides of the entrance as some people can only use one side of their bodies, and can also help people who experience limited mobility, including passengers carrying packages or children. In some cases, folding doors may need to be strengthened at the time of manufacture to support handrails.

Sloping handrails (parallel to the slope of the steps) are better than vertical ones. Handrails can be fixed to the inside of the door as long as they do not move excessively when the door is open. If possible, handrails should be provided in a continuous path from the entrance at a height of 800- 900mm, past the driver, to at least one of the priority seats, to help visually impaired and other disabled passengers reach their seats.

Handrails should be round, 30mm to 35mm in diameter, and fixed with a minimum clearance of 45mm to the adjacent surface to allow for good grip. Good grip is also promoted by using a non-slip rather than a polished finish. Handrails should not be installed with any sharp bends, for example mitred corners of 90° or less [\[25\]](#).

Inside the bus, vertical handrails or stanchions at every second row of seats are very helpful to passengers moving around. Stanchions could even be provided at virtually every row. This is particularly helpful for services that experience overcrowding and may have a high number of people standing onboard. Ensuring that there are adequate handrails and stanchions will make it safer for everyone who stands while travelling in the vehicle, by providing greater stability. The maximum recommended distance between handrails is 1050mm so people can reach one stanchion from another. Inward facing seats should have one vertical stanchion to every two seats. Hanging straps and ceiling mounted rails are not usable for many passengers.

For good visibility, handrails and stanchions should be painted in a colour that contrasts with their surroundings - bright yellow, orange, and bright green are commonly used. The same colour should also be applied to the edges of any steps, the outlines of information sources such as fare boxes, and bell-pushes.

Tactile plates with raised symbols mounted on the entrance and exit handrails can help blind or partially sighted passengers to distinguish features such as the number of steps. Local organisations representing blind or partially sighted people can help determine where these symbols are placed and ensure the message is clear and easily understood [\[25\]](#).



Figure 6: Colourful handholds/grips and stanchions

#### 4.1.1.4 Seats and floor

The floor of the bus should preferably be flat, level, and step-free from the entrance and exit at least to the middle of the bus to make it accessible for wheelchair users [\[25\]](#). The low floor area should not be less than 50% of the total saloon area (excluding the front wheel boxes and driver's cab) and should not be ramped in the longitudinal plane [\[27\]](#). Many passengers feel insecure on sloping surfaces and would also want to avoid internal steps in the bus. If no alternative exists, steps of 150mm to 200mm high or slopes of no more than 3° are acceptable. All wheelchair spaces should be within the low-floor area of the bus, and there should be a minimum width of 750mm between each additional wheelchair space [\[25\]](#).

To allow the greatest number of passengers to travel while seated, seats should be at least 450mm wide (per passenger), between 430mm and 460mm high above the floor, and allow at least 230mm leg room (Figure 7). Well-spaced seats will help speed up boarding and alighting as passengers can move to and from their seats more easily. If

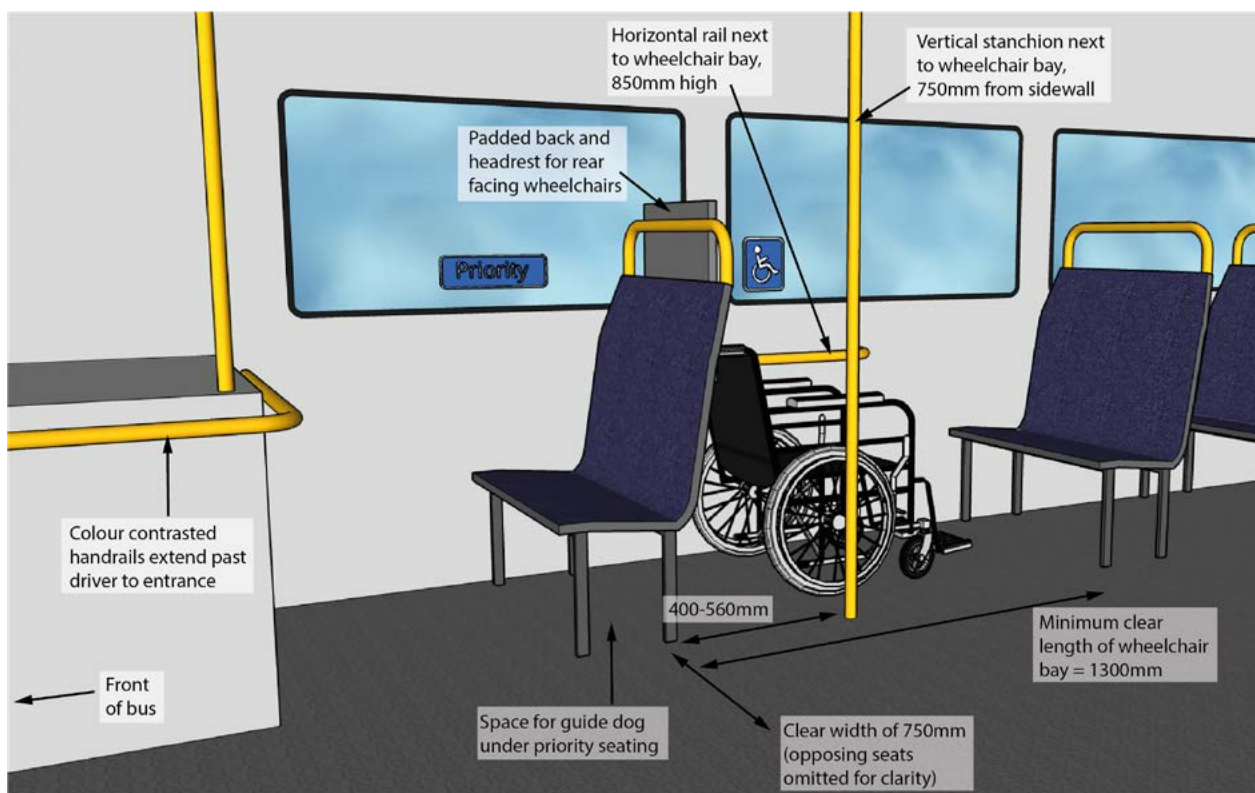


Figure 7: Recommended UK layout and interior dimensions for buses

It is good practice to reserve two or more priority seats for use by passengers who experience limited mobility (e.g. older and disabled passengers, and also pregnant women and people who experience temporary impairments such as injuries), as many find it impossible or dangerous to stand in a moving vehicle. There should be two forward-facing seats in the low-floor space of the bus that are not foldable seats [\[25\]](#).



Figure 8: Level floor seating, wheelchair spaces clearly marked, and brightly coloured handrails in Slovakia

Image Source: Juraj Handzuš

Priority seats are important in overcrowded buses when many people are likely to stand at the front of the bus or in the aisle. The type and size of the bus can determine where the priority seats are located in the vehicle. However, these seats should be as close as possible to both the driver and to the entrance/exit, to facilitate communication with the driver and to minimise the distance walked in the bus. It is good practice in two-entrance buses to allow disabled passengers to board and alight through the front door, even if all other passengers must board through a rear door. Clear signage should identify priority seats. Seats installed on top of the wheel arches are usually raised further from the floor and subject to higher acceleration forces (discomfort) and therefore not suitable for most people with disabilities. Priority seats should be either forwards or rearwards facing, with legroom extended to 460mm, and adequate space should be available for an assistance dog to lie down if needed.



Figure 9: Designated space for assistance dogs on the metrobus, Mexico City

Image Source: Janett Jimenez



Figure 10: Priority seating behind the driver, used in Mexico City



The passage should be wide enough for all passengers to move freely: a minimum unobstructed width of 450mm is recommended. Directly behind the driver (at least up to the priority seating and wheelchair bay, if there is one) this could be increased to 800mm to assist with passenger circulation.

#### 4.1.1.5 Boarding for wheelchair users

The best way to allow wheelchair users to board buses is through Universal Design: the use of low-floor buses with extendable ramps or bridges that are consistently deployed for all passengers, or high-floor buses with raised boarding platforms (such as those used in many Bus Rapid Transit systems). These options also benefit the operator by speeding up boarding and alighting. Access ramps should be no less than 800mm wide and should be of such a length that it does not exceed a maximum slope of 7° [25]. Ramps should be capable of taking a minimum weight of 300kg and should have a slip-resistant surface. It would also be appropriate to have contrasting markings to increase visibility [26] and all vehicles should have a device to lock the ramp when not in use. Ramps should also be fitted with a device to prevent the wheelchair rolling off the sides when the ramp length exceeds 1200mm [27].

The video at the link below shows new low-floor buses in India that come equipped with a foldable ramp, as well as other features such as brightly coloured handrails at the bus entrance, dedicated space for a wheelchair with signage, and a screen onboard to communicate stops:

[Low Floor Buses in India Video](#)

#### Box 11: Case Study: India's Urban Bus Specification Guide

In 2013, India's Ministry of Urban Development produced a guide for bus operators that outlines the specifications for high-quality vehicles to meet increasing demand in cities throughout the country. While these will not necessarily be applicable for all LMICs, they form a good example of a government initiative to develop standards appropriate to the local operating environment. The guide aims to achieve uniformity across buses with minimal variants and encourages all urban bus operators to use the standards irrespective of their

sources of funding. It includes a wide range of features that support people with disabilities, including specifications for:

- Ramp (dimensions, material, load carrying capacity);
- Onboard low floor area;
- Minimum door height;
- Minimum clear door width;
- Maximum first step height;
- Priority seats;
- Stop requests;
- Maximum floor slope;
- Seating and floorspace.

These specifications are considered for different sized vehicles, including standard sized buses, mini and midi buses, and BRT buses.

Source: [\[27\]](#)

### Box 12: Accessible bus fleet in Curitiba, Brazil

Many of Curitiba's bus services are accessible via on-board internal lifts and include designated space for wheelchair users or those accompanied by an assistance dog. These services help people who experience difficulty when using steps to board higher-floored buses so that they can travel from their homes to transport terminals or BRT stops. Currently 97% of the bus fleet without on-level boarding is accessible.

All buses in Curitiba's public transport fleet have: hand grips on doors; balusters, columns and handrails for safety inside the vehicles; identification of boarding steps and level differences in yellow; footrest under the seats; tactile devices for locating areas reserved for





people with visual and hearing impairments to navigate them; deficiency; and preferential seats for the elderly, pregnant women and the disabled, in an amount higher than required by national legislation. All these characteristics make the Curitiba fleet more accessible to its population.

As a result of these efforts, people with disabilities and the elderly represent more than 16% of the total users per month of the integrated transport system in Curitiba.

Source: [\[28\]](#)

Image Source: URBS

Other options for overcoming the height difference between the ground and the bus floor include the use of mechanical lifts (deployed either in the main doorway or from a separate doorway), and level boarding from small roadside platforms, using a removable bridge piece to cover the gap. Both of these options are only deployed when needed by people who experience limited mobility. Deployment of a lift should be indicated by an audible warning signal and clear warning notices should be displayed to inform passengers that they should not use it when moving [\[25\]](#). Wheelchair lifts are more expensive options, both to acquire and to maintain, and thus may be less affordable for widespread use in bus fleets. Nevertheless, lift-equipped high-floor vehicles, especially if these vehicles are used on routes that are specially designed to serve people with disabilities, have been shown to be an effective means of creating accessible transport for some disabled users.

Image Source: [Steve Morgan, 2010](#)



Figure 11: Powered lift on the entrance to a bus in Portland, Oregon in United States

Lift-equipped high-floor buses have also been deployed on major routes as part of an integrated network of accessible bus, rail, and pedestrian infrastructure in some cities in Latin America.

#### Box 13: Hydraulic lifts on buses in Paraguay

Between 2009 and 2015, seven laws and decrees were passed by the Government of Paraguay to support persons with disabilities, one of which requires adequate infrastructure in all public and private space to improve accessibility. This resulted in more than 600 bus conductors receiving training and 250 buses in the capital being fitted with hydraulic lifts to help wheelchair users access the vehicles.

Source: [\[29\]](#)

This video shows a bus in Dubai with a lift that safely carries wheelchair users into the vehicle [Video of bus with a lift](#) and this video demonstrates another example on a bus in India [A second video of a bus with a lift](#)

Where wheelchair lifts are used, they should have a safe working load of 300kg and be at least 750mm wide and 1200mm long when deployed. Colour contrasted guardrails are needed along the sides [\[25\]](#) and roll stops at least 100mm high are needed to provide security for a passenger using a wheelchair.

#### 4.1.1.6 Wheelchair space

If wheelchair users can enter the bus without leaving their chair, there should also be a space inside the bus for them to travel in their wheelchair. The number of wheelchair bays required will depend on the demand for them; in Europe and North America up to two spaces are provided in city buses. A recommended clear width of 800mm from the doorway through to the wheelchair bay should be provided [\[25\]](#). Wheelchair users can travel either facing forwards or backwards, but never sideways, as the wheelchair can tip over much more easily and become a hazard for the occupant and other passengers in case of sudden braking. This is a safety requirement, and the recommended dimensions for a wheelchair space are shown in Fi7.

Wheelchair users can usually travel unsecured on board a bus, provided they travel in a designated rearward facing position. This does depend on variables that include the design and nature of the bus (BRT vehicles can differ from other buses, and minibuses are different again), and the distances over which the route extends. The wheelchair space should be fitted with a backrest at the forward end of the space, positioned centrally in the space, and with a padded surface facing the rear of the vehicle [25]. A vertical pole, or foldable horizontal bar (as used in Berlin), on the aisle side of the wheelchair space prevents occupants of the wheelchair space from rolling into the aisle. A horizontal handrail place on the inside of the vehicle helps a wheelchair user to manoeuvre into the correct position in the wheelchair space.

The practice of enabling wheelchair users to travel ‘unsecured’ is limited to larger buses in fixed route service, and those with lower operational speeds. It also depends on an assurance that they are driven safely by well-trained drivers. In buses that travel at higher speeds, forward facing wheelchair spaces should be used, and should be anchored to the vehicle using tie-downs for safety. Wheelchair securements should also be used when a variety of other factors indicate that they are needed for safety, including in smaller vans or minibus vehicles.

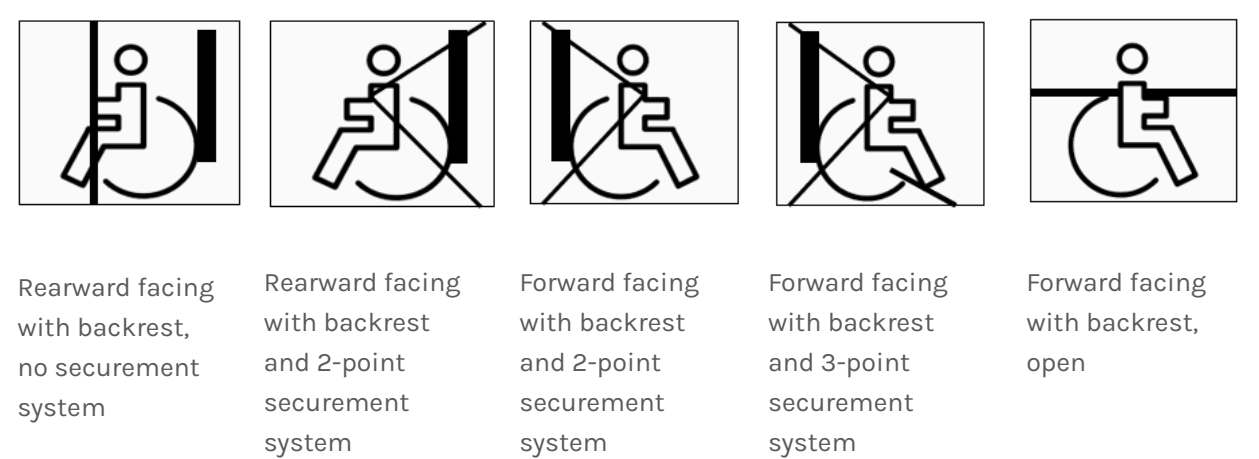


Figure 12: Wheelchair securement options

Image Source: Adapted from Government of Mexico, Secretary of Tourism

Experience has shown that, typically, providing a wheelchair space does not actually decrease the capacity of the bus, as the space can be used by standing passengers if no wheelchair user is present. Depending on the operational speed of the bus and the

size of the vehicle, it can be possible to place side-facing hinged seats in a wheelchair space that can be folded away when the space is needed by a wheelchair user. The wheelchair space should be clearly marked as such and give wheelchair users priority.

#### **4.1.1.7 Bell pushes**

In buses that stop on request only, bell pushes can be very useful to signal a request for the next stop. This makes it not only much easier for speech and hearing-impaired people to use the bus, but also safer for all passengers – and disabled passengers in particular – by not having to leave their seat while the bus is moving. Electronic bell pushes that can be pressed with the palm of the hand are preferable as they assist people with arthritis and rheumatism. However, mechanical systems that are activated by pulling on a cord can also be used if other options are not available. Bell pushes should preferably be available throughout the bus, not more than 1500mm above the floor for standing passengers but should at least be installed next to prioritised seats. To reduce anxiety and aid hearing impaired passengers, the bell systems should light up a ‘STOPPING’ sign in the front, sides, and rear of the bus when the bus is servicing a bus stand en-route (United Nations, 2016) and should remain illuminated until the bus has stopped [\[25\]](#). There should be a minimum of two ways of communicating that the bus is stopping [\[30\]](#). In addition to the ‘STOPPING’ sign, there should ideally be digital signs that display the name of the stop and it would be appropriate to have a public address system or driver announcements that clearly state the names of the stops to help people who have impaired vision [\[6\]](#).

#### **4.1.1.8 Signage and information**

Clearly legible destination and route number displays on the outside of the bus are essential for partially sighted passengers to identify their bus, and helpful for all passengers especially at night. Both the route number (if used) and the destination are most important on the front of the bus (to help identify an approaching vehicle), but displaying the route number on the side (to confirm the information) and the back (to help confirm whether a bus was missed) is also very helpful.

Signage should be printed using lower case letters at least 200mm high (for route numbers) or 125mm high (for destinations). White or bright yellow letters against a black background are most clearly visible, especially for visually impaired passengers. Signage is best mounted above the windscreen where it is not hidden by other traffic, but cheaper options such as printed signs fastened to the inside of the windscreen are also possible provided they remain clearly legible.

There should also be a clear, legible sign on the exterior of the vehicle informing prospective passengers of whether the bus is accessible for people who experience limited mobility, wheelchair users, or both.

#### **4.1.1.9 Driver operation**

Drivers and conductors can greatly increase the usability of bus services for older or disabled passengers in particular by observing some simple operational guidelines. Accessible design features will not help much if passengers are first required to board a moving vehicle or to cross lanes of moving traffic before boarding. Reliability and predictability of the service is very important to many people with disabilities including people with vision or cognitive impairments. Predictability can be enhanced by consistently stopping the vehicle close to the kerb and next to the bus pole at stops.

Driving behaviour is also very important: a well-driven bus with smooth acceleration and deceleration (i.e. without sudden jerks and hard braking) increases safety and comfort for all passengers. The driver should also wait until all passengers (and specifically frail, older and disabled passengers) are seated before starting to move the vehicle.

Disability awareness training courses should be considered for all staff operating public transport vehicles. These courses usually cover communication skills, barriers faced by people with disabilities, information on different disabilities, vehicle driving tips, responding to emergencies, and the principles of access audits. Staff training can be delivered face to face or via video and should use practical examples. An

alternative to delivering training sessions is providing leaflets and information to the drivers to make them more aware of how they can help people with disabilities and support them in making their journey safe and comfortable [\[31\]](#).

This video demonstrates how a trained Delhi Transit driver deploys a hydraulic lift for a wheelchair user [Delhi Public Transport Hydraulic Lift Video](#). This similar video shows how a driver in Nairobi assists disabled passengers with getting in and out of the vehicle, and the difference it makes in enabling individuals to travel. [Video of Driver in Nairobi helping disabled passengers into Matatu](#).

#### 4.1.1.10 Fare policy

Many governments have the practice of subsidising bus travel for people with disabilities by charging them at reduced fares or no fare at all. While this is undoubtedly helpful to overcome affordability barriers among the poorest of disabled users, the issue of introducing concessionary fare policies should be considered alongside (rather than as a substitute for) other physical or operational improvements to the bus service. See Chapter 6.2 for more information on concessionary fares.

#### 4.1.1.11 Contracting

One way for governments to improve the quality and accessibility of transport services that are provided by private operators, is through concession agreements. Concession agreements are contracts - typically for three to five years - spelling out the rights and responsibilities of transport providers ('concessionaires') and the rights and responsibilities of the government agency granting the concession. Such agreements are in widespread use in Latin America, for instance, as a means of regulating the many small-scale operators providing mini or midibus transport.

Ways in which the concessioning process can promote basic accessibility include:

1. **Require low-cost access features at the time of concessioning:** The contract can specify minimum vehicle standards such as non-slip flooring, painting

hand grips and steps a bright contrasting colour, the use of large print destination signs on the vehicle, and the use of priority seating for older and disabled passengers. These features cost very little and assist all passengers, not only those who experience disabilities. In some countries, such as India, laws may insist that bus providers sign up to agreements that support access to all passengers, including wheelchair users, or they cannot procure vehicles or operate services.

- 2. Require basic training in safe accessible operation:** Such training could focus on safe driving practices, including coming to a complete stop to permit disabled passengers to board and remaining stopped until they are seated. Training can also emphasise the value of periodic preventive maintenance to keep vehicles in good operating condition. Training can be reinforced by posters and other means to remind drivers of their duty to operate safely. Depending on the local situation, drivers could be required to pass safe driving tests before being permitted to drive.
- 3. Require vehicle inspection:** Even if nothing else is done, a concessioning agency must at least require a simple inspection of vehicle safety features before permitting a concession to begin, followed up by safety inspections on at least a yearly basis. Initially, an inspection might be limited to a visual inspection to ensure that:
  - headlights and brakes work;
  - tyres are safe;
  - the different access features noted above are present and well maintained.Upon passing the inspection, vehicles could receive an inspection sticker, which would also help with enforcement.
- 4. Mandate methods to empower passengers:** Passengers need to be acknowledged as stakeholders in the provision of accessible transport. It is appropriate to spell out in the concession agreement the methods that will be used for achieving passenger input into improving services.  
The concessioning agency could provide a mechanism for passengers to



evaluate services. Examples could include a complaint number connected to the regulating agency, or surveys of user satisfaction. Special emphasis could be placed on evaluations by members of local NGOs representing people with disabilities. The regulatory agency could appoint an ombudsman or other individual to receive complaints and act on behalf of passengers. Exemplary driver behaviour could be rewarded and publicly recognised (e.g. with cash prizes, letters of commendation, plaques, radio or newspaper publicity). Passengers could be invited to an annual meeting to discuss the service and register their views.

- 5. Provide incentives for accessible operation:** If a government agency charges even a modest franchise or concession fee for the right to operate on a route, this fee could then be reduced or waived as a reward to those who provide accessible services. These approaches are especially helpful when there are multiple providers or associations competing with each other for a concession. However, competing concessionaires on the same route may easily lead to unsafe and inaccessible driving behaviour. The ability to reward good performance and to penalise bad performance is a major factor in assuring transport for all.
- 6. Consider the pros and cons of fare subsidies when preparing to solicit bids for concessioned routes:** This is a controversial matter, since a requirement that people with disabilities pay a lower fare can become an incentive for drivers not to serve such passengers if their income comes directly from the fares received. Subsidies may work best when service is carefully monitored to assure that people with disabilities are not denied service.
- 7. Consider working closely with operator associations in developing requirements for a concession:** Association input could be helpful, depending on the politics of the local situation. Ideally, the interests of an association would include a desire to avoid highly competitive practices among its members such as speeding to pick up waiting passengers or ignoring people with disabilities because they may need more time to board/alight the vehicle.

In other words, in some situations an association can become an instrument to introduce more self-discipline among its members. In such cases, the regulator should have the power to penalise the association itself (not just the individual driver) for unsafe practices, in order to encourage the association to enforce discipline among its members.

#### **4.1.2 Paratransit and services operated by smaller vehicles**

Vehicle accessibility varies along with the range of vehicle designs. In some lower income countries public transport services are increasingly provided by informal public transport operators who operate midibuses, minibuses, autorickshaws, and other small vehicles such as tuk tuks. A defining characteristic of these services is that they are typically provided by a large number of individual owners or operators who hire/rent the vehicles on a daily basis and hence have to guarantee the daily income to the owner before generating income for themselves. The vehicles operate on relatively flexible routes and schedules, and authorities typically have very little regulatory control over them.

While some vehicles have relatively low floors easing entry and exit, others are harder to board or alight due to an absence of steps and handrails and narrow doors. Major problems exist around the way they are operated – fiercely competitive operating conditions often leads to overloading and to a refusal to stop for people with disabilities due to a perception that they will prolong boarding time; and to speeding and unsafe driving habits. However, the informal nature of this mode also means that some drivers are willing to go out of their way to serve passengers with particular needs, especially if they have built up a relationship with them.

It is precisely the informal nature of paratransit operations that makes them difficult to improve – vehicles are often second-hand and governments in practice have little control over their specifications. The only way improvements can be made to the accessibility of vehicles – either through government-sponsored renewal of fleets or incrementally as vehicles are slowly replaced – is predicated on governments succeeding in establishing stronger regulation and formalisation of the industry, both

in terms of vehicle standards and of operating practices. Only then will it be possible to comprehensively address accessibility issues in small vehicles.

The guidelines mentioned here are likely to be useful particularly in situations where sufficient progress is being made with formalising/stabilising the industry so that providing a better service becomes a priority to operators.

#### **4.1.2.1 Basic principles**

##### **Safety**

- Unobstructed space for wheelchair users to travel in their chairs (if possible);
- Wheelchairs should be restrained where possible; as a general rule, the smaller the vehicle, the more restraints are required to secure a passenger travelling in a wheelchair;
- Smooth driving and braking to avoid injury;
- No hazards or sharp edges that could injure passengers;
- Single width ramp preferred to help wheelchair users board;
- Boarding devices should be available if wheelchair spaces are available;
- Handrails and steps highly visible;
- Seats near entrance available for disabled passengers and people who experience limited mobility;
- Easy stowage of mobility aids (wheelchairs, walking sticks);
- Clear signage indicating route/destination and fare.

##### **Accessibility**

- Easy and unhindered boarding via steps.

##### **Reliability**

- Drivers consistently stop to pick up disabled passengers;
- Drivers and helpers providing helpful service and assistance;
- Clear announcement of stops requested by passengers.

## Affordability

To the Provider:

- Include low-cost access features as requirements in concessioning agreements (where relevant).

To the User:

- Prohibit extra charges for carrying wheelchairs and other aids.

### 4.1.2.2 Vehicle entrance and exit

To provide easy entrance for ambulatory passengers, the entrance to all vehicles (regardless of their size) should follow good practice guidelines. These include:

- Door width at least 800mm between handrails;
- Steps at least 400mm wide, 280mm deep, and the first step at 250mm above ground level, other steps 200mm high;
- Sufficient handrails provided on both sides of the entrance, reachable from ground level all the way to the inside of the vehicle;
- Step edges (noses), handrails and top of door opening painted in a bright contrasting colour.



Figure 13: Foldable steps with colour contrast edges and handrails

Image Source: GM Coachwork

If wheelchairs are being accommodated in minibuses, or midibuses, these dimensions should be increased in accordance with the guidelines given for buses.

There is less flexibility to incorporate accessible design features on the entrance of rickshaws and smaller vans, compared with minibuses and midibuses. However, they often have low floors, and colour contrasted handrails on both sides of the door should be considered to help people with disabilities with boarding and alighting. This has been captured in Figure 14, which shows an autorickshaw in New Delhi. Possible changes to the bulkhead behind the driver could create more space for passengers when entering and exiting the vehicle and extra hand grips inside the vehicles, as well as on the entrance, will help stabilise passengers [\[32\]](#).



Figure 14: Autorickshaw in New Delhi

#### Box 14: Autorickshaws and motorcycle taxis

Autorickshaws are small three-wheeled vehicles which run on a motorcycle or scooter engine. Motorcycle taxis are similar but use two-wheeled vehicles. Autorickshaws and motorcycle taxis are used to provide a widely used taxi service in many towns and cities in South America, South Asia and Africa. Their wide availability and door-to-door service make autorickshaws competitive with bus and rail services in Asian cities. Rickshaws generally charge a metered fare, but in many Indian cities the fare is negotiated between the driver and the passenger.



In some cities in Africa, bicycles are used as taxis and are a major source of employment, as are auto rickshaws in India.

Auto rickshaws and motorcycle taxis are an important mode of mobility for many disabled and older people.

Autorickshaws are easier to board than buses because their steps are lower. Their door-to-door services allow users to overcome many of the barriers of an inaccessible built environment, and services can sometimes be personalised, with passengers entering into agreements with operators to provide regular trips.



Images of Boda Boda (Motor)Cycle Taxis in Uganda

Source: [33]

### 4.1.2.3 Seating

Seating should provide sufficient space for people with walking difficulties to move easily. Onboard minibuses and midibuses, legroom of at least 230mm (300mm for priority seats), and seats of about 450mm wide are ideally required to achieve this. If these dimensions can be achieved only in one place (such as the seats directly behind the driver), a sign should indicate that these seats are prioritised and should be vacated for older and disabled passengers. Mini- and midibuses are not usually fitted with seatbelts (besides the driver), but where these can be installed (for instance at priority seats) it will improve the safety and comfort for disabled passengers.





Figure 15: Removable seating inside a minibus

Image Source: AMF Bruns GmbH & Co. KG

Minibuses and midibuses may have the capability to change their internal seating arrangement by removing seats to make room for wheelchair users. This flexible approach enables operators to maximise the vehicle's internal space and ensure there is adequate room for all passengers, and means that they can respond to different transport requirements. Removable seat fittings and tracked floor systems can be deployed to change the layout quickly and easily as and when needed [\[32\]](#).

Low cost modifications in rickshaws could include provision of 2-point or 3-point seatbelts as well as a device to secure crutches or walkers. This is important for enhancing safety and is strongly encouraged. If adding seatbelts into rickshaws, 3-point systems should be prioritised to prevent spinal and other internal injuries. However, if this is not possible, 2-point systems are acceptable. Added padding to protect passengers' knees and legs could also be considered, to make it more comfortable [\[32\]](#).

It is possible for wheelchairs to be folded and stored behind the seat in a weatherproof compartment, as shown in Figure 16. To promote accessible para transit, Svayam and Access Exchange International have collaborated to promote the modification of autorickshaws and cars in India so that they can accommodate wheelchair users. Svayam has donated 12 modified cars to NGOs and individuals with disabilities to ensure they better meet the mobility needs of the users they served.





Figure 16: Folded wheelchair inside an autorickshaw in New Delhi, India

Image Source: AEI and Svayam

For wheelchair users who need to travel in their wheelchair, the most common form of securement system in a minibus or van is a 4-point tie down system which can be used with a wide range of wheelchair designs. The mechanism secures the user and their wheelchair and provides stability while the vehicle is in motion or in the event of a collision. Typically, the floor space required for a forward-facing wheelchair, occupant and tie-down system will be 1300 mm long x 750 mm wide on minibuses and midibuses [32].

Image Source: [Mrunmayi Abroal](#)



Figure 17: The wheelchair and passenger are both restrained in a vehicle using a floor-mounted restraint in Delhi, India

#### 4.1.2.4 Access for wheelchair users

Providing wheelchair access into existing minibuses and smaller vehicles is problematic due to the narrow doors, low roof heights and limited internal maneuvering space common to these vehicles. The high costs of converting vehicles is therefore likely to limit wheelchair access to special programmes using specially designed and subsidised vehicles.

Midibuses with floor heights not exceeding 500mm may, however, be large enough to provide direct access for wheelchair users via a short ramp. The South African Federal Council on Disability has, for instance, recommended that new midibuses to be used in taxi services provide portable ramps at a gradient of 1:4, but this steepness requires an assistant to push the wheelchair user into the vehicle [34]. The 2m long ramp has to be stowed safely inside the vehicle. Since these vehicles are custom-designed for public transport services, sufficient interior space can be provided for a wheelchair user, in combination with a foldable seat. The wheelchair space dimensions given for buses can be modified in consultation with local users to ensure the majority can use it.

A passenger lift can also be fitted to a separate entrance on midibuses to facilitate boarding. The lift should have a load bearing capacity of 300kg and a platform size of at least 750mm wide and 1200mm long. Colour contrasted handrails on both sides and a 100mm sill should be available.

Image Source: Uber



Figure 18: Rear end passenger lift for minibus

Even if floor heights or space constraints preclude provision of wheelchair access on midibuses, it may still be possible for a user to transfer to a regular seat with help. Vehicles should at least have space for a folded wheelchair to be stowed safely. Ideally, appropriate wheelchair and passenger restraints (where seatbelts are provided) on midibuses should be used as described for buses.

Rickshaws are not usually designed to allow for wheelchairs to enter the vehicle, which can be a major barrier to travel. However, there have been recent developments in Cambodia to help people in wheelchairs use this form of transport (as seen in Box 15). Box 16 also summarises how a company in Japan has introduced a ramp for rickshaws, but this is aimed at tourists rather than for local residents who are making everyday journeys.

#### Box 15: Case Study: Mobilituk Wheelchair Accessible Tuk Tuk

Mobilituk is a project of the Agile Development Group which has modified a standard tuk-tuk with a ramp and wheelchair securement system. The founders of Mobilituk recognised that tuk tuks and rickshaws present challenges for people in wheelchairs as it usually requires the driver to carry them out of the wheelchair and place them in the vehicle.

The newly designed tuk tuks have an accesible ramp that is deployed at the rear of the vehicle and enables wheelchair users to board independently without getting out of the wheelchair.

Source: [\[35\]](#)



Image Source: Wheelchair Travel

### Box 16: Case Study: Japan's Ramped Rickshaws

A company called Asakusa Jidaiya in Japan has introduced ramps that can be deployed specifically for wheelchair users who want to travel on rickshaws. People in wheelchairs can use the ramp to transfer on to a stable platform at the entrance to the rickshaw, and once onboard, the platform is disassembled. It has been noted by Accessible Japan that the ramp is quite steep, so they have asked Asakusa Jidaiya to consider offering a lighter, manual wheelchair so users can get up the ramp more easily. Whilst these rickshaws are largely aimed at tourists, it illustrates that there have been advancements in providing more accessible rickshaws and there are intentions to fill the gap in the industry.

Source: [\[36\]](#)

#### 4.1.2.5 Signage

For minibuses and midibuses, clear and legible signage is important for all passengers to identify the correct vehicle to board or hail. Route numbers or destinations should be prominently displayed on vehicles, as well as whether the vehicle is accessible for people with disabilities, including wheelchair users. The use of colour coding to indicate different routes or different origin and destination points has worked well in South Africa and helps not only some low-vision passengers but also people who are unable to read or unfamiliar with the system.



Figure 19: Clear destination signage used on minibuses in Hong Kong

Image Source: [© Him9](#)

#### 4.1.2.6 Communication

Communication inside the vehicle between passengers and drivers/ assistants is critical, as the vehicle typically only stops when requested or hailed by a waiting passenger. In minibuses, rickshaws, and other small vehicles, the size of the vehicle usually aids easy communication between passenger and driver, but drivers should also be trained to communicate better with people with hearing and visual impairments.

For visually impaired people it is problematic to identify when they are approaching their desired location, while hearing and speech impaired people find it hard to communicate their desire to stop. In minibuses and midibuses, these problems may be partly addressed by installing a bell push centrally (see the design of buses for good practice) and drivers should be trained to proactively ask visually impaired people for their destination when they enter the vehicle, and to announce when they are nearing the destination. Where possible, assistants should be positioned on the opposite end of the vehicle, especially when children are present.

Options to improve communications inside rickshaws include a public address system that announces the stopping points and braille plates to provide registration details [\[31\]](#). Drivers should also receive the same training as mentioned above. A large mirror for the driver can often be installed cost-effectively to ensure they have a clear view of the rickshaw, and enable them to see when passengers are indicating that they would like the vehicle to stop.

#### 4.1.2.7 Operating practices

Authorities can improve affordability and combat unfair discrimination by prohibiting drivers from charging extra for the carriage of wheelchairs, walking frames or other equipment needed for personal mobility. It is also particularly important for drivers to be courteous and aware of the needs of people with disabilities – more so perhaps than with formal systems because operating practices are less formalised and therefore depend more on the judgment and attitude of the driver.



This can be achieved by instilling greater awareness through training, monitoring, incentives and contracting arrangements. An effective enforcement mechanism may be to advertise a telephone number for passengers to lodge complaints or compliments, with effective feedback to drivers both positive in the form of incentives and negative by means of criticism.

See Section 1.1.11 on Contracting for more information about how contracting arrangements can be used to regulate operators and promote basic accessibility.

#### **Box 17: Case Study: The Karachi Rickshaw Project**

Established in 2012, The Rickshaw Project was launched to create employment opportunities for people with disabilities as a way of working independently while learning a new skill. Through the project, rickshaws are retrofitted and modified for people with disabilities who are looking to become rickshaw drivers. The vehicles are adapted so that everything is controlled by the driver's hands (brakes, clutch, and gears), to enable people whose lower body is impaired to operate it. Training is also given to the drivers, so they are equipped with skills to repair the vehicle if it breaks down. The project advocates rights for people with disabilities and the team has also started sensitisation training sessions at various workplaces in order to create awareness and make people realise the importance of integrating people with disabilities into their spaces.

Watch a video about the project here: [The Rickshaw Project Video](#)

Source: [\[37\]](#)

### **4.1.3 Trains**

This section deals with the design and operation of heavy rail vehicles operated in some cities of the developing world, including those used in providing urban, suburban, and metro/underground services. Many of the guidelines provided here can also be applied to other variations of rail transport, such as light rail and trams.

### 4.1.3.1 Basic principles

#### Safety

- Unobstructed space for wheelchair users to travel in rail carriage[s];
- Smooth acceleration and deceleration to avoid injury;
- Personal security enhanced through good lighting and surveillance;
- Ramps should preferably be single width.

#### Accessibility

- Level boarding for wheelchair users into train or boarding devices should be provided (e.g. lift or ramp);
- Easy and unhindered boarding via steps (if any);
- Handrails/holds, steps and hazards highly visible;
- Seats near entrance available for disabled passengers;
- Easy storage of mobility aids (wheelchairs, walking sticks);
- Clear signage indicating train destination.

#### Reliability

- All advertised accessibility features available and working;
- Train (or at least accessible carriage[s]) stops in same place every time;
- Markings on the platform to signify where accessible carriage doors will stop ;
- Clear announcement of stations being approached;
- On-board staff providing helpful service/assistance.

#### Affordability

- To the Provider:
- Start by implementing low cost features on designated carriages;
- Upgrade one car per train for better access.

To the User:

- Concessionary fares could be considered.



#### 4.1.3.2 Boarding for wheelchair users

Boarding locations for people with disabilities should be considered. To reduce the gap between the platform and the train, these locations should be away from curved sections of the track (The World Bank and ITP, 2012). Providing direct and level boarding for wheelchair users and others is best practice if the platform and train floor are at the same height. A temporary approach is to construct a partially raised platform where carriages that accommodate wheelchair users stop, or provide a portable ramp.



Figure 20: Level, step-free access via a foldable ramp or a retractable ramp

Image Source: CFL

An unobstructed door width of at least 850mm is needed to accommodate wheelchair users. In some systems a vertical pole in the doorway prevents the achievement of this clear entry width. In order for the gap between the platform and the car floor not to be unmanageable for wheelchair users or unsafe for visually impaired people, a maximum horizontal gap of 50mm, is recommended. This may not be achievable in older systems, or when the train station is built on a curve in the line, but it should be considered an ideal.

An aid to level boarding is the use of portable hand-operated lifts. This is a cost-effective option as only one is required per platform, and it can be wheeled to the desired boarding point when required. Train-mounted lifts – a more expensive option – are also increasingly used, but these require careful design to fit within the specific train car dimensions.



Figure 21: Portable lift used in Luxembourg train stations

Image Source: CFL

Any manual ramps should be securely fixed to the train to ensure they do not impinge on passengers' mobility and pose any hazard if the train suddenly stops [\[26\]](#). Ramps that are longer than 1000mm should not exceed a gradient of 8%, and ramps that are between 600mm and 1000mm should not have a gradient greater than 13% [\[31\]](#). Ramps should have a minimum width of 760mm, and ramps that are narrower than 900mm should have raised edges on both sides to prevent wheelchairs from slipping off [\[31\]](#). The upstands at both ends of the ramp should be bevelled and not exceed a height of 20mm [\[26\]](#). They should also have contrasting colours. Powered ramps should be capable of operating manually should the power fail. A mechanism to securely locate the ramp should also be considered, so it is not mis-placed for boarding and alighting [\[26\]](#).

### Box 18: Case Study: Accessible Rolling Stock in Greater Anglia, UK

Greater Anglia's new accessible fleet is the first in the UK to have both a low floor and retractable step to enable people with disabilities and those with pushchairs to board the train without needing a ramp. There will be "two wheelchair spaces and 48 priority seats for five-carriage trains and three wheelchair spaces and 106 priority seats on ten-carriage trains." Other accessible features include universally accessible toilets with plenty of room to maneuver, installation of privacy screens, USB charge points, design of the coffee tables, and an additional help button in the toilets.

Source: [\[38\]](#)



Train doors should open automatically or when the passenger presses a button on the outside or inside. On the outside the button should be mounted less than 1300mm above the floor, raised from the surrounding area by at least 3mm and it should be big enough to be pressed by the palm (about 20mm diameter). The button should have visual indication on or around it to show when it is in use and it would be beneficial to have tactile marking to help those who are visually impaired [\[26\]](#).

#### 4.1.3.3 Boarding using steps

The design of steps and stairs, to ensure they can be used by the largest possible number of ambulant people, should follow the guidelines given for buses earlier in this chapter. This includes the use of handrails and colour contrasting, both of which are very important.

#### 4.1.3.4 Layout of carriage

Guidelines for the interior layout of rail carriages are similar to those for buses: adequate passageway widths, space allocated for one or two wheelchair passengers,

priority seating near entrances/ exits, and colour contrasted handrails and step edges. Wheelchair spaces should be located close to the entrance, and could be facing forward or backward. Typically, no restraint is provided other than the wheelchair brakes. Wheelchair spaces may be usable by other passengers when no wheelchair is present, such as those with pushcarts, bicycles, or seated passengers (if a hinged seat is installed).



Figure 22: Wheelchair spaces on the London ‘tube’ network

#### 4.1.3.5 Accessible carriages

Entry and exit from overcrowded trains can be very hard for disabled passengers. It is the practice in some systems to reserve one carriage or one section of a carriage for people with disabilities. This practice does, however, raise security concerns due to the isolation of some passengers from the watchful eye of others – it is best to locate the reserved carriage next to the driver or conductor’s cabin. However, where possible, facilities for people with disabilities, in particular people with ambulant disabilities, should be available in all carriages.





Figure 23: An unobstructed train carriage interior with colour contrast, grabrails, handholds, and priority seating spaces in Bangkok

#### 4.1.3.6 Signage

If a station serves more than one train line, the name of the line or the destination of the train should be displayed on the front of each train. Good practice guidelines regarding signage should be followed. Line or destination information should preferably be repeated on the side next to train doors in case passengers missed the signage on the front.

Inside the carriage, diagrams indicating major stops served on a line can be very helpful to hearing impaired passengers and tourists.

#### 4.1.3.7 Communication

On-board announcement of the next stop before the train arrives at the station is very helpful to all passengers, but especially to visually impaired passengers. A public announcement (PA) system is typically needed for this. PA systems are also valued by all passengers for providing details of delays and emergencies. If no PA system is available, it becomes even more important to ensure the platforms display the station name clearly and legibly at every station. Visual signs especially, benefit people with hearing impairments.

#### 4.1.3.8 Fare policy

As with bus systems, many governments have the practice of subsidising rail travel for people with disabilities by charging them reduced fares or no fare at all. While this is undoubtedly helpful to overcome affordability barriers among the poorest of disabled users, the issue of introducing concessionary fare policies should be considered with caution to ensure it does not act as a substitute for other (physical or operational) improvements to the rail service that could be more cost-effective.

#### 4.1.4 Ferries

There are a number of barriers that can prevent people with disabilities from using waterborne transport, including steps, visual information with no audible alternative, confusing layouts, and narrow doors and corridors. The size and age of the vessels can often impact the ability to adapt and improve facilities. Operators should aim to carry out a phased approach to better access, including simple modifications and non-structural alterations. Some countries have developed guidelines and codes of practice to help operators adhere to accessible standards wherever possible. For example, in Hong Kong, the Transport Department sets minimum access standards as a condition of tender for new ferries.

This section focuses on best practice for designing ferries that enhance accessibility for people with disabilities.

##### Safety

- Handrails and handholds with non-slip surfaces;
- Push-locks on doors to enclosed spaces.

##### Accessibility

- Accessible toilet facilities;
- Lighting that is controlled and directed to minimise glare and shadows;
- Tactile and audible guidance;
- Consistent use of colour and tonal contrast.

## Reliability

- Equipment should be regularly checked and well-maintained.

## Affordability

- For the provider – start with making simple changes to seating arrangements and support aids such as handrails.

### 4.1.4.1 Entrance and exit

There are unique challenges to creating an accessible interface between the ferry and the harbour or jetty, including wet surfaces, slippery surfaces (e.g. seaweed), exposed locations, and wide tidal variations that can cause movement of the vessel. Passenger gangways should be deployed to enable people to enter and exit the ferry, and there should be ramps at both ends of the gangway to support wheelchairs [39]. The gangways should also be marked and well-lit, and should have a level, non-slip surface with a tactile finish at either end. Handrails along the gangway will also help improve passenger safety and stability [39].

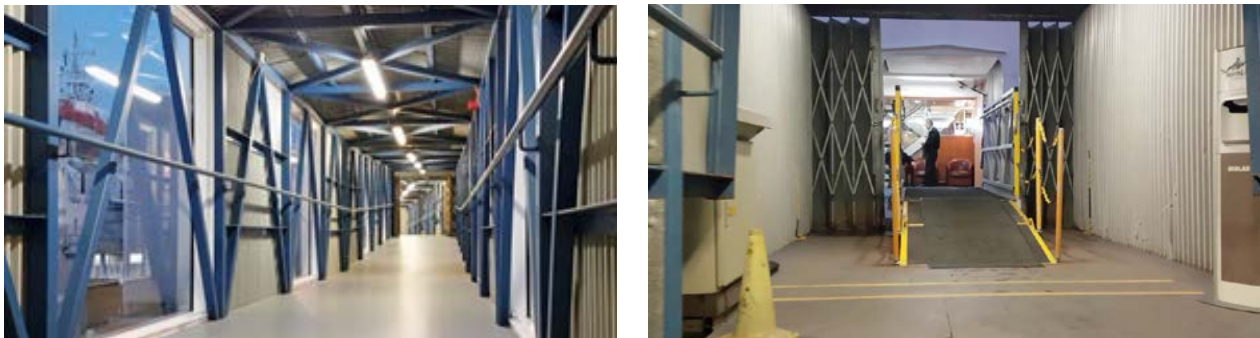


Figure 24: Lit gangway with handrails on both sides and ramp with colour contrast edges on NorthLink Ferries

Image Source: [Emma Muldoon](#)

### 4.1.4.2 Moving around the vessel

Operators should aim to incorporate features that help all passengers move around independently onboard. This includes the provision and construction of ramps and lifts as far as possible [39]. Simple alterations can involve repainting handrails to



improve visibility and reorganising seating arrangements to create more room. Appropriate handrails will enhance the accessibility of corridors and passageways, and when positioned next to a staircase they should extend beyond the first and last step to improve usability [\[39\]](#).

Where possible, corridors and passageways should have a minimum clear headroom of 2030mm from the floor and a minimum clear width of 1500mm that is not reduced by fixed objects. Any barriers or protruding objects should be colour contrasted [\[40\]](#).

Floor surfaces should be slip-resistant and minimise glare, and if carpet is used, it should be securely attached and have a short pile.

Doorways should be at least 850mm wide to ensure easy access for people in wheelchairs and full-length glass doors should be clearly marked with colour contrasting to help people with visual impairments. Doors to cabins, washrooms and other enclosed spaces should be equipped with a push-lock door handle that can easily be released from the outside with a special tool or locking mechanism. Door handles should be operable with one hand and should be mounted at a height of between 800mm and 1200mm from the floor [\[40\]](#).

#### **4.1.4.3 Cabins**

Where cabins are provided, a minimum of 5% of cabins onboard ferries should be accessible for people with disabilities and should be identifiable with the international symbol of access in pictograph or tactile form on or by the door. To enable wheelchair users to manoeuvre around the cabin and use all the facilities, the floorspace should have a minimum clearance of at least 750mm x 1200mm and there should be a call button that can alert staff at all times [\[40\]](#).

#### **4.1.4.4 Seating**

Seating should contrast in tone and colour to the background to help people with visual impairments. There should be a mix of seating available onboard the ferry to

support various disabilities. Seats with armrests should be considered to help people sit down and stand up, but there should also be seats without armrests as these can be a barrier for some people getting in and out of the chair [\[39\]](#). Wheelchair restraints will ensure that the wheelchair is securely fastened adjacent to other seats.

It is recommended that at least 5% of seats onboard are priority seats for people with disabilities, and these seats should be positioned close to entrances and exits, and within close distance of evacuation routes.

#### 4.1.4.5 Signage

It is advisable to have signage onboard that clearly displays the following key information [\[39\]](#):

- Vessel destination;
- Instructions on how passengers can access assistance;
- Visual and audible information in advance of arrival at the destination;
- Location and details of the facilities onboard;
- Visual and audible information on delays, including length of any delays;
- Visual and audible instructions on what to do in the event of an emergency;
- Information on how to make a complaint.
- Information that is being displayed on electronic screens should be available in other formats to assist people with visual impairments. Ensuring that information is easily accessible onboard the vessel will encourage more people to use maritime transport services.
- Signage should be positioned well above the level of head height but also visible for people in wheelchairs. It is advisable to position signs at least 2300mm from the floor and in locations that avoid shadowed areas and glare [\[40\]](#).

## 4.2 Accessible Taxis and Private Hire Vehicles

Like paratransit, taxis and private hire vehicles (including those hailed through apps like Grab Taxi and Uber) are ideal for providing door-to-door services and supporting disabled passengers who are unable to use conventional public transport services or are unable to travel to transport interchange points. Taxis may also be a more reliable option for wheelchair users who might find it difficult to travel on busy, crowded forms of public transport.

### 4.2.1 Entrance and exit

Access for wheelchair users can either be at the side or rear of the vehicle; both have their advantages. Side access prevents the wheelchair user from having to negotiate the kerb and the angle of the ramp is shallower. Rear access enables the wheelchair user to board while facing forwards and may result in simpler manoeuvres inside the vehicle to secure the wheelchair in the correct position. However, rear access could make it more difficult to enter the vehicle from the kerb [\[31\]](#), and it is most likely that the wheelchair user will be required to manoeuvre on the roadway when entering and exiting the vehicle.

Newer versions of some taxis have integrated ramps that can easily and quickly be used to help people in wheelchairs. If this isn't possible, it is advisable to have foldable ramps stored safely onboard the vehicle so they can easily be deployed when needed. They should be stored in a way that does not encroach on the space allocated for wheelchairs. Ramps should have raised edges on both sides to ensure wheelchairs do not slip off [\[41\]](#) and they should be capable of carrying a minimum load of 300kg [\[31\]](#).

The minimum unobstructed opening of the door should be 850mm wide and steps should be 800mm wide, 200mm deep, and the first step should be no more than 250mm above the floor. Each step should also have colour contrasting [\[31\]](#).

Ideally, swivel chairs can be provided to help people with disabilities get in and out of the vehicle and navigate to and from the door more easily.

### Box 19: Case Study: G7 Accessible Taxis

The Parisian G7 Access taxi service company offers a fleet of vehicles that have been modified for people in wheelchairs. The vehicles include electric ramps or low-level flooring which improve accessibility from the road and pavement. Assistance dogs are permitted onboard and drivers are trained to help passengers with physical and visual impairments.

Source: [\[42\]](#)



Image Source: G7 Access Taxi Service

## 4.2.2 Onboard

Hearing loops inside the vehicle help improve communication between the driver and the passenger and are particularly beneficial for people with reduced ranges of hearing [\[43\]](#). Handholds are important for safety and stabilising passengers and should be colour-contrasted and slip-resistant without sharp bends. Seat edges should also be colour contrasted to help passengers find their seat safely.

Assistance dogs should be allowed to travel onboard at no extra cost to the passenger [\[43\]](#). The wheelchair position should be facing forward or backward in the vehicle and should be securely fitted using a tie-down system [\[31\]](#).

There should be sufficient space in the vehicle to allow wheelchair users to manoeuvre. It is advisable to give 1176mm from the back of the seat to any obstruction in front of the seat [\[31\]](#).



Figure 25: A swivel chair and colour contrasted handles inside a London taxi

Image Source: London Electric Vehicle Company

### Box 20: Case Study: London Electric Vehicle Company

The London Electric Vehicle Company (LEVC) has designed an electrically driven taxi (the TXe) to be accessible and convenient for all.

The low entry step allows easy access (just 370mm from the floor) and an integrated wheelchair ramp can be quickly deployed (11 degrees to a kerb, 250kg safe capacity) to allow for wheelchair access. There is also an intermediate step, and a seat which swivels to allow access for those with restricted mobility.

Flat floor space and the open interior aid easy access to the seats for able bodied passengers and for those with restricted mobility. The seating format and floor space ensures greater space for wheelchairs, buggies, bikes and luggage. Bright LED lighting has been used throughout, from floor lighting, puddle lamps and even reading lamps which can be adjusted for brightness by simply pressing and holding the buttons in the passenger space. Other accessibility features include high-visibility handles – which are longer than normal, so useful for manual wheelchair users – and a hearing loop on the intercom system.

Furthermore, when seated on the rear seats, passengers are two metres away from the driver with the Driver Protection Screen providing a physical barrier between driver and passenger. This arrangement is highly beneficial in the context of pandemic and infectious disease control. These features offer extra security for those who consider themselves high risk or vulnerable.

The TXe also features a durable, easy to clean passenger environment, ensuring that drivers can easily clean their vehicles after every fare.



Source: [\[41\]](#)

Image Source: London Electric Vehicle Company

## 4.3 Accessible Cycles

Many people with disabilities struggle to enjoy the benefits of cycling due to physical barriers, but these barriers can be addressed by using a bike that meets the needs of the individual. In recent years, manufacturers and designers have modified cycles to make them inclusive and accessible for people with disabilities. This section discusses the different types of accessible cycles that have become increasingly available to people all over the world.

### 4.3.1 Tricycle

Tricycles have three wheels - usually two at the back and one at the front. This type of cycle is ideal for people who require extra stability and balance. Designers and manufacturers can add extra features to the cycle to support different disabilities, including backrests, seatbelts, and parent control.

Image Source: [Van Raam](#)



Figure 26: Adapted Tricycle



### Box 21: Case Study: Wheelchairs for Nigeria

This organisation aims to support the thousands of people who are disabled in Nigeria, to help them travel independently and access education. There are



around 50 employees who build adapted tricycles, five of whom are polio survivors. The tricycles are particularly suited to polio survivors, almost all of whom can use their arms. The tricycles can perform well on rough terrain and can go much faster and further than a standard wheelchair. Bike parts are imported from India, and tubing, plywood and other supplies are purchased locally. There have been over 21000 hand-pedal tricycles built and donated since the organisation was established.

Source: [\[44\]](#)

Image Source: Wheelchairs for Nigeria

### 4.3.2 Tandem

Tandems are designed for two people riding together, either one in front of the other or side by side. These cycles are ideal for people who are visually impaired and may lack the confidence to cycle on their own. Tandems generally rely on a 'pilot' who controls the steering, gears, and brakes.





Figure 27: Tandems

### 4.3.3 Wheelchair Tandem

For those who can't cycle themselves due to profound disabilities, wheelchair tandems enable them to enjoy the feeling of cycling. These cycles rely on having a pilot who pedals and controls the brakes and gears, while the wheelchair user sits in the front. It is common for wheelchair tandems to have power-assist to support the pilot.



Figure 28: Wheelchair tandem

Image Source: [Van Raam](#)

### 4.3.4 Handcycle

These cycles rely on upper body strength so are suitable for people with lower body limb disabilities. Most handcycles have an upright position, although recumbent versions are available, and can either come in one piece or as a clip-on attachment to a wheelchair.



Figure 29: Upright handcycle

Image Source: Freedom Concepts Inc

### 4.3.5 Recumbent cycle

These cycles require the rider to be in a reclining position, which spreads the body weight over a greater area and puts less strain on the rider's back, knees, and hip joints. Recumbent cycles are available with two or three wheels.



Figure 30: Recumbent cycle

Image Source: ICE Trikes

### 4.3.6 Electric cycle

E-bikes have become increasingly popular in recent years as they enable people to ride for longer without using as much strength and energy. This type of cycle is also beneficial for people who travel on difficult topography such as hills. They are ideal for older people or persons with reduced mobility in their lower body for cycling beyond the distance they would normally be able to.



Figure 31: Spero range of Electric bikes, India

Image Source: Spero

#### Box 22: Case Study: Wheels for Wellbeing

A Guide to Inclusive Cycling has been produced by a London disability organisation called Wheels for Wellbeing. The organisation has a vision to change the common perception of cyclists and help develop a world where people with disabilities can cycle freely wherever they wish. The guide sets out the basic principles for inclusive infrastructure design and discusses the different type of cycles that are available for people with disabilities.

Source: [\[45\]](#)

Image Source: Wheels for Wellbeing



## 4.4 Where to Start?

The first step towards improving safety and accessibility for passengers on vehicles, including those with disabilities, is to start fostering greater accountability of the industry. This requires coordinated approaches to creating partnerships with government, formalising routes and services, stabilising operating conditions, stepping up enforcement, and empowering customers.

The improvement of access to vehicles needs to be coordinated with access features on related infrastructure. This is especially important if wheelchair access is to be provided, as it helps little if vehicles are wheelchair accessible but wheelchair users are prevented from getting to the pick-up point / bus stop / platform by flights of stairs or other obstacles.

It is difficult to significantly improve the accessibility of some vehicles, such as train carriages, short of major refurbishing or rebuilding – especially if doors and passages are too narrow to admit a passenger using a wheelchair. Therefore, new vehicles should be built to incorporate good practice features and include them as specifications when they are ordered. Government regulators should require higher standards of new vehicles and this can be undertaken in an incremental manner, starting with low-cost features such as adequate handrails and stanchions, colour contrasted step edges (noses) and handrails, bell pushes, and well-designed priority seating and wheelchair access. The standards should also set out how to improve the design of entrances and steps to better serve all ambulatory passengers, especially with regard to steepness and the height of steps.

Accessibility audits should be undertaken on existing vehicles to ensure that operators are meeting a minimum standard. There are a number of useful features that can be installed on existing vehicles at low incremental cost. As a starting point, the features above could be concentrated around the entrance and exit area, as well as the layout and availability of priority seating – this will not serve all passengers, but at least target those who could benefit most.



In practice, opportunities for such interventions are severely limited by operators' financial inability to invest in vehicles they do not own. In some cases, Governments have become involved in subsidising the replacement of vehicles, and using this opportunity to specify significantly higher standards for access (see Box 23). The process of procuring new vehicles should become more efficient to give operators greater opportunity to purchase new vehicles that are compliant with accessible design standards.

### Box 23: Case Study: Improving access through bus substitution programme in Mexico City



Mexico City has achieved greater accessibility in their public transport concessions fleet through a government replacement bus funding programme. The city plans to replace a total of 6000 minibuses between 2021 and 2023, with over 800 new buses replaced in 2020. Each vehicle is eligible for between 300,000 to 400,000 pesos (around US\$14,000-19,000) for the replacement. The older, more polluting vehicles are replaced with vehicles

that have: lower CO<sub>2</sub> emissions, added road safety devices and accessible features. The new buses have designated seats for persons with disabilities which use another colour for easy identification, a folding seat to have space for assistance dogs, tactile-visual signage with braille, and non-slip flooring.

Source: [\[46\]](#)

Image Source: SEMOVI

Improving operating practices is another low-cost intervention – but requires some amount of retraining and supervision of drivers and conductors. Practices such as considerate driving habits and cultivating awareness of the needs of passengers with disabilities should be considered for all vehicles. For buses, paratransit, and taxis/private hire vehicles, the calling out of major stops and consistently drawing up close to kerbs (where possible) will work best in the context of a general improvement of passenger experience.

# Chapter 5

## Accessible Infrastructure



# Accessible Infrastructure

The process of designing accessible infrastructure specifically, and proactively, considers the needs of people with disabilities. In this context, accessibility sometimes refers to the characteristics of products, services, and facilities that mean they can be independently used by everyone – including those with diverse needs. Infrastructure, by definition, supports other systems. As such there is an absolute requirement that it must enable accessible interfaces with whatever other systems it is connected to.

In transport contexts, accessible design processes therefore seek to maximise the number of potential users who can readily use a system, such as a rail service or a public space and surrounding street environment:

- To the greatest extent possible;
- Without the need for adaptation or specialised support;
- In diverse contexts.

Designing and delivering accessible infrastructure helps to create an inclusive environment in which people with and without disabilities can enjoy the same opportunities. It can enable those with diverse needs to overcome mobility and other limitations they experience, and empower them to enjoy equal access to opportunities, activities, and key services such as work, education, social interaction, and healthcare. Providing accessible infrastructure can therefore help to improve the quality of life and independence of many people with disabilities, as well as unlocking new segments of the population that are able to join the labour market and contribute to local economic growth.

- The families and assistants of people with disabilities also benefit from accessible infrastructure, through:
- Reduced dependence upon them to provide support and assistance with everyday tasks;
- Fewer physical challenges to overcome when travelling with a disabled person;
- Establishing new opportunities for spending time together as a family.



- Other groups also benefit, including parents travelling with young children, especially those using pushchairs, and people travelling with luggage or bulky items. Making it easier, safer and quicker for people who experience mobility impairments to board transport vehicles also benefits everyone – by reducing dwell times at stops and stations and reducing boarding delays.

## 5.1 Accessible Pedestrian Footways and Public Realm

Pedestrian footways are any areas primarily used by pedestrians. They can be adjacent to roadways (when they are also referred to as sidewalks, or pavements), or away from the road (in which context they are often referred to as footpaths).

Providing accessible footways in the right places is a fundamental aspect of meeting basic mobility needs for everyone, since almost every trip that people make begins and ends with an individual walking or wheeling. For example, to make a bus or train journey, or to hail a rickshaw or taxi, most people first need to get to a public transport stop, station or roadway using a footway. Footways are also usually a key interface for the transport vehicles discussed in Chapter 4 – as this where bus stops and waiting areas are commonly provided, and from which people board and alight transport services.

Furthermore, people with disabilities from low or no income households often cannot afford public transport services, rely on walking, and consequently have the greatest need for safe and accessible footways. Well-designed and maintained footways can benefit diverse users. They remove the need for people to share the roadway with fast moving traffic, and provide a safe space which can be more easily navigated and traversed. Footways also play a role in reducing social isolation, by providing social interaction opportunities and places to browse and shop.

This video looks at the importance of accessible footways, looking at a case study in Delhi:

[My Wheelchair and I Travel on Delhi Roads Video](#)

## 5.1.1 Basic principles of accessible footway design

### Safety

- Level and smooth, non-slip matt surface;
- Physically separated, or distant from vehicular traffic;
- Adequate clear width and height clearance;
- No open utility covers or open street works;
- Street work cordons and furniture to be an appropriate height and detectable at ground level;
- Drain covers to be set perpendicular to footway direction with narrow gaps;
- Street lighting with good colour rendering properties at a minimum of 10 lux with additional lighting to highlight obstacles, wayfinding markers and facilities.  
Lighting needs to be sufficient for people to observe unevenness in surfaces and the contrast between horizontal and vertical surfaces from a distance of 2.5 – 3.0 metres;
- Tactile and visual warnings where vehicle access crosses the footway.

### Accessibility

- Inappropriately, or illegally parked vehicles to be removed from the footway;
- Street furniture to be restricted to the furniture zone, allowing a clear walking/ wheeling route;
- Resting places to be provided at regular intervals (100m max);
- Gradients including crossfalls, not too steep (less than 2.5%);
- Simple layout and adequate tactile guidance and directional cues to guide people who experience sight impairments.

### Reliability

- Uninterrupted accessible transit between designated points;
- Restrictions on re-positioning of mobile street furniture.

### Affordability

To the provider:

- Minimise costs by including access improvements in regular maintenance and new construction;
- Maximise impact by upgrading highly used pedestrian areas first;
- Maximise on first-hand knowledge of accessibility by consulting users during early design stages for new infrastructure;
- Instead of seeing accessibility improvements purely as cost, recognising that incorporating accessibility as a starting point for other footway works affords greater benefits for all users of public realm and transport services they link to.

## 5.1.2 Accessible footway good practices

### 5.1.2.1 Zoning footways to reflect their uses

Pedestrian footways should incorporate the following easily identifiable zones, with each one contributing to enhanced accessibility for diverse users and serving a distinct function as part of the streetscape:

- The frontage zone - the area furthest from the road directly adjoining buildings e.g. homes and businesses;
- The pedestrian/footway clear zone - a continuous clear space for walking and wheeling which is free of obstruction and may include tactile guidance cues to assist people who experience sight impairments;
- The furniture zone - a suitable place for benches, bins, bus shelters and lamp columns.

Designs may also accommodate a fourth zone which sits closest to the road, adjacent to the furniture zone and along the kerb edge. This zone is known as either a 'kerb zone' or 'buffer zone'. The buffer zone can be used for a variety of uses including kerbside bike lanes, parking or bus boarders. An example of footway zoning is shown in Figure 32.

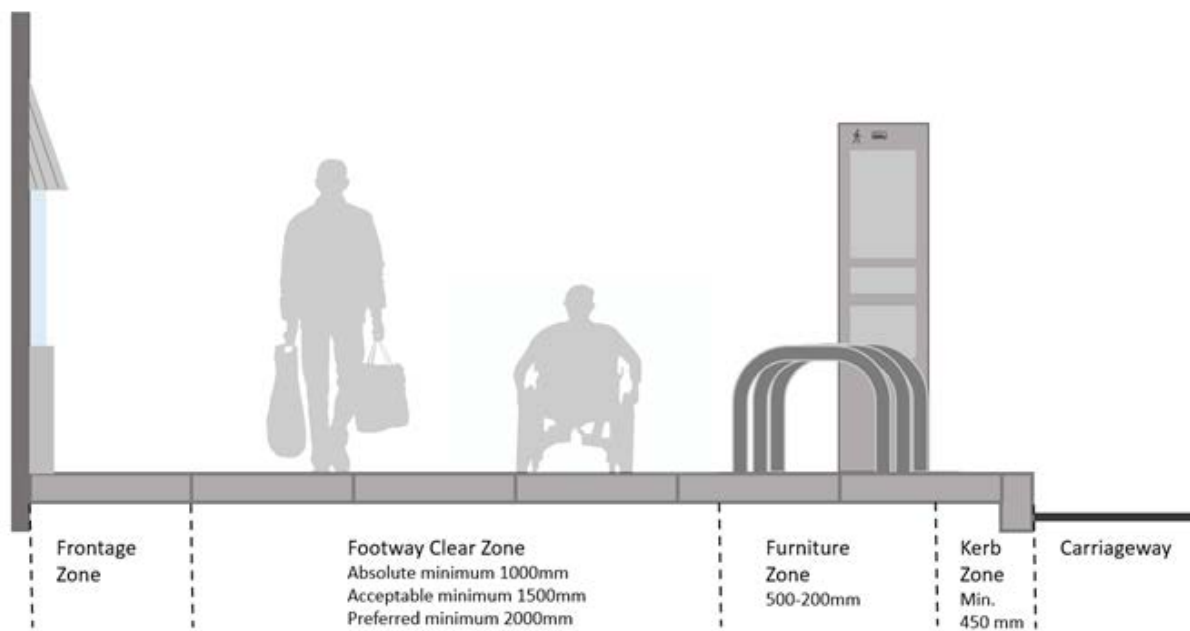


Figure 32: Footway zones

### 5.1.2.2 Surface quality

Firm, even surfaces are important to all users, but particularly for people using mobility aids, including wheelchairs, or people who experience difficulty when walking. Underfoot surfaces should be made of a hard-wearing non-slip material. Materials which have been treated with a non-slip surface treatment are to be avoided, as this tends to erode over time and often exposes the slippery base material.

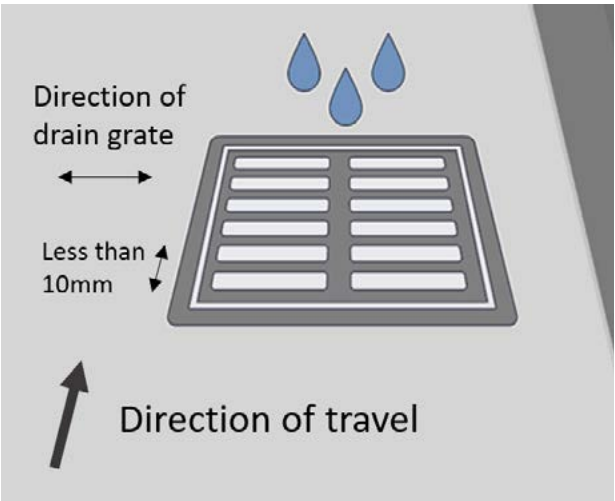
Surfaces should have a matt or semi-matt finish to avoid glare and reflection, which can impact on visual functioning and be particularly problematic for people who experience photosensitivity, sensory or visual impairment or other neuro-diverse conditions. Care should also be taken to avoid patterns of block paving or surface designs which can cause visual distress for some people, such as herringbone paving.

The surfacing material chosen should be appropriate for the climate and weather of the country, and maintain its integrity in high or low temperatures or through heavy rainfall, as appropriate. If brick paving is used, care should be taken to lay it evenly with consideration given to potential for base subsidence and tree root upheaval. For

this reason, it is generally best to pave pedestrian facilities with asphalt or concrete. Lower cost surfacing such as compacted crushed rock or unpaved compacted earth may be an alternative option in footways with very low usage, but these are typically less accessible to persons with wheelchairs unless they are kept smooth, compacted or otherwise stabilised.



Figure 33: Paving surface materials



Where grates over storm water drains cannot be relocated from the pedestrian zone, they should be perpendicular to the direction of travel with gaps no more than 10mm to prevent wheelchair wheels, long canes, or other mobility aids from falling through. Figure 34 demonstrates a perpendicular storm water drain configuration.

Figure 34: Storm water drain grate placement

The removal of obstacles like potholes, tree roots and storm water drains from within the pedestrian zone will help to make it safe and usable for as many people as possible.

### 5.1.2.3 Width



Figure 35: Footway wide enough for two mobility aid users

Footways and paths should ideally be at least 2000mm wide in areas with moderate to high pedestrian traffic. This width allows two wheelchair users to pass each other comfortably. Where this cannot be achieved, or in areas with lower numbers of pedestrians, a width of 1500mm is an acceptable minimum that provides enough space for a wheelchair user to pass a person walking comfortably. Some guides allow widths of

1000mm over short distances if inadequate space is available.

Image Source: Max Bender

These widths should ideally be maintained consistently - even behind bus shelters and along shop fronts.

The clear zone should be kept free from obstacles and clutter including vending. Likely footfall and amenities served by the footway, including transport services and major retail, healthcare and education centres, should be considered when designing footway width to ensure adequate space for all users. Generally speaking, the higher the footfall, the greater the width of the footway.



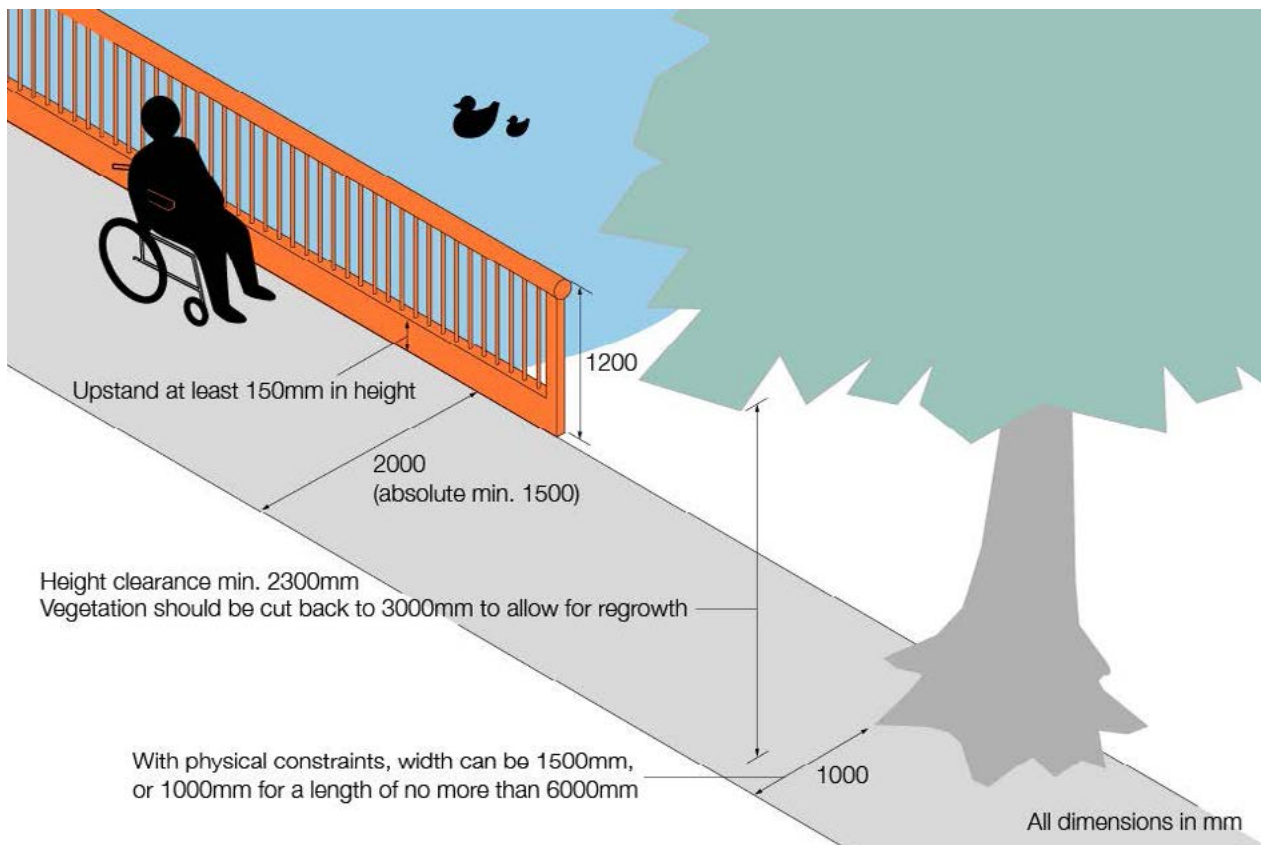


Figure 36: Dimensions for footways, sidewalks, or pavements

Image Source: Department for Transport, Inclusive Mobility

#### 5.1.2.4 Height

Overhead clearances of at least 2300mm from the footway should be provided to prevent people who experience sight impairments from hitting overhanging branches or signs. This measurement should be based on branch height during wet weather, when foliage is likely to hang lower. Where this is not possible a physical barrier should be installed to warn pedestrians, alongside clear visual markings, such as bright yellow banding, on the low-hanging infrastructure.

The kerb height or vertical 'upstand' difference between the road carriageway and pedestrian footway should be a minimum of 60mm, and ideally 100-150mm [23]. If the height difference is much greater it will create a trip/fall hazard for pedestrians and the gradient of dropped kerbs will be too steep, making the footway inaccessible to wheelchair users. If the kerb height is less than 60mm, then it will not be detectable

for people who experience sight impairments and rely on long-canes or assistance dogs to navigate pedestrian environments. The change in level should be easily distinguishable, with top and side surfaces visible in daylight and under artificial lighting.

Kerb heights as high as 480mm have been installed on new infrastructure in Delhi, India. Installing a kerb of this height should be avoided where accessible mitigation measures have not been considered, as an accessible reconstruction will incur additional and unnecessary costs.

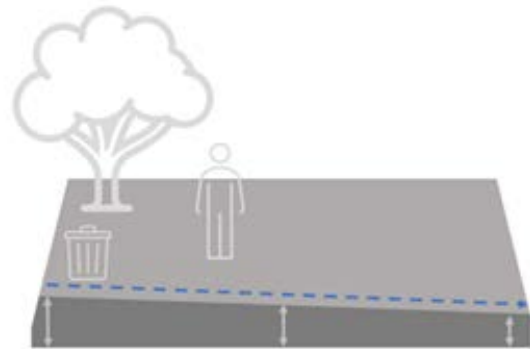


Figure 37: Depiction of a footway crossfall/camber

#### 5.1.2.5 Simplicity of layout

Footways should be easy to navigate and have a straight and simple layout where possible. Features such as benches, poles for traffic signage, and rubbish bins should be kept to the furniture zone. Having a clear walking area greatly assists people who experience sight impairments. Changes in slopes and crossfalls along the footway in



Figure 38: Cluttered footways that have been rendered inaccessible

the direction of travel, for instance when the footway crosses a vehicle driveway, should be gradual and avoided whenever possible. There should be no ambiguity over the pedestrians' right of way on the footway. Frequent inconsistencies and level changes make it more difficult for people who are walking, as well as those using wheelchairs.

### Box 24: Case Study: Ramps in market areas can serve both traders moving goods and their customers

Having barrier-free access to public spaces such as market areas, public squares and parks may significantly enhance the ability of some people with disabilities to independently conduct their own shopping, business, or leisure activities. In some contexts, pedestrian crowding and unregulated street vending may pose significant challenges to making public places safe, accessible and reliable. Good design and enforcement will start to benefit many people, including shoppers with baggage and vendors with trolleys or carts.



Image source: Shmuel Bar-Am for The Times of Israel

#### 5.1.2.6 Tactile paving types

Sometimes people who experience sight impairments need visual and/or guidance cues to help them negotiate their way through a pedestrianised area. This is especially important if the pedestrian route crosses larger open spaces, where the usual guidance provided by the edge of the footway (e.g. next to a road) or the edge of a building (e.g. the inner edge of the frontage zone, where the footway meets building frontages) is not available, or when pedestrians need guidance around specific obstacles in the footway.

A continuous tactile guideway in the direction of pedestrian travel, which has a different texture to the rest of the footway and a contrasting colour, can provide this guidance. The different texture can be followed by people using a long or guide cane, and can also be detected underfoot by others who experience partial sight. Research has shown that a height of 5mm for the raised part of the surface is sufficient for almost all people who experience sight impairments to detect, without causing too

much discomfort for other pedestrians [\[47\]](#). Tactile guideways should, however, be used sparingly as they can hinder wheelchair users and other pedestrians, such as older people who experience walking difficulties. They also need to be accompanied by other forms of warning cues (such as colour contrasts), because not everyone is able to detect tactile surfaces. High priority installations may be around major transport hubs and facilities, such as BRT stops. Where footway width allows, a wheelchair user should be able to travel comfortably alongside the guideway, rather than over it.

Tactile guideways can take the form of prefabricated guide blocks with raised flat-topped bars which should also ideally use a contrasting colour. In Mexico City and Buenos Aires subway stations, tactile guideways incorporating grooves cut in the floor have been used, but these are less common. In Mexico City tactile warning surfaces are used at the edge of pedestrian crossing points. Tactile guidance routes are ONLY used to help guide people who experience sight impairments to mass transit stops (e.g. for Metro and BRT). The city's planners have been conscious not to apply them to every street or footway.

#### Box 25: Case Study: Beijing tactile guideways

Throughout China steps are being taken to develop more accessible places and transportation systems, especially for the old, young, and those with mobility impairments. In 2001 the Chinese central government mandated the construction of tactile guideways across the country. Thousands of kilometres of tactile guideways have been laid, with most urban routes in major Chinese cities such as Beijing, Shanghai and Shenzhen now offering an extensive network of tactile guideways to visually impaired pedestrians.


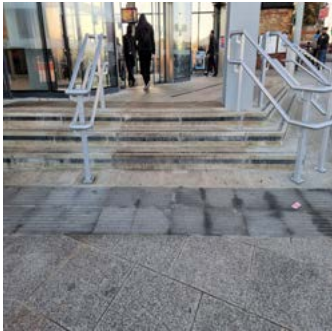

Source: [\[48\]](#)

Image source: Colin Rowan, 2012, via [psuchina.wordpress.com](http://psuchina.wordpress.com)





Where a pedestrian route leads to a hazardous situation (such as a street crossing – see Street Crossings) a tactile warning should be used to warn pedestrians who experience sight impairments. This can take several forms as shown in **Table 4:**

Table 4: Tactile paving types	
<ul style="list-style-type: none"> <li>Pre-cast concrete blistered paving or ‘bubble blocks’ are used to transition paved footways into street crossings at kerb ramps. Red blister paving is traditionally used at signalised crossings and buff is for uncontrolled crossing points in the UK.</li> </ul>	
<ul style="list-style-type: none"> <li>Hazard warning blocks or ‘corduroy’ blocks include closely packed parallel bars. They are traditionally used to indicate hazards such as the top or bottom of stairs.</li> </ul>	
<ul style="list-style-type: none"> <li>‘Lozenge’ paving is used as a warning tile for on-street rail, tram and bus stops.</li> </ul>	

The meaning of warning surfaces should be consistent. In countries or areas where tactile paving is introduced, but not in regular use, the purpose and meaning of each type of paving needs to be well publicised - particularly to people who experience sight impairment, who will benefit most from its installation. The International Organization for Standardization (ISO) sets out a series of terms and definitions relating to tactile walking surfaces in ‘ISO 23599:2019(en) Assistive products for blind and vision-impaired persons – Tactile walking surface indicators’. [\[49\]](#) This aims to provide a basis for a common approach to the design and application of tactile surfaces around the world.

Care should be taken over the materials used for tactile surfaces; which can include tiles, adhesive studs made of rubber/plastic, and metal studs that are screwed into the ground. The type of material preferred can depend on where it is being used (e.g. indoors or outdoors) and the potential for the tactile surface to become slippery when wet – which should be avoided in all contexts. For outdoor applications more robust materials, such as prefabricated tiles, are usually preferred. These can include tactile surfaces that are manufactured from recycled materials. [\[50\]](#)

### 5.1.2.7 Colour

Care should be taken to ensure that street furniture contrasts with its surroundings. Colours which appear to be distinct in colour (chroma) can be similar in tone (e.g. green and brown) and indistinguishable for some people who experience sight impairment. Figure 39 demonstrates how colours red and green, which are quite different in chroma, are seen by people with three different types of visual impairment. Failure to provide sufficient contrast may create a hazardous environment for people who experience certain sight impairments, such as colour blindness, because furniture can become ‘camouflaged’ into the streetscape. As a minimum design standard, free-standing furniture, such as bollards or bins, should have a 150mm deep band of contrasting colour at the top to increase visibility. [\[51\]](#)

It is generally recognised that 30 points of difference in light reflectance between surfaces should give adequate contrast to be noticeable to a large proportion of partially sighted people.



Figure 39: Colours red and green, as perceived by people with different kinds of colour blindness



### 5.1.2.8 Lighting

Where possible, street lighting should illuminate in true colour and not distort the appearance of the streetscape. White artificial light is generally more effective than yellow artificial light at achieving this, as yellow lights, including sodium lights commonly used in street lighting, can make the world appear monochromatic. If other light colours are used, it is important that the tonal contrast is sufficient in both daylight and artificial light.

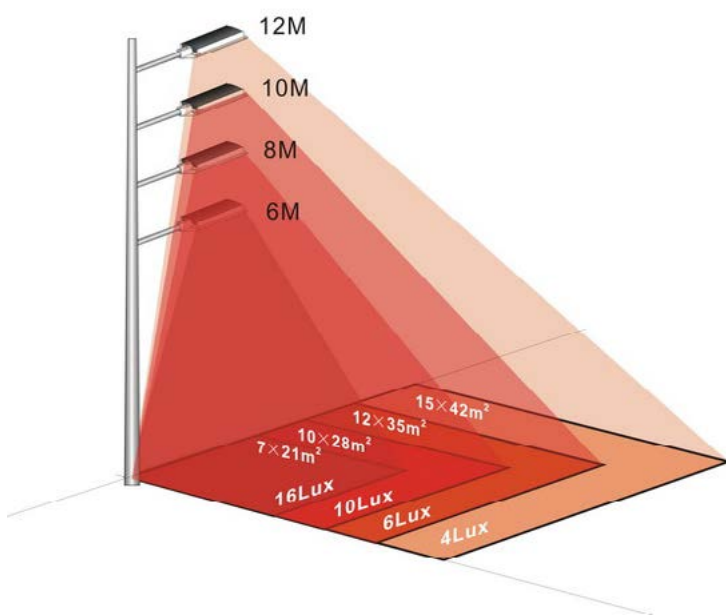


Figure 40: Lux / height of light source ratio

Image Source: [Allenlinroman](#)

Care should be taken to fix lighting at an appropriate height. Figure 40 shows how lux levels are affected by the height of the light source.

Typically, street lighting should be around 10 lux when measured at ground/footway level, as shown in Figure 40, with lighting of up to 20 lux on busier urban routes [52]. Lighting brighter than 30 lux should be avoided in residential areas as exposure can affect sleep patterns [53].

### 5.1.2.9 Rest areas

Some people need to rest at reasonably frequent intervals. Seating should be provided at regular intervals along frequently used pedestrian routes and footways. It should be placed in the furniture zone, wherever possible, and should not obstruct the pedestrian clear way. Seating should be painted in contrasting colours to its surroundings so that it can be perceived and recognised by people who experience sight impairment.

Rest areas should provide shade and shelter where possible, particularly in hot or wet climates. Shelters allow for some privacy and can benefit people with neuro-diverse conditions, who may become disorientated easily and need time and space away from crowds. Shelter should not prevent passive surveillance or invite antisocial behaviour. It should not impact on the visibility of the sheltered infrastructure. See Section 4.2.11 of this chapter for more information on seating.

#### 5.1.2.10 Slopes and grade changes

One of the most commonly occurring grade changes along a footway is at the interface between the footway and the roadway. Dropped kerbs provide ramped access so as to ensure step-free access from the footway to roadway and should be provided at all crossing points along a pedestrian footway if it is to be considered accessible. Dropped kerbs should also be accompanied by appropriate tactile paving on approach to the crossing in order to inform people who experience sight impairments of the presence of a hazard (e.g. road traffic). For more information on dropped kerbs, see Section 2.2.2 of this chapter.

Guidelines from many countries agree that a slope of 8%, or 1 : 12 gradient (a 1 metre vertical rise for every 12 metres of horizontal distance), is the absolute maximum that may be used in pedestrian areas if they are to be accessible for all. Anything greater than this causes difficulties for manual wheelchair users, who can struggle to propel themselves up steeper slopes, and could cause their wheelchair to topple over. Slopes steeper than 8% can be managed by some wheelchair users, but only over very short distances (see Table 5). In fact, any longer footway or ramp that is steeper than an average slope of 5% (1 : 20 gradient) should provide level areas that serve as resting locations approximately every 10 metres.

Changes in slope should be gradual enough that wheelchairs do not become stuck. Crossfalls should only be provided where absolutely necessary – for example to enable rainfall to drain away from a pedestrian route. For wheelchair users, a flat crossfall is often more important than a flat gradient. Where crossfalls need to be provided, these should never be more than 2.5% (1 : 40 gradient). Anything steeper than this makes it difficult for a wheelchair to steer in a straight line.

Table 5: Slopes and gradients for footways and ramps

Slope/gradient of footways or ramp	Recommended use
10% (1 in 10)	Only over very short distances (1.0m or less), such as kerb ramps
8% (1 in 12)	Maximum slope for general use
5% (1 in 20)	Preferred slope where possible
Source: Based on <a href="#">[51]</a>	

To ensure that users of wheelchairs, tricycles, crutches, pushcarts and other assistive equipment can use pedestrian footways, small ramps should be installed in all places where there are changes in level. Chapter 5 provides more information on kerb ramps and street crossings.

#### 5.1.2.11 Footbridges and subways

New footbridges and subways should be designed to include pedestrian ramps alongside stairs, so that everybody can use them. The guidelines on ramps and handrails in Chapter 4 should be followed when designing these features. Where very long ramps will be required to achieve step-free access to a pedestrian footbridge or subway, it is often preferable to provide an at-grade alternative or an elevator/lift.

#### 5.1.2.12 Guardrails

Where there is a large drop at the edge of a footway, guardrails could be provided. Guardrails should be at least 1100mm high and painted to contrast clearly with the surroundings. When designing guardrails, it is important to ensure they do not obscure other road and footway users' (especially drivers') ability to see children, wheelchair users, and people of shorter stature – for example, when they are waiting to cross a road at designated crossings placed between gaps in guardrails. Guardrails should have an upstand of at least 150mm to provide a tapping rail for long-cane users, and the design should prevent assistance dogs from walking under the rails [\[51\]](#).

### 5.1.2.13 Maintenance

To preserve usability and continuity of pedestrian footways, it is critical that they be kept clear of rubbish, dirt, parked cars and other obstacles. Street works may occasionally be necessary and should be guarded by a continuous, rigid barrier (not plastic tape) along the entire perimeter. These barriers should be at least 1m in height and detectable at ground level with a long cane.

These can be made at very low cost from timber painted in contrasting colours (as shown in Figure 41).

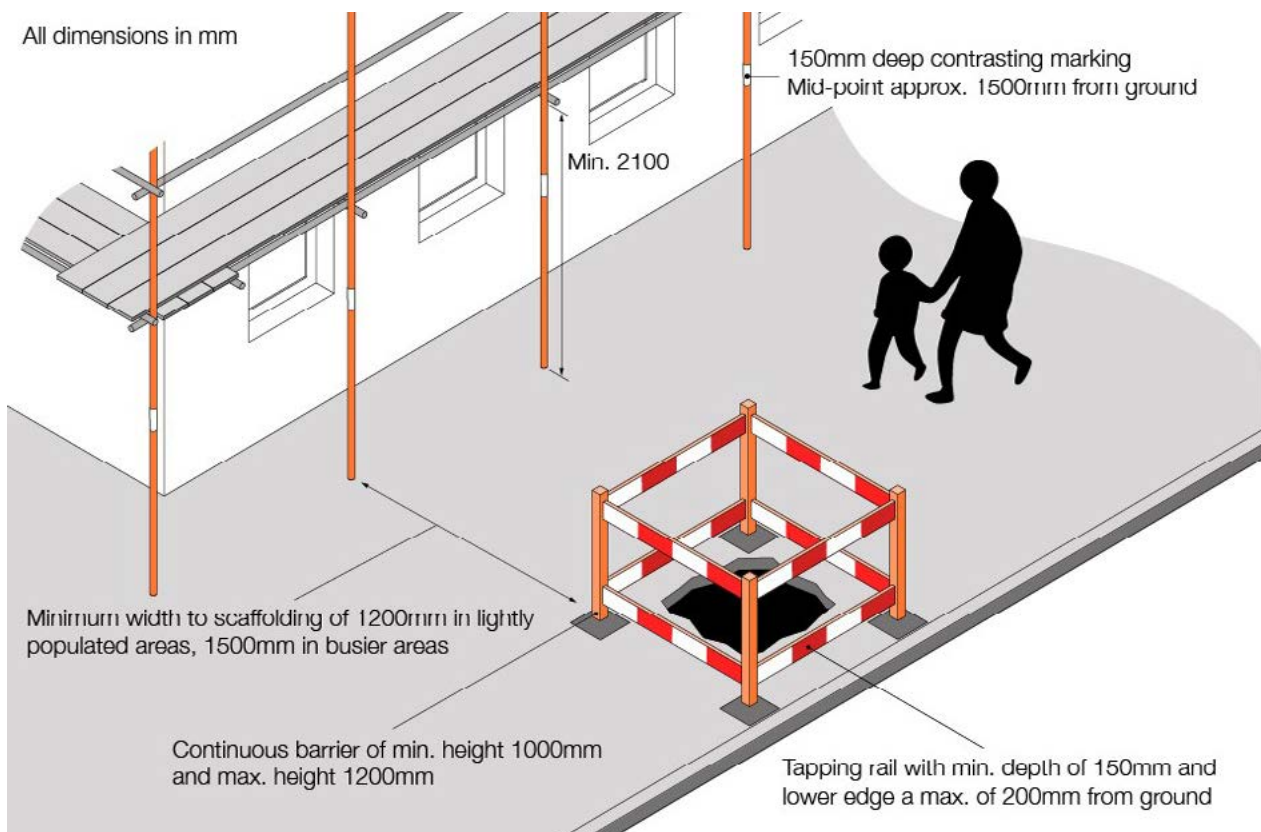


Figure 41: Footway maintenance

Image Source: Department for Transport, Inclusive Mobility



5.1.2.14 Upgrading existing facilities


When prioritising existing footways to be upgraded, consider the likely origins and destinations of people are along this route, in order to ensure that reliable and uninterrupted accessibility is provided between these points. Providing an accessible pedestrian footway on just one side of the street and later completing the other side may be adequate as a start, although it is generally desirable to provide footways on both sides of streets that are used by pedestrians.

5.1.2.15 Key challenges with footway design

A number of key challenges to address when designing accessible pedestrian footways are set out in Table 6:

Table 6: Key challenges with footway design

Street vending	<p>Street vendors should be accommodated within the furniture zone of the footway. Their wares and stalls should not block the accessible clear width in the pedestrian zone.</p> <p>Clearly marked out areas, a public awareness campaign and regular enforcement may be useful in ensuring compliance.</p>	
Placement of street furniture	<p>Steps into a vehicle may cause aStreet furniture should be kept to the furniture zone and mobile furniture (e.g. A-boards) should be placed in a consistent position to assist visually impaired person to trip when entering the vehicleople. This will ensure the predictability of a known route and reduce tripping hazards for all users.</p>	 <p>Image source: Karl Fjellstrom, Far East Mobility</p>

Anti-social vehicle mitigation	Where there is a risk of vehicles mounting the footway (for example for parking), physical barriers may be required. These should not prohibit pedestrian movements, including wheelchair and other mobility aid users. The image (right) shows a barrier designed to deter 2-wheeled motorised vehicles from accessing the footway in Kuala Lumpur. The barrier is spaced sufficiently to enable a wheelchair user to pass through, but not a motorcycle or moped.	 <p>Image Source: Rutul Joshi</p>
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### Box 26: Case Study: Hostile Vehicle Mitigation and implications on people with disabilities

Bollards have been installed along a number of pedestrian footways, and around key public spaces in London, UK.

They are relatively compact, and designed as a defence against hostile vehicle-borne terrorist attacks that have previously occurred in some cities.

The bollards are spaced a maximum of 1200mm apart. This is sufficient space to allow a single wheelchair to pass through freely, as well as to

ensure pedestrian movement and comfort levels are unaffected.



#### 5.1.2.16 Where to start?

The factors that most commonly undermine the safety, accessibility and reliability of pedestrian footways and footpaths relate to poor surface quality and obstructions in the form of poles, kerbs, parked vehicles, or street traders. First steps in providing adequate pedestrian facilities should therefore include:

- Surfacing footways with an all-weather durable material (asphalt or concrete);
- Installing kerb ramps where the footway crosses streets, driveways and so forth;
- Ensuring that drainage and gradients, including crossfalls, are adequate;



- Ensuring that street signs and street furniture are located in a ‘furniture zone’, so as to provide an adequate clear width and height that is continuous along the footway;
- Ongoing enforcement to keep the ‘pedestrian zone’ clear of parked cars, vendors, and rubbish;
- Developing consistent national, regional or local guidelines for street design and construction, such as this example from Delhi [\[54\]](#).

Of course, this standard cannot be achieved everywhere at once, but a public authority can start by taking the following steps:

- When undertaking regular maintenance, upgrading or constructing roads and footways, ensure that accessibility guidelines are followed. Improvements to accessibility can be achieved in this way at minimal cost;
- Start by identifying high priority pedestrian routes that are used by many people – including people with diverse needs, that will ideally be upgraded first.

#### Box 27: Case Study: Delhi Metro

The Delhi Metro is by far the biggest and busiest metro network in India, and one of the most accessible systems of its size. Many stations have accessible entrances with lifts that take passengers to their platform, accessible ticket turnstiles at metro ticket gates allow wheelchair users to pass easily, and tactile pathways guide passengers who experience sight impairments through the stations towards platforms which provide ‘level’ step-free vehicle boarding. Wheelchairs are available at the station for those who need them, and there are handrails fitted to ramps and stairs.

Nevertheless, a trip made on the network requires passengers to use more than one mode of transport to get to and from the metro stations, with many users walking to their nearest station. Poor maintenance and provision of accessible footways adjoining and surrounding the metro stations therefore means that many people with disabilities are unable to access the metro system. This particularly affects individuals who are unable to afford rickshaw or alternative transport to get to the metro stations. The accessibility of some footways is

affected by open roadworks, footway parking, uneven surfaces, and overcrowding. Other routes lack any footway provision at all.

This demonstrates the importance of designing (and maintaining) accessible footways on pedestrian routes to stations into major infrastructure projects, such as new metro systems in major cities. It also emphasises the need for a holistic approach to considering the needs of people with disabilities across a city's different movement networks and infrastructure.

This video shows a journey on the Delhi Metro: [Delhi Metro Journey Video](#)



Figure 42: An accessible footpath in India with successful zoning in place

Image Source: [ITDP](#)

Many of the good practices discussed under the 'Accessible Footways and Public Realm' section and transport interchange sections of this guide can also be applied to public spaces. Pedestrianised areas should be delivered to the same standards and

have at least one step-free path, including ramps where needed, between different levels. Ground markings, especially with tactile features, can be used to mark out a clear path free of obstructions. This will benefit people with disabilities who need additional space to move and provide guidance to people who experience sight impairments, since they may find it difficult to navigate through large open spaces. Where public spaces include boarding areas for public transport services, including rickshaws, the guidelines in Sections 4 and 5 should be followed.

## 5.2 Street Crossings

Street crossings are important elements of the pedestrian environment. People with disabilities are particularly vulnerable, because they often move more slowly or are slower to perceive and react to danger than other pedestrians. All pedestrians – and people with disabilities, children, and elderly people in particular – benefit greatly from well-marked and well-designed crossings. By encouraging pedestrians to use designated crossing points, drivers of vehicles are made more aware of their presence and encourage a culture whereby drivers act more responsibly.

Street crossings can be uncontrolled (with no traffic signal) or controlled (with a traffic signal). Many people with disabilities find uncontrolled crossings harder to use, so controlled crossings are preferable – particularly in locations with high pedestrian volumes and/or higher than average numbers of vulnerable pedestrians or in locations with high volumes of traffic where pedestrians are likely to need to cross the street. These locations include sites on busy roads or near schools, hospitals or welfare centres. In all cases it is crucial to observe good practice to promote safety, accessibility, and reliability.

### 5.2.1 Basic principles

#### Safety

- Crossing clearly marked on the road;
- Appropriate vehicle speed controls and enforcement;

- Advance warning to vehicles to stop or give priority to pedestrians;
- Warning to pedestrians who experience sight impairments that they are approaching a street crossing;
- Method of informing pedestrians who experience sight impairments when it is safe to cross;
- If signalised, keep traffic stopped long enough to accommodate people who need more time to cross;
- Adequate street lighting that provides good visual contrast and ensures pedestrians are clearly visible to motorists.

### Accessibility

- Use of dropped kerbs and ramps, to provide a smooth transition from pedestrian footway to roadway, or 'table-top' crossings;
- Minimise crossing distance, for instance by extending the pedestrian footway across parking lanes or installing refuge 'islands' in the middle of the road;
- Crossing locations should reflect pedestrian desire lines, avoiding detours.

### Reliability

- Warnings, information, and traffic signals well-maintained and in good working order;
- Consistent design of controlled crossings within a neighbourhood/city/region/country.

### Affordability

To the provider:

- Minimise costs by installing at least dropped kerbs/ramps and warning surfaces at all newly constructed or upgraded crossings;
- Maximise impacts by prioritising crossings with high pedestrian volumes, and those in locations that are likely to be used frequently by people with disabilities, as well as locations where there are existing barriers but potentially high demand for a crossing.

## 5.2.2 Good practices

### 5.2.2.1 Crossing design

The design of street crossings should aim for simplicity and consistency. Crossings should reflect pedestrian desire lines, which may vary depending on individual users and their abilities. Avoiding detours improves pedestrian compliance with designated crossing points and improves safety. The recommended minimum width of a street crossing – as measured along the kerb edge – is 2400mm (see Figure 43), however crossings may be significantly wider in areas with higher pedestrian movements. Crossings should be laid out with ample space to ensure pedestrians waiting to cross the road do not obstruct people walking or wheeling along the footway adjacent to the crossing.

Where people need to cross multiple lanes of traffic, centre island refuges can help to reduce the crossing distance. Centre islands should be at least 1500mm wide, to cater for wheelchairs, and avoid any grade changes (i.e. be cut through to the level of the crossing). They are only recommended for controlled crossings as they rely on pedestrians having good judgement of motor vehicle speeds, their own walking/wheeling speed, and gaps in vehicle traffic. Applying them to uncontrolled crossings could therefore put some slower pedestrians or people with disabilities at risk.



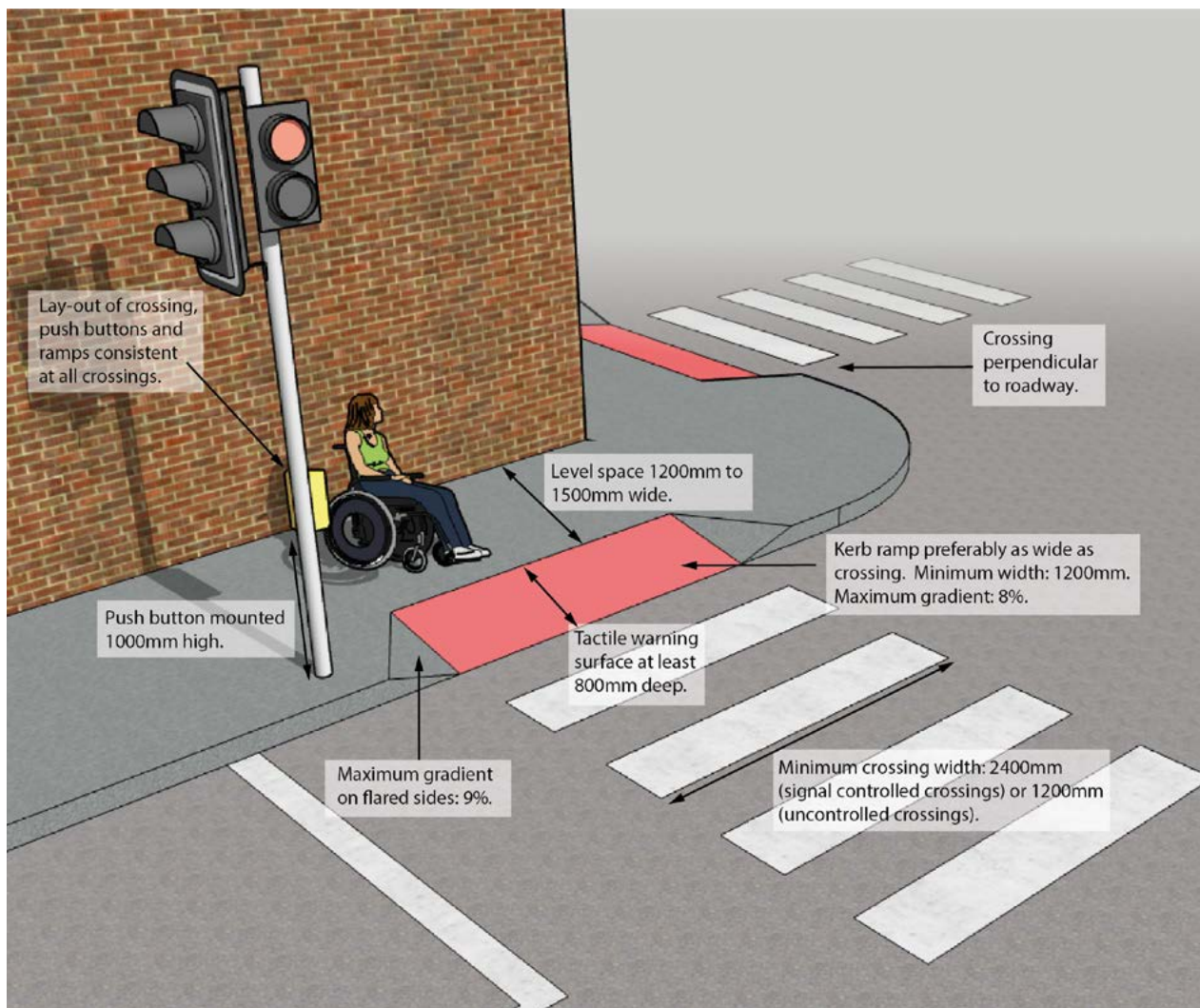


Figure 43: Good practice for street crossings

The safety of a pedestrian crossing can be significantly improved by:

- Elevating the crossing to the height of the footway in a 'table-top' design (See Figure 44). This is an effective way of making pedestrians more visible to other road users, avoids the need for pedestrians to negotiate dropped kerbs, and slowing down traffic. Where elevated crossings are used, there must be a clear delineation between the crossing surface and footway to assist people who experience sight impairments.
- Extending the pedestrian footway out across any parking lanes (See Figure 45) This has the dual purpose of reducing the width of roadway, thereby reducing crossing times for pedestrians, as well as slowing down vehicular traffic.





Figure 44: Example of a table-top crossing India

Table-top and build-out footway extensions can be used in conjunction at a single crossing point.

Image Source: ITDP India



Figure 45: Footway buildout extension

Image Source: [Richard Drdul](#)

### 5.2.2.2 Kerb ramps/ dropped kerbs/ kerb cuts

Kerb ramps (also known in some countries as dropped kerbs, bevelled kerbs, or kerb cuts) should be used wherever pedestrians will encounter a level change - on footways, crossroads, pavements, medians/central reservations, or other raised surfaces. The recommended dimensions for kerb ramps are shown in Figure 43. The ramp should ideally be as wide as the crossing itself (the recommended minimum for which is 2400mm, as measured along the kerb), and have a minimum width of 1200mm to allow space for a wheelchair user to pass other pedestrians unimpeded.

Kerb ramps should be free of obstructions, such as signposts and traffic lights. They should not project into the roadway where they would obstruct traffic (unless part of a wider footway extension).

Where possible, the bottom of the ramp should be flush with the roadway. Even a small 'lip' of more than 6mm can cause the front wheels of a wheelchair to swivel sideways and bring the wheelchair to an abrupt and dangerous stop and risk tipping over the wheelchair and user.

The landing area at the top of the kerb ramp is an important component of the ramp. It provides a level area for people to bypass the kerb ramp, as well as for wheelchair users to change direction after ascending the ramp. Changing direction across the flared sides of a ramp is much more difficult. The landing should allow at least 1200mm of depth to the nearest building or obstruction, but preferably 1500mm if possible.



Image Source: Streets  
Philadelphia

Figure 46: Double kerb ramp design

The maximum slope should preferably be 8% (1 : 12) on the direct approach and 9% (1 : 11) on the flared sides. A ramp that is too steep is inaccessible and unsafe as it cannot be used by wheelchairs and is harder for pedestrians to negotiate. As with footways in general, slope changes between kerb ramp and pavement should be gradual, to prevent the front wheels of a wheelchair from getting caught or leaving the ground.

Kerb ramps should, as far as possible, be oriented perpendicular (at 90 degrees) to the kerb. Skewed ramps can cause problems, both for wheelchair users and people pushing trolleys or carts, because they can cause one wheel to lift off the ground and compromise balance and control. It follows that providing two ramps at road junctions is far preferable to only one if space allows (Figure 46). The single ramp design has the additional drawback of aligning pedestrians in the wrong direction and could lead visually impaired persons inadvertently into the middle of the junction.

Drainage should also be considered at the bottom of kerb ramps to prevent the formation of puddles.

### 5.2.2.3 Traffic signals

Most countries have guidelines on when to install traffic signals at crossings, subject to local safety and traffic flow conditions. If a traffic signal is used, the red phase should keep traffic stopped for around 12 seconds for every 7.5 metres (roughly two traffic lanes) of road width that needs to be crossed. This allows enough time for most people with disabilities to complete their crossing movement.

Signals that can be activated by the pedestrian are useful, particularly at mid-block crossings, using a push button box. A large diameter (up to 50mm) raised button that can be activated by a closed fist will be usable by most people. Traffic signal poles and push buttons should also be colour contrasted so they can be detected by people who experience sight impairments. Locating the push button box in a consistent position relative to the crossings (either to the right or left, and always approximately 1000mm above ground level) helps to ensure the button for activating the road crossing is accessible to people with diverse needs.

At signalised intersections, audible signals can be very useful for people who experience sight impairments. They may also encourage safer crossing behaviours among children and people who experience neuro-diverse conditions.

Where possible, both audible signals and tactile indicators should be used at controlled crossing points with high vehicular traffic and or footfall:

- Audible cues should alert pedestrians that it is safe to cross. The tone or tones used in audible crossing cues should be consistent from crossing to crossing, to avoid confusion and improve safety;
- Textured cones can be provided under the push button box. These cones should rotate or pulse when it is safe to cross and be static to instruct pedestrians to wait. People who experience sight impairments can feel for these 'rotating cones' to inform safe crossing decision-making;
- Where a push button is in use, the box casing can be marked with a tactile arrow, pointing in the direction of pedestrian travel that is controlled by the button. This further assists people who experience sight and impairments and neuro diverse conditions.

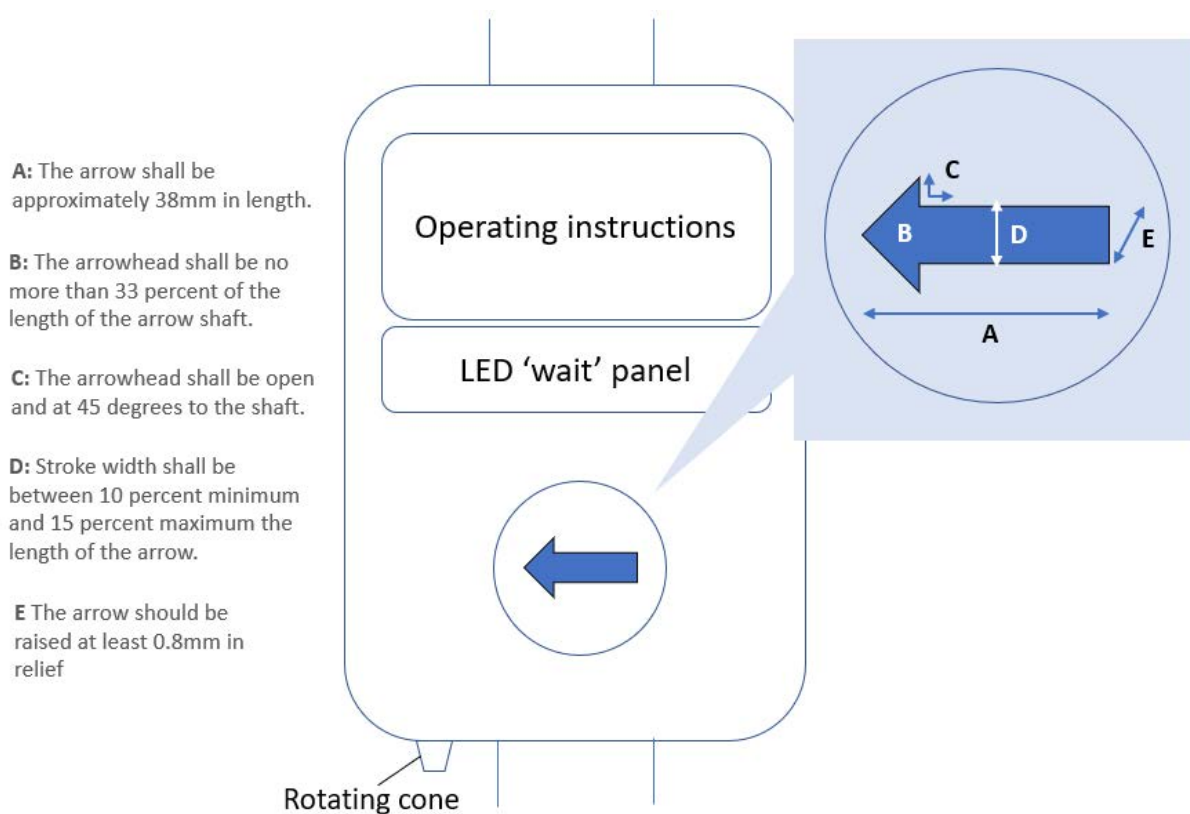


Figure 47: Tactile arrow specification

Whilst priority should be given to pedestrian safety, land use should also be considered. Audible signals may be unwelcome in predominantly residential areas, where housing is sited in close proximity to the crossing. Some countries install a curfew system to regulate audible signals, silencing them overnight to reduce disruption. Local policy can help to ensure consistency in how crossing signals operate.

### Box 28: Case Study: Use of variable audible crossing tones in Canada and the United Kingdom

In Ottawa, Canada, different sounds inform pedestrians whether or not it is safe to cross and which direction they are crossing in. 'Peep-peep' sounds are used for east to west crossings and 'cuckoo' sounds for north to south'.

Variable audio cues are also used in the UK. 'Beep and sweep' sounds are used to differentiate staggered crossing facilities (several bleeps followed by an elongated sound) from single carriageway crossings (single bleeps).

Before installation, variable audio cues should be subject to testing to ensure recognition and a robust communication strategy should be used to raise awareness.

Source: [\[55\]](#)

In addition to audible and tactile cues, the following features can help to make controlled crossings more accessible:



Figure 48: U.K. Puffin Crossing

Image Source: Karl Fjellstrom, Far East Mobility

- Buttons that extend crossing time allow people who need more time to cross the road to do so safely. (See Box 29 below);
- The use of sensors to detect when a crossing is in use and when pedestrians are waiting to cross. This is a feature of 'Puffin Crossings' in the U.K.



### Box 29: Case Study: Singapore smart-card crossings

In Singapore the Land Transport Authority (LTA) has given elderly and disabled pedestrians extra time to cross at pedestrian crossings. In 2009, the LTA started a small pilot program at five intersections called Green Man Plus and it has now been expanded to more than 1000 pedestrian crossings. Singaporeans who are over 60 or have disabilities can apply for a concession card which is used for transit on trains and buses. The same card can also be used to activate Green Man Plus through tapping the card at a sensor installed at the traffic light poles, giving them an extra 3 to 13 seconds to walk across, depending on the size of the crossing. The LED indicator on the Green Man Plus reader will light up together with buzzer sound and vibration alerts when the request has been accepted.

Video link : [The Green Man Plus: Crossing with Greater Ease Video](#)

Source: [\[56\]](#)

### Box 30: Case Study: Accessible Crossings in Tokyo Japan

Japan has long been a world leader in designing accessible transport solutions, being the first country to introduce tactile warning surfaces and audible signals at pedestrian crossings.

In Tokyo, the timings of the pedestrian crossing lights at key intersections have been increased by 20% to provide more time for older and people with disabilities seeking to cross these busy roads. Button boxes have been installed which allow pedestrians to request a longer crossing time if they need it (see image).



The Japanese National Police Agency recently announced that it is to install ‘smart’ equipment to help people who experience sight impairments when using road crossings. Around 2000 traffic lights were due to be upgraded in 2021, enabling smartphones to convey the colour of signals by voice or vibration to people with diverse needs. Whilst this kind of technology may be cost-prohibitive for some lower- and middle-income countries in the short term, smart phone use is increasing globally, and assistive technologies such as this are likely to fall in cost if they are adopted widely.

Source: [\[57\]](#)

#### 5.2.2.4 Tactile warning surfaces on footways near crossings

Tactile surfaces placed on pedestrian footways at the edge of street crossings help to inform people who experience sight impairments that they are about to encounter a road.

Various types of tactile surfaces are used across the world, as described in Section 1.2.6 above. Of critical importance is that whichever tactile surfaces are used, they are applied consistently and sparingly to avoid confusion within a country. This relates to both the layouts, orientation and the types of tactile surfaces applied. Awareness campaigns and travel training can aid tactile surface recognition.

Research conducted by TRL has indicated that flat topped domes or ‘blister paving’ blocks are acceptable both to people who experience walking impairments and to wheelchair users [\[47\]](#). Tactile warning surfaces made of metal paver studs have become increasingly popular but should be avoided, as the studs can become slippery in wet and icy weather conditions.

#### 5.2.2.5 Traffic calming

Various methods can be used to reduce the speed of vehicles close to road crossings. Traffic calming measures like speed bumps or road narrowing can be applied effectively in lower income countries as they are low-cost measures. Footway extensions – building the footway out into the road at crossing points – are also an effective traffic calming measure.

Raised ‘table-top’ crossings can be used both to slow down traffic and to provide a level crossing for pedestrians. In Santiago, for example, raised crossings are used effectively at side streets and junctions to slow down right-turning cars. Raised crossings should be designed with a minimum width of 2400mm (in line with other crossings) and built at the same level as the footway.

#### 5.2.2.6 Guardrails

Guardrails may help to improve pedestrian safety under some circumstances in developing countries where low road user discipline is the cause of many accidents. However, guardrails could also jeopardise pedestrian safety if they obstruct pedestrians from their desire lines, by encouraging pedestrians to climb over them. A full risk assessment should be conducted for all user groups impacted by the installation of guardrails.

To be clearly detectable by people who experience sight impairments, guardrails should be at least 1100mm high from ground level and painted to contrast clearly with the surroundings [\[51\]](#). Simple galvanised railings are not acceptable unless they have contrasting markings on them. Guardrails should have sufficient vertical openings for pedestrians to be seen and designed to prevent assistance dogs from walking underneath [\[51\]](#).

#### 5.2.2.7 Cycle Lanes

Where pedestrians are required to cross a cycle lane to access a kerbside bus-boarder bus stop or cross the road, the crossing should extend across the cycle lane and clear signage should warn cyclists that pedestrians may be crossing. Signalised crossings are installed at cycle lane crossings in some countries to help pedestrians cross safely. These are particularly useful to visually impaired pedestrians and those who need more time to cross. Cycle lanes should be clearly differentiated from the footway and tactile warning strips should warn pedestrians of oncoming cycle traffic at crossing points.

### 5.2.3 Where to start?

Whenever new street crossings are constructed, or existing ones are upgraded, the first design consideration is the speed of motorised traffic flowing along the road. Where this allows, the opportunity should be taken to install kerb ramps and tactile surfaces following best practice guidance as a minimum, even if other accessibility

features are to be added in the future. If possible, the opportunity should also be taken to move street signs, bins etc. that block pedestrian flow on the footway. If an authority has to prioritise at which crossings to install the access features described here, the decision could be guided by factors such as:

- Prioritising street crossings that are part of accessible footway networks and are thus important for completing an origin-to-destination travel chain for people with disabilities;
- If no accessible networks have been identified in the city, then prioritising crossings with high pedestrian volumes (e.g. in central business districts) or near major public transport stops;
- Locations where vulnerable pedestrians such as children, people with disabilities, or hospital patients would benefit from improved safety and accessibility. Examples include crossings near schools, hospitals/ clinics, or sheltered homes/workshops for people with disabilities.

Minimum requirements for these crossings will be dictated by what is needed to ensure adequate levels of safety for pedestrians. Usually this will include at least clear markings, signage and/or traffic calming measures to warn motorists of the crossing and to slow down approaching vehicles. In other cases, high pedestrian volumes and high vehicle speeds may require traffic signals to be installed, if affordable. It is critical to remember that, without signal controls, many people who experience sight impairments will be unable to use crossings on busy roads without assistance.

## **5.3 Small Interchanges**

### **5.3.1 Bus stops**

Improving access to buses can provide significant benefits to many people with disabilities. Bus services cover large areas at relatively low fares in most cities around the world. Together with improved vehicle design and operation (discussed in Chapter 4: ), accessible bus stop designs are required to ensure the mobility and inclusion benefits of bus services are also afforded to people with diverse needs. This may require coordination and partnerships between bus operators and local authorities.

It is important to recognise that bus stops typically consist of several components: a connection to the footway, a waiting area, a boarding area, and street crossings. Attention should be paid to each in turn, to ensure the whole functions in an accessible way. Missing one of these elements can mean that an otherwise accessible bus stop cannot be used at all, or only with great difficulty, by some people with disabilities.

### 5.3.1.1 Basic principles

#### Safety

- Waiting area separated from traffic;
- Adequate clear space without obstacles and hazards;
- Personal security enhanced through good lighting and open design that enables ‘passive surveillance’;
- Stop should be part of/adjacent to the footway and not require pedestrians to transfer by stepping into the road and/or interact with moving traffic.

#### Accessibility

- Shelter and seat, especially if the area is prone to rain or extreme heat/cold;
- Clear markings with information on bus routes served from the stop;
- Kerb or bus boarding platform at right height to provide step-free access or minimise height of first step into the most commonly used bus designs within a town/city/region;
- Layout and kerb height for wheelchair access to buses (if wheelchair accessible buses are provided).

#### Reliability

- Road marking, signage, and enforcement to prevent parked cars and vendors from obstructing bus bay;
- Accessible walking route between bus stop and surrounding footway/building entrance(s).

## Affordability

To the Provider:

- Start by providing at least paved area, kerb and signage at bus stops;
- Install seats and shelters where most needed;
- Fund upkeep of bus stops by selling advertising space on shelters.

### 5.3.1.2 Good practices

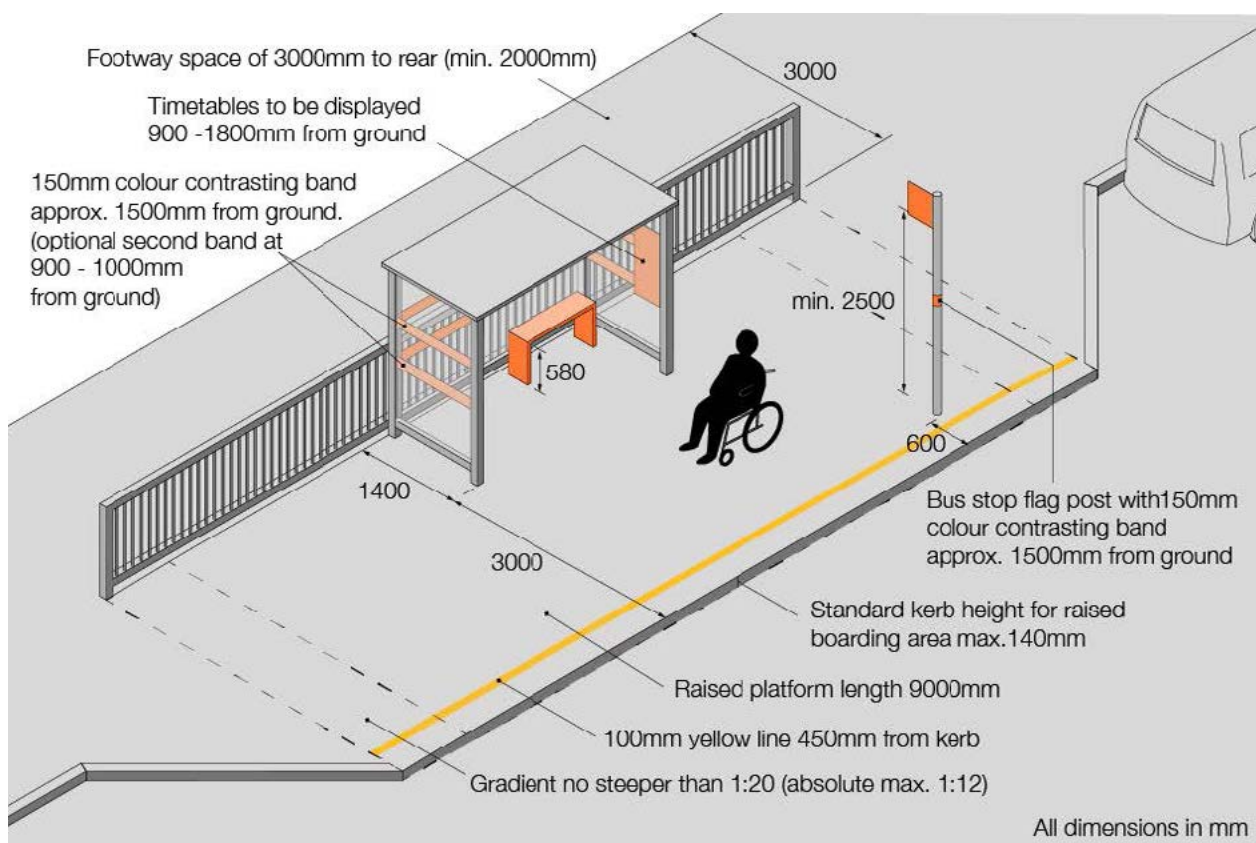


Image Source: Department for Transport, Inclusive Mobility

### 5.3.1.3 Location and spacing of bus stops

As acknowledged in Section 1.2.9, many people with disabilities cannot walk long distances. While it is good practice to always place bus stops close to key destinations, this becomes even more important when seeking to accommodate the needs of people with disabilities. UK guidelines indicate that bus stops that serve residential areas should ideally be provided so that nobody need walk more than 400 metres to access the destination being served. [\[51\]](#)



Bus stops should be located (wherever possible) on a level section of road to maximise accessibility and safety for people with disabilities. Bus stops on hills may need to be located closer together to compensate for reduced walkability of the surrounding area. Features of the road layout should also be considered. The use of speed bumps, particularly on the immediate approaches to/departure from bus stops, should be avoided as there may be a risk of falling for standing passengers when mobilising on-board the vehicle to alight the bus or find a seat.

#### **5.3.1.4 Surface quality**

A paved and level surface around a bus stop can greatly help all passengers to safely board and exit the vehicle. Potholes, gaps between paving slabs, and drains should be relocated or covered (see suggestions for surfacing, Section 1 of this Chapter).

#### **5.3.1.5 Bus stop layout**

Bus stops should be laid out to provide ample space for passengers to enter, wait and board, without obstructing other pedestrians using adjacent footways. Optimal, clear dimensions for bus stops are shown in Figure 49.

Where bus stops are provided in areas with more restricted space (which is often the case), the shelter can be sited against the rear of the footway, along the building line. However, the clear footway width between the shelter and the kerb edge should be 1800mm, with an absolute minimum of 900mm in severely restricted cases. These dimensions are adequate for accommodating wheelchair users while waiting for or boarding a bus, and also help other people with diverse needs when waiting for and boarding bus services.

Even if buses serving a stop are not designed to accommodate wheelchair users, the dimensions should accommodate those who can transfer out of their chairs and other users who need the space. The length of the bus stop should also be sufficient to provide access to and from all entry and exit doors of the bus directly onto the pedestrian footway.

If boarding onto a bus is achieved through the use of mechanical lifts or ramps, then extra space may be required for a lift to deploy and for the wheelchair user to manoeuvre. It is typically recommended to allow 2000mm x 2000mm of clear area to accommodate this.

The use of bus bulbs (also called ‘boarders’ or ‘build-outs’) can be an effective way of providing more space around a bus stop, whilst also ensuring that buses are able to consistently stop close to the kerb. This situation often arises when vehicles parked kerbside obstruct bus stops, or when bus drivers fail to pull up adjacent to the kerb so as to avoid needing to merge back into traffic.

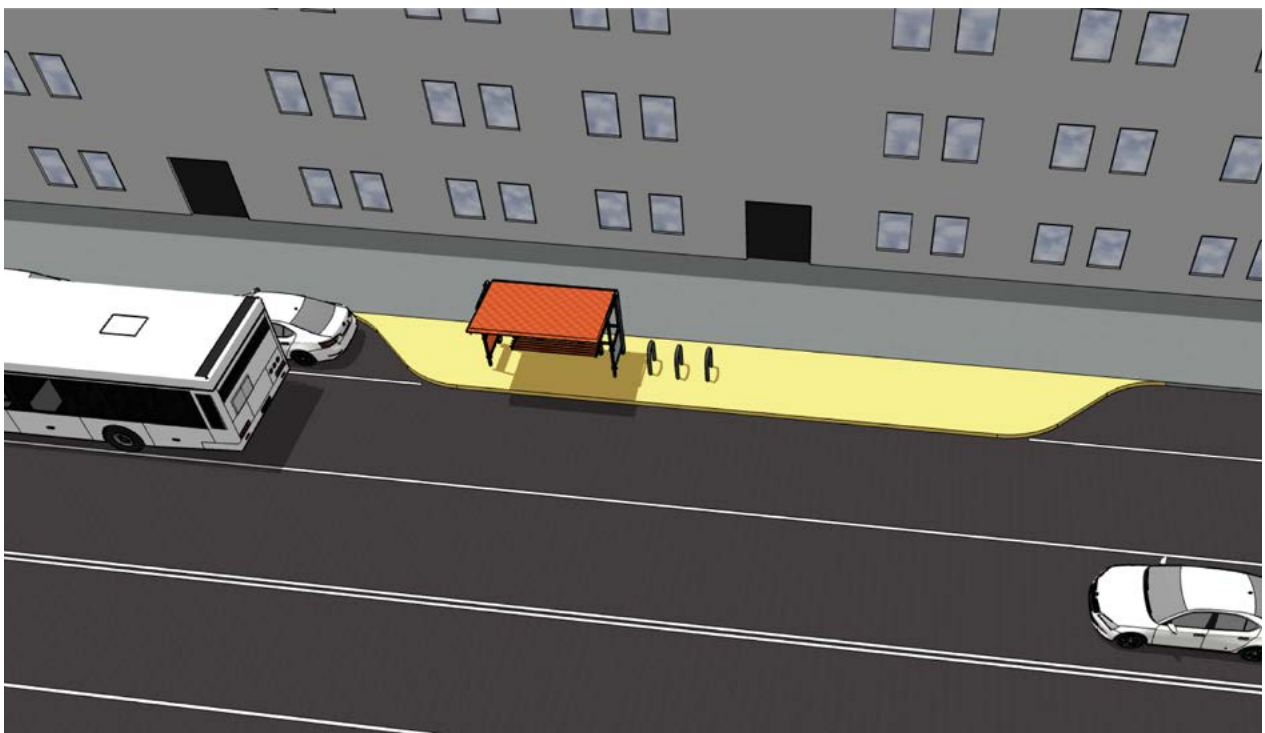


Figure 50: Diagram of a bus bulb or boarder (location of bus shelter not to scale)

Bus bulbs extend the footway across the parking lane to the edge of a traffic lane (Figure 51). Research has shown that the use of bus bulbs decreases the delay caused by stopping buses, to both buses and other vehicles in the street [58]. They are one of a number of measures, such as surface treatments / guidance indicators on the road surface and allowing at least 40 metres of clear carriageway to complete the stopping manoeuvre, that can be applied cost-effectively to assist drivers with the task of arriving consistently 25mm from the kerb and stopping in the same position relative to the bus waiting area. This can help to overcome a significant number of accessibility barriers for a wide range of people with disabilities.



Figure 51: A bus boarder in Barcelona

Image Source: Karl Fjellstrom, Far East Mobility

#### 5.3.1.6 Shelters and benches

Shelters at bus stops make bus travel more comfortable for some passengers,

especially in areas with extreme weather conditions. Very often the costs of providing and maintaining shelters can be fully recovered through the selling of advertising on the shelters. However, advertising should be confined to designated areas on the shelter, so that it does not obscure information about bus routes and schedules that may be provided at the stop.

An accessible shelter provides ample space for users of wheelchairs and other mobility aids to enter and manoeuvre; is level with the surrounding area; and has a bench or seat for waiting passengers (Figure 49). The seat can be as simple as a rail to rest against or a wooden bench to sit upon, but on routes with less frequent services (where longer wait times may be common) a range of more substantial seating options is recommended (Section 1.2.9 and Section 4.2.11 of this chapter). Seating can be invaluable to passengers who are unable to stand for long periods of time and helps to ensure they can use bus services.

Seating at bus stops should be fixed at a vertical height of about 480mm above the footway and painted in a contrasting colour to its surroundings so that it can be detected by people who experience sight impairments (see Section 1.2.7 of this chapter for further information on colour contrasting). At busier stops it can be useful to provide seating at different heights and of different designs to suit a wider range of user needs. Shelter supports should be marked with contrasting colour bands about 1500mm from the ground, to maximise their visibility to partially sighted people and at night.

Security, especially at night, is a major concern for many people. Security in and around bus shelters can be enhanced by providing good lighting (with streetlighting and lighting within the shelter itself) and removing unnecessary structures or panels that can cast the shelter in shadow, restrict visibility or enable them to serve as hiding places. Simple shelters are often the best

### Box 31: Case Study: Delhi accessible bus stops

Whilst not all bus stops in Delhi are built to an equal standard of accessibility, the Delhi Transport Corporation has invested in new accessible bus stops along some routes. These are accessible to a diverse range of users, including people who experience sight impairments and wheelchair users. They include features such as shelters, perch seating, tactile warning surfaces, and ramped access to raised stop platforms.

Additional investment is needed to ensure that stops are connected to an accessible footway (see Section 1 of this chapter)

and that vehicles offer step-free access to aid wheelchair users and people who experience walking impairments (see Chapter 4). Drivers also need to be trained to assist people with disabilities when

required, and to stop as

close to the kerb as possible to minimise the gap between the stop and the vehicle – thereby ensuring passengers can step directly from a raised bus stop onto the waiting bus, rather than stepping down into the road first (as shown in the image).

Source: [\[59\]](#)

Image source: Scroll.in.



#### 5.3.1.7 Bus stop flag poles and information

Bus stop flag poles indicate where a bus service will arrive. They benefit many people seeking to find bus services, but particularly people who experience sight impairments – who may not be able to see the bus as it arrives at a stop.



Bus stop poles should be painted with coloured bands that contrast with the streetscape to enhance discoverability. If existing poles are used (such as lamp poles), very clear markings to distinguish them as bus stop locations are important for passengers who experience sight impairments, as well as people who may be unfamiliar with the bus network.

‘Flags’ (decals) on signs mounted on the bus stop pole can be used to distinguish bus stops. The lower edge should be positioned around 2500mm above the footway (to provide adequate clearance for people walking along the footway), with at least the following information on them (see Figure 52):

- Pictograph of a bus to identify it as a bus stop;
- Route number/ name/ direction of travel (possibly colour coded);
- Wheelchair symbol if services using the stop are fully (wheelchair) accessible;
- Telephone number/ website for more information;
- Information about route and key destinations.



Figure 52: Typical bus stop sign, Singapore

Image Source: Ma Huaqing

A limited amount of information tends to be most effective, since it avoids confusion and simplifies the process of discovering the correct bus stop and waiting location by passengers.

Where information on bus routes, destinations and departure times is available, this should be provided in large print inside the bus shelter (see Chapter 6, Section 3 (Information & Journey Planning) and Chapter 6, Section 5 (Signage). Information like this reduces journey uncertainty and benefits all bus service users, but particularly aids people with disabilities who experience neuro-diverse conditions and/or may experience discomfort while waiting. It also



greatly assists people who experience hearing impairments, and who may find verbal communication with a bus driver to be the single largest barrier to travelling by bus.

In contexts where bus services themselves are less reliable – for example due to significant and frequent road traffic delays or extreme weather events – then it is better to only offer information on the bus routes that serve a given stop, and the hours of operation of the service. In these instances, ensuring that passengers have access to further information via the operator's telephone number, smartphone app or website can also help people waiting at stops.

Another factor that may affect the display of information on a bus shelter is recurring vandalism. In such cases access to information by telephone, smartphone app or website can be a partial alternative. To reduce the risks of recurring vandalism and improve passenger safety, ensure there is adequate lighting and, if possible, passing or camera-based surveillance at the stop.

People who experience sight impairments often welcome basic information about bus routes in tactile form. This can be as simple as slightly raised lettering or numbers (e.g. raised by 3mm from the surface to which they are applied) that are around 20mm in height and attached directly to the bus stop pole and/or adjacent waiting shelter. As with other accessibility features, it is important that such tactile information is consistently sited and applied across a route/network/city if it is to be reliably useable by people who experience sight impairments.

Chapter 6, Sections 3 and 5 describe guidelines for legibility of information, including letter sizes and tactile formats.

#### **5.3.1.8 Boarding area**

It is practice in some countries to mark on the ground the exact spot where bus boarding takes place, to guide people who experience sight impairments to the bus entrance. This can be achieved using a row of coloured tiles, about 2m long, and perpendicular (at 90 degrees) to the kerb.

By raising the height of the boarding area, the height to the first step onto a bus vehicle can be sufficiently reduced to enable people who experience walking difficulties, children, or people carrying heavy items to use the bus independently. The entire boarding area could be constructed at a height of 140 to 160mm above the roadway. Care has to be taken to provide kerb ramps at the edges of the raised area (at a maximum slope 1:12) to ensure wheelchair users are able to access them to board the bus.

### 5.3.1.9 Wheelchair access through raised boarding structures

In most lower income countries, the use of low-floor bus vehicles, and buses with mechanical lifts to facilitate bus boarding for wheelchair users tends to be limited, primarily due to cost factors and the need for high chassised vehicles to operate on roads that are less well made and maintained. An alternative is to use roadside structures that raise the passenger to the approximate height of the bus floor, in conjunction with bridging plates and appropriately designed bus interiors. Such approaches have been applied successfully in Bus Rapid Transit systems in Brazil (see Box 32), where buses operate on their own exclusive rights-of-way and have specially-designed stops.

#### Box 32: Case Study: BRT Accessible Raised Platform Boarding in Curitiba, Brazil

Curitiba is Brazil's seventh largest city and has a population of 1.2 million people. The city's government is addressing accessibility at all points in the transport chain and has a goal that 100% of bus stops in Curitiba will provide raised platforms with ramps or lifts for wheelchair users. Passengers board at platform level via bridge plates that lower automatically as buses reach the stop. This not only helps persons using wheelchairs, but also people who experience difficulty when negotiating steps



onto higher-floored buses. Curitiba also has a large number of accessible ‘feeder’ bus services, which enable people with disabilities to travel from their homes to the BRT stops. As a result of these efforts, people with disabilities “make around 21,000 trips using Curitiba’s public transport system each day, around 1000 of which are made by wheelchair users.”

Source: [28], [\[60\]](#)

Image source: Morio

#### 5.3.1.10 Enforcement of no-parking zones

To reduce the height of the first step into a bus, drivers need to pull up close to the kerb which requires driver training and enforcement of no-parking zones at the stop kerbs. It is therefore important to partner with traffic authorities to paint clearly marked ‘no-parking’ zones around bus stops, and to enforce them using local traffic/ municipal laws.

#### 5.3.1.11 Where to start?

Bus stops that currently have no facilities should, as a minimum be:

- Levelled and paved;
- Provided with a kerb edge that delineates the passenger waiting and boarding areas from the space on the roadway used by buses when they arrive at the stop to pick-up/put-down passengers;
- Accompanied by a colour contrasted pole to clearly identify the presence of a bus stop.

When combined with driver training that ensures drivers understand the importance of pulling up close to the kerb, these improvements directly reduce the effort needed to board and alight a bus, by reducing the height of a passenger’s initial step into the vehicle. Secondary features that should be considered next are the provision of more information on the bus stop pole, a shelter, and seating.

Bus stops that currently have shelters should, likewise, firstly be examined for adjacent footway surface quality, kerb edge, and a clearly marked identifying pole. It is then important to remove obstacles such as street furniture so that people with disabilities can use all aspects of the bus stop (including the shelter). Seating and information – including tactile information – can usually be added at low cost to existing shelters.

New bus stops should at least be paved, have a kerb and be provided with a pole. Even if a shelter is not immediately erected, the bus waiting and boarding areas should be laid out with adequate space for an accessible shelter to be installed in the future. New stops should also seek to provide more space than the minimum indicated in this guide and meet the highest standard of accessibility possible at the time of installation.

Where bus stops have to be prioritised for maintenance or upgrade, it is sensible to select well-used stops that are likely to be frequently used by people with disabilities and/or those along routes that provide access to education, healthcare and essential services. As components of a city's accessible networks, these stops should be connected by accessible footways, street crossings, and kerb ramps that serve the journey origins and destinations of people with disabilities who choose to travel by bus.

### **5.3.2 Taxi ranks**

Taxis are an essential transport option for many people with disabilities around the world. They offer a door-to-door service to any destination, including those not covered by fixed routes of conventional public transport networks. However, in many contexts – and particularly LMICs – taxis can be unaffordable for a significant number of people with disabilities. Notwithstanding this, best practice should still be observed in the upgrading of old facilities and the provision of new ones to ensure progress towards universal accessibility. It is important to remember that the provision of accessible taxi ranks needs to be accompanied by services provided by drivers who are well trained in the needs of disabled passengers and people who experience limited mobility.

### 5.3.2.1 Basic principles

#### Safety

- A level, good quality surface that is firm and slip resistant;
- Passenger waiting and boarding areas separated from vehicles;
- Adequate clear space without obstacles and encroachment;
- Adequate space for vehicles to stop adjacent to the kerb;
- Personal security enhanced through good lighting.

#### Accessibility

- Barrier-free access into and around facility - no stairs or obstacles;
- Simple layout with adequate signage;
- Kerb or platform at a height that facilitates easy entry into vehicles (in combination with correct vehicle design and user-friendly operation).
- If passenger amenities such as toilets, public telephones, and kiosks are provided at ranks or transfer facilities, all shelters, at least one toilet (unisex, where local context allows) and a public telephone should be accessible for people with disabilities.

#### Reliability

- Vehicles stopping in the same place every time when picking-up / setting-down passengers;
- A queuing system for both vehicles and passengers with priority access to accessible vehicles given to disabled passengers;
- Information about vehicle licencing, fares to popular destinations and contact information;
- Consistent and transparent fares that are clearly advertised and communicated to all passengers.

#### Affordability

To the provider:

- Provide paved, off-road boarding areas first in locations with a high numbers of passenger movements.

### 5.3.2.2 Good practices

Many of the accessible design principles covered by other sections of this chapter also apply to taxi ranks, whether they are located on-street or as part of a major interchange / destination (e.g., a railway station or shopping mall). This particularly applies in respect of the need for level and slip-resistant surfacing, adequate footway widths, and good lighting. With the exception of the potential need to provide raised boarding platforms for bus services, in many contexts accessible taxi ranks can be treated very similarly to bus stops.

The provision of dropped kerbs and vehicle access at footway level is also important, as passengers should be able to choose between getting out of the vehicle at either of the footway or road levels. Which of these options is easier depends on the type of vehicle and the method of entry/exit preferred by individual passengers. Where provided, wheelchair access to most taxis is on the kerbside of the vehicle, though some taxis load wheelchair users through the rear door – depending on their design.

Where taxi ranks are being designed or redeveloped, they should be designed to facilitate access into all vehicle types without creating risks or unnecessary inconvenience for either passengers or drivers.

#### Box 33: Case Study: London Accessible taxi rank review

In 2017, Transport for London (TfL) completed a comprehensive review of the taxi rank network to secure additional ranks where needed and identify where improvements were required to ensure taxi ranks that served important destinations were made fully accessible. The audit

concluded that there were 91 fully accessible taxi ranks in London, with further improvements planned to improve accessibility at a number of the 550 other ranks. All of London's distinctive 'black' taxis are fully accessible, and drivers are





legally required to accommodate wheelchair users and offer assistance as and when requested.

Source: [\[61\]](#)

Image source: Transport for London

### 5.3.2.3 Formal on-street taxi ranks

- On-street taxi ranks should be located where taxis can easily manoeuvre alongside, and move away from, the kerb without significant delays or risk;
- There should be a straight length of kerb to allow vehicles to park immediately adjacent to it;
- An accessible taxi rank should have a clearly defined passenger waiting area, and some form of ‘totem’ or flagpole that enables potential passengers to identify the location of the taxi rank;
- Where space allows, passenger set-down and pick-up areas should be physically separated. Where space is restricted, the footway should be wide enough for passengers to exit a vehicle when being dropped-off, without impeding people waiting to board.

### 5.3.2.4 Taxi ranks at major interchanges/destinations

- Seating and shelter should be provided as a minimum, since passenger waiting times are likely to be longer at major interchanges and this may be uncomfortable for some people with disabilities (See section 4.1);
- Designated passenger set-down and pick-up areas should be clearly marked with a combination of signs, to help passengers orientate themselves, and road markings that seek to prevent other vehicles from obstructing the area;
- Drivers should be prohibited from picking up or setting down passengers in other areas as this undermines the system and can result in reduced safety for passengers, as well as disrupting surrounding traffic flows. Enforcement may be required to ensure conformity;
- Provision should be made for passengers to exit the vehicle at footway level. Where this is not possible, and passengers need to enter a vehicle from the roadway, they should have a safe and direct route to the footway with access via a dropped kerb;
- The designated set down area should be located close to a primary entrance into

the interchange facility, with direct visible links to any passenger concourse and ticketing facilities;

- Passenger set-down areas should allow adequate space for unloading, preferably away from the passenger pick-up area so that those who take longer to exit the vehicle are not rushed.

Adapted from: [\[62\]](#)

### **5.3.2.5 Passenger amenities**

If passenger amenities such as toilets, public telephones (in contexts where they are still used), and kiosks are provided at ranks or transfer facilities, attention should be paid to their accessibility. If provided, it is recommended that all shelters, at least one toilet (unisex, where local context allows) and a public telephone should be accessible for people with disabilities. These will ideally follow the layout and dimensions described in Section 4, along with any steps, stairs or ramps along pedestrian footways.

### **5.3.3 Informal transit facilities**

The informal transport sector comprises any number of small vehicles; including small minibuses, shared taxis and motorised rickshaws. A defining characteristic of these services is that they are typically provided by a large number of individual owners, on relatively flexible routes and schedules, and that authorities typically have very little regulatory control over them. It is common, as a result, for vehicles used in the informal transport sector to be physically challenging for people with disabilities to board and use.

Service operators often allow passengers to board and alight anywhere in the system network, which results in a relatively flexible ‘door-to-door’ service that can greatly improve accessibility for some users. However, it also means that such informal services have tended to operate without kerbside passenger facilities such as shelters, and identifiable stop locations. In those locations where such facilities are used, they have often been adopted from formal bus operators and are usually

poorly maintained. The downside of this arrangement is that people who experience sight impairments and/or neuro-diverse conditions can struggle to find and hail the informal transit services they require. Comprehension and discoverability of the route networks operated can also be challenging – both for people with disabilities and visitors unfamiliar with them.

Given the important role that informal operators play in providing public transport services in lower income countries, some governments are starting to become more active in providing and maintaining passenger infrastructure. Where this occurs, a few basic principles can be adopted to ensure that new and re-purposed facilities serve the broadest range of passengers possible, including people with disabilities.

This section focuses on stops (on-route facilities) and ranks (end-of-route or transfer facilities) for informal operators. By their nature there tend to be fewer formal facilities than those associated with formal bus services. As informal services become more formalised, better organised, and institutionalised, facilities may become more formal and many of the good practices described in other sections of Chapters 3 and 4 will become applicable.

### **5.3.4 Basic principles**

#### **Safety**

- Level, firm and slip resistant surfaces around stop and waiting environments;
- Passenger waiting and boarding area separated from vehicles;
- Adequate clear space without obstacles and encroachment;
- Personal security enhanced through good lighting;

#### **Accessibility**

- Shelter, especially if the area is prone to rain or extreme heat/ cold;
- Barrier-free access into and around facility - no stairs or obstacles;
- Simple layout with adequate signage;
- Kerb or platform at right height to ease entry into vehicle (in combination with

correct vehicle design and user-friendly operation).

### Reliability

- Vehicles stopping in the same places every time.

### Affordability

To the Provider:

- Provide paved, off-road boarding areas first in high use locations;
- Partner with route associations for management and maintenance.

## 5.3.5 Good practice

Many of the good practice principles that are relevant to informal transit facilities are consistent with the principles detailed in Chapter 1 and Sections 3.1 and 3.2 of this chapter.

The remainder of this section therefore focuses on good practices that specifically relate to informal transport services.

### 5.3.5.1 Layout

The user-friendliness and safety of informal transport services can usually be improved for all passengers by creating more orderly operations and facilities at interchange locations / key destinations. Along the route, designated on-street stopping places (or lay-bys) can help prevent disorderly stopping and guide prospective passengers to safe vehicle boarding locations. Both at major on-street lay-bys serving numerous destinations, and at off-street ranks and transfer points, destinations should ideally be grouped together and served from the same location – thereby minimising transfer distances for passengers. Clear signage to this effect will benefit both drivers and passengers.

The layout of lay-bys and ranks should furthermore clearly separate the space used by vehicles from the space used by passengers. This will enhance safety for all passengers and enable people with disabilities, and other vulnerable passengers,

to navigate through the facility more easily. A good way of achieving this is to raise pedestrian space above the road level using standard kerbs and paving.

The layout should minimise the number of places where pedestrians have to cross the path of vehicles. Kerb ramps should be installed to allow pedestrians using wheelchairs or walking aids to leave the kerb in safe places. Kerb ramps should have a maximum gradient of 8% (1 : 12) and be fitted with tactile warning strips to alert people who experience sight impairments that they are leaving the pedestrian space (See Sections 2.2.2 and 2.2.4). Raised 'tabletop' crossings can also be used to overcome level changes, while slowing down traffic at the same time.

If drivers tend to ignore the kerbs and park on them, bollards can be installed as a deterrent along the kerb edge. Such bollards should be at least 1000mm high and colour contrasted to enhance visibility for people who experience sight impairments. Bollards should be placed outside the clear 'pedestrian zone' used by people moving to the stop and should also allow enough space for a mobility aid or wheelchair user to pass freely between them to board the vehicle.

Although the smaller buses used by informal operators usually have relatively low floor heights, this is not always the case – sometimes requiring passengers to be helped on-board the vehicle if they are not able to step immediately from the kerb into the vehicle. This can only be achieved, however, if drivers pull up close enough to the kerb. Authorities may have to provide enforcement **and training, along with positive** incentives to encourage this type of good practice.



Figure 53: A clear pedestrian space created with coloured block paving

### 5.3.5.2 Pedestrian clearways

As with bus stops for formal public transport services, clear space for pedestrians (including people with disabilities) should be a minimum 1800mm wide for areas of heavy pedestrian flow, and 900mm in other places – sufficient to allow a wheelchair user to pass pedestrians. The boarding area must also be free of obstacles, including rubbish, vehicle parts and vendors. Maintaining a clear space can be especially challenging at informal transit stops without enforcement, but careful design can contribute towards keeping the waiting and boarding space clear, including:

- Clear marking of the pedestrian space by paving or painting it a different colour;
- Providing designated spaces for vendors that are just outside the waiting and boarding area but not so far removed from pedestrian flows as to be inaccessible (see Figure 53).

Image Source: [Fabiondo](#)

### 5.3.5.3 Surface quality

A level and smooth surface is essential wherever passengers move between informal transit services and pedestrian footways. This ensures that people with diverse needs can safely move around the lay-by or rank. See Section 1.2.2 for further guidance on surface quality.

### 5.3.5.4 Seats and shelters

Operators of informal transit typically operate fairly frequent services, so that passengers tend not to have to wait long before boarding. Nevertheless, during off-peak periods, or when travelling to less popular destinations, passengers may need to wait longer for their service. Major ranks and interchanges should provide seating for people who are unable to stand for long periods of time. Section 3 describes simple shelters for bus stops which are also suited to informal operations, where space allows. Such shelters might be shared between formal and informal transport



services where passengers interchange between them.

#### **5.3.5.5 Signage and information**

Designated lay-bys and ranks for informal transport services should be clearly marked. As with bus stops and taxi ranks, this helps to guide visitors, people who experience neuro-diverse and sight impairments, and anyone who is less familiar with a local area's informal transit network to the correct boarding location. Such signage may be attached to a pole, a shelter or other structure but should leave the minimum clear height of 2500mm above head (see Section 3.1.2 of this chapter) and the information included should be clear and simple.

If stops are separated by the destinations being served, then their names should also be clearly indicated (see Chapter 6: 5 for best practice). Some public authorities employ full-time rank managers to manage operations, these employees can be particularly helpful to people with disabilities by providing information and assistance – provided they have undergone disability awareness training, are easily identifiable and courteous.

#### Box 34: Case Study: Ayala Mall Jeepney interchange in Cebu

Ayala Mall is one of the main Jeepney interchanges in Cebu. Whilst Jeepneys run to set destinations, there are generally no fixed timetables. Jeepneys are often low-cost, making them an attractive informal transport option for many people in the Philippines. The Ayala Mall interchange in downtown Cebu offers sheltered perch seating for passengers, wheelchair access to the interchange via clearly marked ramps and wide footways providing access to all Jeepney bays on the concourse.

Image source: © Map data ©2020 Google



#### 5.3.6 Where to start?

The first step towards improving the user friendliness of informal transport services is often to improve the coordination of the key service stopping/interchange locations so they are clearly identifiable to all potential service users. Potential partners in this process are operators' associations, which represent groups of drivers and/or owners. Positive dialogue with the operators of informal transit services can help to encourage accessibility improvements to vehicles and service provision, rather than through an enforcement-led route.

Once investment in better facilities becomes possible, a good start can involve upgrading facilities at major destinations and interchange points such as in business districts, at shopping malls, and at rail/metro stations and airports. To enhance accessibility, a key priority is often to organise the way vehicles are driven and parked so that pedestrians and vehicles can be safely separated. Where this is achieved through the provision of kerbs and paving, the opportunity can also be taken to define dedicated pedestrian footways that are paved, with level surfaces which provide enough room for unobstructed pedestrian movement. These measures will specifically benefit people who experience sight impairments, have difficulty when walking, and/or use mobility aids – including wheelchairs.

## 5.4 Major stations and interchanges

This section contains information relevant to transport buildings such as train stations, bus stations and bus terminals. Although primarily aimed at buildings serving urban bus and rail services, these guidelines can also be applied to inter-city bus and rail interchanges. Improving the accessibility of existing stations and terminals with high passenger volumes should be high on the priority list when seeking to make a town or city more accessible for people with disabilities. Despite the higher costs of upgrading an interchange (compared to a bus stop), there are fewer of them, and the high passenger volumes they accommodate often guarantees significant impacts.

### 5.4.1 Basic principles

#### Safety

- Waiting area (platforms, kerbs) separated from vehicles;
- Tactile warnings near to, and white line on, rail platform edge;
- Personal security enhanced through good lighting and design;
- Steps should not have open risers as these are a trip hazard.

#### Accessibility

- Accessible shelters (where waiting facilities are in the open-air) and seating;
- At least one 'barrier-free' access route into the station building and onto boarding platforms;
- Simple layout and clear information to help navigate to the correct platform/boarding area;
- Kerb or platform at correct height to ease entry into vehicle (in combination with correct vehicle design and user-friendly operation);
- Inclusive accessibility to ticket counters, toilets, kiosks and other facilities.

#### Reliability

- Lifts, stairlifts etc. in good working order and operator available (where applicable);

- Real-time information on service changes or delays available in written and audible formats;
- Trained staff, available to provide assistance;
- Accessible walkway between station and surrounding footways.

## Affordability

To the Provider:

- Minimise costs by including accessibility features on new/upgraded stations;
- Maximise impact by installing accessibility features in high use stations first.

## 5.4.2 Good practices

### 5.4.2.1 Entrances

A single step outside the main entrance to a transport facility can make the whole building inaccessible for some people with disabilities. Although it is preferable to make all entrances fully accessible, this is not always practical and, in such cases, the entrances which are to be made accessible should be carefully chosen (for instance at least one accessible entrance on each side of a rail line). An accessible entrance has the following features:

- Entrance should be marked as accessible using the international symbol;
- Non-accessible entrances should bear signage directing passengers to the nearest accessible entrance;
- Step-free access between street level and doorway should be available (see ramps below). Thresholds should be no more than 10mm high so as not to prevent wheelchair users from entering the building;
- A level landing at least 1500mm long is needed in front of the entrance to avoid wheelchair users (and other users) having to balance themselves on a slope while opening the door;
- The door, or door frame, should have a contrasting colour to the building. If a fully glazed door is used it should include white or yellow bands at eye height;
- The entrance should be wide enough (at least 900mm) and unobstructed by

turnstiles. Doorway widths, and the number of entrances, should be designed to cater for the flows of people anticipated into/out of the facility, so as to prevent unnecessary crowding and jostling;

- If doors do not open automatically, it should be possible to open them with minimum effort. Lever or loop-type door handles are much easier to use than knob handles, and should be colour contrasted to the door. The force required to open or close a manual door should not exceed 25N;
- Automatic doors should take at least three seconds to open and 6–9 seconds to close. Where double sets of automatic doors are used, they should close in a “Z” pattern to prevent a person using crutches from being caught in them;
- Door operating devices, where available, should be at a height of between 800mm and 1200mm from the footway;
- Audible signals should be used to alert people who experience hearing impairments to the opening and closing of doors;
- Door mats (if used) should be flush with the floor surface and securely fastened at all edges.

#### **5.4.2.2 Layout of station**

A simple and compact layout makes stations and terminals easier to navigate for people who experience sight impairments and neuro-diverse conditions, as well as occasional visitors. It also minimises walking/wheeling distances, which can help disabled and older people who experience walking difficulties or who rely on mobility aids. Wherever possible, passengers should not have to cross the path of vehicles – passenger areas should be clearly delineated (for instance by raised kerbs) to separate passengers from moving vehicles. Wherever passengers do need to cross the path of buses, clearly marked crossing points, with level access and priority for pedestrians is essential.

Station buildings should have level, easily cleaned, and slip-resistant flooring. This should have a matt or semi-matt finish to avoid reflection and glare, which can disorient people who experience neuro-diverse conditions. Changes in colour and texture should be used to mark the edges of thoroughfares and potential hazards.

Walls should not have glossy reflective surfaces, and should be painted in a tone that contrasts with the floor and the ceiling, so that the boundaries are clearly visible (aiding people who experience sight impairments and neuro-diverse conditions).

### 5.4.2.3 Ramps

Ramps are usually the best way to provide wheelchair access between different floor levels – such as between overhead walkways and platforms – as they are much cheaper to install and maintain than lifts and can serve almost everybody. Having the correct gradient is very important: an overly steep gradient can render a ramp too dangerous and inaccessible for wheelchair users and many others.

As stated in Sections 1.2.10 and 4.2.3 of this chapter, most guidelines specify 5% (1 in 20) as the preferred gradient, and 8% (1 in 12) as the maximum acceptable. However, although not recommended it may be necessary to provide short ramps (1000mm or less) with slopes of up to 10% to meet local constraints.

The steeper the gradient, the shorter the distance that most wheelchair users can cover without resting. Table 7 shows the maximum preferred horizontal distances for different slopes. In all cases:

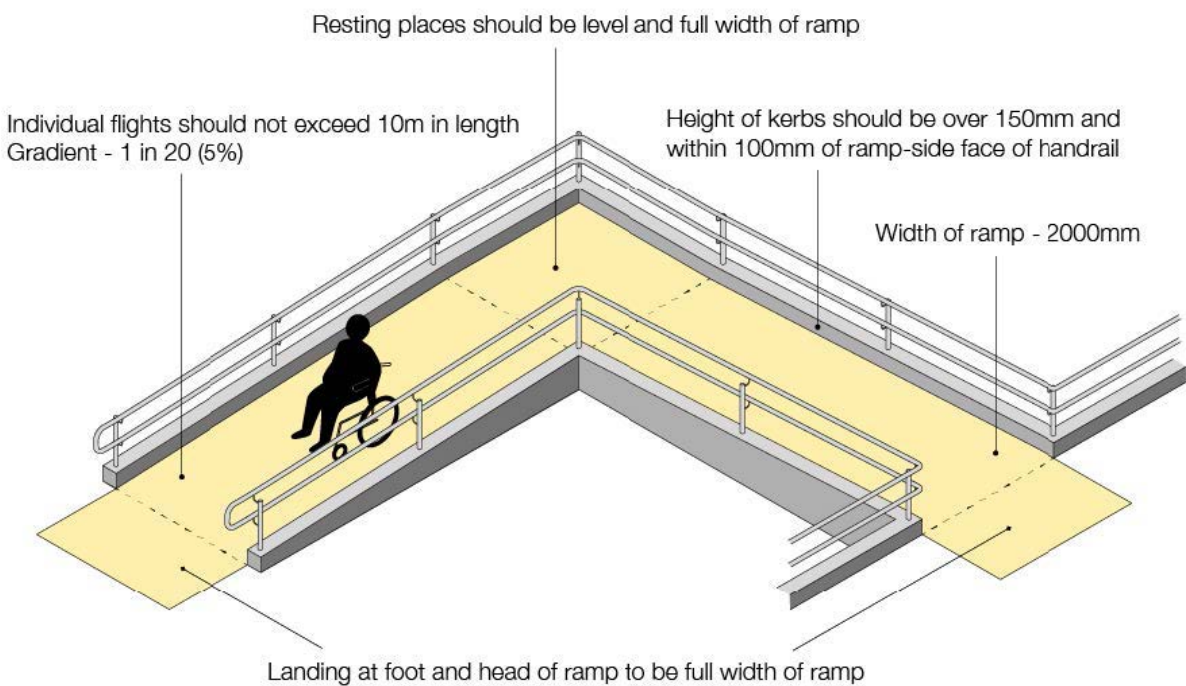
- Individual ramps should not be longer than 10 metres;
- Resting places in between should be level, at least 1200mm (preferably 1500mm) long, and the full width of the ramp;
- Level and unobstructed landings at the foot and head of a ramp should be at least 1200mm long;
- Ramp surfaces should be firm, stable, non-slip and anti-glare in all contexts they are implemented.
- Handrails should preferably be provided on both sides, to cater for people with different body strengths on their left and right sides. The sides of the ramp (if not against a wall) should be protected by a solid raised kerb at least 75 to 100mm high.

Recommended practice for ramps is illustrated in Figure 54.



Table 7: Recommended gradients and lengths of ramps

Recommended gradients and lengths of ramps:		
Slope/gradient of ramp	Recommended Use	Maximum horizontal length
10% (1 : 10)	Very short distances only	Less than 1 metre
8% (1 : 12)	Maximum slope for general use	2 metres
5% (1 in 20)	Preferred slope	9 to 10 metres



All dimensions in this diagram indicate what is preferred, rather than what is a minimum requirement.

Figure 54: Layout and dimensions for ramps

Image Source: Department for Transport, Inclusive Mobility

Some level changes are so great that ramps of very long lengths would be required to bridge them. European guidelines [\[63\]](#) recommend that ramps should never be longer than 132 metres in total, as the extra distance they add becomes too burdensome for many people. However, the alternative – installing lifts or stairlifts on each platform – may be too costly to achieve and it may be unavoidable to see long ramps being used in many developing countries. Adequate resting places are then very important.

#### 5.4.2.4 Steps and stairs

Even though ramps or lifts are needed to provide access to wheelchair users (while benefiting many other passengers), the design of steps and stairs is also important to assist people who experience difficulty when walking. It is usually desirable to have both a ramp and steps, especially if ramps are longer than 9m, as many people prefer to climb a shorter staircase than walk around a much longer ramp. However, if there is insufficient space for both, a ramp should be provided rather than stairs.

Guidance on providing accessible stairs:

- Steps should be 150mm high and 300mm deep to be manageable by most people. Risers should be vertical, round nosed, and should not have an overhang. Open riser staircases should not be used as these are a trip hazard;
- All the steps in a flight should have the same dimensions to avoid trip hazards;
- UK guidelines recommend the use of tactile warning surfaces at the foot and head of the stairs (Section 1.2.6). The tactile surface should be 400mm deep and installed 400mm back from the step edge;
- The number of steps in a flight should be limited to 12, with resting places in between to assist people who cannot manage long flights of steps. Resting places should be at least 1200mm long;
- The clear width of stairways between handrails should be at least 1000 – 1200mm, which is sufficient for a disabled person and companion. Stairways should be wider if they are expected to carry a significant two-way flow of people;
- Handrails should be provided on both sides, and also in the centre if stairways are more than 1800mm wide. See Figure 55 for handrail dimensions;
- Colour contrasts (e.g. yellow or white paint on a dark background) visible on the edge of each step, and on handrails, are essential for people who experience sight impairments;
- The underside of freestanding stairs or ramps can present a collision hazard to people who experience sight impairments and other pedestrians. Where the clear height from the footway is less than 2100mm, the area should be protected by handrails or barriers.

Recommended practice for steps and stairs is illustrated in Figure 55.

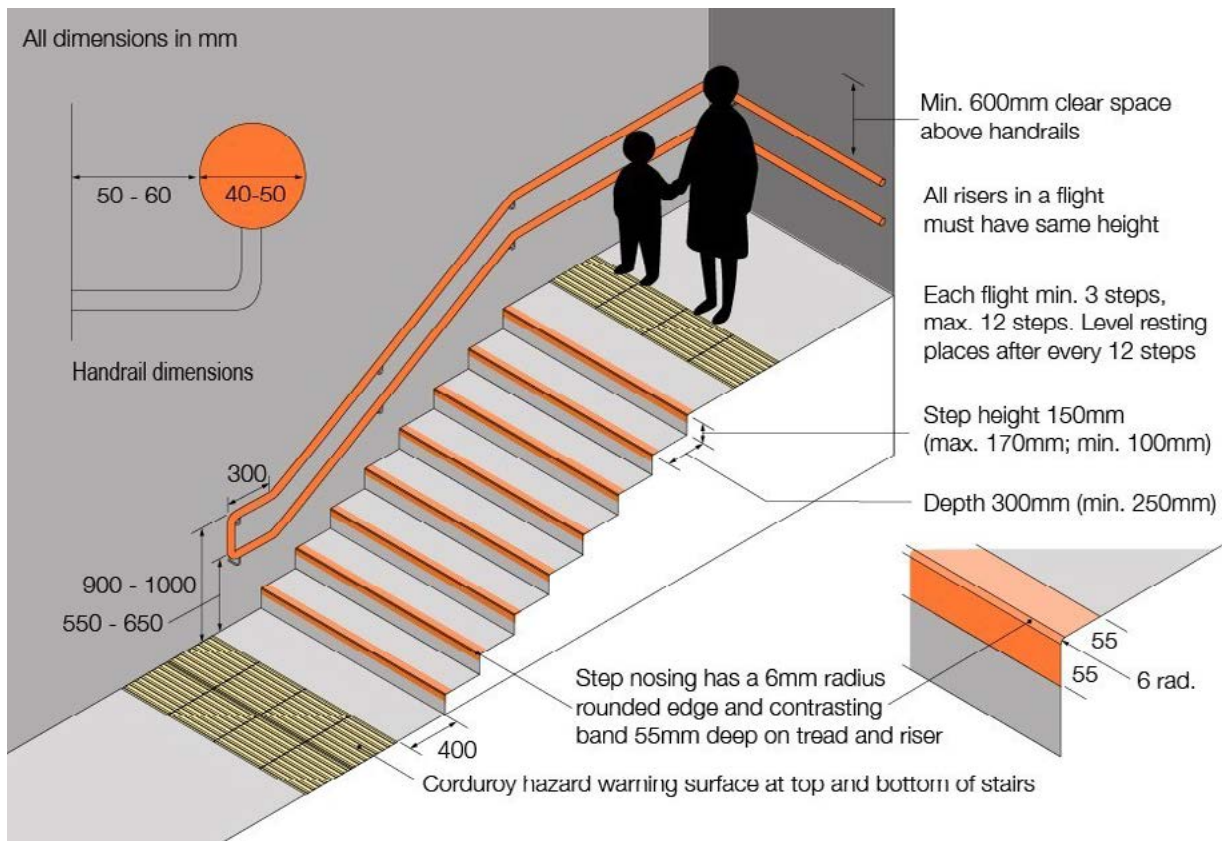


Figure 55: Dimensions – steps and stairs

Image Source: Department for Transport, Inclusive Mobility

#### 5.4.2.5 Escalators, lifts and stair lifts

Good practices around the use of escalators relate to the width and height of stairs, the speed at which they move, and provision of clear space at the top and bottom of the escalator. Escalators are difficult to use for some people who experience walking difficulties and do not meet the needs of wheelchair users or people travelling with assistance dogs. As such they cannot replace the need for an alternative ramp, staircase or lift being installed. Stair lifts are sometimes used to enable wheelchair users to move up or down flights of stairs. They cost less than lifts but can have significant operating costs, as they usually require trained personnel to operate and maintain them, and can only be used by one person at a time.

Internationally established best practice in the design of lifts addresses the internal dimensions, location, and type of control buttons, use of audible signals, and door



Figure 56: Wheelchair lift in Lisbon

opening times. While lifts are an expensive option, their cost can be justified in certain circumstances by heavy passenger volumes (such as in major stations and transport interchanges) or when there is a substantial change in levels. It must be remembered that, unlike stairlifts and escalators, well designed lifts meet everybody's needs.

Image Source: [TeWebs](#)

#### 5.4.2.6 Pedestrian clearways

Passageways, and the spaces between seats, stalls, waste bins and other furniture should be wide enough to provide adequate clear space for wheelchair users and other pedestrians to circulate. As indicated in Section 1.2.1 of this chapter, the minimum recommended width for two-way pedestrian flows is 1800 to 2000mm. Where this width needs to be restricted, it should never be less than a minimum 900mm and continue for more than 6m in length. A clear height of at least 2100mm from the footway is recommended. To assist people who experience sight impairments hazards such as advertising boards, vendors and rubbish bins should not be present in clear pedestrian routes. Fixed objects that protrude more than 100mm into the clear space from the side should be protected and marked with two horizontal bands 150mm wide and placed at 800mm and 1600mm from the footway. Passengers should be encouraged not to leave luggage or belongings in the clearway, where it may create a tripping hazard.

#### 5.4.2.7 Handrails

Handrails are extremely important accessibility features that many people with disabilities rely on to maintain balance and avoid falling. They are needed in queuing and waiting areas and should be:

- Fixed between 800mm and 1000mm above the stairs or ramp floor;
- Fixed at least 50mm from the adjacent wall to prevent hands being caught between the rail and wall;
- Continuous along the ramp/stairs and continue past the end of the ramp or stairway by at least 300mm and then be turned towards the wall or floor;
- Between 40 - 50mm in diameter if made from circular tubing. Other types of handrails should not be more than 50mm wide and have rounded edges (with no more than 15mm radius) to be most comfortable to people who experience arthritis, and be smooth - without any sharp edges;
- Contrast with the surroundings (e.g. painted bright yellow) to assist people who experience sight impairments;
- Installed without any sharp bends, for example mitred corners of 90° or less.

#### 5.4.2.8 Signage

Clear signage throughout the building is important for everyone, particularly people who experience hearing impairments. See Chapter 6, Section 5 for more information on formats and requirements for signage.

#### 5.4.2.9 Tactile and visual guidance

In the absence of other cues, people who experience sight impairments may be able to navigate through a station by following a tactile path. People with some vision generally focus on the floor up to 1500mm ahead of their feet, so are typically less aware of information or hazards that are placed higher up. Directions to platforms and toilets, or warnings of stairs ahead should take this into account, and recognise that crowded public areas can also make wayfinding information marked on the floor hard to see or detect.



Image Source: CFL

As with tactile surfaces on footways outside, it is suggested that tactile and visual clues be used sparingly and consistently. The input of local people with disabilities can be invaluable in identifying appropriate approaches.



Figure 57: Braille and raised text used in Luxembourg

#### 5.4.2.10 Information

Helpful and knowledgeable personnel are often key to providing useful information and assistance that helps to empower people with disabilities, and give them the confidence to travel independently. Trained personnel working at stations and major interchanges should be clearly identifiable (such as through distinctive clothing or badges), and available to answer questions. If such staff are based behind a counter, the counter should be designed to be as user- friendly as possible. For further guidance on information, including smart phone apps and real time information, see Chapter 6, Section 3.

Information on transport schedules should be displayed visually using best practice to improve legibility (See Chapter 6, Sections 3 and 5). In addition, it is important that information on any changes to the posted schedule, such as platform/bay changes or delays, is communicated both visually and audibly. At its simplest, this can take the form of pre-printed cards stuck on a signboard, but more advanced options can include computerised message signs and automated alerts sent to smartphone devices via the dedicated apps.



Audible announcements should preferably be made with a public announcement (PA) system. Even if no amplification is available, station personnel should make every effort to inform passengers audibly of real-time changes, as this benefits all travellers - not just those who experience sight impairments. Speech in relaxed conversation is intelligible to most people in background noise levels of about 35 dBA, and can be understood fairly well in background levels of 45 dBA. [\[64\]](#). Typical background noise in some train stations is louder than this, therefore announcements should be made at increased volume to overcome the local background noise levels. European standards dictate that spoken information announcements shall have a minimum speech intelligibility score of 0.45 [\[62\]](#).

Some people with disabilities, and in particular those who experience neuro-diverse conditions, can find the crowds and noises associated with busy transport interchanges challenging. Establishing quieter areas that are sheltered from large open concourses, which tend to be noisier and more crowded, can help people who experience conditions such as autism and dementia (and their families/assistants) to manage the stress they may experience when travelling through busy stations and interchanges.

#### **5.4.2.11 Amenities**

Ticket-counters, ticket gates, public telephones (where widely used), waiting areas, and toilets can be designed so they are accessible to all.

##### **Public telephones**

If public telephones are provided inside the station, at least one handset should be placed lower than the standard to cater for wheelchair users, children, and people of short stature. The top of the unit should be about 1040mm above the floor and there should be enough clear space in front of it (about 1200mm for a wheelchair user) to ensure it can be used without blocking any pedestrian routes through the station or interchange.

## Seating

Seating should be provided so that people who are unable stand for long periods of time are able to await a bus or train in comfort, and without resorting to sitting on the floor. It should be provided in both waiting areas and on platforms if there is enough space.

A good height for seats or benches is about 480mm above the floor. To enhance visibility, seats should be colour contrasted with their surroundings. For outdoor seats, the use of small drainage holes in the seat surface is a good way to prevent rainwater collecting on the seat (though these should not make the seat uncomfortable). In waiting areas some seats should be reserved (and marked) for use by older and people with disabilities.

Some people find armrests helpful when lowering or raising themselves from a seated position. It is good practice to provide a mix of seating types (some with armrests, and some without) where possible. Where provided, arm rests should be about 200mm above the level of the seat. Armrests should not be used on the open ends of a bank of seating, as this will allow wheelchair users to transfer onto the seat should they wish to.



Figure 58: Seating with drainage holes

Image Source: [Steelline](#)

Some (but not all) seating can consist of perch-type rails, against which passengers can lean or half-sit for a while. They are simple and inexpensive to construct and maintain, unobtrusive, and attractive to people who find it difficult to rise from a low seat. Perch-type seats should be about 700mm from the ground.

## Information points

At least one ticket information counter in a major station or interchange needs to be low enough to meet the needs of wheelchair users, children, and people of short stature.

A height of about 800mm is needed, with enough recessed knee space below the counter for wheelchair users (about 500mm deep and 900mm wide). At least 1200mm of clear space should be provided in front of the counter (free of queuing rails and other barriers), so that someone using a wheelchair can approach unimpeded.

Since it can be very difficult for people who experience hearing impairments to hear a staff member through a glass window, at least one counter should have a removable window or intercom and be provided with an induction loop (to amplify sound directly into a person's hearing aid) in situations where this is appropriate. Where an induction loop is provided, a sign should be displayed at the counter to indicate its presence.



Figure 59: Typical assistance booth at Gatwick Airport U.K.

Image Source: Gatwick Airport

The glass used at counter windows should be non-reflective, to help people who experience sight and hearing impairments and neurodiverse conditions. It is also a good idea to provide handrails along the area where people queue up, for passengers to lean against if they find it difficult to stand while waiting.

## Automated ticket machines

For manned ticket offices, please refer to the 'Information points' section above. The remainder of this section covers automatic ticket machines.

Ticket vending machines need to be well lit (200 lux) and display clearly visible operating instructions. If the ticket vending machine is outside, then it is important to ensure the operating instructions remain clear in both daylight and under artificial lighting conditions during hours of darkness. Operating instructions should also be printed in relief or available in Braille.

The buttons and slots on automatic ticket machines should be no more than 1200mm from the ground, so they are accessible for wheelchair users and people of short stature. The buttons should be at least 20mm in diameter and protrude from the machine, along with all other interactive elements (push buttons, coin slots and ticket collection), to enable people who experience sight impairments to use them.

Ticket machines with an audible assistance function, or screen reader technology, should allow users to plug in their earphones for better comprehension and privacy. This is particularly important in noisy environments.

Ticket gates, or turnstiles, controlling the entrance to the station or to platforms are either difficult or impossible for many people with disabilities to use. Where such ticket barriers, or gate-lines, are installed (as they are at increasing numbers of mainline rail and metro stations), there should be a clearly-marked accessible route (a minimum of 900mm wide), that enables people who are unable to use automated ticket gates and barriers to present their tickets for manual inspection by a staff member.

## Accessible Toilets

The unavailability of toilets can completely prevent people with certain disabilities from being able to travel. The absence of suitable toilets means that people with complex disabilities who need assistance cannot take part in everyday activities outside the home. Without a suitable changing bench and hoist, many people with

complex needs have to be laid on unhygienic toilet floors or become trapped in their own homes.

In general, if toilets are available for non-disabled people, they should also be available for people with disabilities. Accessible toilets should be marked as ‘unisex’ rather than separate male and female toilets where local context allows, as it can be used by the many people with disabilities who are accompanied by an attendant or companion of the opposite sex. Accessible toilets should be open at all times that other toilets are open [\[62\]](#).

In many LMICs, squat toilets are the norm. In these countries, people with disabilities will often be adapted to using these toilets, potentially making pedestal type toilets difficult to use. When designing the layout of either type of toilets, it is important to:

- Provide enough clear space for people using wheelchairs and other equipment to enter and manoeuvre;
- Put amenities at a reachable height;
- Provide sufficient handrails to assist people transferring from a wheelchair, or people with reduced strength, to enable people to lower and support themselves;
- Provide easy-to-operate amenities such as taps and door handles for people with reduced hand dexterity. Door handles should be large and easy to grasp;
- For easy identification by blind and partially sighted people, all door opening furniture should contrast visually with the surface of the door [\[62\]](#).

Wherever possible, additional facilities should be provided for people with severe or complex disabilities including hoists and changing tables.

Many countries have their own standards for accessible toilets. Guidance on specifically improving the accessibility of squat toilets is provided by [\[65\]](#). Figure 60 and Figure 61 summarise some best practice recommendations for both common types of toilet designs.

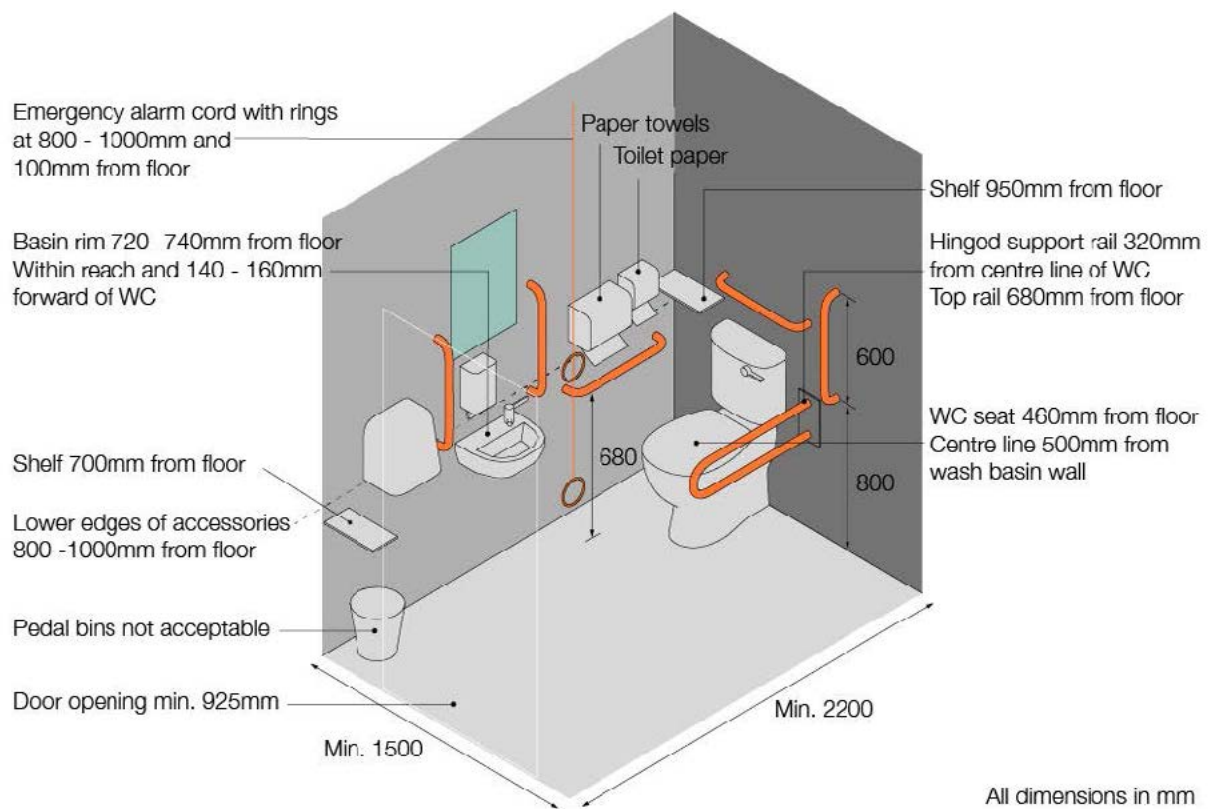


Figure 60: Dimensions and amenities for a typical wheelchair accessible toilet

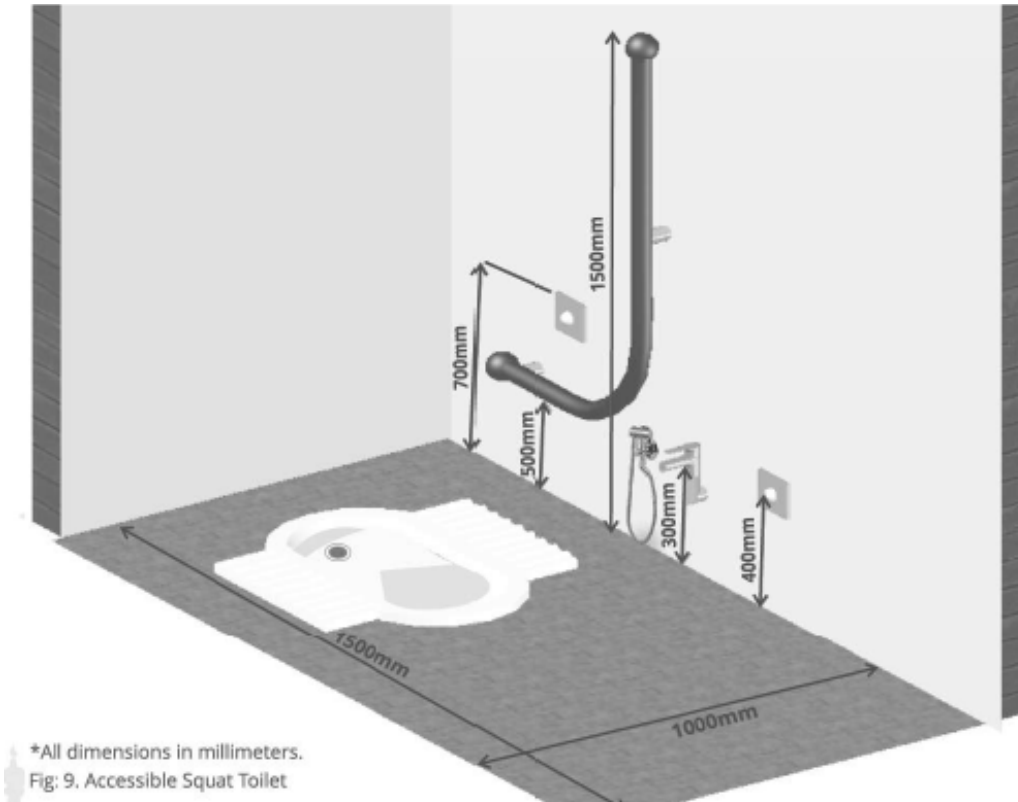


Image  
Source:  
Svayam

Figure 61: Dimensions and amenities for an accessible squat toilet



### Box 35: Case Study: Changing Places

‘Changing Places’ toilets provide the extra equipment and space required for people with a range of disabilities to use the toilets safely and comfortably. The requirements for a Changing Places toilet are as follows: adequate space for a disabled person when they are not in their wheelchair, their wheelchair and one or two carers – 12sqm (3m x 4m); an adult sized, height adjustable changing bench, wall mounted or free standing; a ceiling tracking or a mobile hoist; a peninsular (centrally placed) toilet; a privacy screen or curtain; a large bin for pads; an emergency alarm; a paper roll; and a non-slip floor.



“Until Tamsin was 13, we managed to get by using regular disabled loos. This involved manually lifting Tamsin from her wheelchair and holding her in a standing position. However, as Tamsin cannot stand, this meant holding her entire body weight over one arm whilst using the other hand to remove her clothing. Then lifting her onto the loo and holding her in position (she cannot sit either). It was back-breaking and it was heart-breaking. It wasn’t easy, it wasn’t safe and it wasn’t dignified. [...] Since her [recent] surgery, Tamsin understandably does not feel safe being lifted manually; she needs a ceiling hoist to lift her safely from her wheelchair and a height-adjustable, adult-sized, changing bench to be able to lie down to prepare for toileting. This was when we discovered Changing Places. Changing Places provide exactly the right space and equipment we need for our daughter to enjoy going out[...]”

Source: [\[66\]](#)

Image source: PAMIS

For many people with disabilities, having specifically accessible toilets may not be as important as the widespread availability of toilets more generally. This is the case for people who might need to go to the toilet suddenly, for example. Providing public toilets (and particularly accessible toilets) can be unappealing to city authorities

due to the cost implications of maintenance. However, there are ways to partner with businesses to improve the availability of toilet facilities, including the example of Nette Toilette in Germany.

### Box 36: Case Study: Nette Toilette

In Germany the “Nette Toilette” (“Nice Toilet”) system has created a compromise between public and private toilet facilities. German city authorities pay businesses a monthly fee of anything from £30 to £90 to open their toilets for the general public. Participating businesses place a sticker in their window to let members of the public know they are welcome to use the facilities, even if they’re not buying goods or

services. First launched in 2000, the scheme now includes 210 member cities across Germany and Switzerland. The network is a private one that charges participating cities a modest fee to use the branding. City maps and an app are also available



showing the location of participating businesses and detailing the facilities they provide. The scheme is broadly popular with children and parents, pregnant women, older people and people with disabilities.

Source: [\[67\]](#)

Image source: [BlueBreezeWiki, 2014](#)

### 5.4.2.12 Platforms

Apart from being reachable by ramps or lifts, accessible platforms (at rail, metro and rapid transit stations) should also provide sufficient space and tactile cues for safe use (see Figure 62). UK guidelines recommend a minimum clear width of 2000mm,

but this should be increased if more passengers are expected to use the platform so as to prevent overcrowding and boarding delays. A level and well-maintained non-slip surface is essential for safety.

In order to warn people who experience sight impairments that they are approaching the platform edge, it is good practice to install a tactile warning strip 400mm deep, set back about 500mm from the edge, and contrasting with the surrounding floor (see Sections 1.2.6 and 2.2.4 of this chapter for further information). A white line or equivalent warning along the edge of the platform should always be used to caution passengers. Furniture such as rubbish bins or information boards should be placed outside the clear space along the platform, and colour contrasted for high visibility. (See Section 1.2.7 of this chapter for more information on contrasting colour use).

If the practice is to designate one carriage, or vehicle area, as an accessible space with priority given to people with disabilities (see Chapter 4), and the carriage/vehicle routinely stops in approximately the same position, then it is helpful to indicate the corresponding space on the platform so that passengers know where to wait.

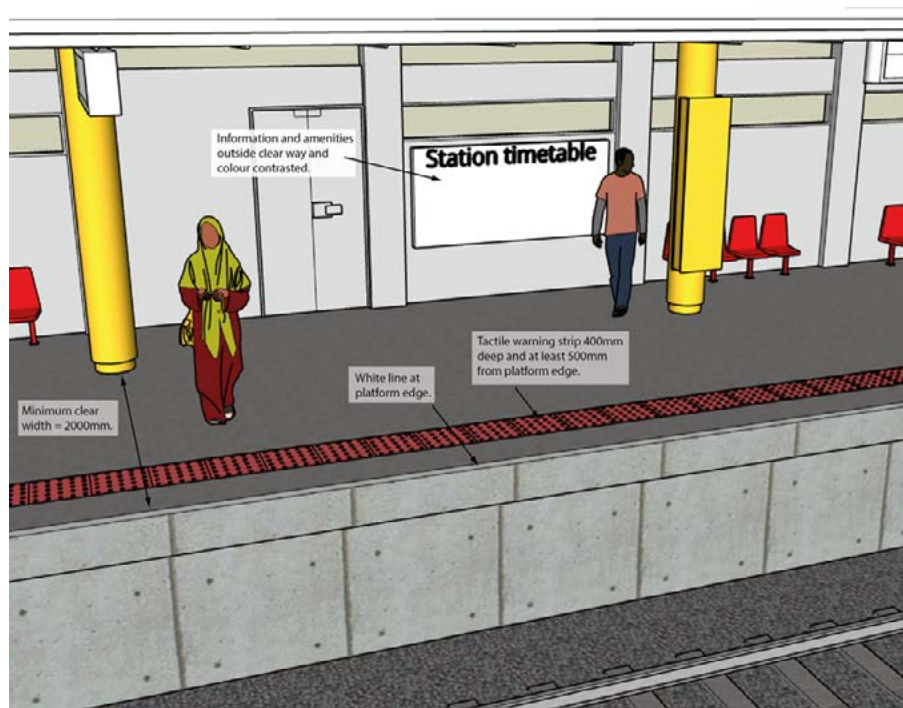


Figure 62: Platforms at rail stations

### Box 37: Case Study: São Paulo Accessible Metro

Two-thirds of Companhia Paulista de Trens Metropolitanos (CPTM)'s 94 stations are now accessible for people with disabilities. Stations have been fitted with lifts and escalators, ramps, public address systems, information in braille, information tailored to the needs of wheelchair users and people who experience hearing impairments, accessible toilets, and tactile surfaces applied to floors. Assistance dogs are allowed to travel on public transport services in the city and are welcome inside metro stations. Specific areas on the platforms of the busiest stations are reserved for "preferential boarding" of disabled passengers and people who are uncomfortable when standing on-board the metro.



Source: [\[68\]](#)

Image Source: LeoMSantos

### 5.4.3 Where to start?

It is much easier – and, importantly, cheaper – to achieve full access from the design and construction stage, rather than by trying to modify a station or interchange building at a later date.

When it is necessary to retrofit accessibility features, major stations with high passenger flows, stops and stations that form part of accessible public transport route networks, and interchanges serving major destinations in the city are good starting points. Changes to these facilities are likely to yield maximum benefit because they are used most frequently by a large number of passengers. When existing stations are upgraded or maintained the opportunity should also be taken to start making incremental improvements to better meet the diverse needs of people with disabilities.

## 5.5 Urban passenger ferry terminals

Improving access to ferry terminals can provide significant benefits to people with disabilities, especially in locations with an extensive ferry or waterborne transport network. Achieving waterborne transport accessibility can be much more challenging than for other modes of transport, as tidal fluctuations may impact on the positioning of the vessel and buoyant (floating) infrastructure in relation to fixed land-based infrastructure. Furthermore, operators of ports, harbours and piers may not always have control over all aspects of a particular site and may need to liaise with local authorities or other stakeholders.

### 5.5.1 Basic Principles

#### Safety

- Passenger waiting areas for boarding should preferably be on land, rather than a floating pontoon;
- Where waiting is necessary on a pontoon, those who experience discomfort when standing must be provided with seating or given priority transfer onto the vessel;
- Barriers to be provided around open water where there is a risk of falling;
- Tactile guideway to be installed if access to the vehicle requires transit across an open space;
- Adequate lighting which provides sufficient contrast and illumination to improve personal security and ensure passengers are able to identify changes in surface height, texture, and the edges of surfaces. Guidelines on street lighting in Section 1.2.8 are relevant here;
- Non-slip walkways and floor surfaces and handrails, where required.

#### Accessibility

- Accessible shelter and seating;
- At least one barrier-free access route through the terminal and onto the gangway;
- Simple layout and clear information to help navigate to correct dock;
- Access to ticket counters, toilets, kiosks and other facilities.

## Reliability

- Lifts, stairlifts etc. in good working order and with staff operators available (where required);
- Real-time information on service changes or delays available in written and audible formats;
- Trained staff, available to provide assistance;
- Accessible walkways between terminals and surrounding footways and transit stops.

## Affordability

To the provider:

- Minimise costs by including access features on new/ upgraded facilities;
- Maximise impact by installing access features in high use terminals.

### 5.5.2 Good practices

Many of the basic principles of accessible design, discussed in Chapters 3 and 4, also apply to waterborne transport. The remainder of this section specifically relates to waterborne transport facilities.

#### 5.5.2.1 Layout

- Terminal entrances should be located as close as possible to the vessels they serve, minimising walking distances;
- The route from the entrance to the vessel should be clearly signposted, easy to follow, and avoid any obstacles that are common in port facilities and dockside areas.

#### 5.5.2.2 Gangways

- Gangways which connect the port with the vessel should have handrails at both sides, the first set at a height of 1000mm and a second lower rail set at a height of 750mm;
- Handrails should extend beyond the length of the gangway by 300mm and each railing should have at least three stanchions;



- Gangways should be wide enough for a wheelchair user to self-propel along, with a minimum clear width of 900mm and have ramped overhangs at each end to cover any gaps;
- Gangways can become slippery when wet and anti-slip surfacing is required. Anti-slip cross-pieces should not be more than 300mm long or raised more than 300mm high;
- Drainage maybe required on the gangway to reduce flooding and slip risks. The holes of perforated surfaces should not be more than 100mm wide or 300mm long;
- An attendant should be present wherever possible for assisting passengers with boarding and disembarking waterborne vessels, and there should be a means of raising alarm in an emergency.

#### 5.5.2.3 Car/transport ferries

- Pedestrians with disabilities are especially vulnerable in any environment shared with moving vehicles;
- Car and transport ferries that allow foot passengers should take steps to segregate pedestrian boarding from vehicle boarding;
- The different channels of access should be clearly signposted and tactile guideways should enable people who experience sight impairments to guide themselves to the correct boarding area. Assistance should be provided where this is not possible;
- Where car passengers are able to alight from their vehicles (e.g. to access terminal facilities at a port) the same provisions for clear obstacle-free footways and tactile cues apply.

#### 5.5.2.4 Terminal buildings

For information on accessible terminal buildings, including seating, ticketing, signage and layout please see Section 4 of this chapter on Major Stations and Interchanges.

### Box 38: Case Study: Accessible Vaporettos in Venice

Vaporetto is a Venetian public waterbus. There are multiple scheduled lines that serve locals within Venice, and travel to nearby islands.

Vessels on some popular lines are wheelchair accessible and designed to float at the same level as the floating docks, making for a wheelchair-

accessible flat transfer between the boat and the dock. On other lines, a platform is used to overcome the small gap between the dock and vaporetto. The vessels can carry up to four wheelchairs, depending on the type of boat, and an attendant is on-hand to help with boarding and disembarking passengers who require extra assistance. People with disabilities also pay a reduced fare.

Source: [\[69\]](#)

Image source: Sage Traveling



This video looks at how to improve the accessibility of waterways in Bangladesh:

[Water Transport Accessibility for persons with disabilities Video](#)

## 5.5.3 Alternative provision

Across narrow water channels, new bridges may provide an accessible alternative to transit by ferry.

### Box 39: Mombasa Port floating bridge

Kenya launched a 1.2-kilometre floating bridge across the Likoni Channel, which serves as a gateway for Mombasa Port. Ferries are currently used to transport people and vehicles across the channel, but due to increased demand as the population of the city grows, and (in part) responding to public health concerns following the COVID-19 pandemic, the viability of the ferry service has become limited. The 6m wide bridge deck is 715m long. In the middle, it has a 150m swing opening to allow the passage of ships calling at Mombasa Port to transit through

the channel. For some people with disabilities, and people who experience limited mobility, the bridge affords a viable alternative to using the ferry – which was inaccessible for many.

Further information and local reaction is available here: [\[70\]](#)

Source: [\[71\]](#)

#### **5.5.4 Where to start?**

- Ensure that passengers are able to access the terminal by providing accessible footways and work with other operators to ensure that nearby public transport facilities are accessible;
- At existing facilities, start by upgrading facilities associated with routes which attract a high number of passengers;
- Invest in accessible mobile gangways and ramps that can be moved between docking bays as required if frequency of departures allows.

### **5.6 Car Parking**

In lower income countries, relatively few people with disabilities can afford private cars. However, as car ownership increases, and it becomes more common for people with disabilities to travel in cars (either as passengers or drivers) it is good practice to begin providing accessible parking in key locations.

Accessible parking spaces can also be useful for disabled users of metered taxis or specialised door-to-door services, so may serve a dual purpose in some locations.

#### **5.6.1 Basic principles**

##### **Safety**

- Surface even and firm;
- Parking space adequately removed from traffic;
- Tactile warning surface on the pavement at dropped kerbs;

- Drainage designed-in to the parking space to prevent rainwater from collecting where people alight from vehicles.

### Accessibility

- Adequate space for wheelchair user to enter or exit vehicle;
- Parking spots/spaces close to facility being visited to avoid long walks;
- At least one accessible route provided to an accessible building entrance;
- Dropped kerbs provided close to accessible parking to facilitate access onto footways.

### Reliability

- Accessible parking spots/ spaces should be reserved for use by disabled drivers and passengers;
- Adequate enforcement to prevent abuse.

### Affordability

- Reduced or waived parking fees;
- Concessionary parking schemes for disabled drivers/passengers.

## 5.6.2 Good practices

### 5.6.2.1 Number and location of parking spaces

In off-street car parks, it is usual practice to designate the parking spaces closest to a nearby destination's entrance so they may be used by people with disabilities. In the UK, government legislation requires that between 2% and 6% of parking spaces are designed and reserved specifically for disabled users (see Table 8), with a minimum of one space at each facility. This is in addition to spaces reserved for disabled employees who arrive by car.

Table 8: UK guidelines for number of accessible parking spaces

Proportion accessible parking spaces	Application
2% of all spaces (plus additional spaces for disabled employees arriving by car)	Existing employment centres
5% of all spaces (including for disabled employees)	Neurodiverse employment centres
6% of all spaces (plus additional spaces reserved for disabled employees arriving by car) Minimum of one space per car park/facility	Shopping, leisure, public spaces all car parks

[51]

5.6.2.2 Layout

The recommended layout and dimensions of parking spaces and clear spaces around them are shown in Figure 63. Parking bays should ideally be sited where the road gradient is reasonably level, as steep gradients cause difficulties for wheelchair users with a side lift fitted to their vehicle. Accessible parking space(s) should also connect to an accessible footway, or route that leads to an accessible building entrance. The route should not require wheelchair users to pass behind vehicles that may be backing out and is likely to require a dropped kerb/ramp between the footway and roadway/parking area.

Parking spaces that are 3.6m wide, compared to standard width of 2.4m allow a wheelchair user to transfer from their chair into the car. They also allow disabled and older people who struggle to get in and out of cars to fully open their door to make the process of exiting and entering the vehicle easier. Adequate space should be provided on both sides of the space to allow for forward or reverse parking.

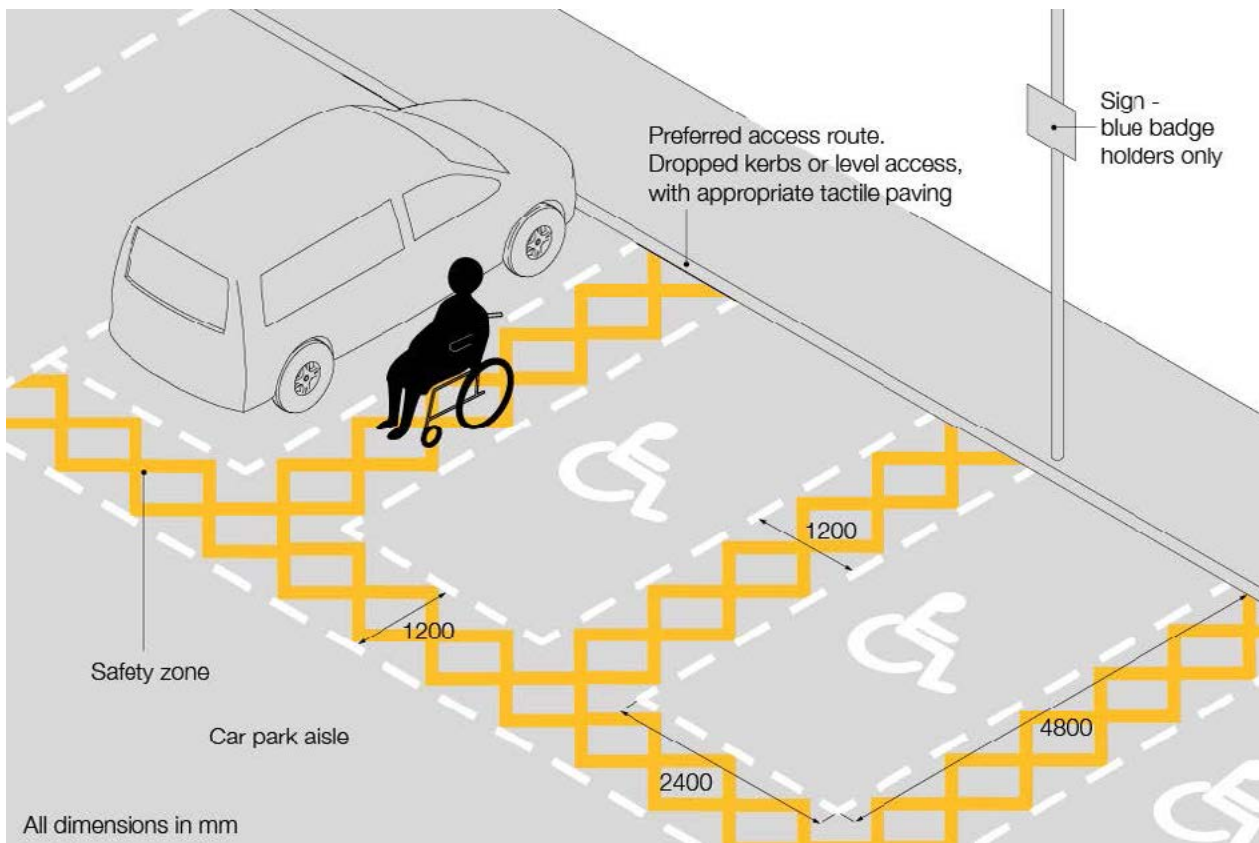


Figure 63: Recommended dimensions on parking spaces

Image Source: Department for Transport, Inclusive Mobility

### 5.6.2.3 Enforcement

Designated parking spaces should be clearly marked with the international disability symbol. Many countries impose a fine if these spaces are abused. Adequate law enforcement is necessary to prevent abuse.

### 5.6.3 Where to start?

Ideally, provision should be made for accessible parking spaces wherever any parking spaces are provided. However key locations such as shopping or business districts, medical facilities, and government offices could be prioritised first. In addition, employers could be encouraged to provide designated parking for every disabled employee who needs one.



## 5.7 Where to Start?

The first step in delivering the kinds of accessible infrastructure improvements highlighted in this section typically involves raising local awareness of best practice and international design standards. The information contained in this section seeks to help improve this understanding by demonstrating the kinds of accessible infrastructure measures that have been adopted elsewhere around the world and evidencing why they are desirable on a global scale.

The next steps to implementation are as follows:

- Work with people with disabilities to improve accessibility by producing local and, where applicable, national accessibility design standards;
- Raise awareness of the importance of accessibility amongst planners, designers, transport operators and government officials;
- Consult with groups representing people with disabilities on the challenges they face locally and establish a working group if possible;
- Introduce accessibility auditing on new projects, and to facilities that are earmarked for upgrades and maintenance;
- Maximise impact by installing access features in high use terminals and terminals most likely to be used by people with disabilities;
- Begin to audit existing infrastructure, prioritising infrastructure used by a large number of people and infrastructure serving essential services such as education, healthcare and employment to maximise impact;
- Continue with infrastructure improvements as funding allows.

This video looks at the importance of accessibility auditing in India: [Moving Beyond Disability To Accessibility Video](#)

# Chapter 6

## Accessible Transport Services and Information



# Accessible Transport Services and Information

People with disabilities can experience many challenges when accessing transport systems and services. In 2013, an online survey carried out by the Global Alliance on Accessible Technologies and Environments (GAATES) Transport Committee with its members (completed by 257 people from 39 countries) aimed to better understand the mobility issues experienced by people with disabilities around the world. A lack of accessible information was one of the biggest problems affecting the mobility of 15% of respondents, with 11% citing a lack of reliable information [\[72\]](#). This highlights the importance of reliable and accessible information to help people with disabilities plan successful journeys.

This chapter focuses on how ‘non-infrastructure’-based services and information related to the transport system can also make it easier for people with diverse needs to travel independently. In some cases, provision of excellent non-infrastructure elements can help to alleviate the barriers presented by the more ‘fixed’ elements of the system such as infrastructure and vehicles.

An example of this might be providing passenger assistance at stops and stations, which enables people with disabilities to access vehicles they would not be able to independently. However, it is important to recognise that:

- Providing assistance does not remove the need to improve the accessibility of transport infrastructure and services;
- In contexts where changes to infrastructure might take a long time to deliver, it can help to bridge the accessibility gap for some people with disabilities in the short-term;
- In the longer-term, even after improvements are made to transport infrastructure and vehicles, some people with disabilities with more complex needs may still rely on passenger assistance in order to use the transport system.

## 6.1 Basic Accessibility Requirements for Transport Services and Information

Approaches to providing information and transport services should reflect Universal Design Principles, aiming to include as many people as possible within the ‘general’ design. This has benefits for everyone by reducing the requirement for additional or specialised services or information formats. There are some general good practice points which apply across many of the sections of this chapter:

- Information should be made available ahead of time and be as detailed as possible;
- Information should be presented clearly and concisely;
- Information and communication should be available in various formats (and where possible these formats should be readily available to everyone, i.e. not require specific applications or requests);
- In general, people with disabilities should be accommodated in the ‘general’ transport system, but in some cases it can be beneficial to include more specialised services and facilities (including toilets);
- Providing staff training can greatly improve the experience of people with disabilities when travelling. Training for people with disabilities themselves can also help them maximise their access to the existing transport system;
- When implementing any changes to the existing transport system, the opportunity should be taken to consult with people with disabilities and other relevant stakeholders.

## 6.2 Concessionary fares

Many people with disabilities are disproportionately affected by poverty and are more significantly impacted by higher living costs associated with the impairments they experience. For this reason, many countries’ governments have adopted the practice of subsidising travel for people with disabilities - either by charging reduced fares or no fare at all. For some (but by no means all) people with disabilities, this kind of travel concession can make a significant difference to their daily lives. It can help to prevent social isolation and the sense of disempowerment often identified as a

secondary societal impact of disability, by removing or reducing cost as a barrier to travel.

While concessions of this nature are undoubtedly helpful to overcome affordability barriers for some people with disabilities, the issue of introducing concessionary fares also requires careful consideration. It should not, for instance, act as a substitute for other (physical or operational) improvements to public transport services that could be more cost-effective and beneficial in the long-term.

Specialised services are covered in more detail in a later section.

#### **6.2.3.1 Safety**

- Concessionary fare policies must not inadvertently disincentivise operators from accepting disabled passengers, for example leaving people with disabilities by the roadside.

#### **Accessibility**

- Where concession agreements are used, authorities should consider including low-cost accessibility features as a requirement;
- Information regarding concessionary fares should be made available to passengers pre-journey;
- The process for assessing eligibility for concessionary fares should be simple and easy to access for people with a wide range of diverse needs.

#### **Reliability**

- Concession arrangements should be consistent across the public transport network;
- Concession arrangements should be consistent between travel modes (although there are commonly differences between bus and rail).

## Affordability

To the provider:

- Operators must be compensated for any loss they make by offering a concessionary fare for people with disabilities.

To the User:

- Concessionary fares should reduce the financial burden of travel on people with disabilities;
- Prohibit extra charges for carrying wheelchairs and other aids [\[63\]](#).

Overall, the development and implementation of travel concessions is very specific to the country-context and depends on a wide range of factors. These include the operational model for bus or rail services, and whether vehicles are already accessible for people with diverse needs. Reimbursing operators for foregone revenue associated with concessionary fares is significantly easier where routes are formally franchised and contracted. Where this is not the case, and public transport is provided on a more informal basis, mandating free or reduced travel for people with disabilities may disincentivise operators from picking them up. In these cases, a specialised transport service which caters for the specific mobility needs of people with disabilities may be more appropriate. This relationship is summarised in Figure 64.

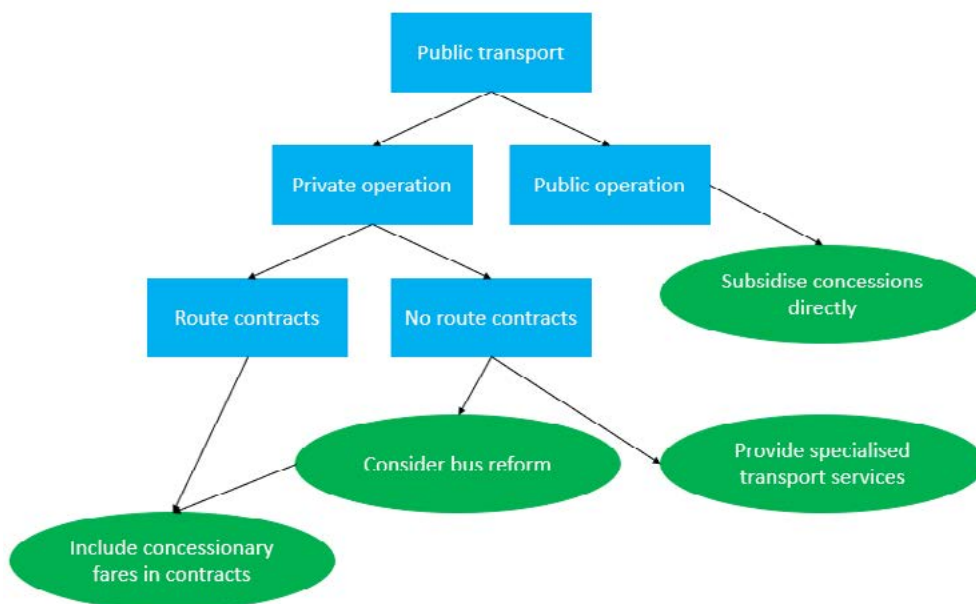


Figure 64: Interactions between current public transport operations and implementation of concessionary fares



Any approach that aims to provide a differential service for people with disabilities (e.g. a reduced fare or a specialised transport service) will necessitate the development of a set of eligibility criteria, to determine who should receive the concession. For example, where travel demands a significant degree of challenge or discomfort for someone who experiences a disability, due to inaccessible infrastructure/vehicle design, it may be appropriate for them to be completely exempted from paying a fare. Where transport vehicles are fundamentally inaccessible for the majority of people with disabilities, a concessionary fare scheme may be irrelevant and risks being viewed as a hollow gesture – since there is little point in offering a concession if it cannot be utilised.

Bus reform will be necessary to allow these changes in many cases [\[73\]](#). Where bus reform is already planned in some form, this can present the perfect opportunity to include concessionary fares agreements or to require vehicles to be provided with a variety of low-cost access features [\[63\]](#).

#### Box 40: Case Study: Public Utility Vehicle Modernisation Program (Muntinlupa, Philippines)

The Department for Transport of the Philippines began its Jeepney Modernisation Programme in 2017. Jeepneys have become a core symbol of Filipino culture and transport, with approximately 75,000 in Metro Manila alone. The scheme mainly focused on reducing the pollution created by Jeepneys which run on diesel and are more than 15 years old, requiring replacement vehicles to be a minimum of Euro 4 standard in terms of emissions. At the same time as renewing the vehicle



fleet, it has been possible to include further requirements, including those related to safety and accessibility.

While the scheme has been contentious and slow-moving in many cities, a pilot project for the e-Jeepneys and an associated smartcard has been carried out in the city of Muntinlupa with great success.

“In 2015, the city government of Muntinlupa and Lingkod Muntinlupa Foundation, a non-profit community organisation, launched a project called ‘Leading the e-Jeepney revolution in the Philippines’, which introduced 14 e-Jeepneys into areas that previously lacked adequate public transport, providing free rides to students, and disabled and older people.

The e-Jeepneys utilise the Muntinlupa Care Card (MCC), the most advanced

electronic smart card system in the Philippines, for payment. Citizens that sign up for the Muntinlupa Care Card annual membership, at a cost of 80 pesos or US\$1.60, can use the smart card both on-board e-Jeepneys, and for a number of other public services. The MCC is the first and only city government benefit card in the Philippines that uses smart technology to collect and use the data of its constituents to provide a more efficient delivery of services.”

The drivers of the new e-Jeepneys in Muntinlupa received technical and safety training. “The new vehicles also possess flat screen televisions with surround sound, which are intended to be used as a paid advertising platform, but in the infancy of the programme were used to promote local city government services.” From its launch in 2015 to 2017, US\$270,000 was invested into the e-Jeepney initiative, with financing coming from new membership and renewal fees of the Muntinlupa Care Card programme.

[E-Jeepney Ride For Free in Muntinlupa Motoring News Video](#)

Source: [\[74\]](#)

Image Source: [Carguide.ph](#)

#### **Box 41: Case Study: Rail Concessions in India**

For travel by rail in India, the Ministry of Railway sets varied discounts according to different disabilities. For most disabilities, including sight impairments, physical impairments and neurodiverse conditions, a 75% discount is available on most tickets, with 50% off for season tickets. People who experience hearing impairments can receive a 50% discount across the board. The concession applies both to the disabled person themselves and a companion, if they have one. To access the discount, the individual must present a certificate from an approved doctor showing that they have an eligible disability. This aspect of the scheme has been somewhat unpopular, although it is recognised that some form of eligibility criteria must exist for schemes such as this.

Source: [\[75\]](#)

#### Box 42: Case Study: UK Transport Concessions

The current English National Concessionary Travel Scheme (ENCTS) was introduced in April 2008. The basis of the national scheme, administered by the country's transport authorities, has remained largely unchanged since its inception, although there have been some changes to the list of eligible services. "The ENCTS covers only local bus services. It does not statutorily include trams, light rail systems, train services, taxis, ferries or Community Transport (although some transport authorities choose to extend the concession to cover these travel modes), nor does it include cross-border travel into neighbouring Scotland or Wales" [\[76\]](#).

In general, the ENCTS seeks to provide an alternative to driving for those who cannot, or can no longer, drive. The ENCTS allows free travel on buses services in England for journeys starting:

- Monday to Friday from 09:30 until 23:00 (both inclusive); and
- Saturday, Sunday and Bank Holidays at any time.
- There are two categories of eligible person:
- Older People – the age limit was originally set at 60 (regardless of gender) but now tracks state pension age;
- People with disabilities – a range of sensory, physical and neuro-diverse conditions are included in the eligibility criteria, but are generally related to conditions that would prevent an individual from being able to drive independently.

Beyond the ENCTS, local authorities can extend the scheme beyond the core hours or to further groups of people, if they wish, and many operators provide their own discounts or concessions which are also additional to the ENCTS. [\[76\]](#).

"Local transport authorities are responsible for reimbursing bus operators for journeys made by passengers in receipt of an ENCTS pass. The Government funds this reimbursement as part of the main Revenue Support Grant for local authorities. In 2018/19 £879 million was reimbursed to local authorities in England by the Government. Around 75% (£662 million) went to authorities outside London. There were 9.1 million concessionary travel passes (8.2 million

older person's passes and 0.9 million disabled person's passes) issued across England, and pass-holders made a total of 884 million concessionary bus journeys. The average value of reimbursement per pass was £83 per year in England outside London and £184 for people who live in London." [77].

For other modes of travel, different schemes are used. On rail services, eligible people with disabilities can purchase a Disabled Persons Railcard, which entitles them and a travelling companion to 1/3 reduced fares. The cost of the railcard is £20 for one year [78]. There are also concessionary rail fares without a railcard for people with visual impairments, and travellers who use their own wheelchair throughout a rail journey – in these cases, discounts range from 34% to 50% [79].

### 6.2.1 Where to start?

The implementation of concessionary fares is very complex, and depends greatly on country-context, existing operating models and ticketing practices. Cities and regions must assess their current system before deciding if operating a concessionary fares policy is feasible or desirable. The most important aspect of a concessionary fares policy within a general transport system is operator reimbursement. Without this, authorities run the risk of disincentivising the carriage of people with disabilities, which is clearly undesirable.

Where subsidy is available but opportunities for reimbursement are not, providing specialised transport services at a reduced fare may be more appropriate. This does not reflect a Universal Design approach, and presents a lower level of service (through reduced capacity) for people with disabilities. Nevertheless, it may be the most pragmatic approach.

Where routes are operated under franchised/commercial contracts, or where there are ambitions for bus operation reform along these lines, there is more opportunity for concessionary fares to be included in route contracts. This should ensure reimbursement of operators to a level where they are 'no better, no worse off' when

they carry people with disabilities on a concessionary basis. Ticketing is necessary to allow this, with smartcards providing a better opportunity to control fraud and collect data on who is travelling.

## 6.3 Information & Journey Planning

For people with disabilities, having access to information in usable formats is particularly important. It helps to avoid unnecessary effort and ensure they can plan journeys with confidence. Knowing what facilities will be available in certain locations (including accessibility features, and specialist services) can be essential to planning a successful journey, and avoiding a trip that cannot be completed. Similarly, basic information about fares and journey costs can be critically important for some people with disabilities when seeking to plan journeys – either because of affordability concerns and/or because it causes uncertainty that some can find discomforting.

### Safety

- Pre-travel information should include safety information.

### Accessibility

- All information should be simple and concise, using pictures and symbols where possible;
- Visual information provided in correct size, colour, format to be easily legible by all passengers including people who experience partial sight impairments;
- Information provided in various formats where possible;
- Data provided in formats which are compatible with journey planning apps where possible and relevant.

### Reliability

- Information on times, services and fares should be accurate and updated in a timely way to reflect changes;
- Unexpected changes should be communicated in various formats, with as much advance notice as possible.



## Affordability

- Information in all formats should be available at no cost.

### 6.3.1 Information

The more detailed information that can be provided about the accessibility of transport facilities (e.g. at a station), the more people with disabilities are able to assess the viability of their planned journey. In general, accessibility information should cover the following areas (UK Code of Practice Guideline A1b/c; [\[62\]](#)):

• Platform width, edge of platform and end of platform;	• Visual and spoken information;
• Local transport interchanges (bus stops, drop-off, and pick-up points);	• Ramps, lifts and escalators;
• Information desks and customer assistance points;	• Stairs, steps and handrails;
• Hours of facility operations (e.g. opening and closing hours);	• Boarding aids;
• Floor surfaces, glass and wall markings, tactile information;	• Car parking facilities;
• Toilets and baby-changing facilities;	• Lighting;
• Station furniture (seating, waiting rooms);	• Level track crossings;
• Ticket offices and ticket vending machines;	• Doors and single-level entrances;
• Commercial outlets, telephones, vending machines;	• Obstacle-free routes through the station.

Information can be provided in a variety of ways. For example, audible information can come from a public address system within a station or stop or be received via a personal hand-held device. Increasingly, information is provided via websites and smartphone apps, but there is a requirement to continue providing alternative formats of information.

Information should be available in a range of formats, including large print, audio and braille (where it is widely used and understood) [\[62\]](#). Accessible formats that meet diverse users' needs are given below:

- Consider which types of impairment/conditions need to be catered for and ensure that materials can be provided quickly if they are requested [\[80\]](#).
- Accessible format options:

- sight-related impairments – audio, audio description, Braille, [Moon](#), telephone.
- neurodiverse conditions and literacy difficulties – audio, audio description, easy read, easy access, [Makaton](#), subtitles.
- hearing-related impairments – Sign Language, [Makaton](#), subtitling, textphone, SMS.
- co-ordination difficulties – large print, audio, audio description, telephone [\[80\]](#).

It is not always possible or practical to provide accessible formats for all types of impairment as standard. There are also ways to reduce demand for special accessible versions:

- Write in plain language.
- Make information as concise as possible.
- Design text to be as legible as possible, for example using a minimum 14-point text size [\[80\]](#).

Information should also be available through a variety of channels, including phone, SMS, the internet and by request from any ticket office or customer information point [\[62\]](#).

Wherever possible:

- Web content should follow the W3C Web Accessibility Initiative’s 14 criteria for “Triple-A” compliance [\[62\]](#);
- Electronic information should be supported by a freephone number [\[81\]](#);
- Real time information should be audio enabled [\[81\]](#);
- Audible information may be pre-recorded or live announcements to deal with particular circumstances;
- The volume of audible information should be loud enough to be clearly heard if the user is unable to control the volume themselves, and if possible, a t-coil (induction loop) should be available for people who use hearing aids. Alternatively, the volume of audio devices should be able to be amplified [\[31\]](#) (see Box 43);
- Tactile information can provide additional assistance for people who experience sight impairments. This is often presented in the form of embossed Braille plates. This may include, for example, information next to a “stop” button, indicating to the visually impaired traveller the purpose of the button [\[31\]](#).

### Box 43: Case Study: Hearing Loops on the Hong Kong Metro

The Hong Kong MTR Corporation (Mass Transportation Railway) opened the city's first underground line in 1979. Today it keeps over 2.3 million people on the move every weekday, making it one of the most heavily used mass transit systems in the world.

People who experience hearing impairments struggled to understand spoken communication at information desks and on platforms due to the very high noise levels in busy stations. Hearing loops were installed in both locations, information desks and platforms, thereby improving accessibility for people who experience hearing impairments throughout the metro network's stations.



Created by Carl Holderness  
from Noun Project

Source: [82]

Image Source: Universal Telecoil / Hearing Loop Symbol. Carl Holderness from the Noun Project

### Box 44: Case Study: Providing information as a comic strip (Atende+, Sao Paulo)

Information regarding Sao Paulo's specialised accessible transport service is provided in a document which includes a comic strip. The comic shows a young boy using a wheelchair with his guardian, asking questions to the representative of the service – a purple hummingbird. The comic strip uses simple language and presents a friendly character for those who might be feeling apprehensive about using the service.

By presenting the information in this way, alongside traditional text formats, it is easier to understand for people who experience some neurodiverse conditions. It is also particularly relevant to children, and supports the use of screen-reader technologies to access the same information that is presented more conventionally elsewhere in the document.

The comic strip is available at:

[https://www.sptrans.com.br/media/1392/regulamento\\_atende-nov\\_17.pdf](https://www.sptrans.com.br/media/1392/regulamento_atende-nov_17.pdf)

Source: [83]

## 6.3.2 Real-time information

There may be changes to a journey or schedule, for example due to delays or weather disruption, which cannot be communicated ahead of time. When this happens, information about what has changed must be accessible to everyone - including people with disabilities.

Real-time information (RTI) can take advantage of telecommunications technologies in order to update and inform passengers about changes to public transport while they are waiting. It facilitates more flexibility and interaction than static visual information. The same digital information feeds that are used within stops and stations are also increasingly being shared directly with passengers via smartphone apps and websites that can be personalised to meet their specific needs.

RTI reflects changes as they happen, helping travellers to react to rapid changes in the transport network. Digital displays can also be used in other ways to show information which might be more likely to change, or to show different types of media including videos. The way that information is displayed on electronic boards (including RTI), as well as the design and placement of the electronic boards themselves are vitally important for the accessibility of the information they display.

### 6.3.2.1 Real-time information screen quality

- Screens should be manufactured from a material that is as matte as possible so as to help reduce veiling reflections (Code of practice guideline K7l; [\[62\]](#)). Veiling reflections occur when a source of natural or artificial light can be seen reflected in the screen. These veiling reflections reduce the contrast between the text and the background and can make sections of the screen unreadable;
- Where LED or dot-matrix displays are used, a clean letter shape should be established. A 32-dot display will provide a clearer text than an 8-dot display, where the letter shape will be broken (Code of practice guideline K3k; [\[62\]](#))

### 6.3.2.2 Siting real-time information screens:

- Linking bus stop numbers / rail stations to an accessible smartphone app enables

passengers to check the service status at the stops they commonly use remotely – and before setting off on a journey [81];

- At larger interchange sites, screens showing real time departures of all bus stops should be displayed centrally within a passenger concourse [81];
- Real-time information signs should be positioned in the line of sight of a waiting customer looking towards the direction of the arriving bus and not obscured by canopies [81];
- It is recommended that low-level screens are also provided where suspended screens are used. This will benefit wheelchair users and people who find it difficult or uncomfortable to look up for long periods of time (Code of practice guideline K7g; [62]);
- High-level screens should be fixed at an angle between 5 and 15 degrees, depending on the mounting height (Code of practice guideline K7m; [62]);
- Consideration should be given to the positioning of screens and to avoid veiling reflections and providing adequate shading from areas of glazing or light fittings. Veiling reflections reduce the contrast between the text and the background and can make sections of the screen unreadable. (Code of practice guideline K7k; [62]);

### 6.3.2.3 Screen settings for digital real-time information boards

- Good luminance contrast between the text and the background will improve the quality of the display (Code of practice guideline K7e; [62]);
- Screen information is easier to read when it is refreshed rather than scrolled. (Code of Practice Guideline K7d; [62]);
- If a scrolling display is used (either horizontal or vertical), each complete word shall be displayed for a minimum of two seconds and the horizontal scrolling speed shall not exceed six characters per second (European Standard Persons with Reduced Mobility Technical Specification for Interoperability (PRM TSI: 5.3.1.1; [62]));
- The text on these displays should be large enough for people to read clearly. If the text rotates, it should not move too quickly for people to read it ([31]);
- Displays shall be sized to show individual station names or words of messages. Each station name, or words of messages, shall be displayed for a minimum of two seconds (European Standard PRM TSI: 5.3.1.1; [62]);
- Systems that give changing information (such as the list of stations on route)

or display alternative information should allow enough time for people to read and comprehend the information before it changes. It is useful if the display times are set to correspond with the amount of information that needs to be read and understood. Consideration should be given to people who experience sight impairments and/or neuro-diverse conditions, to ensure they have enough time to read, digest and understand the information before it changes (Code of practice guideline K7b/c; [\[62\]](#)).

### 6.3.3 Journey Planning

For many people with disabilities, journey planning is an essential part of making travel possible. For people who experience different types of impairments, their journey planning may centre around different priorities (see Box 47). In recent years the development of a wide range of smartphone apps has made it easier for people with disabilities to carry out multi-stage journeys on public transport, supported by various additional elements of transport information. These technological developments support unprecedented independence for many people with disabilities, and are available to anyone with a smartphone in locations where good data feeds are maintained by transport operators and authorities.

However, many mobility services today are offered to customers through digital channels, leaving some, literally, at the side of the road. This is a critical point for some older and people with disabilities, who may feel disoriented by the widespread digitisation of society and the pace of change. It can also be challenging for people who do not have the financial means to purchase a smartphone and maintain a data contract [\[84\]](#). It is important that information remains non-exclusionary and accessible to all, particularly in LMIC contexts where financial disparity can be greater than in higher income countries.

Furthermore, journey planning apps (including Google Transit, Citymapper and many others) are reliant on accurate data. Finding ways to accurately reflect informal transport networks can be challenging, but there are methodologies for achieving this (See Box 45). The data standard that underpins these types of apps is called



General Transit Feed Specification (GTFS), and is open, internationally available and maintained on a not-for-profit basis ([Google](https://www.google.com/transit/gtfs/); [gtfs.org](https://gtfs.org)). Transport authorities can play an important part in maintaining good transport data feeds, which are necessary to underpin journey planning apps and other related tools.

It should be noted that signage and wayfinding information is covered in a later section – this section focuses mainly on service information and how this might be used as part of a journey planning process.

#### Box 45: Case Study: WhereIsMyTransport

WhereIsMyTransport is a mobility technology company based in London with offices in South Africa, Mexico, Peru, Thailand, and Germany. Its data production team works on digitalising network information for both formal public transport (centrally-managed modes which run on fixed routes) and informal public



transport (modes which are owned and operated independently, run on demand, and follow variable routes).

The company works in cities across Africa, South Asia, Southeast Asia, Eastern Europe and Latin America, collecting and maintaining public transport datasets that include fares, vehicle types and on-board facilities. Their consumer app Rumbo provides reliable network information which can help disabled people avoid unexpected barriers, which are at best an inconvenience and at worst may

lead to the termination of a trip.

WhereIsMyTransport maintains a group of data collectors in a city to keep its transit data up to date, recording any changes to the network as they happen. This data maintenance task can involve the support of relevant mobility bodies – including the local transport authority.

Source: [\[85\]](#)

Image Source: [WhereIsMyTransport](#)

#### Box 46: Case Study: Moovit

Moovit was launched seven years ago, in Israel, and has become a widely-used journey-planning and navigation app, with more than 400 million users in 2700 cities across 90 countries. Moovit helps people who experience a wide range of disabilities to use buses, trains, subways, ride-hailing services and other modes of public transit.



In 2018 Moovit combined their offering with the ‘[Be My Eyes](#)’ app, which connects sighted volunteers with people who are blind or low-vision. Be My Eyes and Moovit want to challenge obstacles relating to vision and access to make traveling individually with public transit more accessible for blind and visually impaired people. Be My Eyes is discussed in greater detail in Chapter 3, Section 2 (Box 5).

A testimony from a student who is legally blind and uses the app and shows how influential the app can be: “I am very happy that Moovit is accessible and offers a good amount of information about Moscow public transportation, I feel it adds more confidence and independence.”

Source: [\[86\]](#)

Image Source: [Microsoft](#)

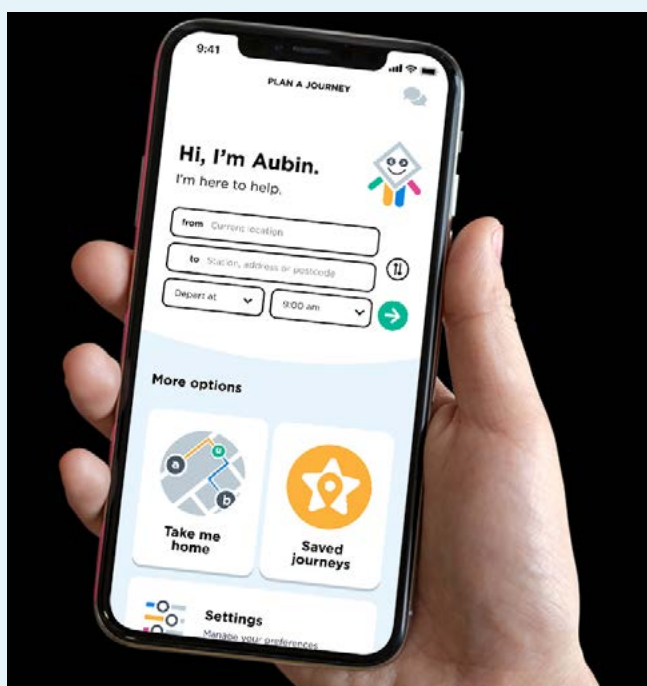
#### Box 47: Case Study: Aubin: A Journey Planning Tool for aAutistic pPeople

Aubin is a new journey planner app designed with the autistic community, for the autistic community. Unlike other journey planner apps, Aubin combines journey planner and travel companion and calculates the least stressful journey for the user, not the fastest or cheapest.

The app has recently launched in the UK. However, as the system uses open source software and data, more widespread international application is easily achievable. Some funding is required to integrate with the local transport IT systems, but Aubin are keen for discussions with transport ministries and other relevant bodies to develop the app in locally relevant contexts.

Source: [\[87\]](#)

Image Source: [Aubin](#)



## 6.4 Where to start?

Reviewing existing information to provide it in additional formats may be the best place to start. This might be best implemented when producing new or updated

information. Information is only useful when it is accurate and up-to-date, so this should be the main focus of providing information in any format. It is also why web- and app-based information may be most editable and simple to keep up to date. Updating existing web content to ensure its compatibility with web accessibility guidelines is also a relatively easy-to-implement change.

Standards can be developed for the provision of new information, following the broad guidelines set out in this section, along with relevant country-specific context. These should then be followed for all subsequent information provision.

Authorities should consider partnering with journey planning apps, which may be able to advise or assist with developing standards for input data. Depending on existing data and the formality of the network, this may include data collection.

While there is a wide range of technology available for the provision of transport information, it may not be most appropriate for immediate implementation. In general, small interventions that are widely available are more useful than inconsistent application of lots of innovations.

## **6.5 Booking transport, Reservations & Passenger Assistance**

Booking transport services and making reservations is usually necessary for any traveller, but often has particular significance for people with disabilities because they must reserve a specific space or request assistance in advance of their journey. Ensuring the process of making a reservation, and providing passenger assistance, is as accessible as possible can be critical in determining whether an individual is able to complete their journey successfully and independently.

### **Safety**

- Where passenger assistance is provided, staff should be trained in appropriate methods for assistance.

## Accessibility

- Transport booking should be possible through a range of channels, with alternative or adaptive approaches provided where appropriate;
- Ticket counters and kiosks should be accessible;
- Fares and information about them should be simple, without complex interactions between types of tickets, for example.

## Reliability

- People with disabilities should be able to book transport or routes using different priorities than might traditionally be used (i.e. physical accessibility or lowest number of interchanges);
- Information on how to book should be clearly displayed and provide various different options. It should be consistent between modes where possible;
- When people with disabilities are required to book a specific space or request passenger assistance, this should always be available at the time and location agreed with the traveller.

## Affordability

- Fares should be consistent with fares for general passengers;
- Where the journeys of people with disabilities may require a longer route, due to accessibility limitations, they should not pay a higher fare;
- Payment options should be varied; including cash, card and mobile payments, for example.

### 6.5.1 Booking transport

Booking transport is a vital aspect of accessing transport. Booking services should allow people with disabilities to reserve their ticket ahead of time or at the point of access, including hailing transport on-street. For booking transport at the station or terminal, a number of aspects should be taken into consideration. For example, the cheapest ticket for the quickest journey may not always be the best option for a disabled person. In many cases, disabled people may find other factors, such as the number of vehicle changes required to make a trip, to be of equal or greater

importance. (UK Code of Practice Guideline N1j) [\[62\]](#).

As discussed in Section 3 of this chapter, as much information as possible should be made available to passengers before they travel, including information relating to routes, schedules, fares and any available assistance. Ideally, there should be multiple ways of accessing reservations, for example both telephone and online reservations, as well as the ability to ‘turn-up-and-go’.

For information on physical accessibility for ticket counters and kiosks, please refer to Chapter 5, Section 4.

- At unstaffed stations, where vending machines are relied upon for ticketing, an alternative means of ticketing, that is accessible for people who experience sight impairments, should always be available (for example, permitting purchasing either on the train or at the destination) (European Standard PRM TSI: 4.4.1);
- Accessibility limitations at some stations, which could lengthen the journeys of people with disabilities, should not cause them to have to pay more for a ticket than non-disabled passengers (UK Code of Practice Guideline N1i) [\[62\]](#));
- Station booking offices should sell a wide range of tickets to passengers accurately and impartially;
- Passengers should be able purchase tickets in a range of ways, including cash, card, via smartphone apps, and any other locally relevant options, including on-vehicles where relevant;
- For hailing transport – e.g. a bus at a bus stop – additional thought may be required to enable passengers with diverse needs to access them. Whilst there is not best practice guidance for this aspect of travel, there are examples of innovative approaches to improving the situation for people with disabilities.



#### Box 48: Case Study: Bus Hailers in the UK

**Pedestrian infrastructure** People who experience sight impairments can sometimes have problems distinguishing an approaching bus from a van or a car. To help, Transport for the West Midlands designed a Bus Hailer showcard that enables the user to show the bus service number that they want to catch, whilst at the stop. The free Bus Hailer is A5 size (148 x 210 mm) and has large black tactile numbers with Braille on a bright yellow background. These can be flipped over to show the required bus service number; the word 'bus' is also available so passengers can still flag down a bus even if they are unsure of the number. The bus driver can spot the Bus Hailer from a distance, and it informs them both that a person is waiting to catch the bus they are driving, and that they may need more time to find their seat when they board (ensuring the driver waits until the passenger is seated before driving away from the stop). It is particularly useful at busy locations where many different buses use the same stop.



Bus Hailers have been used in various UK city regions, including the West Midlands and Greater Manchester, but may have limited application in some contexts – where it may not be appropriate for vulnerable passengers to advertise which bus service they are waiting for.

Source: [\[88\]](#); [\[89\]](#)



Image Source: Henshaws and TfGM

## 6.5.2 Reservations & Passenger assistance

Reserving transport ahead of time may be particularly pertinent for people with disabilities if they need to book assistance for all or part of their journey. Somebody travelling with a wheelchair, for example, may need to reserve a dedicated wheelchair space on-board a train. For people who experience neuro-diverse conditions, reserving a specific bus or train, knowing information about their journey ahead of time can dramatically reduce the stress and anxiety they might feel prior to travelling – making it much easier for them to travel independently. Reservations can have particular importance for people with disabilities who require assistance on their journey, as this often needs to be booked ahead of time.

Even though the required notice period to book assistance under EU law (Article 24, Regulation 1371/2007) is 48 hours, this notice period is already significantly shorter in many EU Member States. In Belgium it has been reduced to 24 hours and will soon be reduced even further to three hours in 18 major stations, in the Netherlands it is one hour, and in Spain the pre-notification period has been abolished completely at staffed stations [\[90\]](#). Although these regulations apply as law in the EU, they present good practice for most other countries.

- Staff should provide assistance wherever required (whenever this is possible), even if a passenger has not booked assistance ahead of time;
- The maximum required notice period to book assistance should be 48 hours;
- Passengers who experience hidden disabilities may also require assistance, though their needs may differ to the needs of passengers with limited mobility.

#### Box 49: Case Study: Passenger Assist on the Great Britain Rail Network

“Passenger Assist provides rail passengers with assistance to travel by rail. The assistance can be booked in advance and includes a range of services, such as meeting passengers at stations and accompanying them to a train, provision of a ramp to get on and off a train and someone to help with luggage. Although assistance may be booked up to 24 hours in advance, passengers can also receive assistance to travel via "Turn Up and Go" without booking in advance, but this is dependent on staff availability.



Passenger Assist is provided by station facility operators (SFOs), with the booking system managed by the Rail Delivery Group (RDG). In 2017-18, there were 1.3 million passenger assists across the GB rail network. On average, there were 3.4 assists per booking.”

However, many people with disabilities are unaware of passenger assistance services that are available when travelling by rail. Of those that are aware of assistance services, it is usually reported that they worked well and increased their confidence to travel by rail. However, when failures in assistance services are experienced, they can be emotionally draining for passengers and lead to negative experiences of rail travel.

Source: [\[91\]](#)

Image Source: Network Rail

### Box 50: Case Study: Sunflower Lanyards to Identify People with “Hidden” Disabilities

In 2016, Gatwick Airport (UK) launched the first-of-its-kind lanyard, which is optional for passengers who experience hidden disabilities and who may require additional support when travelling through the airport. The lanyard allows trained staff to recognise the wearer as someone who experiences a hidden disability. For instance, by wearing the lanyard at Gatwick or other major UK airports, passengers could receive support with:

- Getting more time to prepare at check-in and security;
- Getting a more comprehensive briefing on what to expect as you travel through the airport;
- Staff assisting with reading a departure board or sign.



The scheme has been adopted by a range of different organisations since its launch and is now recognised at large railway stations and on-board trains, supermarkets and other stores, visitor attractions, hospitals and other places.

Source: [\[92\]](#); [\[93\]](#)

Image Source: Hidden Disabilities Sunflower Scheme Ltd

### 6.5.3 Where to start?

As with concessionary fares, booking transport is very specific to the context of the existing network. If all fares are currently paid on board the vehicles/hailed on-street it may not be most appropriate to begin developing new approaches to booking transport as a first step.

Transport authorities should develop programmes for the provision of passenger assistance. This will require staff training. Thought must be given to how these will be accessed in terms of reservations, and how this will be advertised. Depending on the model of staff availability, it may be possible for passenger assistance to be accessed on a turn-up-and-go basis.

## **6.6 Signage, Wayfinding & Navigation**

Beyond providing pre-travel information, travellers also require specific information about how to navigate within transport environments - whether that is in a station, between bus stops, or on-street more generally. There are various considerations to be taken into account when developing signage and wayfinding information, to ensure that it is as accessible as possible.

### **Safety**

- Information signs and boards posted close to but not obstructing passenger circulation areas.

### **Accessibility**

- Visual information provided in correct size, colour, format to be easily legible by all passengers including people who experience sight impairments;
- Adequate lighting to ensure legibility at night, without glare or reflections;
- Key information provided in alternative formats where possible;
- Visual information should be simple and concise, using symbols where possible;
- Clear audible information provided to assist people who experience sensory impairments.

### **Reliability**

- Information must be accurate and reflect any new or temporary changes;
- Colours and designs should be used consistently across a network, for example a specific colour for a metro line.

Affordability

- Alternative and additional formats should ideally be available without specialist or expensive equipment to access them.

6.6.1 Design

Guidance on the layout of signage in terms of size and format has been fairly consistent for many years.

The minimum size of letters and symbols that should appear on signage depends on the distance from which it is read and the degree of visual impairment of the reader. It is recommended that character heights are determined by the formula: reading distance (mm) /100 = character height (mm) (UK Code of Practice Guideline K3f) [62]. The best typefaces to use for signs and information are sans serif (such as Helvetica or Standard), with a width to height ratio of between 3:5 and 1:1. In general, words with lowercase letters are much easier to read than All Caps words using UPPERCASE (capital) letters.

Table 9: Recommended letter sizes and applications for signage

Minimum letter height	Application
200mm	Route number shown on buses and trains
150mm	Long distance reading e.g. signs on building entrances
125mm	Route name/destination on buses and trains
50-100mm	Related condiIndoor use e.g. signs in corridors and stations
50mm	Information on bus stop flags and shelters
15-25mm	Close reading e.g. wall-mounted timetables

Symbols can help significantly to convey a ‘snapshot’ of information, especially to passengers looking for a sign from a moving vehicle. However, it is important for signage to be unambiguous and to be used consistently, to avoid confusion. Regarding the sizes of symbols, the minimum letter heights shown in Table 9 can be approximately doubled to ensure adequate visibility of symbols.



The international symbol for access can be used to identify accessible entrances, routes or facilities within a building, or transport services that are fully (wheelchair) accessible only. Pictures of recognisable landmarks can be used alongside text if these are locally recognised, and information should be presented in a suitable format to facilitate comprehension - for example a schematic map to illustrate the route network, alongside a map showing local landmarks ([\[31\]](#)).

All safety, warning, mandatory action and prohibition signs should include pictograms, although there should be no more than five pictograms, together with a directional arrow, indicating a single direction placed adjacent to each other at a single location (European Standard PRM TSI: 4.2.1.10; [\[62\]](#)). Colours used to convey safety messages should not be used on information signs (UK National Standards BS 8300:9.2.3.2, 9.2.1.4; [\[62\]](#)).

Colour coding on routes and stops can also help people who experience sight impairments, as well as people who are unable to read (and who may experience other neuro-diverse conditions). A clear colour contrast is also important for visibility of signage – guidelines for colour contrasts are shown in Table 10. All signage and information boards should be well lit; it is recommended that lighting levels should be a minimum of 200 lux. (Code of Practice Guidance K8a; [\[62\]](#));

Infrastructure persons of reduced mobility (PRM) signage dimensions can be calculated according to the formula: reading distance in mm divided by 250, multiplied by 1, 25 = frame size in mm, where a frame is utilised (European Standard PRM TSI: Appendix N.2; [\[62\]](#));

Table 10: Guidelines for colour contrasts in signage

Background	Sign board colour	Letter/symbol colour
Red brick or dark stone	White	Black, dark green or dark blue
Light brick or light stone or whitewashed walls	Black/dark	White or yellow
Green vegetation	White	Black, dark green or dark blue
Back-lit sign	Black	White or yellow

### Box 51: Case Study: Pictograms – Mexico City Metro

The metro in Mexico City, designed in 1967, was the first in the world to use pictorial icons for every station. Since then, the network has grown to 12 lines and 195 stations. The pictograms were used for several reasons, including a high rate of illiteracy in the country at the time, but has many benefits for people with disabilities. For people who experience sight impairments, the icons can be easier to recognise than smaller writing, and the colours associated with different lines also offer an easy differentiation. For people who experience learning difficulties, or who may have trouble reading or remembering due to neurodiverse conditions, the icons provide a more

legible system. The icons also provide benefits for visitors to the country who do not speak Spanish, allowing them to use the system as readily as people who live in the city. The icons used in Mexico City's metro are a good example of universal design.

Source: [94]

Image Source: Lance Wyman

#### LINEA 2



### 6.6.2 Placement of signage

The placement of signage is also vitally important. Often, the most accessible route through a station may not be the main route into or out of the station, or to facilities (platforms, toilets and ticket offices). Therefore, there should be adequate and accessible signage to assist people with disabilities when making their way through the station or terminal. There may be ways to indicate some of this as pre-travel information, allowing people with disabilities to avoid potentially lengthy journeys around the outside of a station to locate the more accessible entrance (see What3Words Case Study, below).

Importantly, signs are not a substitute for good, inclusive station design. As far as possible, stations should be laid out in a logical way, so that finding a particular facility within the station is largely intuitive (code of practice guidance K2a) [\[62\]](#). As such, signage should be considered an ancillary measure that is one of a number of important accessibility features that help to ensure spaces and facilities within station environments are legible and easily discoverable by all users.

Wall-mounted signs should be placed at a consistent height of between 1300mm and 1600mm above floor level to be at an optimum viewing angle. Signs that should not be obscured by other people (such as directional or emergency signs) should be higher than 2000mm, or 2100mm above floor level if they are suspended overhead. In large areas like station halls, signs may be higher than this to ensure visibility from a greater distance.

### 6.6.3 Wayfinding and navigation

Signposting should be provided at all points where passengers need to make a route-taking decision and at intervals along the route (European standard PRM TSI: 4.2.1.10) [62]. Provision of static network, timetable and fare information – timetables and route information should be displayed at all times. The accessibility of this information can be optimised by positioning it near thoroughfares, under shelter with large print and braille ([81]).



Image Source: CFL

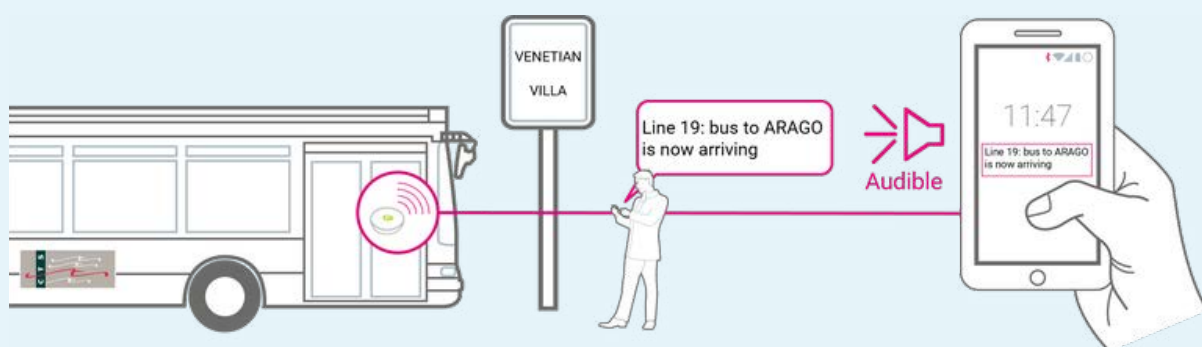
Precise information about navigation and wayfinding can be valuable to people with disabilities, particularly people who experience sight impairments who may not be able to locate their own position easily (required for navigation). There have been various technological advances in recent years which support this, including the use of Bluetooth beacons in conjunction with smartphone apps which allow precise navigation for users inside transport interchanges and in the public realm.

#### Box 52: Case Study: Wayfindr's Open Standard for Bluetooth Low Energy Beacons (BLEBs)

BLEBS are Bluetooth™ transmitters which produce a medium intensity Bluetooth™ signal. The signal can be detected by a smartphone app within a range of approximately 30 metres.

The beacons allow a smartphone to detect the distance from the user to the BLEB. One BLEB enables a smartphone to determine the distance from the beacon, whilst three BLEBs can be used to triangulate the position of the user within the environment. A user must have a relevant smartphone app installed to allow the BLEBs to be used in this way.

The use of BLEBs in indoor environments such as airports or large public



transport interchanges can be particularly useful for blind or partially sighted people to enable confident navigation of unfamiliar areas.

Source: [\[95\]](#)

Image Source: Herow

### Box 53: Case Study: What3Words

Traditional addresses are not accurate enough for modern technology and can be a serious hindrance for those with disabilities.

Addresses to large venues in particular often cover a broad area, pins drop in the middle of buildings and postcodes lead visitors to back entrances or car parks. This makes specific entrances difficult to find, which is especially frustrating for people with disabilities trying to find an accessible entrance.

Some venues are solving this challenge with what3words - the location technology app making exact locations easier to find. Those with mobility impairments can use what3words to find exact entrances or share and describe accessible routes with others. People with visual impairments are able to input a precise address by voice through the app, (what3words is the first addressing system optimised for voice input). Also, the OCR scanning function appeals to those who find it easier to digitally scan an address, rather than reading it.

what3words has divided the globe into 3m x 3m squares and given each square a unique combination of three words: a what3words address. For example, navigating to `///filled.count.soap` will take you to the exact 3m square in front of the gate of the what3words offices in West London.

Given the simplicity and accuracy of what3words, many venues in the UK are now providing their what3words address to ensure all visitors have the confidence of knowing exactly where they're going. The O2 Arena has just added what3words to their accessibility page and Alexandra Palace also uses what3words to help its visitors find their way around the site more easily.

Source: [\[96\]](#)



Image Source: [What3Words](#)

#### 6.6.4 Where to start?

All signage in newly constructed transport facilities (stations, ranks, stops) should follow good practice guidelines. The refurbishment or maintenance of existing facilities also presents good opportunities to improve the quality of signage and information. Where new facilities are being provided or where layouts are changing, care should be taken that the layout of facilities is at least partly intuitive.

While there is a wide range of technology available for the provision of signage and wayfinding information, it may not be most appropriate for immediate implementation. In general, small interventions that are widely available are more useful than inconsistent application of many innovations.

### 6.7 Specialised Transport Services

Specialised services refer to transport services that are specifically tailored to the diverse needs of people with disabilities. Specialised services usually use vehicles that provide full access to wheelchair users through mechanical lifts or ramps, but



differ from regular public transport in the way they are operated. Service models range from door-to-door services that exclusively serve people with disabilities, to ‘service routes’ which also serve the general public but which travel close to the origins and destinations of elderly and people with disabilities. Accessible (metered) taxis, although not a specialised service, are also used to provide kerb-to-kerb services for people with disabilities.

The use of specialised transport services acknowledges that regular public transport cannot meet the needs of all people with disabilities. For example, some people with disabilities are simply unable to walk to, board, or travel independently in public transport vehicles due to the impairments they experience. Specialised transport services are usually more expensive to provide (on a per passenger basis) than accessible regular public transport systems. However, such services are publicly funded in several LMICs, including Sao Paulo, Brazil; Cape Town, South Africa; Kuala Lumpur, Malaysia (door-to-door services); and Puebla, Mexico (service routes).

Private hire specialised transport services are increasingly available and provide commercially operated options for specialised transport services. However, these may not yet be deliverable in low- and middle-income countries, where many people with disabilities also live in poverty and may not be able to afford such services. Driver training and consultation with people with disabilities, to understand whether they want and how they can access these services, remain relevant to all countries. This is particularly true for demand-responsive services which are becoming more commercially viable, and operationally flexible, due to the increasingly worldwide availability of smartphones and apps.

Whether specialised transport services are provided publicly or privately, as stand-alone or substitute services, they all need to adhere to the guidelines for accessible vehicles set out in Chapter 4.

Some general considerations for designing specialised transport services include the points below.

## Safety

- Vehicle design and features are safe to avoid injury;
- Lifting equipment and ramps designed and operated safely to avoid injury;
- Vehicles driven smoothly and considerately.

## Accessibility

- Easy and unhindered boarding via steps (if any);
- Level boarding for wheelchair users into vehicle;
- Hand grips and steps highly visible;
- Easy stowage of mobility aids (wheelchairs, assistance dogs, walkers);
- Signage identifying vehicles and specialised services;
- Call-in telephone services for reservations or queries (if any) with text telephone/ Telecommunication Device for the Deaf (TDD);
- Alternatives to telephone booking for non-telephone owners.

## Reliability

- All advertised accessibility features available and working;
- Driver/staff provide helpful service and special assistance where needed.

## Affordability

- Affordable fares, possibly achieved through concessions, for people with disabilities;
- Dedicated funding for school transportation that meets the needs of children with disabilities (see [Access Exchange International's, Bridging the Gap, Section 8](#)).

### 6.7.1 Choice of vehicle

Current door-to-door services typically use small vehicles (mini or midibuses) as they are cheaper to operate (especially if a ramp can be used for wheelchair access rather than mechanical lift). Small buses may also be better able to negotiate narrow lanes, and poorly-maintained roads, in residential areas where regular public transport vehicles do not operate. In some parts of the world volunteer drivers carry disabled passengers in their own car. Such services can be very useful in low density areas

where conventional public transport is scarce, but since regular private vehicles are used they can only serve ambulatory passengers and wheelchair users who are able to transfer to a car seat.

Service routes are usually operated by medium or full-size vehicles with higher capacities than door-to-door services. Vehicles are fully accessible, preferably low-floor or with ramps or lifts.

### **6.7.2 Choice of operator**

Some door-to-door services in the US and Europe are contracted out to private operators, many of whom are taxi companies using regular taxis and wheelchair accessible taxis or vans to provide the service in urban areas. Contracting the service typically results in lower costs to the subsidising agency, as taxi operators frequently accept relatively low profit margins and provide an efficient service [\[63\]](#). The use of taxis especially in urban areas takes advantage of the inherent efficiency of the taxi system in high demand areas using vehicles with lower capital costs and operating costs than other vehicle types that could provide such a service.

### **6.7.3 Trip reservation**

Reservations for door-to-door service are traditionally made by telephone between two days and a few hours in advance of the trip, although technological developments mean that services are increasingly booked using a smartphone app shortly before the journey begins. As discussed in the previous section (Booking Transport, Reservations & Passenger Assistance), alternative channels for booking should be supported as much as possible.

### **6.7.4 Route planning & vehicle scheduling**

Thought needs to be given to good scheduling of vehicles, to ensure vehicles carry as many passengers as possible on each trip, without requiring people to wait for too long. If stops are ‘clustered’ in the same neighbourhood or corridor rather than

scattered over a large area, more passengers will be carried at a lower cost per trip, making the service more cost-effective. Although software is available for automating the scheduling exercise, simple manual scheduling techniques undertaken by a person who is familiar with the operating area, have been shown to be adequate for systems with less than 25 vehicles.

Service routes operate along fixed routes which are specifically chosen to connect origins and destinations frequently used by older and disabled passengers. Routes may run past retirement homes, home-care facilities, medical facilities, social service facilities, and shopping areas. Consequently, the routes maximise access to various destinations, while minimising walking distances, but often comes at the cost of increased travel time as routes are more circuitous. In Johannesburg, South Africa, there are several routes where buses stop at organisations of people with disabilities. These include the Soweto Workshop for the Blind, the National Council for Persons with Physical Disabilities, and special schools [\[97\]](#).

Recent developments in technology have allowed more widespread availability of Demand Responsive Transport (DRT), administered through apps with routes calculated by user-friendly software tools. Community transport can be operated on this basis, as well as privately run transport services which may provide for the general population as well as people with disabilities. This model may make the provision of specialised transport services more financially sustainable.

Service routes also often have more flexible pick-up/alighting points, including stop-on-demand (instead of only at designated bus stops) and possible route deviation. With route deviation services it is possible to deviate slightly from the core route on request. The timetable usually allows more time at stops than on conventional services. Both service routes and door-to-door services can be used to provide a feeder service to accessible bus routes or rail stations.

### 6.7.5 Fares

Door-to-door services typically charge between one and two times the fare for an equivalent trip by other urban public transport options. As with other accessible services, specialised services should be priced to ensure that people with disabilities – many of whom have very low incomes – can afford to use them. However, this often requires higher subsidies from government, as the services are more expensive to provide than general use services.

In general, services need to have a level of financial sustainability if they are to be successful in the longer term – this can work in favour of services which do not serve only people with disabilities.

### 6.7.6 Eligibility

Restricted capacity usually forces service routes and dial-a-ride services to limit eligibility for the service to people with disabilities. Consequently, passengers are usually required to pre-register for using door-to-door services. Best practice in eligibility certification uses face-to-face contact with potential users to determine if they are eligible for specialised services (for instance if they are functionally unable to use regular public transport) [\[63\]](#). This is considered a better approach than simply screening people on the basis of the nature of the impairments they experience.

Where extra capacity exists, the service can be marketed to other potential passengers in order to become more cost effective whilst providing a service in an increasingly integrated setting. A premium fare could potentially be charged to non-disabled passengers to increase revenues and ensure the sustainability of the service. However, care must be taken to ensure that these processes only make use of unused seats, rather than incentivising preference for these premium-paying passengers.

The eligibility process can be used to ensure that subsidies are targeted at those who really need them, for instance benefitting people who cannot readily use any other transport services.

### 6.7.7 Assistance

Drivers and assistants of door-to-door services and service routes should be trained to provide a high-quality service for people with disabilities. Assistance should be given boarding and alighting and to ensuring wheelchairs are correctly secured so that their occupants are safe to travel. This is covered in more detail in Section 4 of this chapter.

#### Box 54: Case Study: Sao Paulo SPTrans Atende+ Service

A free door-to-door service operates in São Paulo using 265 lift-equipped vans for poor people who are certified to experience severe mobility problems. Atende+ is offered by the Municipality of São Paulo and managed by São Paulo Transporte (SPTrans). It is operated by public transport companies and accessible taxi cooperatives and is aimed at people with autism, deafness, blindness or a physical impairment that results in a high degree of severity and dependency. Atende+ uses specially adapted, liveried vehicles and runs approximately one million kilometres per month.

The service is available from 7am to 8pm, Monday to Sunday, except holidays, and is provided free of charge to registered customers. ‘Weekend events’ are services provided by institutions that work with people who experience physical impairments.

The system is oriented towards independent living, with many allowable trip purposes within an overall focus on trips to rehabilitation centres, schools and hospitals. The service pursues efficiency by limiting trips to within each of the nine large districts which divide up the city. Feeder services to accessible bus lines provides service between districts.

São Paulo’s door-to-door services are financed by monthly payments from the concessioned fixed-route bus operators, with quotas based on the number and kilometres of their vehicles. Van drivers are selected by the various bus operators and they must complete training sessions focused on (1) relations with



passengers with disabilities, (2) driver training, (3) different types of disability, (4) regulations and management governing the service, and (5) mechanics of vehicles.

Source: [\[98\]](#); [\[99\]](#)

### Box 55: Case Study: Uber Access in Bengaluru

Uber Access is an example of a specialised transport service run by a private company, and accessed through a smartphone app.

Uber Access is Uber's forward-facing wheelchair accessible product. All vehicles are fully wheelchair accessible and available for riders in non-foldable wheelchairs which generally cannot fit into most taxi cabs. UberAccess driver partners are top-rated partners who have received comprehensive in-person training from Diversity & Equal Opportunity Centre (DEOC - an Indian social enterprise that promotes the inclusion of people with disabilities). The training includes going through accessibility exercises, demonstrations on how to fold and unfold wheelchairs and on how to guide people who experience sight impairments. These driver-partners also have access to special learning modules to further their knowledge in this area. Furthermore, Uber



Assist was jointly launched in Bengaluru with Uber Access, to cater to the needs of persons who might require assistance during their journeys.

In the UK, in addition to Uber Access, Uber also offers Uber Assist - an option for those who need additional assistance in a standard uberX vehicle. This is particularly useful for older people, riders travelling with assistance animals,

those who experience sight or hearing impairments, or riders with foldable wheelchairs. Driver partners are eligible to opt in and sign up to Uber Assist once they have completed free online disability equality training developed by our disability partner Transport for All.

Source: [\[100\]](#), [\[101\]](#)

Image Source: Uber Assist in Bengaluru

### 6.7.8 Where to start?

Providing subsidised door-to-door services should be considered if funding can be raised and commercial operators are unable to meet this travel demand. Specialised services for people with disabilities are the most common first step to meet the diverse needs of people who are unable to use other forms of public transport - especially wheelchair users who do not have access to private vehicles. Door-to-door services can often be initiated more quickly than the time needed to make network-wide accessibility improvements to existing bus and rail services. Door-to-door services also do not rely as heavily on the delivery of accessible footways and other infrastructure as bus and rail services. One approach that has been used successfully, in demonstration projects such as in Cape Town, is to initially limit the areas served by door-to-door services so that vehicles do not have to cover a large area of the city. Productivity can also be enhanced by choosing areas with higher concentrations of persons who are likely to require the service.

Service routes are also more expensive to operate than regular bus and rail services, although productivity may be higher than with door-to-door services. Yet this may be an approach particularly suited as an interim solution in lower income countries where accessibility of mainstream public transport systems is poor. Targeting initial funding at carefully designed service routes may ensure it is focused on meeting the mobility needs of people who cannot use other travel options. Service routes can be initiated inexpensively by using existing buses retrofitted with wheelchair access equipment and other accessibility features.

It remains necessary to go beyond this and invest in upgrading the rest of the transport system, because this will ensure the needs of most passengers (including people with disabilities with diverse needs) can be met cost-effectively in the long run. It also represents an important equality objective for many people with disabilities – enabling them to use the same transport services as everyone else.

## 6.8 School Transport Services

School transport services follow many of the same principles laid out for service-route specialised transport services. Detailed discussions on school transport for children with disabilities are relatively recent and made more difficult by lack of research on this topic in low-income countries. Even so, data shows that transport is a key barrier to education for children with disabilities. One estimate suggests that attendance at certain schools in LMICs would increase by an average of 24% if appropriate transport was available to students with disabilities [\[102\]](#).

School transport is particularly challenging in rural locations and viable modes of transport will vary between rural and urban settings. However, many of the basic principles of transport accessibility covered by other sections of this guide apply. Interventions specifically relevant to school transport are covered below.

While this section addresses ideal standards, it is understood that the situation currently facing disabled school children in many regions forces parents and other stakeholders to make decisions that may compromise safety in order to ensure their children to receive an education.

### Safety

- Routes from residential areas to schools should be well lit, and benefit from overlooking homes and commercial land uses providing ‘passive surveillance’ to enhance safety;
- Accessible crossings should be provided in the vicinity of schools;
- Road signs that warn of children crossing the road should be installed;
- Children with disabilities who are making long journeys should not be encouraged

to travel alone;

- Children should receive education on what to do and how to get help if they have a problem whilst travelling to school. This is particularly beneficial to children with disabilities who may face more challenges accessing transport and the built environment.

### Reliability

- Routes to schools should be well sign-posted;
- Consistency of vehicle accessibility, with vehicles identified by route where multiple routes serve an area;
- Drivers of school transport vehicles should have specialised training.

### Accessibility

- Travel training with a volunteer, peer or family member can help children with disabilities to learn their route to school;
- Guidance on accessible footways and public transport stops should be followed. See Chapter 5, Section 1;
- Vehicles used for school transport should provide accessibility features for wheelchair users when needed.

### Affordability to the provider

- Support can be offered to individual families based on their access needs;
- Volunteer community schemes for taking children to school should be explored where funding is limited;
- Where school catchment areas are compact, a school bus service may be commercially viable.

## 6.8.1 Pedestrian transport

Children are often particularly reliant on pedestrian access for journeys to school. While many children walk 5-6 miles (8-9 kilometres) to school, this is significantly further than a mobility impaired child would be likely to manage. Therefore, accessible footways are particularly important for school transport. See Chapter 5, Section 1 for

more information on accessible footways. Where children are likely to be walking to school, directions should be well sign-posted and easy to follow. A child-friendly design may help children to identify which signs to follow.

‘Walking school bus’ or ‘buddy’ schemes can be helpful for children travelling in the same direction. Road safety education, with specific support for children with disabilities, engenders safe travel to school. Speed reduction measures, such as speed humps, should be used around schools and on routes with high volumes of school-bound pedestrians. This is especially important near crossings that are regularly used by children with disabilities. Crossings should coincide with pedestrian desire lines near schools to discourage children from crossing informally. Table-top pedestrian crossings around schools can help to make children using the crossing more visible to traffic and act as a traffic calming measure, allowing children with disabilities more time to cross safely. These challenges are faced by all people with disabilities who need to travel, but children are especially affected as it prevents them from accessing education, leading to poverty.

### **6.8.2 Public transport**

In some cases, children with disabilities can catch the bus, or other public transport vehicle, to school. However, buses are often unavailable, especially in rural areas.

Where a bus service is available, if the vehicle providing the service is likely to vary, the level of accessibility should be consistent. Bus stop placement and quality is important. See Chapter 5, Section 1 for more information on accessible footways and Sections 3 and 4 for accessible bus stops. Ideally, buses and other vehicles should be fully wheelchair accessible via ramps or lifts, with access features once within the vehicle. Ideally, drivers should receive training on the needs of children as well as adult passengers with disabilities. Parents or other assistants should be available as required by children using public transportation and should follow the measures set out in Chapter 4.

### 6.8.3 Dedicated school transport services

Assessing the level of need is a good place to begin. School transport should broadly follow the guidelines laid out throughout this guide, while allowing for specialised training of transport staff and necessary liaison between educators, transporters, parents, medical personnel, and others.

As with many accessible transport services, the design of dedicated school transport services will be dependent on the specific context of the location (urban / rural, large city / small town) and the education arrangements for disabled children. In many locations around the world, most students with disabilities travel to school in the same way as non-disabled peers. While it varies from one location to another, research by Access Exchange International has found that up to 25% of students with disabilities are dependent upon specialised school transport services to enable them to get to school. These students typically require:

- Bus vehicles that can accommodate their specific needs;
- Appropriately trained driver(s) who can regularly operate the service from a student's home to school and back;
- Information about their needs to be understood and shared with the transport service provider;
- Parents willing to entrust their child with the service provider – typically achieved by accompanying their child on a journey to ensure the driver (and any attendants) are able to understand and meet their needs.

All four of these criteria must be present for successful transport to occur. If even one of them is missing the transportation of the student may be compromised. This often requires a high degree of collaboration, and an ongoing dialogue, between educators, specialised school transport providers, healthcare providers and parents. Healthcare plans for students with disabilities should be shared with all parties, along with protocols associated with any medication that the student may need to take with them to school and agreed protocols for challenging behaviours or medical symptoms (such as seizures).

Drivers and attendants should be trained (as a team, ideally) to accommodate the



specific needs of the students with disabilities that they will be support. Typical topics for such training include:

- Strength and mobility requirements for serving special needs;
- Prevention of child abuse and bullying;
- Proactive pupil and behaviour management techniques;
- Responding to medical challenges including seizures, bloodborne pathogens, and infectious disease exposure;
- Characteristics of different disabilities;
- Handling student data confidentially;
- Supporting medically complex students;
- Wheelchair securement and evacuation;
- Emergency evacuation for students with special needs;
- Methods of communication;
- Proper handling of adaptive/assistive devices;
- Basic sign language;
- Quality of ride;
- The student loading / unloading process;
- Basic emergency first aid;

Notwithstanding that some children may have very specific mobility needs that define the provision of their school transport service, they should, wherever possible, be treated the same way as their non-disabled peers. Accommodating the student's disability should be focused on ensuring they are able to travel safely and with dignity, thereby providing the 'least-restrictive' environment possible for their journeys to/from school.

Other key considerations when planning and designing specialised school transport services are:

- Understanding the riding time that a student with disabilities may be able to tolerate, which can often be a function of any medical conditions they experience;
- Ensuring bus attendants are available for students with particularly complex needs, that they work as a team with their driver(s) and that they are appropriately trained;
- Accompanying students to/from the vehicle loading zone, wherever necessary, so as

to ensure their safety and comfortable journeys;

- Providing clear and simple signage/information for disabled students when they are boarding/alighting and on-board specialised transport services – recognising that pictograms and visual imagery are likely to be more appropriate for some students with disabilities;
- Seeking to lessen, over time and through gradual steps, the extent of assistance a student with disabilities requires from specialised transport service providers. This helps to ensure that individuals are well prepared for journeys they may make after graduation – e.g. to access further education and other opportunities – and can take the form of training for the students themselves.

Many of these recommendations and guidelines are drawn from AEI's 'Let's Get Disabled Children to School' publication [103].

#### **Box 56: Case Study: Curitiba Integrated Special Education Transport System (SITES)**

Curitiba, Brazil, has a range of accessible public transportation to serve all its citizens, including disabled people. Bus Rapid Transit – typically offering a range of access features which make it easier for older and disabled people to use – was pioneered in Curitiba many years ago and has since been implemented in cities around the world. The city has also pioneered an effective means of helping disabled children travel to school. The city's public policies related to transportation for disabled children goes back to the 1980s, when city planners responded to requests from parents unable to afford transport for children with diverse needs. The system was originally operated by the same bus companies providing regular public transportation. It was subsidised by the municipal transport system except for the costs of attendants on the buses, which were paid for by rehabilitation and charitable agencies.

Curitiba, Brazil's SITES (a Portuguese-language acronym for Integrated Special Education Transport System) system operates as a courtesy service integrated with the main public transport system, bringing disabled children from across the city via private buses to a central terminal, where they transfer to other

vehicles traveling to their schools [104]

“SITES currently has 60 buses operated by nine contracted bus companies. The SITES vehicles average nearly 8200 km travel per day. The buses make daily runs on 55 routes that carry 2500 students to and from 35 different special education schools. Most of the schools are private schools, while a few are public. The service is free to parents and caregivers.

Of the 55 bus routes, 34 provide direct service between students’ homes and their schools. These routes serve 1391 students. The other 21 routes, serving 1126 students, connect with a terminal where students transfer between buses which dock around the perimeter. The students then proceed to their destination schools which typically are specialised for one or another type of disability (e.g. blind and low-vision, or deaf and hard of hearing). Transfer time is programmed to not exceed 15 minutes. The transfer area is protected by railings and is fully monitored. Students are guided between buses by bus and terminal personnel. The terminal has private bathrooms for boys and girls, including a toilet with a shower and a first aid room. The transfer saves time and reduces operating costs by (1) picking up children clustered in a single neighbourhood while (2) being able to deliver the children to and from a specific school.” [103]

Source: [103]; [105]

#### **6.8.4 Other transport**

In rural settings, some children may travel to school with the assistance of animal traction. Water troughs should be available along the route where this is the case. Cycles can be helpful for children who have long journeys to schools. See Chapter 4, Section 3 for adapted cycles.

### 6.8.5 Where to start?

Assessing the level of need is a good place to begin with this. Providing specialised transport to schools for children with disabilities or that have a particularly high proportion of children with disabilities might be the best places to prioritise funding for specialised school transport. School transport should broadly follow the guidelines laid out throughout this guide, but may also require innovative operational models in order to run with efficiency. Designing these systems will be dependent on the specific context of the location – whether it is urban or rural, the size and sprawl of the city, and the education arrangements for children with disabilities.

## 6.9 Training

Wherever public transport services have become increasingly more user-friendly towards people with disabilities, the training of staff, managers and officials has been an important element. In many LMICs, this is particularly important as managers, drivers and conductors often do not have a service ethos towards their passengers, let alone sensitivity towards people with diverse needs. People with disabilities consistently identify attitudinal barriers and ignorance as a major barrier restricting them from using public transport.

Part of the objective of improving public transport access will only be achieved if governments, users, and operators partner to establish a more customer-oriented culture in public transport service provision. But experience has also shown that the needs of people with disabilities can better be served if staff are not only courteous and helpful, but are also equipped with specific knowledge on how to serve people with specific and diverse needs. Well-trained staff are also important to retaining existing passengers and attracting new passengers to public transport by improving the quality of the service.

Another aspect of training relates to the training of people with disabilities on how to use the public transport system. This so-called ‘travel training’ can help some people with disabilities – particularly those with visual or cognitive impairments – to be able to travel without assistants, thus enhancing their independence.

## Safety

- Driver training should emphasise safe driving;
- Staff trained in safe handling of wheelchairs, walkers etc.

## Reliability

- Staff able to think on their feet in emergency or unexpected situations.

## Accessibility

- Training could enhance service delivery for people with disabilities without unfair discrimination or prejudice;
- Knowledge of how to mitigate effects of inaccessible places, vehicles, services etc;
- Carriage of necessary mobility aids should be possible, ideally without being separated from the user (as far as practicable).

## Affordability

- Drivers/conductors trained not to charge extra for passage of necessary mobility aids (wheelchairs, assistance dogs etc.).

### 6.9.1 Staff training

Training courses in disability awareness have been developed in many countries across the world, including some developing countries (Box 57). The United Kingdom's DPTAC suggest the following elements should be included in courses [106]:

- Barriers faced by people with disabilities, covering attitude, environment and organisation;
- Principles of access audits: how to identify accessibility and inaccessibility;
- Information on all disabilities, including hidden disabilities;
- Suggestions for removing barriers faced by people with disabilities (including changed driving behaviour to improve safety for disabled passengers), and the skills needed for serving disabled travellers (for instance, how to 'push' and 'brake' a manual wheelchair);
- Communication and interpersonal skills for communicating with people with

disabilities, particularly those with a hearing impairment or with learning disabilities (including etiquette and language – (See accompanying document ‘Part 1’ of this guide, ‘Guidelines for Policymakers’, for some guidelines on how to use language relating to disability);

- Enabling staff to deal with unexpected occurrences – to ‘think on their feet’ when a problem arises (this could include basic first aid training if needed).

Disability awareness training should be based on the Social Model of Disability (see Section 4 of Chapter 2 in Part 1 of this guide), in order to help transport staff to view their jobs in terms of promoting equality, rather than undertaking welfare work. It is usually very useful to involve organisations representing people with disabilities directly in the training, for instance by inviting representatives to present some or all of the topics mentioned above. Furthermore, it is very important to expose not just front-line staff (such as drivers and ticket collectors) to disability awareness training, but also those who design, plan and manage transport systems, as it is managers who help set the ethos of the organisation and who drive decisions regarding access improvements.



Figure 66: Wheelchair user Anjlee Agarwal briefs auto-rickshaw drivers about the access needs of wheelchair users during disability awareness training workshops in Delhi, India

#### **Box 57: Case Study: World Bank’s Transit Access Training Toolkit**

The Transit Access Training Toolkit was first developed in 2009. The focus of the toolkit is to improve operator attitudes to customer service and driving habits which often significantly impact older passengers and people with disabilities. The toolkit provides (1) a set of posters promoting safety and courtesy by transit drivers for disabled passengers; (2) pocket-size handouts for bus, taxi, and other transit drivers and staff; (3) public service announcements for the general public and transit staff; and (4) ideas for outreach to bus drivers and others in



situations where there has been little or no capacity to provide needed training. The Toolkit is available free of charge in English, Spanish, and Portuguese. It can easily be translated into other languages and modified to fit local conditions around the world.

The development of the Toolkit materials benefited from focus groups in Mexico City and New Delhi, India, involving nearly ninety bus drivers and transit staff as well as people with disabilities. The materials are also being reviewed by transit professionals and disability leaders in other countries. As part of its access training in Delhi, India, Svayam subsequently ran a campaign aimed at encouraging safe driving practices by installing posters on bus shelter billboards.

Source: [107]

<p><b>DRIVER RESPONSIBILITIES</b> (taxi service, continued next page)</p> <ul style="list-style-type: none"> <li>• Drive safely and smoothly.</li> <li>• Treat passengers with disabilities &amp; seniors with courtesy and respect.</li> <li>• If possible, phone the passenger if you will be more than __ minutes late.</li> <li>• Phone the taxi office if the passenger is more than __ minutes late.</li> <li>• Help passengers to and from their door and into the vehicle. Make sure their seat belt is fastened.</li> <li>• <b>Assist</b> if needed by carrying up to 2 packages weighing not more than __ kg each.</li> <li>• Fill out log sheets for each trip.</li> </ul>	<p><b>DRIVER RESPONSIBILITIES</b> (bus service, continued next page)</p> <ul style="list-style-type: none"> <li>• Always pick up passengers with disabilities and seniors. Be courteous and respectful.</li> <li>• Allow time for passengers with disabilities to sit down or hold on.</li> <li>• Allow time for them to get up from their seat and alight after you stop.</li> <li>• Drive safely and smoothly. Avoid sudden starts and stops, slow down before curves, and stop as close to the curb as you can.</li> <li>• Call out major stops and requested stops for blind passengers.</li> <li>• Speak to deaf or hard-of-hearing passengers in a normal voice, looking directly at the passenger.</li> </ul>	<p><b>TO REQUEST A FREE SET OF TRANSIT ACCESS TRAINING TOOLKIT MATERIALS</b> for bus, minibus, and taxi agencies in your community, contact Tom Rickert:</p> <ul style="list-style-type: none"> <li>• E-mail: <a href="mailto:tom@globalride-sf.org">tom@globalride-sf.org</a></li> <li>• Fax to 1-415-661-1543</li> <li>• Write c/o</li> </ul> <p><b>Access Exchange International</b> 112 San Pablo Ave. San Francisco, CA 94127, USA</p> <p>The Toolkit will be available in English, Spanish, or Portuguese as an e-mail attachment (preferred), or in hard-copy or CD versions.</p>
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### 6.9.1.1 Disability simulation

One way of exposing non-disabled staff to the issues faced by people with disabilities when travelling is to engage them in simulation exercises. Disability simulation exercises could consist of putting participants in wheelchairs or blindfolding them.

### Box 58: Case Study: OpenVisSim

OpenVisSim is a free virtual reality simulator of many of the symptoms of common visual impairments (e.g., glaucoma, AMD, diabetic retinopathy, etc.). Simulators, such as OpenVisSim, are often used to help communicate the day-to-day challenges that visually impaired individuals may experience. Whilst even the most sophisticated simulator will never be able to recreate exactly ‘what it is like’ to see through somebody else’s eyes, advanced simulations are sufficiently realistic to be of practical utility.

OpenVisSim is due to be replaced by VARID (A]ugmented [R]eality for [I]nclusive [Design]) in late 2021.

Source: [\[108\]](#)

### Box 59: Case Study: Luxembourg Railway Company Staff Training

“Accessibility training is given to staff at the Luxembourg Railway Company and comprises a one-day training session including theoretical information and practical exercises. One of the key objectives of the training is to increase the number of people with disabilities able to use public transport by improving the reception and

assistance that they receive from staff both at stations and on-board the train.

The training was implemented because there had historically been a high level of complaints from

disabled passengers. The training is run by five disability organisations that represent the needs of different groups of People with Limited Mobility (PLM), including physical mobility, cognitive, hearing and visual impairment. The trainers include people with disabilities, and members of staff from the railway company.



Each course lasts for one day and takes between one and three days to prepare. The cost of each training session is around \$1000 (USD) and the total annual operating cost is between \$4000 and \$5200 (USD). Since the training has been put in place, it has been fully integrated with routine staff training and takes place three to four times per year. Feedback from trainees has been very good, and complaints from people with disabilities have reduced.”

Source: [\[31\]](#)

Image Source: CFL

## 6.9.2 Training of users

In many cases, orientation, also called ‘travel training’, can be offered to assist new passengers who have never travelled by public transport before. Training may be especially important to people who experience neuro-diverse conditions, many of whom can independently use public transport if it is reliable and predictable. Public transport operators can work effectively with organisations representing people with disabilities and social workers to promote travel training. It is beneficial to include road safety education in travel training to reaffirm the basics regarding safe places to cross the road.

Another aspect of travel training is to provide skills for accessing built environments that are currently inaccessible. This has particular relevance for wheelchair users, who may need to negotiate poorly designed ramps, steps and speed bumps on a daily basis. Providing training on how to navigate these obstacles, as well as dealing with falls, for example, can provide independence for people with disabilities who otherwise might face insurmountable barriers in the built environment.

- **Travel training can be delivered in a range of contexts**, including general awareness raising events, face to face advice, information and guidance, journey support and assistance, and vocational or academic training programmes concerning all aspects of undertaking a journey. It may cover aspects of travel such as pre-journey planning, finding a transport stop or station, identifying the correct

vehicle, purchasing a ticket, boarding and alighting the vehicle, communicating with the driver and other passengers, and what to do in an emergency [31].

- **Travel training should be adaptable to fit the local transport model.** The ‘bus in the classroom program has a complete transportation skills curriculum which should be applicable as a model for transporters in a variety of countries. Even if accessible transportation in other countries involves different skills, the teaching curriculum can still be applied’ [102].
- **Ideally, travel training should begin at an early age:** ‘travel training in primary and secondary schools enables disabled students to live more independently as they progress into adulthood’ [102].
- **Travel training can take place either in a classroom setting, or out in the field.** It usually involves a travel trainer advising and assisting a trainee through the various aspects of making a journey as outlined above. This type of training is often tailored to the needs of the individual [31].
- **Travel training can be delivered by a range of organisations,** including local government, the local transport operator or a charity [31]. In the UK and the USA travel training is often given to school children with cognitive impairments to enable them to travel independently and reduce the need for specialised transport. Some similar schemes are also provided for adults, for example to help them travel to employment.

Travel training can be thought of as an extension of pre-travel information, improving the independence of people with disabilities when making routine journeys – thereby reducing their potential reliance on staff assistance.

#### Box 60: Case Study: Vida Independiente, Mexico City

Vida Independiente run intensive training courses for wheelchair users in the 32 states of the Mexican Republic and 17 countries in Latin America. The camps or intensive courses take place for seven consecutive days, where people with disabilities live 24 hours a day with other people with disabilities and a range of professionals including physical and occupational therapists, rehabilitation doctors, Government officials, businessmen, family members. The course instructors are people with disabilities themselves who are fully included

in society. The specialised team of instructors facilitate both emotional and physical training, teaching participants skills in handling their wheelchair, practical knowledge for inclusion and personal life experiences.

The programme deeply appreciates the differences between each individual's experience of their impairments, and tries to provide relevant training. As part of this, the paired instructors are required to have a similar level of impairment as the participant – for example, if the participant's spinal cord injury level is C6, the instructor must present with a similar injury.

The camp teaches participants skills for safely navigating various elements of the commonly inaccessible urban environment, including steps, poorly installed ramps, rough terrain and speed bumps. In order to reflect the diversity of impairments, the techniques are taught in a range of different ways, in order to ensure relevance to the abilities of the individual participant.

Source: [\[109\]](#)

#### Box 61: Case Study: TfL Travel Mentors scheme

The Travel Mentors scheme, by Transport for London, was set up to support disabled Londoners who wish to use public transport but lack the confidence or experience to do so. The aim of the project is to enable people to broaden their travel horizons and plan journeys. A participant can have up to five accompanied sessions using the service, where a mentor travels with the person on any TfL modes of public transport. The service also includes an element of “train the trainer”, whereby potential travel trainers from organisations such as charities can be equipped with the skills that they need to provide travel training on the TfL network.



Source: [\[110\]](#)

Image Source: Transport for London (TfL)

### 6.9.3 Passenger Awareness

This category includes schemes which focus on changing the behaviour of other travellers who might be able to remove barriers for people with disabilities. This might be called Passenger Awareness. An example of increasing passenger awareness in order to improve conditions for people with disabilities might be encouraging passengers to offer help to their fellow travellers.

#### Box 62: Case Study: London Underground's 'Please Offer Me A Seat' Campaign

In April 2017 Transport for London (TfL) introduced a badge with the message 'Please Offer Me a Seat' to help raise public awareness of passengers who experience hidden impairments, who might be less able to stand. After the issue of more than 26,000 badges in the city, 78% of users found it easier to get a seat as a result of the badge and 95% of users said they were likely to recommend the scheme to someone who needs it.



Source: [\[111\]](#)

Image Source: Transport for London

### 6.9.4 Where to start?

Many formalised public transport operators (bus and rail) routinely train their staff in safety and operational aspects of the service. Modules on disability awareness can easily be incorporated into these programmes, especially for new recruits. The costs of developing and delivering the training can be kept low by involving disabled persons' organisations in the process – this will also enhance the value of the training to both parties.

A training video can be made relatively easily and used on a continuing basis to train staff.



Helpful videos and other training materials can be shared between transport stakeholders in different countries, or provided by overarching organisations such as the World Bank. Care should be taken to ensure that training approaches are appropriate for the local context.

Providing training for passengers can help to maximise the abilities of people with diverse needs to navigate the existing transport system, potentially reducing the requirement for specialised services. While this is often provided through charitable or specialised organisations (e.g. Vida Independiente – Box 60) it can also be administered by the transport authority itself (e.g. TfL Travel Mentors – Box 61). Ensuring that other passengers behave considerately towards people with disabilities can also enable people with disabilities to access transport they may not otherwise be able to, and is comparatively simple and low-cost to implement as an advertising campaign.

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Table 2: Advantages and disadvantages of different types of wheelchair - Attendant propelled	Image produced courtesy of Joe Van Eekhout for Human Rights Watch. Available at: <a href="https://www.hrw.org/news/2018/12/03/un-wars-impact-people-disabilities#">https://www.hrw.org/news/2018/12/03/un-wars-impact-people-disabilities#</a> Reproduced under license CC BY-NC-ND 3.0 US
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Table 2: Advantages and disadvantages of different types of wheelchair - Standing wheelchair	Image produced courtesy of the Shirley Ryan AbilityLab. Reproduced with permission. To note: The pictured manual standing wheelchair was developed by the Center for Bionic Medicine at the Shirley Ryan AbilityLab. The pictured device is a research prototype and not yet commercially available.

Table 2: Advantages and disadvantages of different types of wheelchair - Special seating for children	Image produced courtesy of Wheelchairs of Hope. Reproduced with permission.
Table 2: Advantages and disadvantages of different types of wheelchair - Tricycle	Image produced courtesy of Mulindi Japan One Love Project. Reproduced with permission
Table 2: Advantages and disadvantages of different types of wheelchair – Trolley	Retained from original 2004 publication.
Table 4: Tactile paving types: Precast blister paving	Produced by author.
Table 4: Tactile paving types: corduroy	Produced by author.
Table 4: Tactile paving types: lozenge	Produced by author.
Table 6: Key challenges with footway design: Street vending	Image produced courtesy of Tho-Ge. Available at: <a href="https://pixabay.com/zh/photos/india-market-sales-car-men-parasol-4764918/">https://pixabay.com/zh/photos/india-market-sales-car-men-parasol-4764918/</a> Reproduced under Pixabay License.
Table 6: Key challenges with footway design: Placement of street furniture	Image produced courtesy of Karl Fjellstrom, Far East Mobility. Available at: <a href="https://photos.fareast.mobi/photo?id=3342&amp;c=14">https://photos.fareast.mobi/photo?id=3342&amp;c=14</a> Reproduced under license CC BY 4.0.
Table 6: Key challenges with footway design: Anti-social vehicle mitigation	Image produced courtesy of Rutul Joshi. Reproduced with permission.



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Figure 4: Example of a wheelchair and its fundamental features	Produced by author.
Figure 5: Retractable front step	Image produced courtesy of GM Coachwork, United Kingdom. Reproduced with permission
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Figure 7: Recommended UK layout and interior dimensions for buses	Produced by author.

Figure 8: Level floor seating, wheelchair spaces clearly marked, and brightly coloured handrails in Slovakia	Image produced courtesy of Juraj Handzuš for imhd.sk. Reproduced with permission.
Figure 9: Designated space for assistance dogs on the metrobus, Mexico City	Image produced courtesy of Janett Jimenez. Reproduced with permission.
Figure 10: Priority seating behind the driver, used in Mexico City	Retained from original 2004 publication.
Figure 11: Powered lift on the entrance to a bus in Portland, Oregon in United States	Image produced courtesy of Steve Morgan - Own work. Available at: <a href="https://commons.wikimedia.org/w/index.php?curid=36580715">https://commons.wikimedia.org/w/index.php?curid=36580715</a> Reproduced under License CC BY-SA 3.0
Figure 12: Wheelchair securement options	Produced by author. Adapted from Government of Mexico, Secretary of Tourism.
Figure 13: Foldable steps with colour contrast edges and handrails	Image produced courtesy of GM Coachwork, United Kingdom. Reproduced with permission.
Figure 14: Autorickshaw in New Delhi	Image produced courtesy of Access Exchange International. Reproduced with permission.
Figure 15: Removable seating inside a minibus	Image produced courtesy of AMF Bruns GmbH & Co. KG, Germany. Reproduced with permission.



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Figure 17: The wheelchair and passenger are both restrained in a vehicle using a floor-mounted restraint in Delhi, India	Image produced courtesy of Mrunmai Abroal. Available at: <a href="https://mrunmai.com/list-of-wheelchair-accessible-taxis-in-india/">https://mrunmai.com/list-of-wheelchair-accessible-taxis-in-india/</a> Reproduced with permission.
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Figure 19: Clear destination signage used on minibuses in Hong Kong	Image produced courtesy of Him9 - Own work. Available at: <a href="https://commons.wikimedia.org/w/index.php?curid=89095860">https://commons.wikimedia.org/w/index.php?curid=89095860</a> Reproduced under License CC BY-SA 4.0
Figure 20: Level, step-free access via a foldable ramp or a retractable ramp	Image produced courtesy of Société Nationale des Chemins de Fer Luxembourgeois (CFL), Luxembourg. Reproduced with permission. Image produced courtesy of edwardye. Available at: <a href="https://pixabay.com/zh/photos/train-transportation-railway-travel-1042827/">https://pixabay.com/zh/photos/train-transportation-railway-travel-1042827/</a> Reproduced under Pixabay License.
Figure 21: Portable lift used in Luxembourg train stations	Image produced courtesy of Société Nationale des Chemins de Fer Luxembourgeois (CFL), Luxembourg. Reproduced with permission.
Figure 22: Wheelchair spaces on the London 'tube' network	Produced by author.

Figure 23: An unobstructed train carriage interior with colour contrast, grabrails, handholds, and priority seating spaces in Bangkok	Image produced courtesy of nuttanart. Available at: <a href="https://pixabay.com/zh/photos/metro-train-interior-subway-1953661/">https://pixabay.com/zh/photos/metro-train-interior-subway-1953661/</a> Reproduced under Pixabay License.
Figure 24: Lit gangway with handrails on both sides and ramp with colour contrast edges on North-Link Ferries	Image produced courtesy of Emma Muldoon. Available at: <a href="https://www.simplyemma.co.uk/northlink-ferries-wheelchair-accessible-cabin/">https://www.simplyemma.co.uk/northlink-ferries-wheelchair-accessible-cabin/</a> Reproduced with permission.
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Figure 31: Spero range of Electric bikes, India	Image produced courtesy of Spero Pedelecs, India. Reproduced with permission.
Figure 32: Footway zones	Produced by author.
Figure 33: Paving surface materials	Image produced courtesy of Pavingexpert.com. Reproduced with permission.
Figure 34: Storm water drain grate placement	Produced by author.
Figure 35: Footway wide enough for two mobility aid users	Image produced courtesy of Max Bender. Available at: <a href="https://unsplash.com/photos/W5BN8OxGhrE">https://unsplash.com/photos/W5BN8OxGhrE</a> Reproduced under Unsplash License.

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Figure 37: Depiction of a footway crossfall/camber	Produced by author.
Figure 38: Cluttered footways that have been rendered inaccessible	Image produced courtesy of PX Fuel. Available at: <a href="https://www.pxfuel.com/en/free-photo-qwvjx">https://www.pxfuel.com/en/free-photo-qwvjx</a> Reproduced within the terms of the site.
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Figure 43: Good practice for street crossings	Produced by author.
Figure 44: Example of a table-top crossing India	Image produced courtesy of Institute for Transportation and Development Policy (ITDP), India. Reproduced with permission.
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Figure 50: Diagram of a bus bulb or boarder	Produced by author.
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Figure 54: Layout and dimensions for ramps	Image reproduced from Inclusive Mobility, published by the Department for Transport. Available at: <a href="https://www.gov.uk/government/publications/inclusive-mobility-making-transport-accessible-for-passengers-and-pedestrians">https://www.gov.uk/government/publications/inclusive-mobility-making-transport-accessible-for-passengers-and-pedestrians</a>



Figure 55: Dimensions – steps and stairs	Image reproduced from Inclusive Mobility, published by the Department for Transport. Available at: <a href="https://www.gov.uk/government/publications/inclusive-mobility-making-transport-accessible-for-passengers-and-pedestrians">https://www.gov.uk/government/publications/inclusive-mobility-making-transport-accessible-for-passengers-and-pedestrians</a>
Figure 56: Wheelchair lift in Lisbon	Image produced courtesy of TeWeBs – Own work. Available at: <a href="https://commons.m.wikimedia.org/wiki/File:Lisbon_Metro_Stair_Lift.JPG">https://commons.m.wikimedia.org/wiki/File:Lisbon_Metro_Stair_Lift.JPG</a> Reproduced under license CC BY-SA 4.0
Figure 57: Braille and raised text used in Luxembourg	Image produced courtesy of Société Nationale des Chemins de Fer Luxembourgeois (CFL), Luxembourg. Reproduced with permission.
Figure 58: Seating with drainage holes	Image produced courtesy of Steelline. Reproduced with permission. Further information about products is available at: <a href="http://www.Steelline.co.uk">www.Steelline.co.uk</a>
Figure 59: Typical assistance booth at Gatwick Airport U.K.	Image produced courtesy of Gatwick Airport. Reproduced with permission.
Figure 60: Dimensions and amenities for a typical wheelchair accessible toilet	Image reproduced from Inclusive Mobility, published by the Department for Transport. Available at: <a href="https://www.gov.uk/government/publications/inclusive-mobility-making-transport-accessible-for-passengers-and-pedestrians">https://www.gov.uk/government/publications/inclusive-mobility-making-transport-accessible-for-passengers-and-pedestrians</a>

Figure 61: Dimensions and amenities for an accessible squat toilet	Image produced courtesy of Svayam – Global Centre of Inclusive Environments. Reproduced with permission.
Figure 62: Platforms at rail stations	Produced by author.
Figure 63: Recommended dimensions on parking spaces	Image reproduced from Inclusive Mobility, published by the Department for Transport. Available at: <a href="https://www.gov.uk/government/publications/inclusive-mobility-making-transport-accessible-for-passengers-and-pedestrians">https://www.gov.uk/government/publications/inclusive-mobility-making-transport-accessible-for-passengers-and-pedestrians</a>
Figure 64: Interactions between current public transport operations and implementation of concessionary fares	Produced by author.
Figure 65: Raised map in Luxembourg	Image produced courtesy of Société Nationale des Chemins de Fer Luxembourgeois (CFL), Luxembourg. Reproduced with permission.
Figure 66: Wheelchair user Anjlee Agarwal briefs auto-rickshaw drivers about the access needs of wheelchair users during disability awareness training workshops in Delhi, India	Retained from original 2004 publication.

## Appendix D: Image permission for Boxes (Case Studies)



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Box 26: Case Study: Hostile Vehicle Mitigation and implications on people with disabilities	Produced by author.
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Box 30: Case Study: Accessible Crossings in Tokyo Japan	Image produced courtesy of Photock. Available at: <a href="https://www.photock.jp/detail/sign/3844/">https://www.photock.jp/detail/sign/3844/</a> Reproduced within the terms of the site.
Box 31: Case Study: Delhi accessible bus stops	Image produced courtesy of Scroll.in. Reproduced with permission.
Box 32: Case Study: BRT Accessible Raised Platform Boarding in Curitiba, Brazil	Image produced courtesy of Morio - Own work. Available at: <a href="https://commons.wikimedia.org/w/index.php?curid=494375">https://commons.wikimedia.org/w/index.php?curid=494375</a> Reproduced under license CC BY-SA 3.0.
Box 33: Case Study: London Accessible taxi rank review	Image produced courtesy of Transport for London. Reproduced with permission.



Box 34: Case Study: Ayala mall Jeepney interchange in Cebu	Image produced courtesy of Google Map Data, 2020. Reproduced within the terms of the site.
Box 35: Case Study: Changing Places	Image produced courtesy of Muscular Dystrophy UK and PAMIS. Reproduced with permission.
Box 36: Case Study: Nette Toilette	Image produced courtesy of BlueBreezeWiki - Own work. Available at: <a href="https://commons.wikimedia.org/w/index.php?curid=33832583">https://commons.wikimedia.org/w/index.php?curid=33832583</a> Reproduced under license CC BY-SA 3.0
Box 37: Case Study: São Paulo Accessible Metro	Image produced courtesy of LeoMSantos - Own work. Available at: <a href="https://commons.wikimedia.org/w/index.php?curid=10272778">https://commons.wikimedia.org/w/index.php?curid=10272778</a> Reproduced under license CC BY-SA 1.0
Box 38: Case Study: Accessible Vaporettos in Venice	Image produced courtesy of Sage Travelling - John Sage. Reproduced with permission.
Box 40: Case Study: Public Utility Vehicle Modernisation Program (Muntinlupa, Philippines)	Image produced courtesy of Car Guide Philippines. Reproduced with permission.
Box 43: Case Study: Hearing Loops on the Hong Kong Metro	Image produced courtesy of Carl Holderness from The Noun Project. Available at: <a href="https://thenounproject.com/term/telecoil-symbol/2011213/">https://thenounproject.com/term/telecoil-symbol/2011213/</a> Reproduced under license CC-BY

Box 45: Case Study: WhereIsMyTransport	Image produced courtesy of WhereIsMyTransport. Reproduced with permission.
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Box 47: Case Study: Aubin: A Journey Planning Tool for Autistic People	Image produced courtesy of Aubin. Reproduced with permission.
Box 48: Case Study: Bus Hailers in the UK	Images produced courtesy of Henshaws, Transport for Greater Manchester, Transport for West Midlands. Reproduced with permission.
Box 49: Case Study: Passenger Assist on the Great Britain Rail Network	Image produced courtesy of Network Rail. Reproduced with permission.
Box 50: Case Study: Sunflower Lanyards to Identify People with “Hidden” Disabilities	Image produced courtesy of Hidden Disabilities Sunflower Scheme. Reproduced with permission.
Box 51: Case Study: Pictograms – Mexico City Metro	Image produced courtesy of Lance Wyman. Reproduced with permission.
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Box 53: Case Study: What3Words	Image produced courtesy of what3words. Reproduced with permission.

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Box 55: Case Study: Uber Access in Bengaluru

Image produced courtesy of Uber. Reproduced with permission.

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Box 57: Case Study: World Bank's Transit Access Training Toolkit

Image produced courtesy of Access Exchange International. Reproduced with permission.

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Box 59: Case Study: Luxembourg Railway Company Staff Training

Image produced courtesy of Société Nationale des Chemins de Fer Luxembourgeois (CFL), Luxembourg. Reproduced with permission.

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Box 61: Case Study: TfL Travel Mentors scheme

Image produced courtesy of Transport for London. Reproduced with permission.

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Box 62: Case Study: London Underground's 'Please Offer Me A Seat' Campaign

Image produced courtesy of Transport for London. Reproduced with permission.

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## Appendix E: Organisations featured in this guide



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[Accessible Vaporettos](#)

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[Arise Standing Wheelchairs](#)

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[Asakusa Jidaiya](#)

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[Assistance Dogs International](#)

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[Atende+](#)

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[Aubin](#)

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[Be my Eyes](#)

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[Changing Places](#)

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[Design for All Foundation](#)

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[Flexmotiv \[now Flexmo\]](#)

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[G7 Access Taxi Service](#)

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[Greater Anglia](#)

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[Hidden Disabilities Sunflower Scheme Ltd](#)

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[Lingkod Muntinlupa Foundation](#)

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[London Electric Vehicle Company](#)

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[Luxembourg Railway Company \(CFL\)](#)

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[Mobilituk – Agile Development Group](#)

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[Moovit](#)

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[Motivation](#)

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[Nette Toilette](#)

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[OpenVisSim](#)

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[The Rickshaw Project \(Karachi\)](#)

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[SafariSeat](#)

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[Sakari Foundation](#)

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[Singapore Land Transport Authority Green Man Plus](#)

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[Transport for London](#)

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[Uber Access](#)

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[Vida Independiente \(Mexico\)](#)

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[Wayfindr](#)

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[What3words](#)

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[Wheels for Wellbeing](#)

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[Wheelchairs for Nigeria](#)

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[WhereIsMyTransport](#)

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[Zero Project](#)

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## Appendix F: Advocacy organisations



Albania	<a href="#">Albanian National Council of Disabled People (NCDPO)</a>
Angola	Federation of Organisations of Disabled People in Angola (FAPED)
Antigua and Barbuda	<a href="#">Antigua &amp; Barbuda Association of Persons with Disabilities (ABAPD)</a>
Argentina	<a href="#">Fundación Rumbos</a>
Australia	<a href="#">Australian Federation of Disability Organisations AFDO</a>
Austria	<a href="#">Independent Living Austria (Selbstbestimmt Leben Österreich) (ILA)</a>
Azerbaijan	<a href="#">The Society "For International Cooperation of Disabled People of Azerbaijan"</a>
Bahamas	Disabled Persons ' Organization (DPO)
Bangladesh	<a href="#">Bangladesh Protibandhi Kallyan Somity BPKS</a>
Barbados	Barbados National Organization of the Disabled Inc. (BARNOD Inc.)
Belarus	<a href="#">Belarussian Society of the Handicapped</a>
Belize	<a href="#">Belize Assembly for Persons with Diverse Abilities (BAPDA)</a>
Benin	Federation des Associations de Personnes Handicapées du Bénin

Botswana	Botswana Society of People With Disabilities BOSPED
Burkina Faso	<a href="#">Federation Burkinabe des Associations pour la Promotion des Personnes Handicapées FEBAH</a>
Burundi	<a href="#">Union des Personnes Handicapees du Burundi (UPHB)</a>
Cambodia	<a href="#">The Cambodian Disabled Peoples' Organization (CDPO)</a>
Cameroon	CAFOD - UNAPHAC
Canada	<a href="#">Council of Canadians with Disabilities</a> <a href="#">International Centre for Accessible Transportation - Le Centre International d'Accessibilité aux Transports</a>
Cape Verde	<a href="#">Associacao Caboverdana de Deficientes (ACD)</a>
Central African Republic	Union Centrafricaine de la Fraternité Chrétienne des Malades et Handicapés Physiques
China	<a href="#">China Disabled Persons Federation (CDPF)</a>
Cook Islands	<a href="#">Cook Islands Nation Disability Council</a>
Costa Rica	Federación Costarricense de Organizaciones de Personas con Discapacidad
Cuba	<a href="#">Asociación Cubana de Limitados Físicos Motores (ACLIFIM)</a>
Czech Republic	<a href="#">Czech National Disability Council (CNDC)</a>

Democratic Republic of Congo	Intercommunautaire Congolais pour les Personnes avec Handicap - CICPH
Dominica	<a href="#">Dominica Association of Persons with Disabilities Inc. (DAPD Inc.)</a>
Dominican Republic	Federación Nacional de Discapacitados Dominicanos (FENADID)
Ecuador	<a href="#">Federación Nacional de Ecuatorianos con Discapacidad Física (FENEDIF)</a>
Egypt	<a href="#">The Arab Organization of Persons with Disabilities (AOPD)</a>
El Salvador	Asociación Cooperativa de Grupo Independiente Pro Rehabilitación Integral (ACOGIPRI)
Estonia	<a href="#">Independent Living Estonia</a>
Ethiopia	<a href="#">Federation of Ethiopian Associations of Persons with Disabilities (FEAPD)</a> <a href="#">Ethiopian Center for Disability and Development</a>
Fiji	Fiji Disabled Peoples Association
Gabon	<a href="#">Handicap sans Frontières</a>
Gambia	<a href="#">Gambia Federation of the Disabled (GFD)</a>
Ghana	<a href="#">Ghana Federation of the Disabled (GFD)</a>
Greece	Paraplegics Association of Greece

Grenada	<a href="#">Grenada National Council of the Disabled (GNCD)</a>
Guatemala	Coordinadora de Organizaciones de Personas con Discapacidad de Guatemala (COPDIGUA)
Guinea	Federation Guineenne Pour La Promotion Des Associations De et pour Personnes Handicapees (FEGUIPAH)
Guyana	<a href="#">Guyana Council of Organisation for Persons with Disabilities (GCOPD)</a>
Haiti	National Network Association for the Integration of Disabled Persons (RANIPH)
Honduras	Fundación Hondureña de Rehabilitación e Integración del Limitado (FUHRIL)
Hong Kong	<a href="#">The Association for Universal Accessibility Hong Kong (AUAHK)</a>
Iceland	<a href="#">The Organization of Disabled in Iceland OBI</a>
India	<a href="#">National Centre for Promotion of Employment for Disabled People (N.C.P.E.D.P.)</a> <a href="#">Svayam</a>
Indonesia	<a href="#">Persatuan Penyandang Cacat Indonesia (Indonesia Disabled People Association)</a>
Iraq	<a href="#">Iraqi Alliance for Disability</a>
Ivory Coast	<a href="#">Federation des Associations Des personnes Handicapees de Cote d'Ivoire (FAHCI)</a>



Jamaica	Combined Disabilities Association
Japan	<a href="#">Japan National Assembly of Disabled Peoples' International (DPI-Japan )</a>
Jordan	Coalition of Jordanian DPOs
Lao PDR	<a href="#">Lao Disabled People's Association (LDPA)</a>
Latvia	<a href="#">The Latvia Umbrella Body for Disability Organizations - Sustento</a>
Lebanon	Lebanon Council for disabled people
Lesotho	<a href="#">Lesotho National Federation of Organizations of the Disabled (LNFOD)</a>
Liberia	National Union Of Disabled (NUOD)
Macedonia	<a href="#">Polios Plus - Movement Against Disability</a>
Madagascar	<a href="#">Plateforme Des Federations Des Personnes Handicapees De Madagascar (PFPH)</a>
Malawi	<a href="#">Federation of Disability Organizations of Malawi (FEDOMA)</a>
Malaysia	<a href="#">Malaysian Confederation of the Disabled (MCD)</a> <a href="#">Society of the Disabled Persons Penang (SDPP)</a> <a href="#">Beautiful Gate Foundation for the Disabled</a>
Maldives	<a href="#">Maldives Association of the Disabled People</a>
Mali	<a href="#">Federation Malienne des Associations de Handicapés</a>

Malta	Maltese Council of Disabled Persons
Mauritius	<a href="#">Physically Handicapped Welfare Association (PHWA)</a>
Mexico	<a href="#">Libre Acceso</a>
Mongolian	Disabled Peoples International of Mongolia
Montserrat	<a href="#">Montserrat Association for Persons with Disabilities Inc. (MAPD Inc.)</a>
Morocco	Morocco Federation for PwDs
Mozambique	<a href="#">Forum das Associades dos deficientes de Mozambique (FAMOD)</a>
Namibia	<a href="#">National Federation of People with Disabilities in Namibia (NF-PDN)</a>
Nepal	<a href="#">National Federation of the Disabled-Nepal</a>
New Zealand	<a href="#">Disabled Persons Assembly (New Zealand ) Inc. (DPANZ)</a>
Nicaragua	<a href="#">Organización de Revolucionarios Discapacitados .(ORD)</a>
Niger	<a href="#">Fédération Nigerienne des Personnes Handicapées (FNPH)</a>
Nigeria	<a href="#">Joint National Association Of Person With Disabilities (JONAP-WD)</a>
Pakistan	<a href="#">Pakistan Disabled People Organization (PDPO) (DPI-Pakistan)</a>

Palestine	<a href="#">Palestinian Disability Coalition</a> <a href="#">Palestinian general union people with disability</a>
Panama	ASOCIACION NACIONAL DE PERSONAS IMPEDIDAS(ANPI)
Papua New Guinea	Papua New Guinea Assembly of Disabled Persons (PNGDA) PNG Assembly of Disabled People (PNGADP)
Paraguay	<a href="#">ARIFA (Asociación de Rehabilitación de Impedidos Físicos del Paraguay)</a> <a href="#">Fundación Saraki</a>
Peru	Confederación Nacional de Discapacitados del Perú (CON-FENADIP) <a href="#">Centro de Atención a Personas con Discapacidad Intelectual Grave (CADIG-APROMIPS)</a>
Philippines	<a href="#">Philippines National Federation of Persons with Disabilities in the Philippines, Inc.</a>
Portugal	<a href="#">Associacion Portuguesa de Deficie</a>
Puerto Rico	<a href="#">Asociación Mayagüezana de Personas con Impedimentos (AMPI)</a>
Republic of Korea	<a href="#">Disabled People's International Korea (DPIK)</a>
Republic of the Congo	Union Nationale des Handicapés du Congo (UNHACO)
Russia	<a href="#">All Russian Society of Disabled People</a>
Rwanda	<a href="#">National Union of Disabilities Organisations of Rwanda (NUDOR)</a>

Samoa	<a href="#">Nuanua O Le Alofa, Disability Advocacy Organisation in Samoa</a>
Senegal	<a href="#">Fédération Sénégalaise des Associations de Personnes Handicapées</a> <a href="#">Comité des Femmes de la Fédération Sénégalaise des Associations De Personnes Handicapées</a>
Seychelles	Seychelles Disabled People Association
Sierra Leone	Disability Awareness Action Group
Singapore	<a href="#">Singapore Disabled People's Association (DPA Singapore)</a>
Slovak Republic	<a href="#">Alliance of Organizations of Disabled Peoples Slovakia</a>
Slovenia	<a href="#">YHD Association for the theory and culture of handicap</a>
Solomon Islands	People With Disabilities Solomon Islands (PWDSI)
Somalia	<a href="#">Somali Disability Empowerment Network</a>
South Africa	<a href="#">Disabled People South Africa (DPSA)</a>
Spain	<a href="#">Confederacion Coordinadora Estatal de Minusvalidos Fisicos De Espana (COCEMFE)</a>
Sri Lanka	<a href="#">Sri Lanka Confederation of Organizations of the Handicapped People</a>
St. Kitts and Nevis	<a href="#">St. Kitts Nevis Association of Disabled Persons</a>
St. Lucia	<a href="#">National Council of and for Persons with Disabilities (NCPD)</a>

St. Vincent and the Grenadines	National Society of Persons with Disabilities (NSPD)
Sudan	Sudan Union for PwD
Swaziland	Federation of the Disabled in Swaziland FODSWA
Sweden	<a href="#">Independent Living Institute (ILI)</a>
Taiwan	<a href="#">Eden Social Welfare Foundation</a>
Tanzania	<a href="#">SHIVYAWATA (Tanzania Federation of Persons with Disabilities)</a>
Tchad	Union des Association des Personnes Handicapées du Tchad
Thailand	<a href="#">Disabilities Thailand association (DTH)</a>
Togo	<a href="#">Fédération Togolaise des Associations de Personnes Handicapées</a>
Trinidad and Tobago	Trinidad and Tobago Chapter of Disabled People's International (TT/DPI)
Turkey	<a href="#">The Turkish Disability Education and Solidarity Foundation (ÖZEV)</a>
Uganda	<a href="#">National Union Of Disabled Persons Of Uganda (NUDIPU)</a>
Ukraine	<a href="#">National Assembly of People with Disabilities in Ukraine NAPD</a>
United Kingdom	<a href="#">United Kingdoms Disabled Peoples Council (UKDPC)</a> <a href="#">Motivation UK</a>

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United States	<a href="#">United States International Council on Disabilities (USICD)</a> <a href="#">Access Exchange International (AEI)</a> <a href="#">Inter-American Institute on Disability (IiDi)</a> <a href="#">Mobility International USA</a> <a href="#">The American Association of People with Disabilities (AAPD)</a>
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Vanuatu	<a href="#">Disability Promotion &amp; Advocacy Association(DPA Vanuatu)</a>
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Yemen	<a href="#">Yemeni Forum for People with Disabilities</a>
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Zambia	<a href="#">Zambia Federation Of the Disabled ZAFOD</a>
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Zimbabwe	<a href="#">Federation of Organisations of Disabled People in Zimbabwe FODPEZ</a>
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## Global advocacy

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1	<a href="#">Disabled Peoples International</a>
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2	<a href="#">Humanity &amp; Inclusion</a>
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3	<a href="#">Rehabilitation International</a>
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4	<a href="#">Global Alliance on Accessible Technologies and Environments</a>
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## Appendix G: Design and delivery guides



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### **Access to transport for disabled people**

Author/s: Louise Butcher, House of Commons

Language: English

Year: 2018

Link: <https://researchbriefings.files.parliament.uk/documents/SN00601/SN00601.pdf>

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### **Accessible bus stop design guidance**

Author/s: Transport for London

Language: English

Year: 2017

Link: <https://content.tfl.gov.uk/bus-stop-design-guidance.pdf>

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### **Addressing transport safety and accessibility for people with a disability in developing countries: a formative evaluation of the Journey Access Tool in Cambodia**

Author/s: Julie A. King, Mark J. King, Niki Edwards, Sara A. Hair, Sarim Cheang, Anita Pearson & Sophie Coelho

Language: English

Year: 2018

Link: <https://eprints.qut.edu.au/122932/1/122932.pdf>

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### **Bridging the Gap: Your role in transporting children with disabilities to school in developing countries**

Author/s: Access Exchange International (AEI)

Language: English

Year: 2017

Link: <https://www.globalride-sf.org/TransportingChildren/GuideToSchool.pdf>

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**Conduct an accessibility audit in low and middle income countries**

Author/s: Handicap International

Language: English

Year: 2014

Link: [https://asksource.info/sites/default/files/accessibilityaudit\\_pg13.pdf](https://asksource.info/sites/default/files/accessibilityaudit_pg13.pdf)

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**Design Standards for Accessible Railway Stations**

Author/s: Department for Transport

Language: English

Year: 2015

Link: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/918425/design-standards-accessible-stations.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/918425/design-standards-accessible-stations.pdf)

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**Disability at a Glance 2019: Investing in Accessibility in Asia and the Pacific – Strategic Approaches to Achieving Disability-inclusive Sustainable Development**

Author/s: Economic and Social Commission for Asia and the Pacific (ESCAP)

Language: English

Year: 2019

Link: <https://www.unescap.org/sites/default/d8files/knowledge-products/SDD-DAG-2019.pdf>

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**Disability Hate Crime on Public Transport**

Author/s: Communities Inc

Language: English

Year: 2019

Link: <https://communitiesinc.org.uk/2020/04/15/dialogue-debriefs-2/>

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**Doing Transport Differently How to access public transport – a guide for everyone with lived experience of disability or health conditions**

Author/s: Royal Association for Disability Rights (RADAR)

Language: English

Year: 2011

Link: <http://accessinlondon.org/wordpress/wp-content/uploads/Doing-Transport-Differently-RADAR.pdf>

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**Footpath Design: A guide to creating footpaths that are safe, comfortable, and easy to use**

Author/s: Institute for transportation & development policy

Language: English

Year: 2013

Link: [https://www.itdp.in/wp-content/uploads/2014/04/05.-Footpath-Design\\_Hand-out.pdf](https://www.itdp.in/wp-content/uploads/2014/04/05.-Footpath-Design_Hand-out.pdf)

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**Guidelines for public transport infrastructure and facilities**

Author/s: New Zealand Transport Agency

Language: English

Year: 2014

Link: <https://nzta.govt.nz/assets/consultation/guidelines-for-public-transport-in-frastructure/docs/guidelines-pt-infrastructure-draft.pdf>

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**Good Practices of accessible urban development**

Author/s: United Nations

Language: English

Year: 2016

Link: [https://www.un.org/disabilities/documents/desa/good\\_practices\\_in\\_accessible\\_urban\\_development\\_october2016.pdf](https://www.un.org/disabilities/documents/desa/good_practices_in_accessible_urban_development_october2016.pdf)

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### **A guide to inclusive cycling**

Author/s: Wheels for Wellbeing

Language: English

Year: 2020

Link: [https://wheelsforwellbeing.org.uk/wp-content/uploads/2020/12/FC\\_WfW-Inclusive-Guide\\_FINAL\\_V03.pdf](https://wheelsforwellbeing.org.uk/wp-content/uploads/2020/12/FC_WfW-Inclusive-Guide_FINAL_V03.pdf)

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### **Guidelines for pedestrian facilities**

Author/s: Indian Roads Congress

Language: English

Year: 2012

Link: <https://law.resource.org/pub/in/bis/irc/irc.gov.in.103.2012.pdf>

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### **Nueva Guía Básica de Derechos de Accesibilidad para personas con Discapacidad**

Author/s: Defensoría del Pueblo de la Ciudad de Buenos Aires

Language: Spanish

Year: Unknown

Link: <https://en.calameo.com/read/002682399da970f53e96f?page=1>

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### **The Inclusion Imperative: Towards Disability-inclusive and Accessible Urban Development**

Author/s: Disability Inclusive and Accessible Urban Development Network

Language: English

Year: 2016

Link: [https://www.cbm.org/fileadmin/user\\_upload/Publications/The-Inclusion-Imperative-Towards-Disability-Inclusive-and-Accessible-Urb....pdf](https://www.cbm.org/fileadmin/user_upload/Publications/The-Inclusion-Imperative-Towards-Disability-Inclusive-and-Accessible-Urb....pdf)

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### **Inclusive mobility: a guide to best practice on access to pedestrian and transport infrastructure**

Author/s: Department for Transport

Language: English

Year: 2021

Link: <https://www.gov.uk/government/publications/inclusive-mobility-making-transport-accessible-for-passengers-and-pedestrians>

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### **Improving accessibility in transport: infrastructure projects in the Pacific Islands**

Author/s: Pacific Region Infrastructure Facility

Language: English

Year: Unknown

Link: [https://www.theprif.org/sites/default/files/documents/prif\\_transport\\_report\\_web.pdf](https://www.theprif.org/sites/default/files/documents/prif_transport_report_web.pdf)

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### **Improving Accessibility to Transport for People with Limited Mobility (PLM)**

Author/s: World Bank

Language: English

Year: 2013

Link: <https://openknowledge.worldbank.org/bitstream/handle/10986/17592/Accessibility0Report0Final.pdf?sequence=1&isAllowed=y>

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### **Lo Urbano y lo Humano. Hábitat y Discapacidad**

Author/s: Silvia Aurora Coriat

Language: Spanish

Year: 2003

Link: <http://www.rumbos.org.ar/sites/default/files/LO%20URBANO%20Y%20LO%20HUMANO-low.pdf>

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### **Manual de Accesibilidad Universal**

Author/s: Corporación Ciudad Accesible Boudeguer & Squella ARQ

Language: Spanish

Year: 2003

Link: [https://www.ciudadaccesible.cl/wp-content/uploads/2012/06/manual\\_accesibilidad\\_universal1.pdf](https://www.ciudadaccesible.cl/wp-content/uploads/2012/06/manual_accesibilidad_universal1.pdf)

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### **Making access happen: Promoting and planning transport for all A guide for advocates and planners**

Author/s: Access Exchange International (AEI)

Language: English, Spanish

Year: 2002

Link: <https://www.independentliving.org/mobility/rickert200302.pdf>

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### **Mobility for all: Accessible Transportation Around the World**

Author/s: Access Exchange International (AEI)

Language: English

Year: 2002

Link: <https://www.independentliving.org/mobility/mobility.pdf>

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### **Paratransit for mobility-impaired persons in developing regions: Starting up and scaling up**

Author/s: Access Exchange International (AEI)

Language: English/Spanish

Year: 2012

Link: <https://www.globalride-sf.org/paratransit/Guide.pdf>

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### **A Review of International Best Practice in Accessible Public Transportation for Persons with Disabilities**

Author/s: United Nations

Year: 2010

Link: <https://g3ict.org/publication/review-of-international-best-practices-in-accessible-public-transportation-for-persons-with-disabilities>

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### **Roads for all: Good practice guide for roads**

Author/s: Transport Scotland

Language: English

Year: 2019

Link: <https://www.transport.gov.scot/media/43830/roads-for-all-good-practice-guide-for-roads-july-2013.pdf>

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### **Safe and accessible public transport for all**

Author/s: International Association of Public Transport (UITP)

Language: English

Year: 2019

Link: [https://hi.org/sn\\_uploads/document/190518-sdgs\\_uitpHI\\_REPORT\\_LRes.pdf](https://hi.org/sn_uploads/document/190518-sdgs_uitpHI_REPORT_LRes.pdf)

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### **Guidance on the use of tactile paving surfaces**

Author/s: Department for Transport

Language: English

Year: 2021

Link: <https://www.gov.uk/government/publications/inclusive-mobility-using-tactile-paving-surfaces>

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## **Urban Street Design Guidelines Pune**

Author/s: Pune Municipal Corporation / ITDP

Language: English

Year: 2016

Link: <https://www.itdp.in/wp-content/uploads/2016/07/Urban-street-design-guide-lines.pdf>

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## Appendix H: Further Research Papers and case studies



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### **Access to urban transportation system for individuals with disabilities**

Author/s: N.N. Sze, Keith M. Christensen

Year: 2017

Link: [https://ira.lib.polyu.edu.hk/bitstream/10397/80048/1/Sze\\_Urban\\_Transportation\\_System.pdf](https://ira.lib.polyu.edu.hk/bitstream/10397/80048/1/Sze_Urban_Transportation_System.pdf)

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### **Challenges and Successes in the Application of Universal Access. Principles in the Development of Bus Rapid Transport Systems in South Africa**

Author/s: Thompson, P

Year: 2008

Link: <https://www.mdpi.com/2071-1050/12/2/589/pdf>

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### **Diseño inclusivo y diseño universal**

Author/s: Silvia Coriat

Year: 2011

Link: <http://www.rumbos.org.ar/sites/default/files/D.%20inclusivo%20y%20d.%20universal.%20Coriat.%202011.pdf>

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### **EDF report on the situation of passengers with disabilities 2015**

Author/s: European Disability Forum (EDF)

Year: 2015

Link: [https://view.officeapps.live.com/op/view.aspx?src=http%3A%2F%2Fold.edf-feph.org%2Fsites%2Fdefault%2Ffiles%2Fedf\\_report\\_passenger\\_rights\\_2015\\_0.doc&wd-Origin=BROWSELINK](https://view.officeapps.live.com/op/view.aspx?src=http%3A%2F%2Fold.edf-feph.org%2Fsites%2Fdefault%2Ffiles%2Fedf_report_passenger_rights_2015_0.doc&wd-Origin=BROWSELINK)

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### **Empowering People with Disabilities Using Urban Public Transport**

Author/s: J.Schlingensiepen, E.Naroska, T.Bolten, O.Christen, S.Schmitz, C.Ressel

Year: 2015

Link: <https://www.sciencedirect.com/science/article/pii/S2351978915003832/pdf?md5=01238e8516dc9b63e24882ca8485d908&pid=1-s2.0-S2351978915003832-main.pdf>

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### **Enhanced accessibility for people with disabilities living in urban areas**

Author/s: Venter C J, Savill T, Rickert T, Bogopane H, Venkatesh A, Camba J, Mulikita N, Stone J and Maunder D

Year: 2002

Link: [https://ecommons.cornell.edu/bitstream/handle/1813/76514/Enhanced\\_Accessibility\\_for\\_people.pdf?sequence=1&isAllowed=y](https://ecommons.cornell.edu/bitstream/handle/1813/76514/Enhanced_Accessibility_for_people.pdf?sequence=1&isAllowed=y)

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### **Evaluating a GPS-Based Transportation Device to Support Independent Bus Travel by People with Intellectual Disability**

Author/s: Daniel K. Davies; Steven E. Stock; Shane Holloway; Michael L. Wehmeyer

Year: 2010

Link: <https://meridian.allenpress.com/idd/article/48/6/454/1506/Evaluating-a-GPS-Based-Transportation-Device-to>

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### **Improving access to transport in developing countries**

Author/s: Savill T, Stone J, Venter C J and Maunder D

Year: 2003

Link: [https://www.researchgate.net/publication/30509347\\_Improving\\_access\\_to\\_transport\\_in\\_developing\\_countries](https://www.researchgate.net/publication/30509347_Improving_access_to_transport_in_developing_countries)

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### **Improving accessibility for people with disabilities in urban areas**

Author/s: Venter C J, Bogopane H, Rickert T, Camba J, Venkatesh A, Mulikita N, Maunder D and Savill T

Year: 2002

Link: [https://www.ucl.ac.uk/dpu-projects/drivers\\_urb\\_change/urb\\_infrastructure/pdf\\_transport/DFID\\_Venter\\_%20accessibility\\_disabilities.pdf](https://www.ucl.ac.uk/dpu-projects/drivers_urb_change/urb_infrastructure/pdf_transport/DFID_Venter_%20accessibility_disabilities.pdf)

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### **Improving transport access and mobility for people with disabilities**

Author/s: Maunder D, Venter C J, Rickert T and Sentinella J

Year: 2004

Link: [http://transport-links.com/wp-content/uploads/2019/11/1\\_833\\_PA4061-04.pdf](http://transport-links.com/wp-content/uploads/2019/11/1_833_PA4061-04.pdf)

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Independent-Mobility Rights and the State of Public Transport Accessibility for Disabled People: Evidence From Southern Punjab in Pakistan

Author/s: Mahtab Ahmad

Year: 2013

Link: [https://www.researchgate.net/publication/272369938\\_Independent-Mobility\\_Rights\\_and\\_the\\_State\\_of\\_Public\\_Transport\\_Accessibility\\_for\\_Disabled\\_People\\_Evidence\\_From\\_Southern\\_Punjab\\_in\\_Pakistan](https://www.researchgate.net/publication/272369938_Independent-Mobility_Rights_and_the_State_of_Public_Transport_Accessibility_for_Disabled_People_Evidence_From_Southern_Punjab_in_Pakistan)

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**Learning with Older People about their transport and mobility problems in rural Tanzania: focus on improving access to health services and livelihoods**

Author/s: HelpAge International

Year: 2012

Link: <https://assets.publishing.service.gov.uk/media/57a08aa440f0b649740006d2/AFCAP-GEN-rural-tanzania-Final-Report.pdf>

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**Measures of Transport-Related Social Exclusion: A Critical Review of the Literature**

Author/s: Md. Kamruzzaman, Tan Yigitcanlar, Jay Yang and Mohd Afzan Mohamed

Year: 2016

Link: <https://pdfs.semanticscholar.org/0233/722d579bb481017756068f490d-63b642e34b.pdf>

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**Practical solutions for transport access of urban residents with disabilities**

Author/s: Venter C J, Maunder D, Stone J, Venkatesh A, deDeus K and Munthali D.

Year: 2004

Link: <https://www.semanticscholar.org/paper/Practical-solutions-for-transport-access-of-urban-Venter/1b755c955e9dd95894f03371f8cbef31b78605a7#paper-header>

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### **Public transport and people with disabilities the experiences of non-users**

Author/s: Oksenhalt K., Aarhaug J.

Year: 2016

Link: <http://universaldesignaustralia.net.au/wp-content/uploads/2017/02/public-transport-and-people-with-disabilities.pdf>

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### **Saskatoon Bus Rapid Transit Accessibility**

Author/s: Saskatoon City Council

Year: 2018

Link: <https://pub-saskatoon.escribemeetings.com/filestream.ashx?DocumentId=66125>

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### **The taxi industry and transportation for people with disabilities: implications for universal access in a metropolitan municipality**

Author/s: Lister H, Dunpath R.

Year: 2016

Link: [https://www.researchgate.net/publication/303953057\\_The\\_taxi\\_industry\\_and\\_transportation\\_for\\_people\\_with\\_disabilities\\_implications\\_for\\_universal\\_access\\_in\\_a\\_metropolitan\\_municipality/link/5c90d42445851564fae71677/download](https://www.researchgate.net/publication/303953057_The_taxi_industry_and_transportation_for_people_with_disabilities_implications_for_universal_access_in_a_metropolitan_municipality/link/5c90d42445851564fae71677/download)

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### **Transport and Access to Inclusive Education in Mashonaland West Province, Zimbabwe**

Author/s: Maria Kett, Marcella Deluca

Year: 2016

Link: <https://www.cogitatiopress.com/socialinclusion/article/download/502/502>

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### **Transport Policy and Social Inclusion**

Author/s: Ricci M., Pankhurst G.

Year: 2016

Link: <https://www.cogitatiopress.com/socialinclusion/article/view/668/668>

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**Integrated Transport Planning Ltd**

1 Broadway

Nottingham

NG1 1PR

Tel: +44 (0)115 824 8250

Email: [taylor@itpworld.net](mailto:taylor@itpworld.net)

Web: [www.itpworld.net](http://www.itpworld.net)

# ROAD NOTE 21

**Enhancing the mobility of disabled people**

Part 1: Guidelines for policy makers

March 2022

